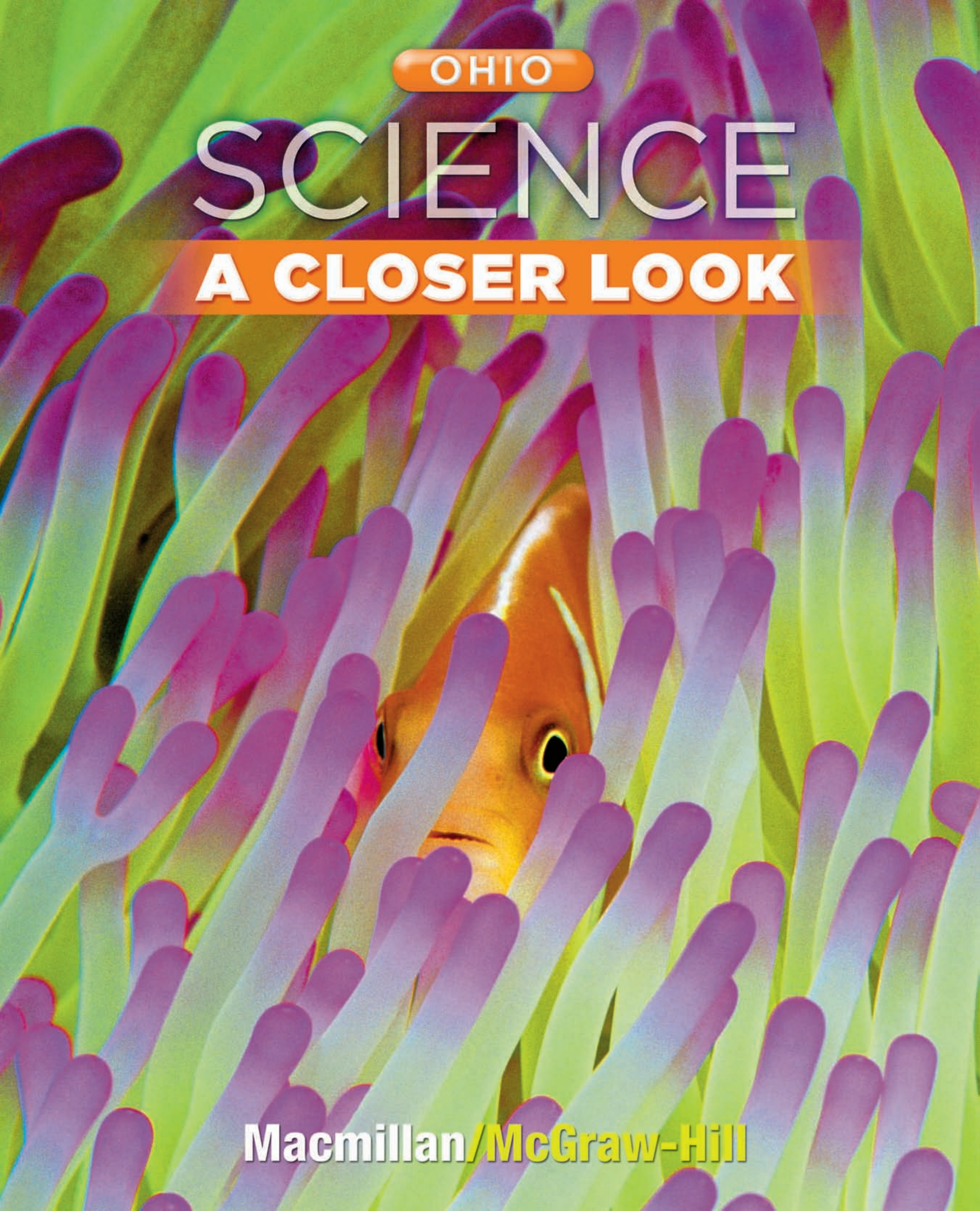
OHIO

SCIENCE
A CLOSER LOOK



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SCIENCE

A CLOSER LOOK

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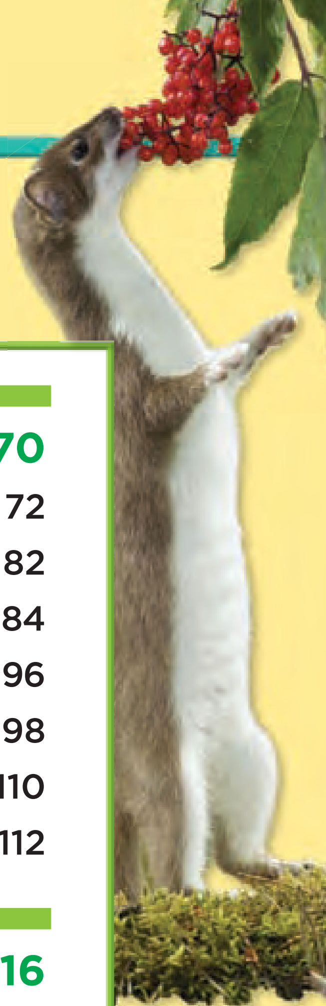
The American Museum of Natural History in New York City is one of the world's preeminent scientific, educational, and cultural institutions, with a global mission to explore and interpret human cultures and the natural world through scientific research, education, and exhibitions. Each year the Museum welcomes around four million visitors, including 500,000 schoolchildren in organized field trips. It provides professional development activities for thousands of teachers; hundreds of public programs that serve audiences ranging from preschoolers to seniors; and an array of learning and teaching resources for use in homes, schools, and community-based settings. Visit www.amnh.org for online resources.

Be a Scientist

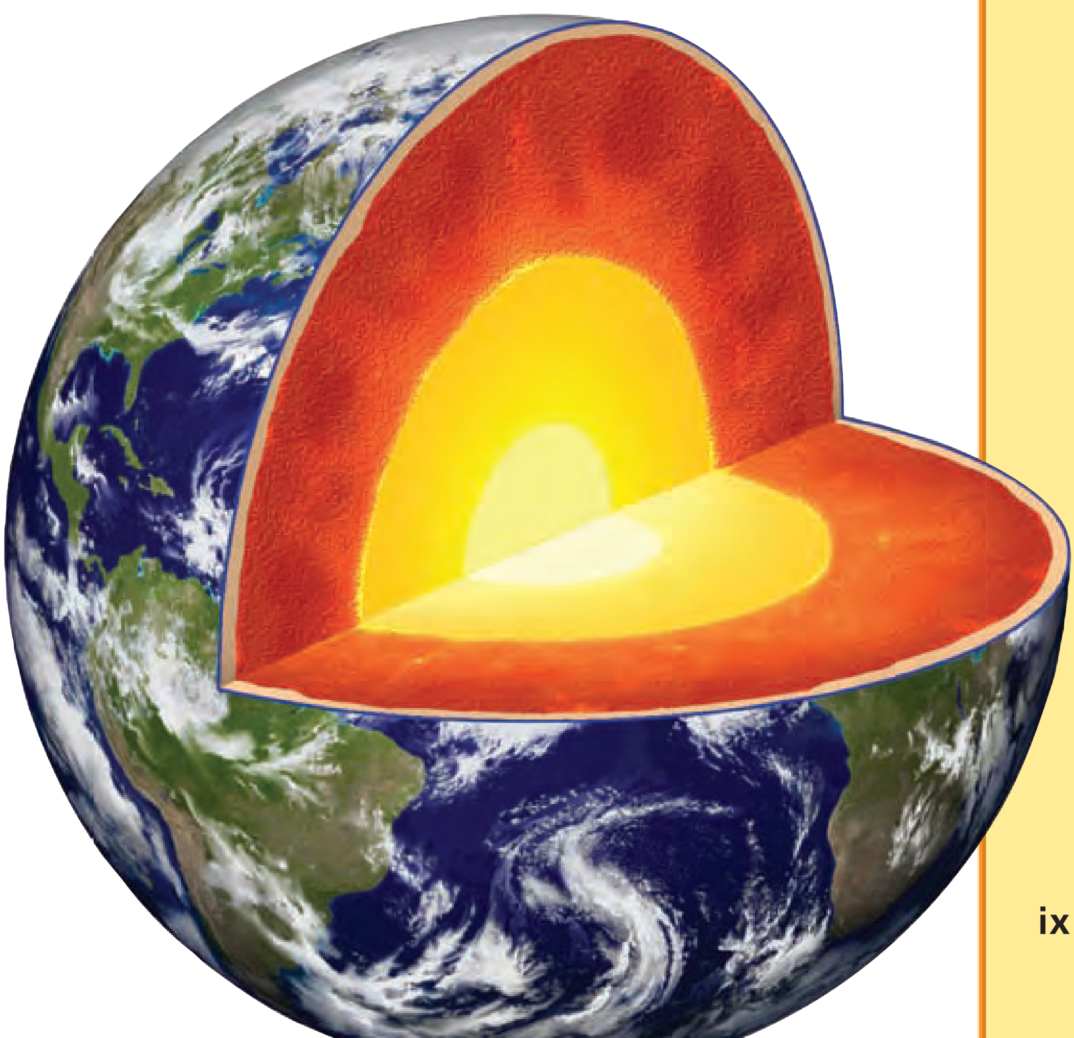

Scientific Method
Make Observations
Ask a Question
Form a Hypothesis
Test Your Hypothesis
Results Support Hypothesis
Results Do Not Support Hypothesis
Draw Conclusions / Ask Questions

Life Sciences



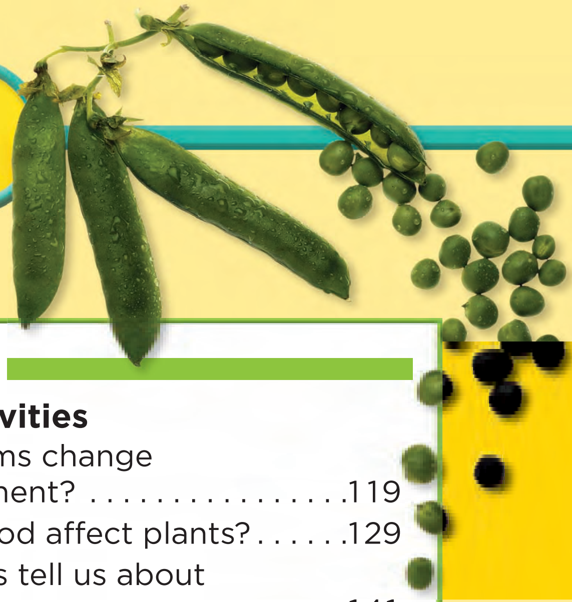
Earth and Space Sciences

CHAPTER 5



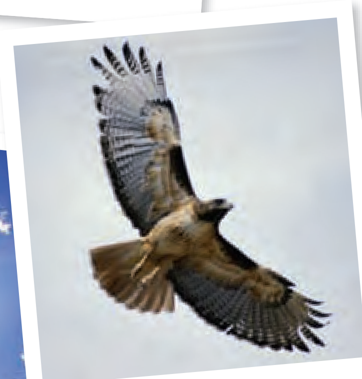
Physical Sciences

Activities and Investigations



Life Sciences

snake



hawk

Sun

Earth and Space Sciences

Activities and Investigations

Physical Sciences

CHAPTER 6

Explore Activities

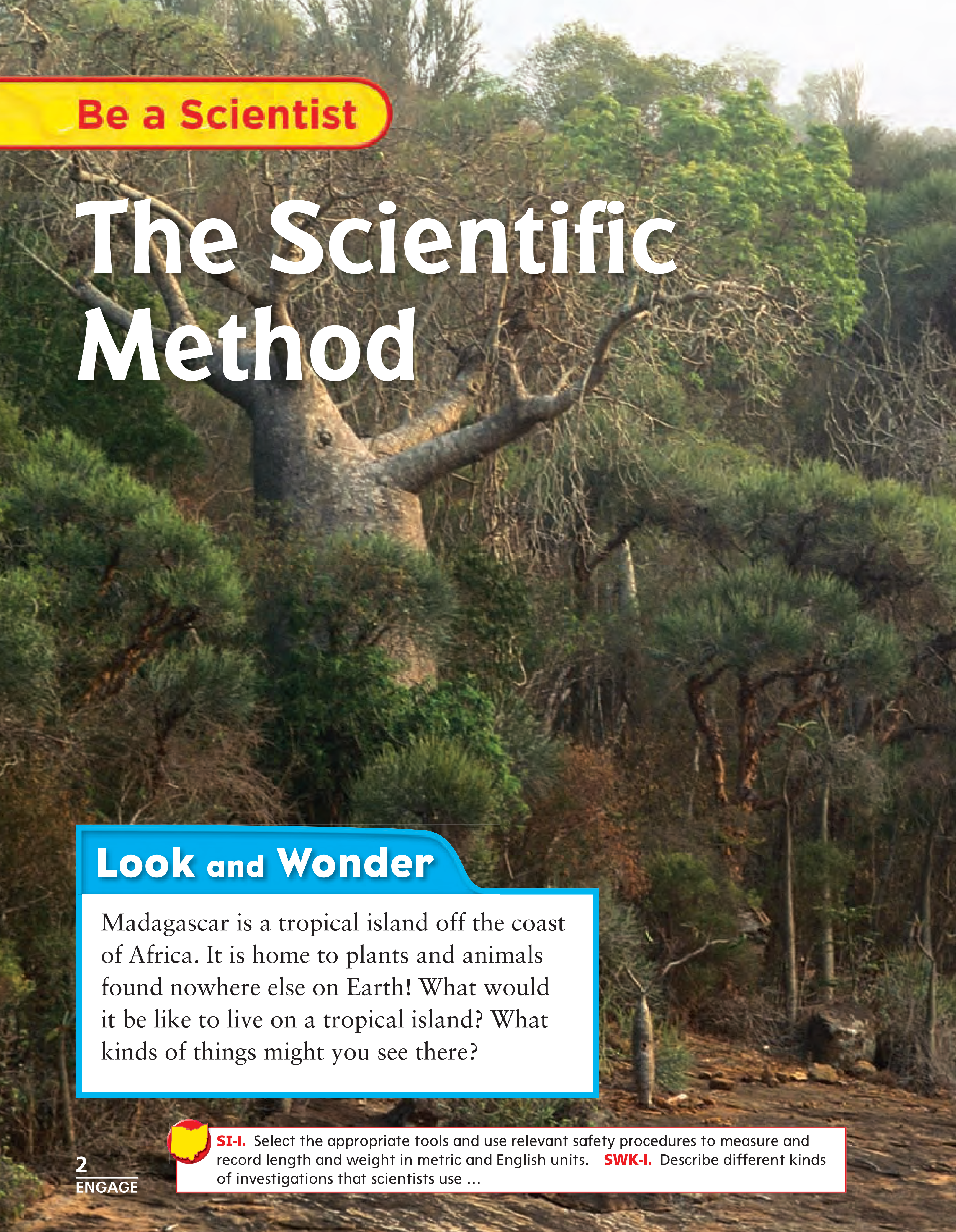
Inquiry Skills and Investigations

Quick Labs

Be a Scientist

Chameleons can change color to communicate.

giant Madagascan chameleon



Be a Scientist

The Scientific Method

Look and Wonder

Madagascar is a tropical island off the coast of Africa. It is home to plants and animals found nowhere else on Earth! What would it be like to live on a tropical island? What kinds of things might you see there?

SI-I. Select the appropriate tools and use relevant safety procedures to measure and record length and weight in metric and English units. **SWK-I.** Describe different kinds of investigations that scientists use ...

Explore

What do you know about animals that live in Madagascar?

- How do you look for animals in their natural habitat?
- What kinds of animals would you see in a forest?
- What does an animal need to live in a forest?
- How do scientists find answers to these questions?


Chris Raxworthy


Paule Razafimahatratra

Meet two scientists who are curious about the natural world and everything that lives in it. Chris Raxworthy and Paule Razafimahatratra study animals that live in Madagascar. They work at the American Museum of Natural History in New York City and at the University of Antananarivo in Madagascar.

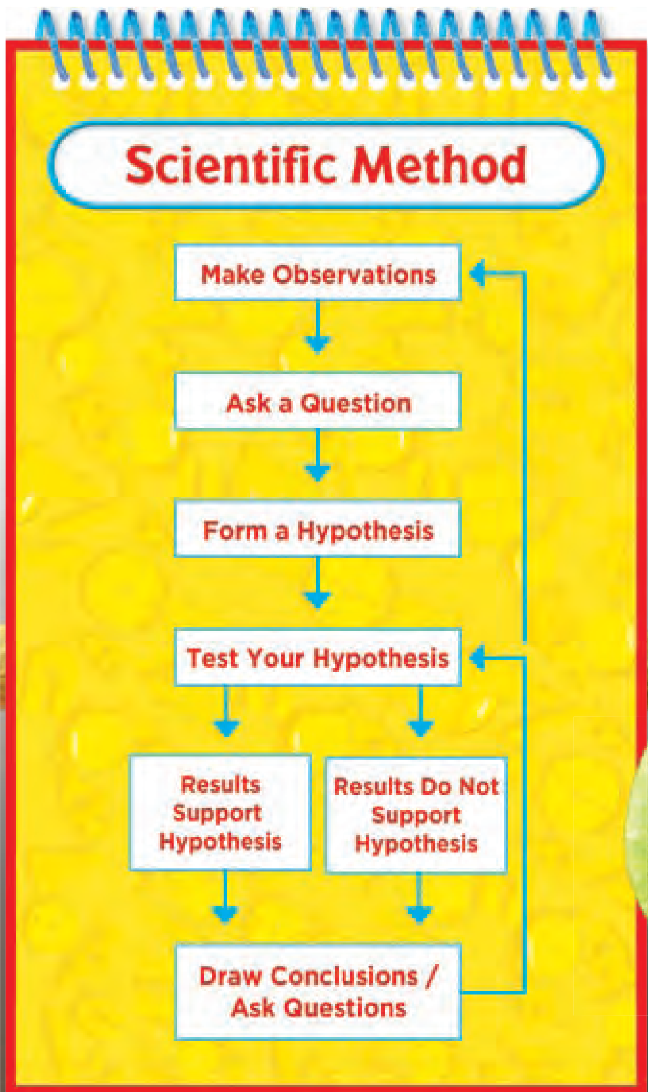
SWK-3. Explore through stories how men and women have contributed to the development of science. **SWK-5.** Discuss how both men and women find science rewarding as a career and in their everyday lives.

What do scientists do?

Chris and Paule want to find out about the many amazing animals that live in Madagascar. Much of the island has never been explored by scientists. New plants and animals are discovered all the time.

The scientific method is a process that scientists use to investigate the world around them. It helps them answer questions about the natural world.

Right now, Chris and Paule are studying a lizard called a giant Madagascan chameleon. Chris has observed these chameleons in dry forests. He wants to know where else in Madagascar the chameleons live.



All scientists use the scientific method. However, they might not use all the steps, or they might do the steps in a different order.

Chris knows that variables such as temperature and rainfall affect where animals live. A variable is something that can change.

Chris uses this information to form a hypothesis. A hypothesis is a statement that can be tested to answer a question.

Here is Chris's hypothesis. If a place has temperatures between 10 and 40 degrees Celsius and between 50 and 150 centimeters of rainfall every year, then giant Madagascan chameleons could live there.

Form a Hypothesis

1. Ask lots of "why" questions.
2. Look for connections between important variables.
3. Suggest possible explanations for those connections.

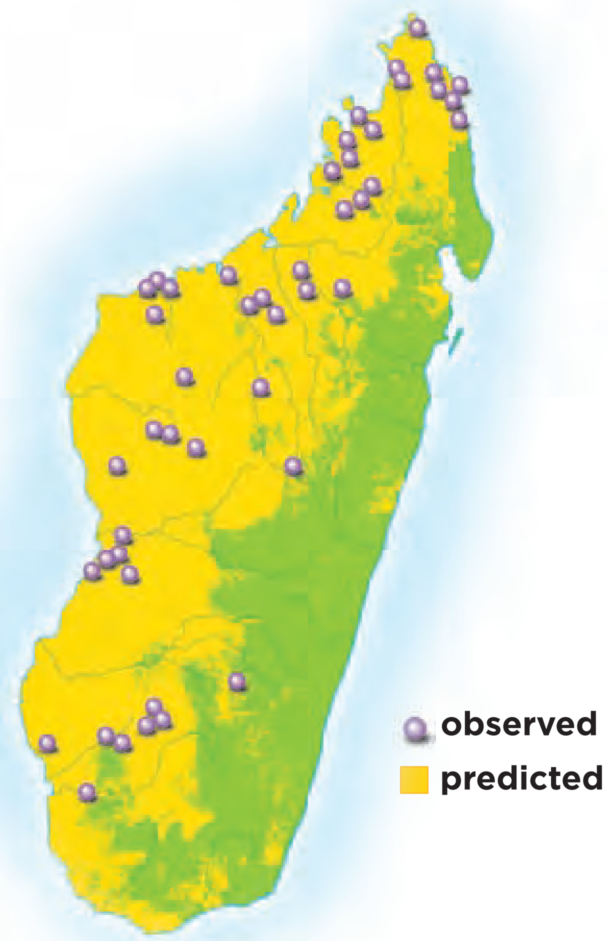
▶ **Make sure the explanations can be tested.**

giant Madagascan chameleon ▲

How do scientists test a hypothesis?

The giant Madagascan chameleon is about as long as a banana. It is hard to find in the dense forest, though, because it hides. People in Madagascar say you can never find a chameleon when you are looking for one!

Where should Chris and Paule look for chameleons? In order to find out, they study their data about temperature and rainfall. Data is information. They put this data into a computer and make a map. The computer colors yellow all the areas that are likely to have chameleons. Those areas have similar temperatures and rainfall to places where chameleons have been found before. Chris predicts that if they go to those areas, they will find giant Madagascan chameleons.



▲ The purple dots on this map show where giant Madagascan chameleons have been seen before. The yellow areas show where Chris and Paule think the chameleons live.

◀ Chris uses his headlamp to find chameleons at night when they sleep.

Chris and Paule choose new places to look for chameleons. They choose places that are in the yellow areas on the map. They collect data in these places to test their hypothesis. They use procedures that other scientists can repeat. That way other scientists can check Chris's and Paule's results.

"We wear headlamps and search at night, when the chameleons are sleeping and are easier to find," Chris explains. "We look up in the branches for pale-colored comma shapes." Every time they find a chameleon, Chris and Paule make careful notes and take photographs. They record the exact date, time, and place in their field journals.

Test Your Hypothesis

1. Think about the different kinds of data that could be used to test the hypothesis.
2. Choose the best method to collect this data.
   - **perform an experiment** (in the lab)
   - **observe the natural world** (in the field)
   - **make and use a model** (on a computer)
3. Then plan a procedure and gather data.

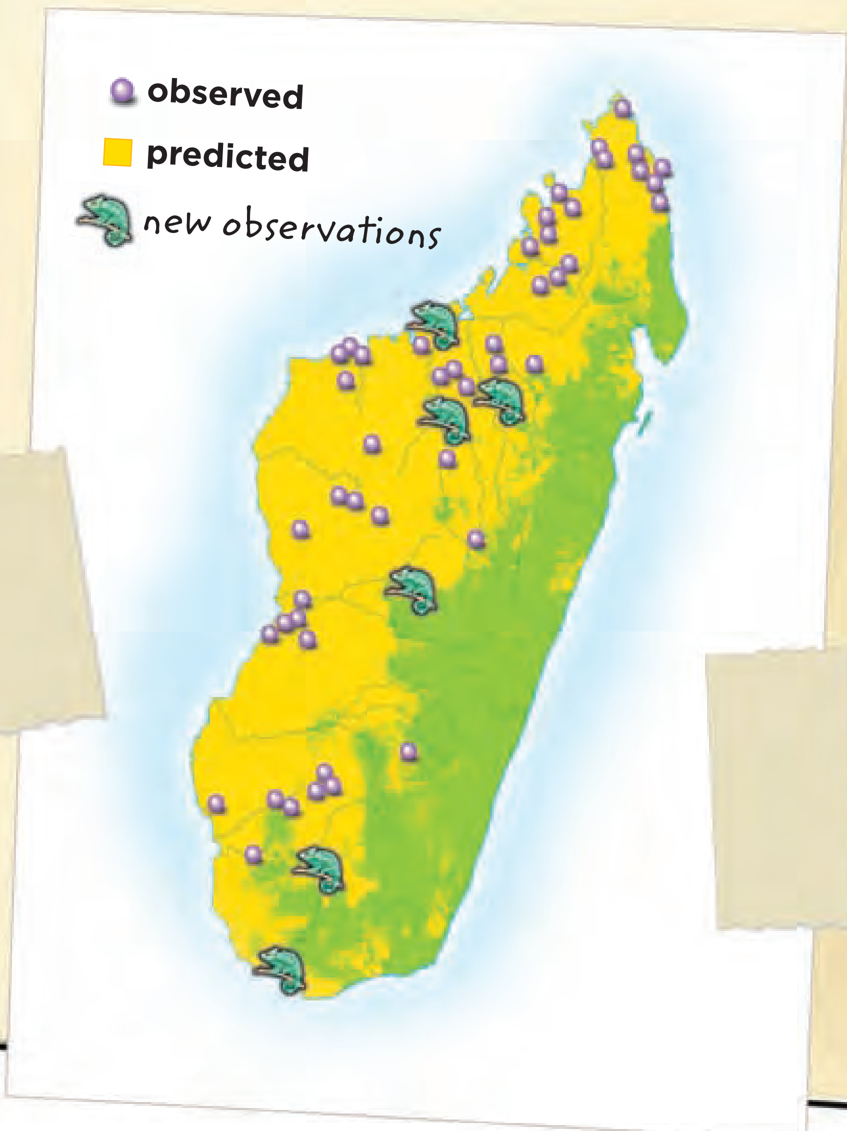
▶ **Make sure that the procedure can be repeated.**

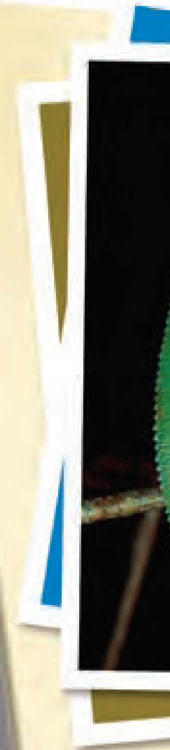
Chris and Paule record data when they find giant Madagascan chameleons and other lizards.

CHRIS'S FIELD JOURNAL

April 9th, 2006
Ambohibola Forest
15mm rain measured in rain gauge
Temperature range from 20-34°C
Heavy afternoon rain shower

This deciduous forest has large trees and cut tree stumps. The forest edge is burnt. Hunting and cattle grazing occur in the forest. It has many small streams that dry up in the winter.





giant Madagascan chameleon
(Furcifer oustaleti)
Found at 10:45 A.M. in grassland with scattered trees. Laid 17 eggs 14x8mm.

Madagascan day gecko
(Phelsuma madagascariensis)
on a tree trunk at 11:30 A.M., in a small clump of trees growing by a small stream.

Analyze the Data

1. Organize the data as a chart, table, graph, diagram, map, or group of pictures.
2. Look for patterns in the data. These patterns can show how important variables in the hypothesis affect one another.

▶ **Make sure to check the data by comparing it to data from other sources.**

How do scientists analyze data?

Part of testing a hypothesis is looking for patterns in the data that has been collected. Chris and Paule study the information from all of the locations they visited. They mark the seven places on the map where they found a giant Madagascan chameleon. Then they look for patterns in their data.

They observe that the chameleons they found were in the yellow area on the map. They talk about the temperatures and rainfall in the places where they found the chameleons.

fantastic leaf-tailed gecko ▼

▲ suraka silk moth

How do scientists draw conclusions?

Did Chris and Paule find chameleons in the new places that the map predicted? Yes! The results support their hypothesis. If a place has a certain temperature and amount of rainfall, then giant Madagascan chameleons can live there.

Chris and Paule report their results so that others can learn from their work. Knowing where the chameleons live can help scientists protect the animals' homes. "This can help biologists make conservation plans for Madagascar," says Paule.

▼ fossa

Malagasy tree frog ▲

Chris and Paule's results lead them to new questions. What other variables affect where giant Madagascan chameleons live? The animals shown on this page all live in Madagascar. Could scientists search for these living things in the same way? Which places on the island are home to the greatest number of plants and animals? New questions can lead to a new hypothesis and to learning new things. Learning more about the animals that live in Madagascar will help protect them.

Draw Conclusions

1. Decide if the data clearly support or do not support the hypothesis.
2. If the results are not clear, rethink how the hypothesis was tested and make a new plan.
3. Write down the results to share with others.

▶ **Make sure to ask questions.**

ring-tailed lemur ▶

Think, Talk, and Write

1. Why is the scientific method useful to scientists?
2. What other questions about animals can you think of? Choose one and form a hypothesis that can be tested.

▼ red millipede

Focus on Skills

Scientists use many skills as they work through the scientific method. Skills help them gather information and answer questions they have about the world around us. Here are some skills they use.


sea star

Observe Use your senses to learn about an object or event.

Form a Hypothesis Make a statement that can be tested to answer a question.

Communicate Share information with others.

Classify Place things with similar properties into groups.

Use Numbers Order, count, add, subtract, multiply, and divide to explain data.

Make a Model Make something to represent an object or event.


lizard

goldfish


beetle

animal	what I observed

▲ **Observe** the animals on these pages. Then make a chart to **communicate** your observations.

SI-3. Read and interpret simple tables and graphs produced by self/others.
SI-5. Record and organize observations (e.g., journals, charts and tables).

hedgehog

parrot

dragonfly

Use Variables Identify things that can control or change the outcome of an experiment.

Interpret Data Use information that has been gathered to answer questions or solve a problem.

Measure Find the size, distance, time, volume, area, mass, weight, or temperature of an object or event.

Predict State possible results of an event or experiment.

Infer Form an idea from facts or observations.

Experiment Perform a test to support or disprove a hypothesis.

snail

Animal Young

Animal	Average Number of Young
beetle	75
sea star	2,000,000
lizard	14
hedgehog	4
gazelle	1

▲ **Use this chart to infer how an animal's size affects how many young it has at a time.**

Inquiry Skill Builder

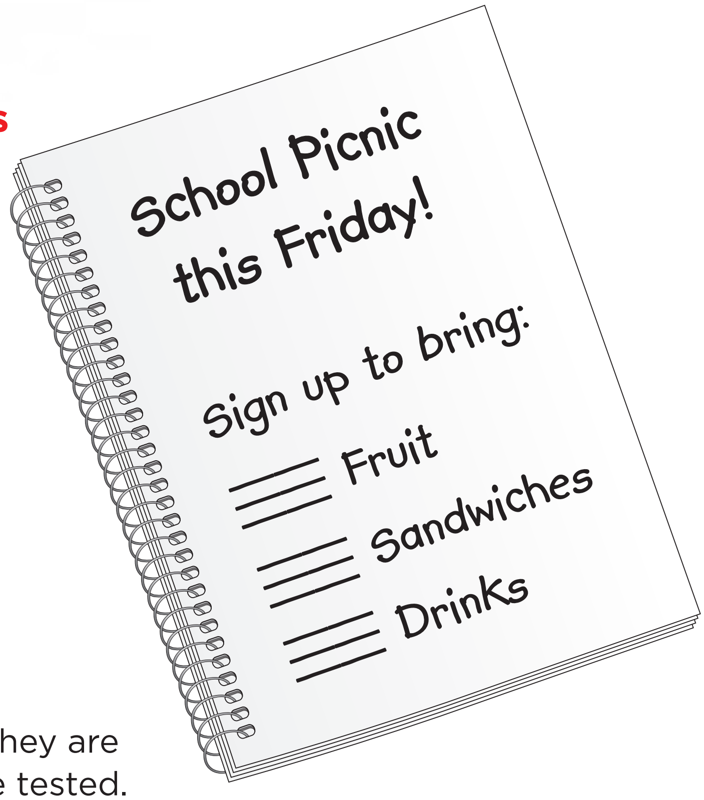
In each chapter of this book, you will find an Inquiry Skill Builder. These features will help you build the skills you need to become a great scientist.

gazelle

Focus on Skills

Science and Technology: The Design Process

Have you ever invented something? You have used the design process! The **design process** is a series of steps for solving problems.



▶ Learn It

The **design process** is like a process you probably use already. First, you identify a problem. Then, you identify several possible solutions.

Sometimes, the best idea cannot be designed. It can be too expensive or the materials are not available. Other times, the design can have harmful results. Finally, not all great ideas work the way they are supposed to. That is why they need to be tested.

▶ Try It

Kay made a sign to tell students about the school picnic. She posted it outside. But the sign kept blowing away!

Help Kay design three solutions to solve her problem. Illustrate them, and include labels. When you have permission from your teacher, test your design.

▶ Apply It

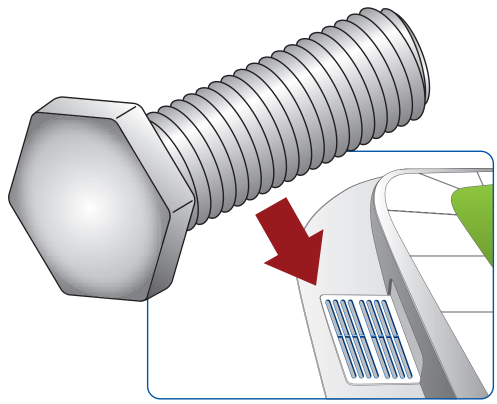
Explain how the **design process** has improved your life. How has it improved your family's life? How has it improved your community?

ST-1. Describe how technology can extend human abilities ... **ST-2.** Describe ways that technology can have helpful and/or harmful results.

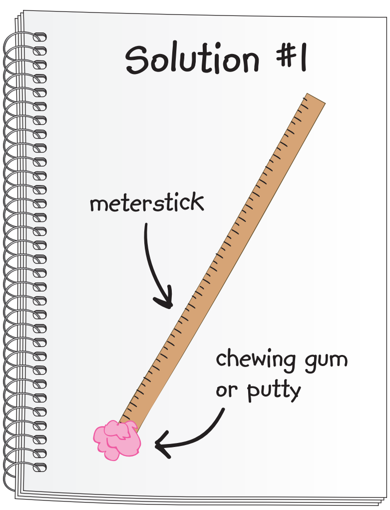
A Simple Design Process

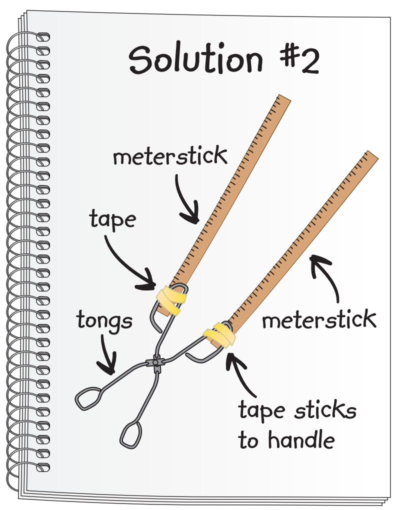
Fredo tried to change his bicycle tire. One of the bolts fell through a sewer grate! Now he cannot put the wheel back on.

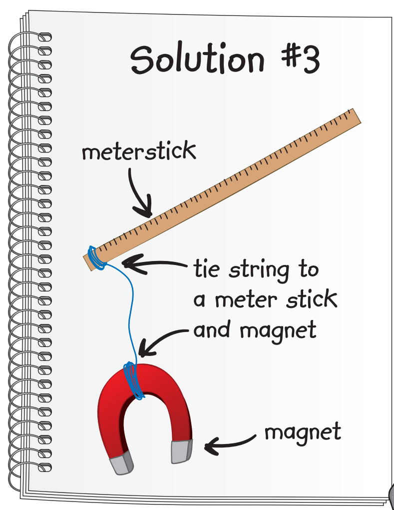
Identify a Problem



Identify Possible Solutions

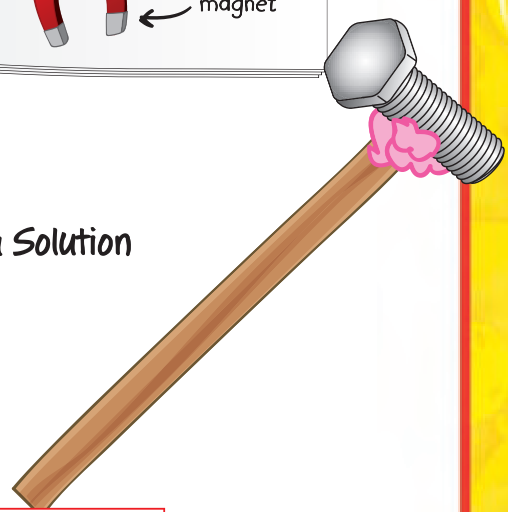






Design a Solution

Fredo did not have a magnet. He did not have tongs. He did have chewing gum. He used a flat stick in place of a meterstick. His design worked!



ST-3. Investigate ways that the results of technology may affect the individual, family, and community. **ST-4.** Use a simple design process to solve a problem.... **ST-5.** Describe possible solutions to a design problem....

Safety Tips

In the Classroom

- Read all of the directions. Make sure you understand them. When you see "**Be Careful,**" follow the safety rules.
- Listen to your teacher for special safety directions. If you do not understand something, ask for help.

- Wash your hands with soap and water before an activity.
- Be careful around a hot plate. Know when it is on and when it is off. Remember that the plate stays hot for a few minutes after it is turned off.
- Wear a safety apron if you work with anything messy or anything that might spill.

- Clean up a spill right away, or ask your teacher for help.
- Dispose of things the way your teacher tells you to.
- Tell your teacher if something breaks. If glass breaks, do not clean it up yourself.

- Wear safety goggles when your teacher tells you to wear them. Wear them when working with anything that can fly into your eyes or when working with liquids.
- Keep your hair and clothes away from open flames. Tie back long hair, and roll up long sleeves.
- Keep your hands dry around electrical equipment.
- Do not eat or drink anything during an experiment.
- Put equipment back the way your teacher tells you to.
- Clean up your work area after an activity, and wash your hands with soap and water.

In the Field

- Go with a trusted adult—such as your teacher, or a parent or guardian.
- Do not touch animals or plants without an adult's approval. The animal might bite. The plant might be poison ivy or another dangerous plant.

Responsibility

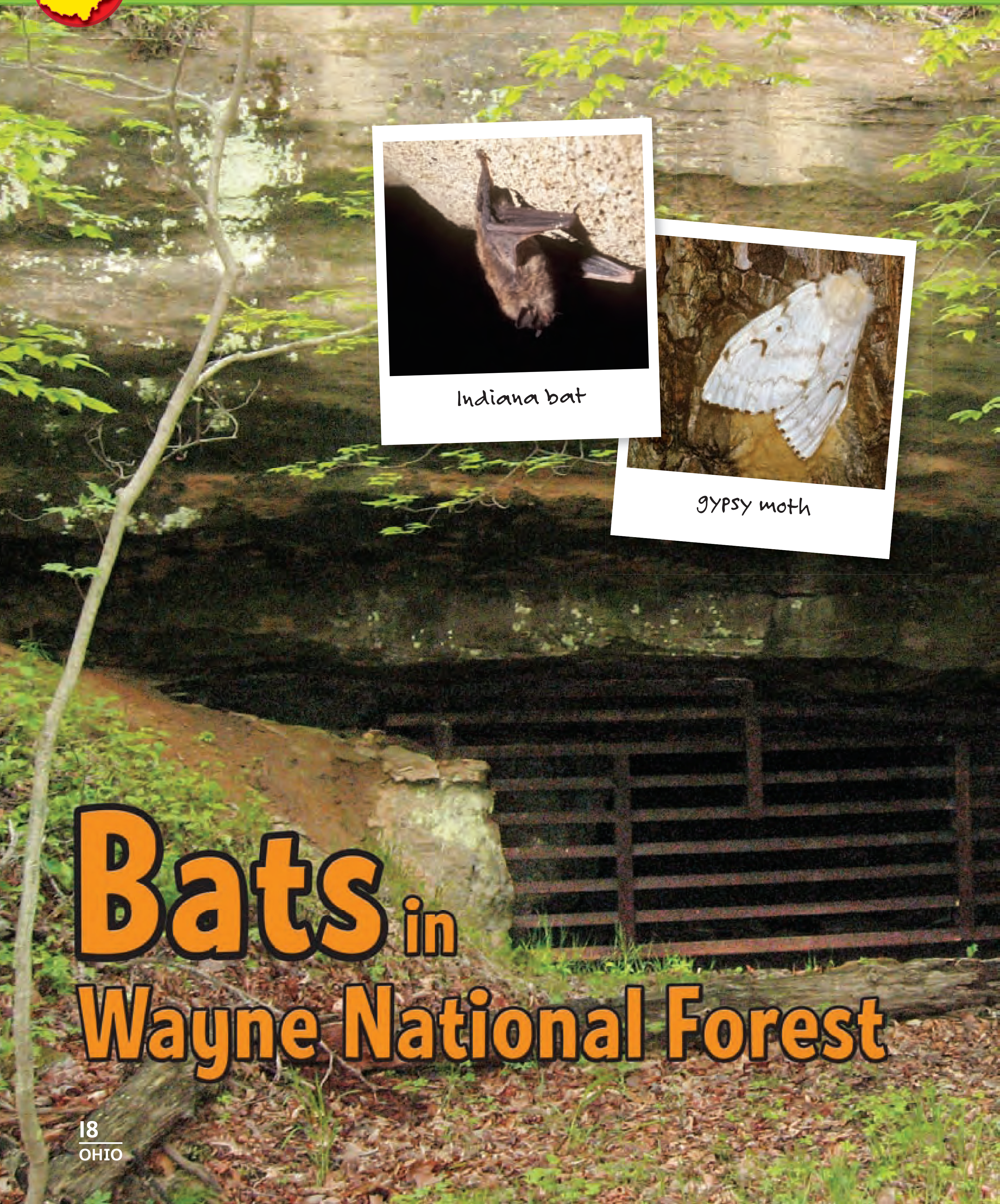
Treat living things, the environment, and one another with respect.

Ohio

Life Sciences

Ladybugs eat insects that can harm crops and flowers.

Ohio state insect: The ladybug



Indiana bat

gypsy moth

Bats in Wayne National Forest

Rare Bats

Wayne National Forest is Ohio's only national forest. In 1997, scientists were surprised to find Indiana bats living there. Indiana bats are *endangered*, which means there are very few of them left.

Bat Gates

Indiana bats live in caves or in old mines that once contained valuable rocks or metals. During the winter, many bats *hibernate*, or sleep very deeply. They do not even eat while they are hibernating! Bats that hibernate live off stored fat. If people disturb Indiana bats while they are hibernating, the bats might use up their stored fat and die.

In 2001, scientists put up special gates on the entrances to the Wayne National Forest mines where the Indiana bats live. The gates keep people out but let bats go through. Indiana bats are very small and do not bother people. They are helpful because they eat many harmful insects, such as gypsy moths. The bat gates protect the endangered bats. Now Wayne National Forest has twice as many Indiana bats as before!

Think, Talk, and Write

Critical Thinking How can people harm bats? How can we help them?

Ohio

A CLOSER LOOK

Main Idea

People can help endangered animals and plants.

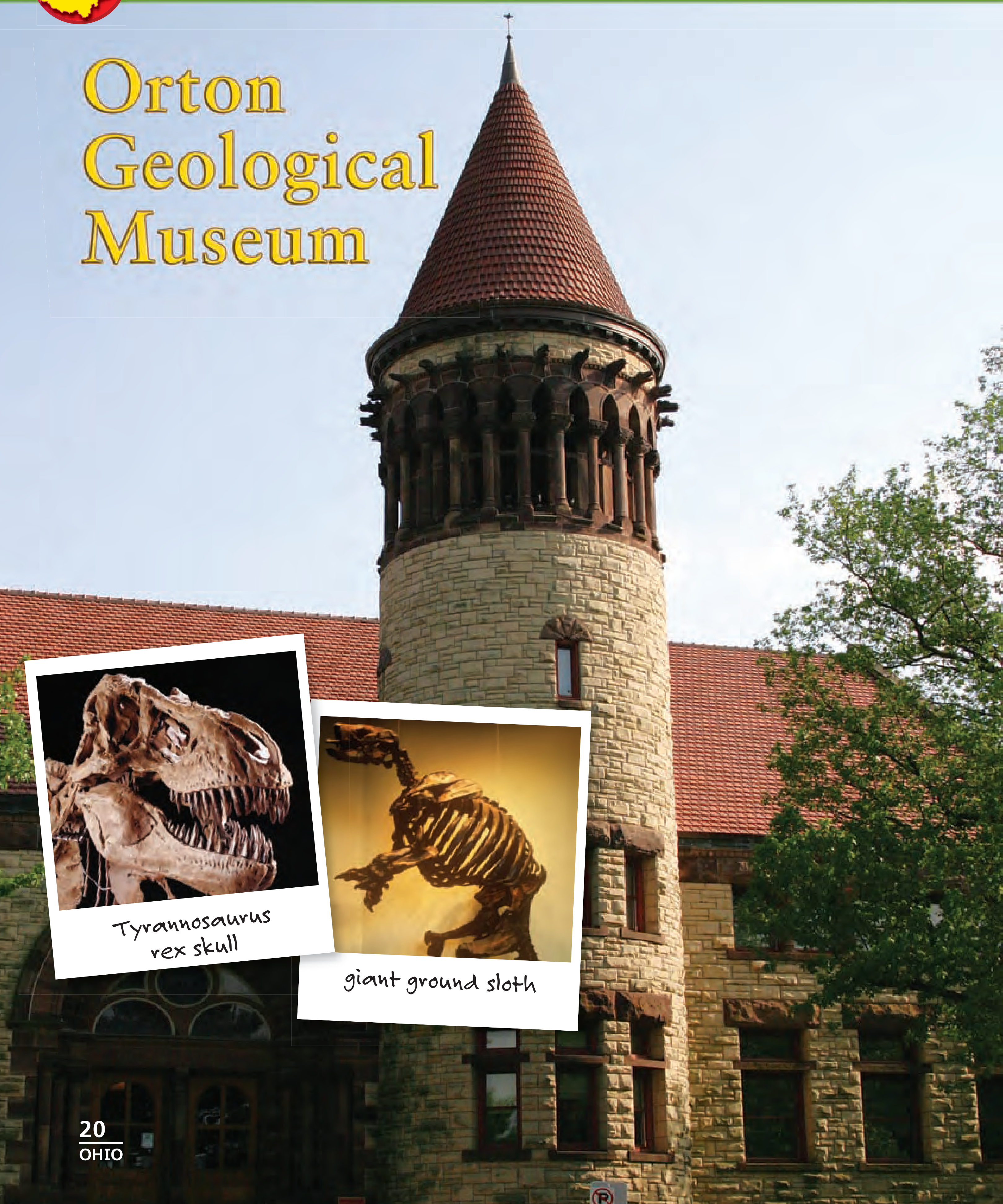
Activity

Observe Look at pictures of endangered plants and animals.

- Pick one plant or animal and find out why it is endangered.
- Draw a picture of how you could help this plant or animal survive.

LS-6. Describe how changes in an organism's habitat are sometimes beneficial and sometimes harmful.

Orton Geological Museum



Tyrannosaurus rex skull

giant ground sloth

A Trip in Time

Visiting the Orton Geological Museum in Columbus, Ohio, is like taking a trip back in time. One of the items on display at the museum is a skeleton of a giant ground sloth. Only a few giant ground sloth fossils have been found in Ohio. Other fossils you can see in the museum include mammoth teeth and a full-sized model of a *Tyrannosaurus rex* skull.

Fossil Finds

Fossils are the imprints or remains of organisms that lived in the past. Hard body parts such as teeth, bones, and shells are often preserved as fossils. Soft parts usually decay or get eaten.

Many organisms of the past, such as the giant ground sloth, are extinct. An organism is *extinct* when there are no more of its kind alive. Fossils help scientists learn about past organisms and environments. For example, shell fragments have been found in mountain rocks. These findings tell scientists that the land was once underwater.

Think, Talk, and Write

Critical Thinking You find fossils of whales and dolphins in a desert. What do you think this area looked like in the past?

LS-5. Observe and explore how fossils provide evidence about animals that lived long ago and the nature of the environment at that time.

Ohio

A CLOSER LOOK

Main Idea

Fossils give scientists clues about what both organisms and Earth were like in the past.

Activity

Communicate What fossils have been found in Ohio?

- Use research materials to find out more about Ohio's fossils.
- Collect pictures of these fossils and make a poster that shows what you have learned.

CHAPTER 1

A Look at Living Things

The Big Idea

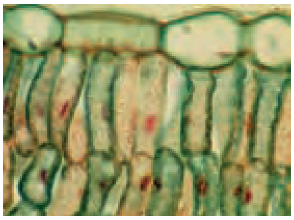
How do living things get what they need to live and grow?

Gecko hatches from an egg.

Key Vocabulary

organism
a living thing (p. 26)

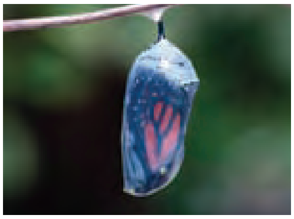
environment
all the living and nonliving things that surround an organism (p. 28)



cell
the basic building block that makes up all living things (p. 30)

vertebrate
an animal with a backbone (p. 46)

invertebrate
an animal that does not have a backbone (p. 47)



metamorphosis
a series of changes in which an organism's body changes form (p. 59)

More Vocabulary

respond, p. 26

reproduce, p. 27

lung, p. 39

gills, p. 39

shelter, p. 40

exoskeleton, p. 49

bird, p. 50

reptile, p. 50

amphibian, p. 51

fish, p. 51

mammal, p. 52

egg, p. 59

larva, p. 59

pupa, p. 59

LS-A. Differentiate between the life cycles of different plants and animals. **LS-B.** Analyze plant and animal structures and functions needed for survival....

Lesson 1

Living Things and Their Needs

Watering hole in Namibia, Africa

Look and Wonder

Living and nonliving things can be found all over Earth. How can you tell the difference between living and nonliving things? How many of each can you see here?

Building block lesson for LS-2. Relate animal structures to their specific survival functions (e.g., obtaining food, escaping or hiding from enemies).

Explore

Inquiry Activity

How do living and nonliving things differ?

Purpose

Find out some characteristics of living and nonliving things.

Procedure

1. **Predict** How are all living things alike? How are nonliving things alike?
2. Make a table. Label the columns *Living Things* and *Nonliving Things*.
3. Place 4 pieces of string outside on the ground so that they form a square.
4. **Observe** Look for living things in your square area. List them in your table. Tell how you know they are living. Do the same with nonliving things that you see.

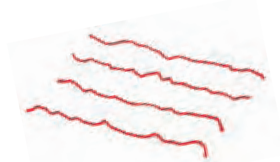
Draw Conclusions

5. **Interpret Data** What characteristics do the living things share? Which do the nonliving things share?
6. Trade tables with a partner. Do the things on your partner's table share the same characteristics as yours?
7. **Infer** How are living things different from nonliving things?

Explore More

Experiment Does the amount of sunlight affect how many living things are in an area? How could you test this?

Materials



four 1-meter pieces of string

Step 2

Living Things	Nonliving Things

Step 4

Read and Learn

Main Idea LS-2

All living things have certain characteristics and needs in common.

Vocabulary

organism, p. 26

respond, p. 26

reproduce, p. 27

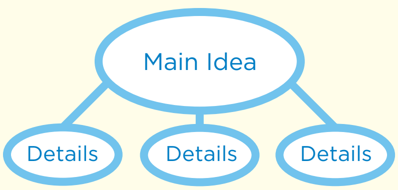
environment, p. 28

cell, p. 30

LOG ON e-Glossary at www.macmillanmh.com

Reading Skill

Main Idea and Details



What are living things?

Look outside. Do you see any plants or animals? Plants and animals are living things. What are some characteristics that all living things share?

Living Things Grow

Living things are called **organisms** (AWR•guh•niz•uhmz). All organisms use energy to grow. To *grow* means to change with age. A young sunflower plant is small and green. Over time, it grows taller and its stem grows harder. Eventually, a flower forms. A young bird grows into an adult. It gets bigger and less fuzzy.

Living Things Respond

Living things **respond** (ri•SPOND), or react, to the world around them. When a plant is in shade, it responds by bending toward sunlight. When a bird sees a cat and senses danger, it may fly high into the trees. When a day gets hot, a lizard may go underground to keep cool.

Living Things Grow

Read a Photo

How will the small gulls change as they grow?

Clue: Young organisms grow more similar to their parents.

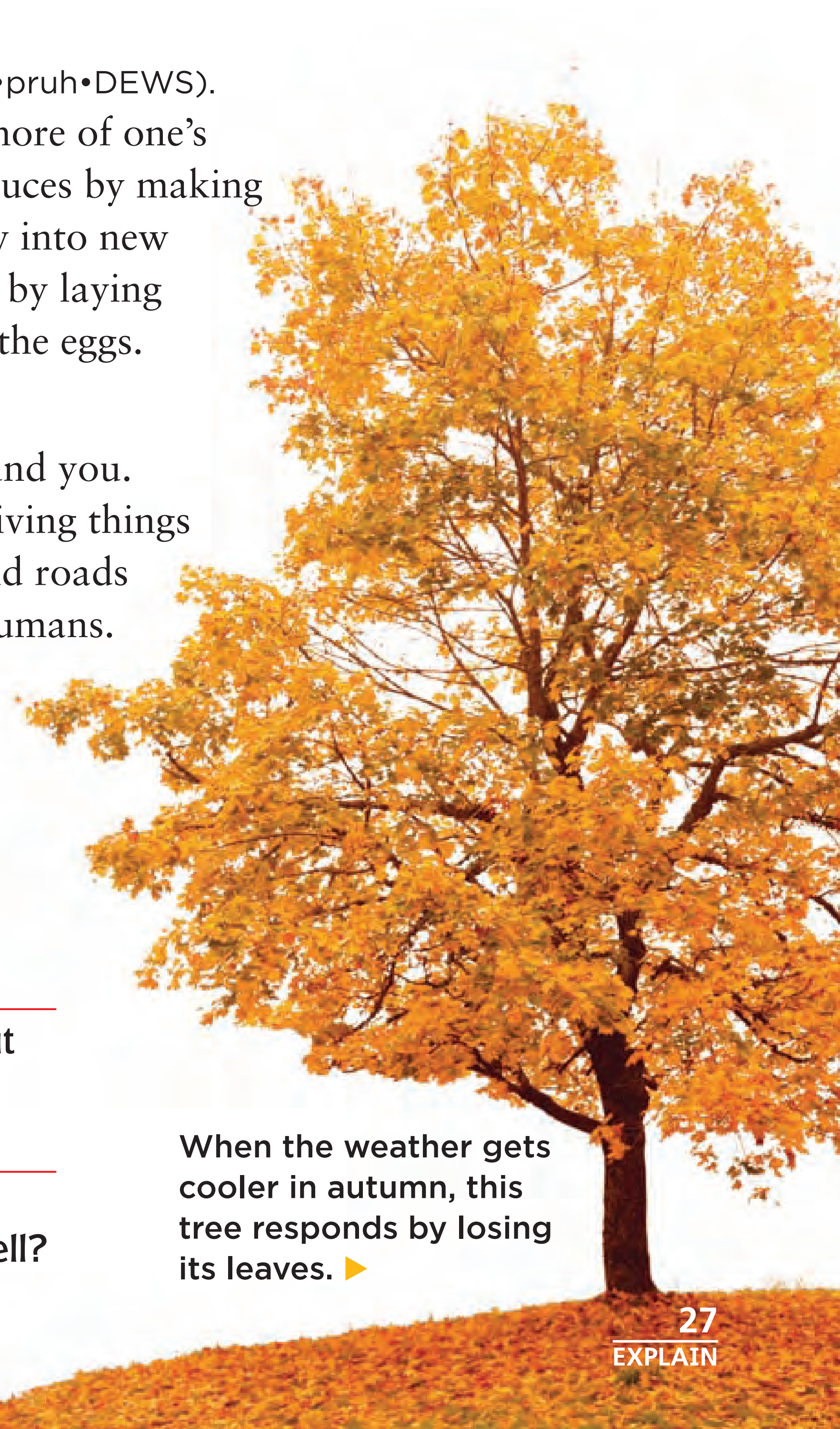
When skinks reproduce, the female lays eggs. New skinks hatch from the eggs.

Living Things Reproduce

Living things reproduce (ree•pruh•DEWS). To **reproduce** means to make more of one's own kind. An apple tree reproduces by making apple seeds. The seeds can grow into new apple trees. A turtle reproduces by laying eggs. Young turtles hatch from the eggs.

Nonliving Things

Nonliving things are all around you. Rocks, soil, and water are nonliving things that come from nature. Cars and roads are nonliving things made by humans. Nonliving things are different from living things. They do not use energy to grow, respond, or reproduce.



When the weather gets cooler in autumn, this tree responds by losing its leaves.

Quick Check

Main Idea and Details What are some characteristics of living things?

Critical Thinking Is a toy a living thing? How can you tell?

What do living things need?

Living things have needs. They need food, water, and space. Many also need gases found in air or water. A living thing will die if its needs are not met.

Living things get everything they need to survive from their environment (en•VYE•ruhn•muhnt). An **environment** is all the living and nonliving things that surround an organism.

A caterpillar gets the energy it needs to grow by eating leaves.

Food

Living things need energy to live and grow. They get energy from food. Animals get food by eating other organisms. Plants make their own food using energy from sunlight.

Water

Did you know that more than half of your body is water? All living things are full of water. They use the water in their bodies to break down food and get rid of waste. They use it to transport food throughout their bodies. Living things need a regular supply of water to stay healthy.

These plants soak up water from wet soil in their environment.

Gases

Animals need oxygen (OK•suh•juhn) to survive. *Oxygen* is a gas found in air and water. Every time you breathe, you take in oxygen from the air. Fish, clams, and most other sea animals get oxygen from the water around them.

Plants need oxygen and a gas called *carbon dioxide* (KAHR•buhn dye•OK•side). They use energy from sunlight to change carbon dioxide and water into food.

Space

Organisms need space, or room. Plants need space to grow and find water and sunlight. Animals need space to move and find food. Different organisms need different amounts of space. Whales swim for miles in oceans. Goldfish can live in tiny ponds.

Quick Check

Main Idea and Details What are some things that all organisms need to survive?

Critical Thinking What might happen to an animal in a crowded environment?

▲ Some water animals, such as this manatee, must come to the surface to take in oxygen from the air.

▲ Foxes hunt in forests and fields. Small dens help them stay safe.

Quick Lab

Observe Cells

1. **Observe** Look at a piece of onion. Then observe it using a hand lens. What do you see?
2. **Communicate** Draw how the onion looks when viewed with a hand lens.
3. **Observe** Look at a slide of an onion under a microscope. What do you see? Is there any space between the cells?

4. **Communicate** Draw how the onion looks when viewed with a microscope. Then compare your two drawings.
5. **Infer** How small are cells? What tool do you need to observe cells?

What are living things made of?

How are you like a brick building? The building is made of many small bricks. You are made of many small parts called cells. **Cells** are the building blocks of life. All organisms are made up of one or more cells.

Cells are too small to see with just your eyes. They are so small that it takes millions to make one little ant. You need a tool called a *microscope* (MYE•kruh•skohp) to observe cells. A microscope makes tiny things look larger.

Some organisms are made of a single cell. Organisms called bacteria are an example. They live in soil and water. Some live on our skin and in our bodies!

Quick Check

Main Idea and Details What are cells?

Critical Thinking What do you think cells need to survive?

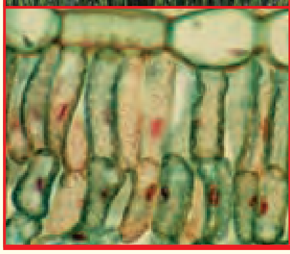
These cells from a lilac leaf were magnified with a microscope.

Lesson Review

Visual Summary

Living things grow, respond, and reproduce.

Living things **need** food, water, gases from air or water, and space to live.



Living things are made of **cells**.

Make a FOLDABLES™ Study Guide

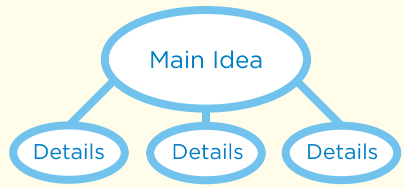
Make a Three-Tab Book. Use it to summarize what you learned about living things and their needs.

Think, Talk, and Write

1. **Main Idea** How can you tell the difference between a living and nonliving thing?

2. **Vocabulary** What is an environment?

3. **Main Idea and Details** What do living things need to survive?



4. **Critical Thinking** Suppose you wanted to grow plants in your backyard. What would you do?

5. **Test Prep** **People need all of the following to survive EXCEPT**
   - **A** air.
   - **B** water.
   - **C** cars.
   - **D** space.

Writing Link

Write a Story
Suppose you were a bird. What would you need to live? How would your life be different? Research to learn more about birds. Write a story about life as a bird.

Health Link

Food Pyramid
People need the right balance of foods to stay healthy. The Food Guide Pyramid shows this balance. Do research to find out about the Food Guide Pyramid.

Real World

Reading in Science

EATING AWAY AT POLLUTION

You cannot see microorganisms, but they are all around you. Microorganisms are tiny living things. You need a microscope to see them. Many are made of just one cell.

Some microorganisms are harmful. They can make animals and plants sick. Others are helpful. They can eat things that are harmful to plants and animals. Some can even help clean up Earth's water, land, and air. Scientists use these tiny organisms to eat pollution.

American Museum of Natural History

Some microorganisms eat oil. When oil spills on water or soil, the tiny creatures eat the oil. The waste they leave behind is safe for the environment. Other microorganisms can help keep air clean. Factories and power plants often produce a lot of smoke. Microorganisms can eat dangerous chemicals in the smoke that would pollute the air.

Classify

When you classify

- you compare things to see how they are alike and different
- you put things into groups based on their characteristics

Workers spray microorganisms onto an oil spill in Alaska. The round photo shows the microorganisms as seen through a microscope.

Write About It

Classify This article explains that some microorganisms are harmful and others are helpful. This is a way to classify them. Read the article again with a partner. Look for another way to classify microorganisms. Then write about it.

LOG ON e-Journal Write about it online at www.macmillanmh.com

ST-2. Describe ways that using technology can have helpful and/or harmful results.

Lesson 2

Animals and Their Parts

Look and Wonder

This koala bear's strong arms and teeth help it get food. Do all animals use the same structures to get what they need?

LS-2. Relate animal structures to their specific survival functions (e.g., obtaining food, escaping or hiding from enemies).

How do an animal's structures help it meet its needs?

Purpose

Observe a snail to learn about its structures.

Procedure

1. **Observe** Look at the snail. What parts does it have? Do you see legs or eyes?

   ⚠ **Be Careful.** Handle animals with care.

2. Draw the snail. Label all the parts you can.
3. **Predict** Which parts help the snail move? Which parts help it get food or stay safe?
4. **Experiment** Gently touch the snail with a cotton swab. Observe the snail's actions for a few minutes. Record what you see.
5. **Experiment** Place a wet paper towel in the container. Record the snail's actions. Now repeat this step using a lettuce leaf.

Draw Conclusions

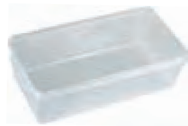
6. **Communicate** On your drawing, circle the parts that the snail used to move and to eat—if it ate. Describe how it responded to its environment.
7. **Infer** Think about other animals you have seen, such as hamsters, birds, and fish. Do they have the same parts as the snail? What parts do they use to meet their needs?

Explore More

Experiment Does the snail respond to light and dark? Make a plan and find out.

Materials


snail


clear plastic container


cotton swab


paper towel


water


lettuce leaf

Step 2


Step 4


SWK-I. Describe different kinds of investigations that scientists use depending on the questions they are trying to answer.

Read and Learn

Main Idea LS-2

Animals have structures that help them get what they need from their environments. Different kinds of animals have different structures.

Vocabulary

lung, p. 39

gills, p. 39

shelter, p. 40

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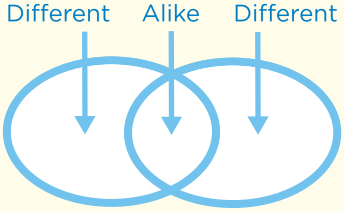
Reading Skill

Compare and Contrast



When wasps sense danger near their nest, they respond by stinging.

A hummingbird beats its wings so fast that it hovers like a helicopter.

What are animals?

What do snails, elephants, and even tiny ants have in common? They are all part of a group of living things called *animals*. Animals are organisms made of many cells. Animals cannot make their own food. They must eat other organisms to get energy and nutrients.

Animals have certain traits in common. Most animals can move. Birds can fly. Foxes can run and jump. Sharks can swim.

Animals respond to their environments in noticeable ways. They use their senses to get information. A wolf may growl when it sees, hears, or smells another wolf near its young. A snake may lie in the Sun when it feels cold. A cat may look for food when it is hungry.

Animals have certain kinds of structures, or parts, that help them get what they need. Ears, eyes, legs, fins, and wings are some animal structures. Can you think of others?

How Animals Move

Animals move to find food and water. They move to escape danger. Animals may use feet, legs, tails, wings, or other structures to move.

Animals such as wolves, cheetahs, and house cats have strong legs for running and jumping. Big, rough paws help them balance.

Some animals do fine with no legs. Snails make a trail of slime to slide on. They use muscles on their underside to push themselves forward. Snakes use their whole bodies to slither forward. Birds fly and glide through the air with wings.

▲ This snake's slithering has left a trail on the sand.

Quick Check

Compare and Contrast What are some different ways that animals move?

Critical Thinking How can you tell that a cat is an animal?

To jump, this wolf pushes off with its strong back legs.

How do animals get what they need?

Animals need water, food, and oxygen. They have structures that help them get these things.

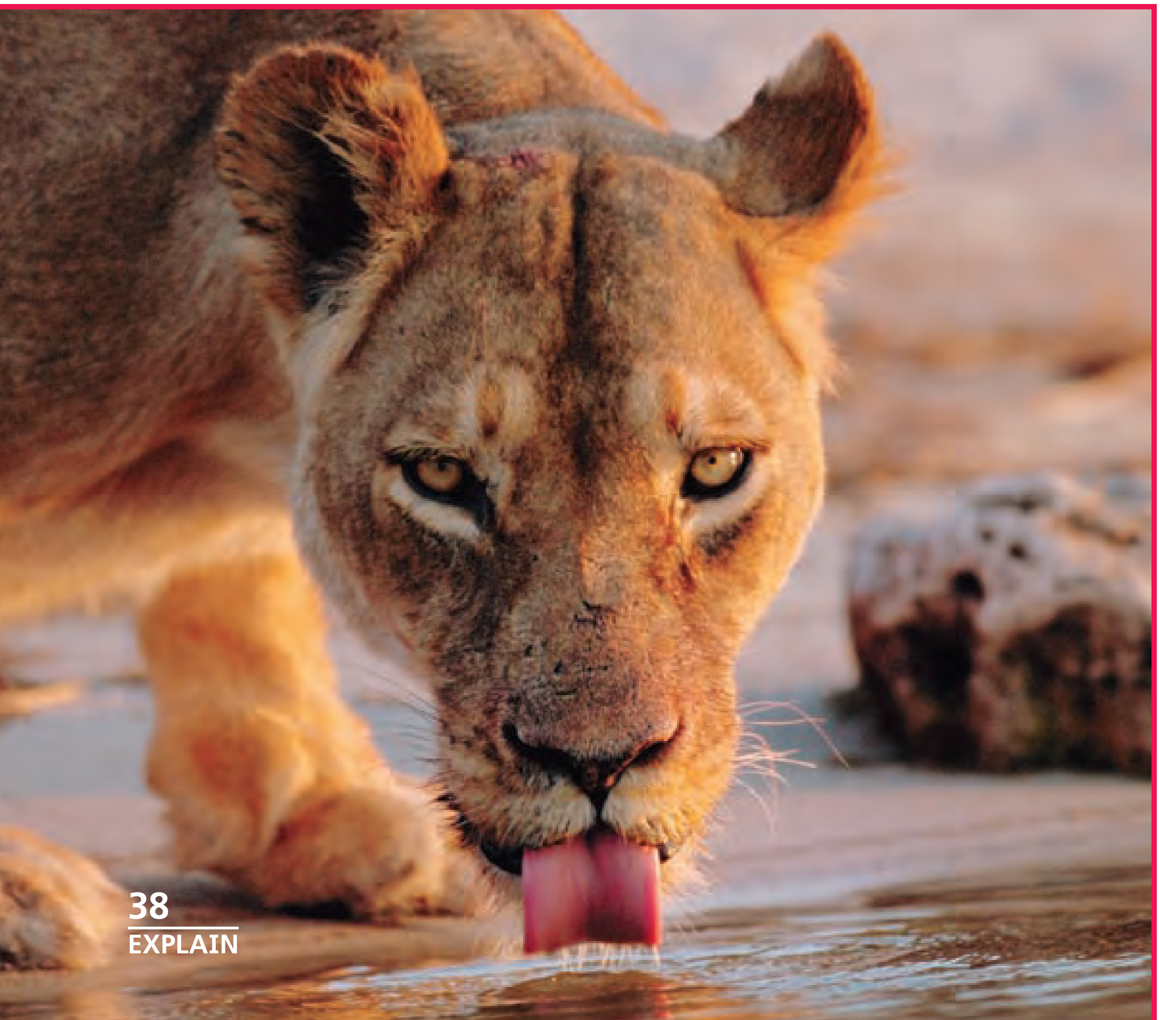
Obtaining Water and Food

Some animals have long tongues for lapping water. Birds scoop up water in their beaks. Elephants pick up water in their trunks then pour it into their mouths.

The same structures help animals obtain food. Lions scrape meat from bones with their rough tongues. Birds grab worms or seeds with their beaks. Elephants use their trunks to pull plants to their mouths.

Lions and many other animals have long, sharp front teeth. These are good for biting. Many animals have flat back teeth for chewing. Strong jaws help some animals bite and chew.

This squirrel uses its paws and sharp teeth to eat an acorn.



A big, strong tongue helps this lion lap up water.

Getting Oxygen

Animals breathe to get oxygen. Many animals breathe with lungs. **Lungs** are structures that take in oxygen from the air. Fish get oxygen using gills. **Gills** are structures that take in oxygen from the water.

Some animals can breathe without lungs or gills. Worms and salamanders, for example, take in oxygen through their skin.

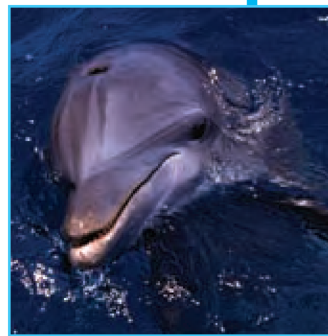
Quick Check

Compare and Contrast How are lungs like gills? How are they different?

Critical Thinking What structures do you use to eat food?

Quick Lab

Observe Animal Structures

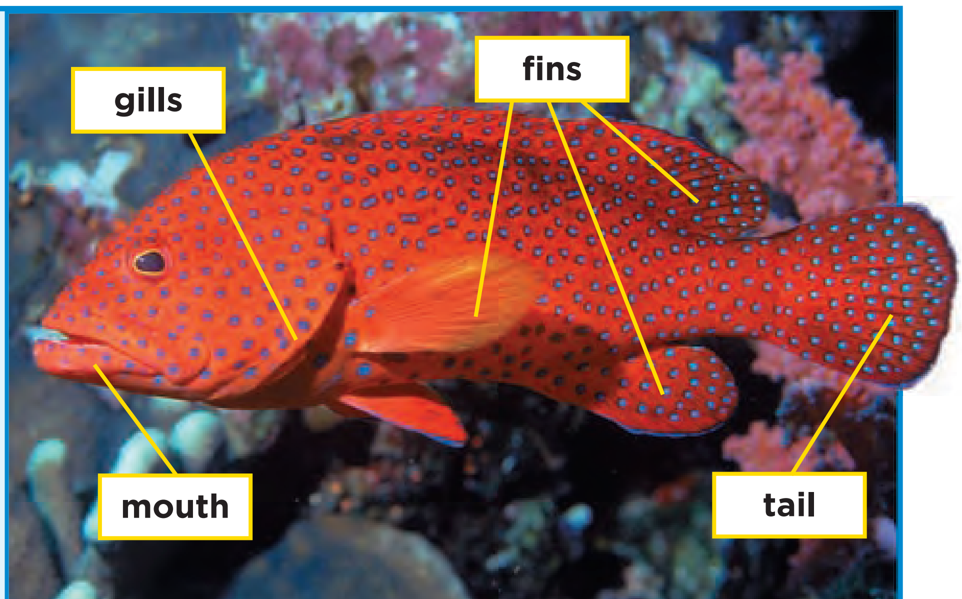


1. Look for photos of dolphins in magazines or other resources.
2. **Infer** Look at the dolphins' structures. How does a dolphin use its tail? How does it use its blowhole? What structures help it get food?
3. **Communicate** Make a data table to show how each structure helps a dolphin meet its needs.

Breathing and Moving

Breathing Water enters the fish's mouth and exits through the gills. As water flows out, the gills take in oxygen from the water.

Moving A fish moves forward by waving its muscular tail. Fins help the fish steer toward food or away from danger.



Read a Photo

Which two structures help fish get oxygen?

Clue: Labels and captions give information.

▲ A bird builds a nest to keep its young safe.

▲ Young kangaroos stay safe in their mother's pouch.

How do animals stay safe?

Animals need a way to stay safe in their environments. They must protect themselves from bad weather or escape from other animals. Some animals stay safe by finding a safe place, or **shelter**. Other animals have structures that help protect them.

Some animals find shelter in the ground. Groundhogs dig holes in the soil with their paws. Lizards flatten their bodies and crawl under rocks.

Other animals use trees or other plants for shelters. Birds build nests as shelters for their young. They use their beaks and feet to gather materials and build their nests.

Some animals have structures that protect their bodies. A porcupine's sharp quills help keep away other animals. A snail's hard shell protects it. Fur can shield animals from the cold.

Quick Check

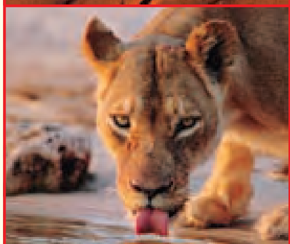
Compare and Contrast Describe two different ways that animals stay safe.

Critical Thinking Think of some animals you know. How do they stay safe?

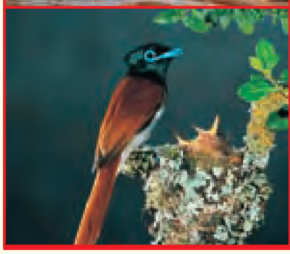
Lesson Review

Visual Summary

All animals have some characteristics in common. Most have structures that help them **move**.



Animals have structures that help them get **food**, **water**, and **oxygen**.



Some animals find shelter in which to **stay safe**. Others have structures that keep them safe.

Make a FOLDABLES™ Study Guide

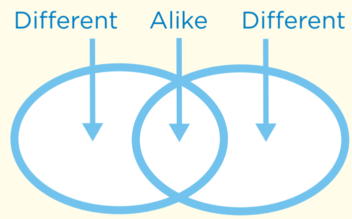
Make a Layered-Look Book. Use it to summarize what you learned about animals and their structures.

Think, Talk, and Write

1. **Main Idea** How are animals alike?

2. **Vocabulary** What is a shelter?

3. **Compare and Contrast** How are an animal's needs like a plant's needs? How are they different?



4. **Critical Thinking** How might long legs help a bird that lives in a pond environment?

5. **Test Prep** **Animals use all of the structures below to get oxygen EXCEPT**

   A lungs.
   B gills.
   C eyes.
   D skin.

Writing Link

Writing That Compares
Choose two animals. How are these animals alike? How are they different? Write an essay that compares the animals and how they meet their needs.

Social Studies Link

Do Research
People need shelter to stay safe from danger and harsh weather. Research homes from around the world. How do homes from different places compare?

Focus on Skills

Inquiry Skill: Classify

Earth is a big place. Millions of living things find homes in many different environments around our planet. With so many living things and so many environments, what can scientists do to understand life in our world? One thing they do is **classify** living things.

▶ Learn It

When you **classify**, you put things into groups that are alike. Classifying is a useful tool for organizing and analyzing things. It is easier to study a few groups of things that are alike than millions of individual things.

▶ Try It

Scientists **classify** plants. They classify animals, too. Can you?

1. To start, observe the animals shown on the next page. Look for things they have in common.
2. Then come up with a rule. What characteristic can you use to group the animals? Let's try wings. Which animals have wings? Which animals do not? Make a table to show your groups.

Wings	No Wings

rhea

▶ Apply It

Classify these animals using your own rule.

fish

eagle

frog

dog

chameleon

butterfly

bear

wild sheep

snake

squirrel

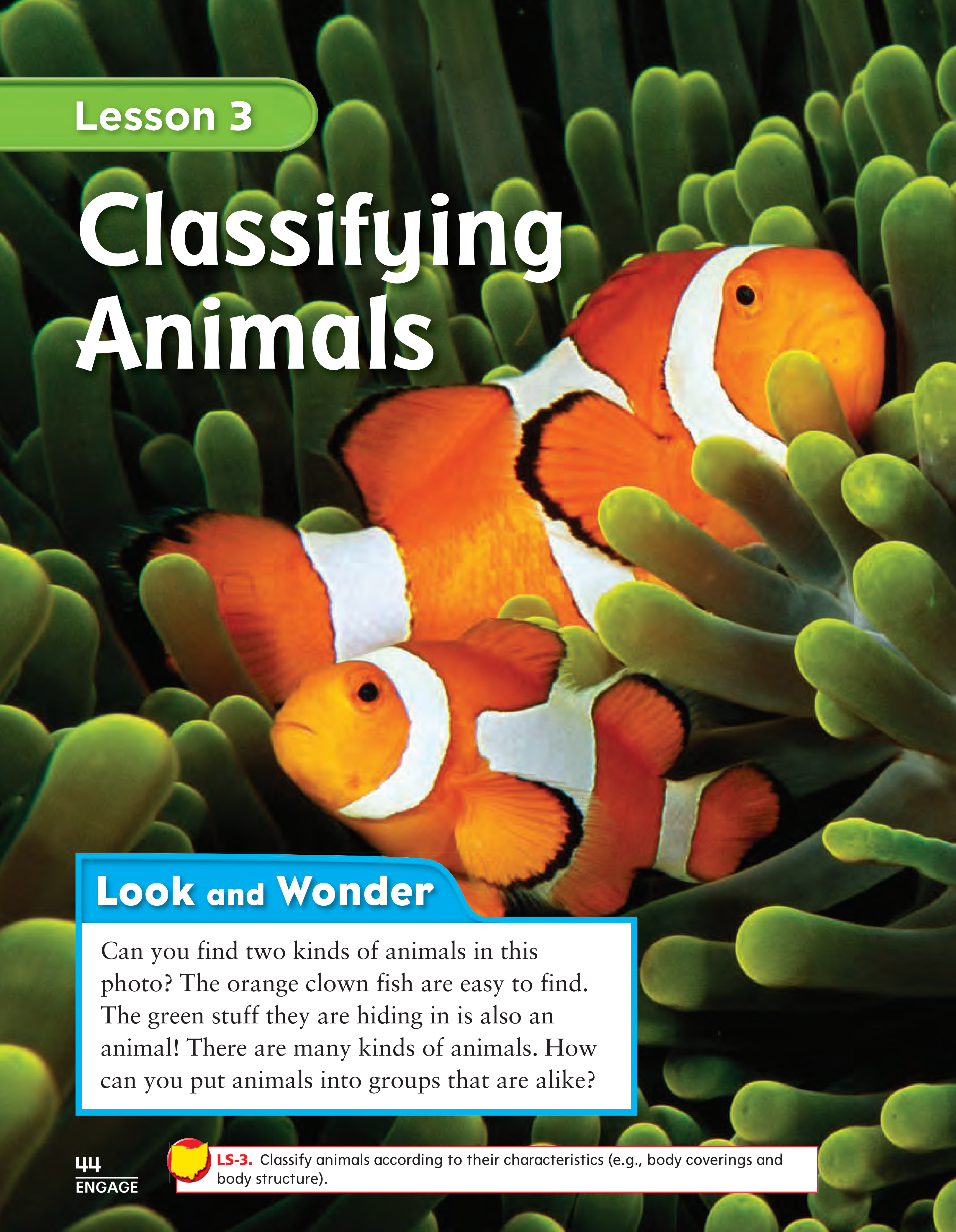
tiger

dragonfly

SI-5. Record and organize observations (e.g., journals, charts and tables).

Lesson 3

Classifying Animals



Look and Wonder

Can you find two kinds of animals in this photo? The orange clown fish are easy to find. The green stuff they are hiding in is also an animal! There are many kinds of animals. How can you put animals into groups that are alike?

LS-3. Classify animals according to their characteristics (e.g., body coverings and body structure).

Explore

Inquiry Activity

How can you classify animals?

Purpose

Classify animals to form groups that have similar characteristics.

Procedure

1. **Observe** Look at each animal. What structures does each animal have? Does each animal have legs? If so, how many? Does each animal have a distinct head and body?
2. **Communicate** Make a chart like the one shown. Use words and pictures to describe characteristics of each animal.
3. **Classify** Put the animals into groups that are alike. Use the information in your chart to help you. Is there more than one way to group the animals?

Draw Conclusions

4. **Interpret Data** Which two animals are most similar to each other?
5. **Communicate** What rule did you use to classify the animals? Why did you classify the animals the way you did?

Explore More

Classify What other animals fit into your groups? Add animals to each of your groups. Research any animals you are not sure of.

Materials


4 plastic containers


hand lens


worm


beetle


snail


ant

Step 1

Step 2

Animal Structure	beetle	snail	worm	ant
legs	6			
antennae	2			
head				
mouth				
eyes				
shell				

SI-5. Record and organize observations (e.g., journals, charts, and tables).

Read and Learn

Main Idea LS-3

Animals can be classified based on their structures.

Vocabulary

vertebrate, p. 46

invertebrate, p. 47

exoskeleton, p. 49

bird, p. 50

reptile, p. 50

amphibian, p. 51

fish, p. 51

mammal, p. 52

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Reading Skill

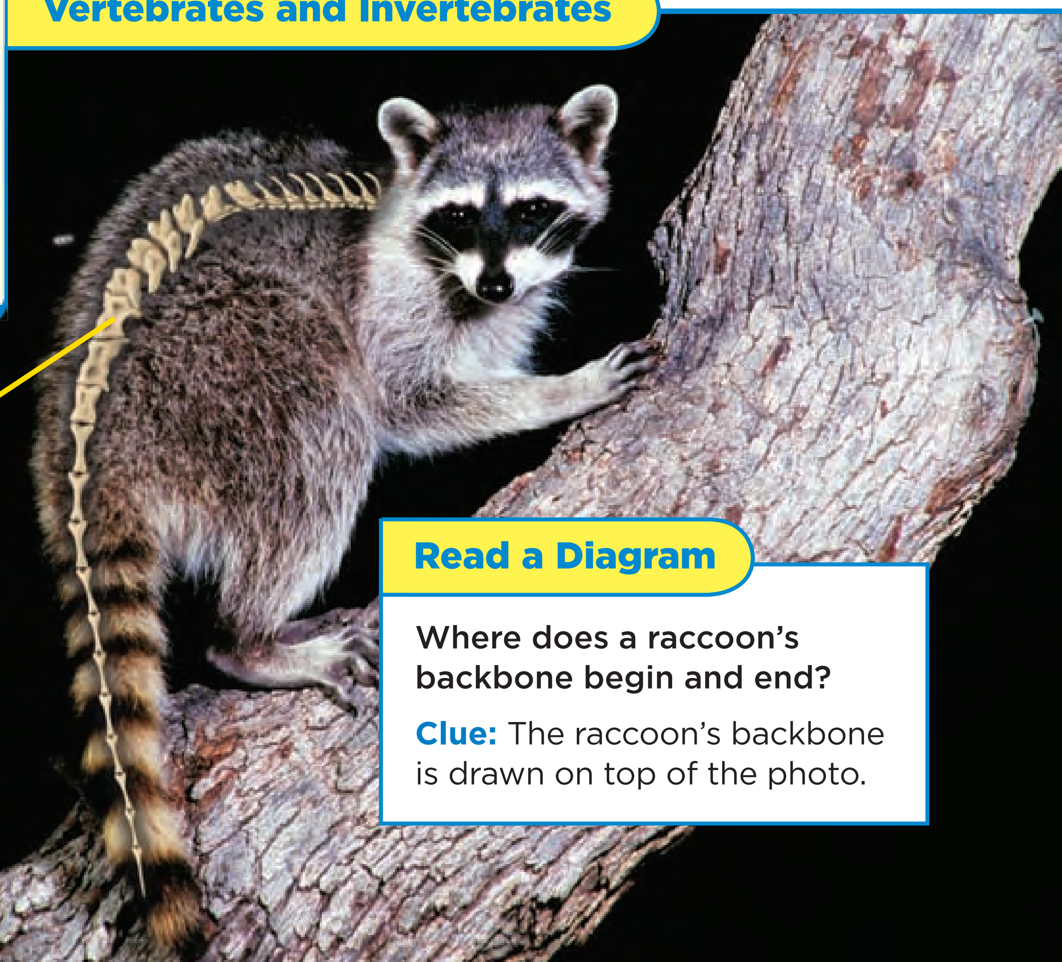
Classify

How can you classify animals?

What does an animal look like? There is no one answer. Tigers, ants, bluebirds, and sharks are all animals. They all move and respond to their environment. They all reproduce and have the same basic needs. Yet they are all very different from each other. Classifying animals to form smaller groups makes it easier for scientists to study them. One way scientists classify animals is by their structures.

One structure that is useful for classifying animals is a backbone. A backbone is made of many small bones running down the center of an animal's back. Animals with backbones are called **vertebrates** (VUR•tuh•brits). Tigers, dogs, eagles, and goldfish are all examples of vertebrates.

Vertebrates and Invertebrates



A raccoon is a vertebrate. Its backbone helps hold up its body.

Read a Diagram

Where does a raccoon's backbone begin and end?

Clue: The raccoon's backbone is drawn on top of the photo.

Animals without backbones are called **invertebrates** (in•VUR•tuh•brits). Most of the animals on Earth are invertebrates. Invertebrates lack more than backbones. They have no bones inside their bodies at all! Insects, spiders, worms, and jellies are common invertebrates.

Quick Check

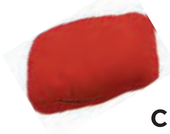
Classify What characteristic separates vertebrates from invertebrates?

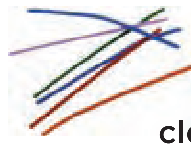
Critical Thinking How do bones help vertebrates?

Quick Lab

Model a Backbone

1. **Observe** Look at the photo of the raccoon. What does its backbone look like?
2. **Make a Model** Use clay and pipe cleaners to make a model of a backbone. Design your model so that it can bend from side to side and forward and backward.





3. **Experiment** How can your model move? Can you move one bone without moving all the others?
4. **Infer** If a backbone were one solid bone, could it move in the same ways?

A jelly is an invertebrate that lives in the ocean. The water helps hold up its body.

What are some invertebrates?

Invertebrates can be found all over Earth. They live on land and in water. Most are small, like insects. A few, such as the giant squid, can grow as long as a school bus! The photos below show some common invertebrate groups.

sponges

These simple animals have holes in their bodies. They pull water and floating food into the holes.

worms

Worms have no skeleton, inside or out. There are more than one million types of worms.

sea stars and urchins

Sea stars and sea urchins have shells inside their bodies. They eat through tubes on their feet.

jellies

These invertebrates have no bones, brains, or eyes. Their tentacles can sting their prey.

Invertebrates have no bones. However, they have other structures that hold up and protect their bodies. Many have a thin, hard covering, for example. This outer covering is an **exoskeleton** (ek•soh•SKEL•uh•tuhn).

Quick Check

Classify Name one invertebrate that lives in water and one that lives on land.

Critical Thinking Is an octopus an invertebrate? How can you tell?

arthropods

northern lobster

Arthropods make up the biggest group of invertebrates. Animals in this group have thin exoskeletons and legs that bend in many places. Insects, spiders, and lobsters are some arthropods.

beetle

mollusks

squid

This group of invertebrates has soft bodies. A few have hard shells. Most push their bodies along with a muscle called a *foot*. Clams, snails, and octopuses are mollusks.

snail

▲ Penguins are one of the few birds that cannot fly.

What are some vertebrates?

Are all vertebrates alike? Compare these four types and see what you think.

Birds

A **bird** is a kind of animal with a beak, feathers, two wings, and two legs. Birds are built to fly. Birds breathe air with lungs. They reproduce by laying eggs. Most birds feed their young until the young can find food on their own.

Reptiles

Crocodiles, turtles, and snakes are reptiles. **Reptiles** (REP•tuhlz) are vertebrates with scaly skin. Tough scales help protect them. Some reptiles live on land and some live in water. All breathe through lungs. Most reproduce by laying eggs, but some give birth to live young.

◀ Like all reptiles, this chameleon has waterproof skin that keeps it from drying out.

Amphibians

Some animals spend part of their lives in water and part on land. They are called **amphibians** (am•FIB•ee•uhnz). Frogs, toads, and salamanders are amphibians.

Most amphibians start out as an egg floating in water. When they hatch, they look like fish. They breathe through gills. As they get older, they grow legs and lungs and begin to live on land.

▲ Adult amphibians, like this frog, breathe through lungs or their skin.

Fish

Fish are vertebrates that spend their whole lives in water. Fish breathe oxygen using gills. They reproduce by laying eggs. Most are covered in scales and a slimy coating.

Quick Check

Classify What kind of vertebrate is a frog?

Critical Thinking Do you think turtles breathe with lungs or gills? Why?

A flat shape and slippery skin help fish such as this stingray cut through water.

What are mammals?

The last type of vertebrate includes mice, dogs, and elephants. It includes people, too! **Mammals** (MAM•uhlz) are vertebrates with hair or fur. Mammals do not hatch from eggs. They are born live. Female mammals make milk to feed their young. They care for the young until the young can find food on its own.

Mammals are covered with hair or fur. Mammals such as cats and bears have thick fur. Others, such as elephants and people, have thinner hair.

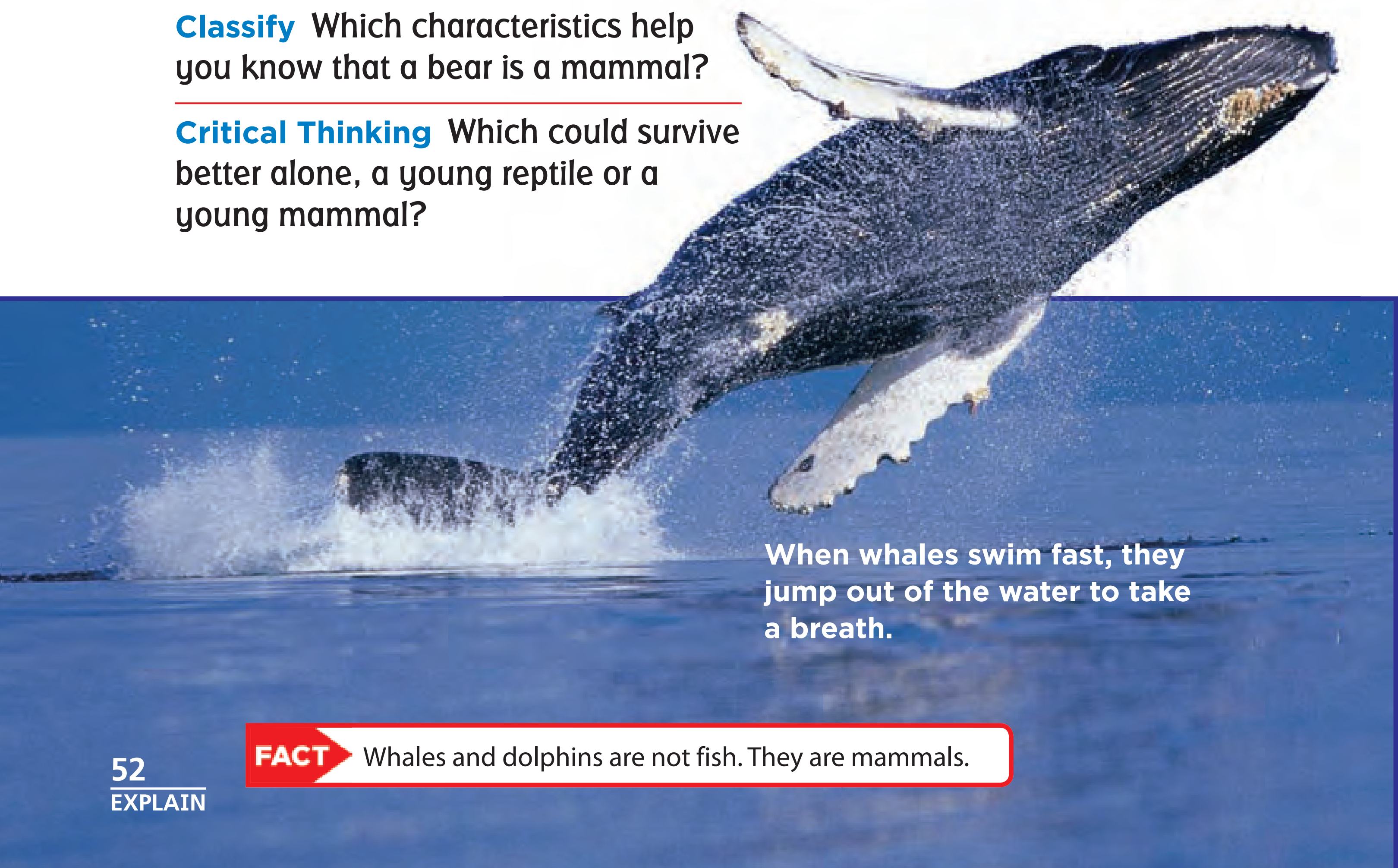
Mammals breathe with lungs. Dolphins and whales are mammals that live in water. They poke their heads out of the water to breathe.

▲ A mammal's first food is milk from its mother.

Quick Check

Classify Which characteristics help you know that a bear is a mammal?

Critical Thinking Which could survive better alone, a young reptile or a young mammal?



When whales swim fast, they jump out of the water to take a breath.

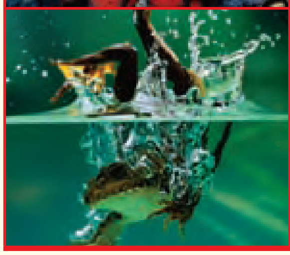
FACT Whales and dolphins are not fish. They are mammals.

Lesson Review

Visual Summary

Animals are classified according to their structures and characteristics.

An **invertebrate** is an animal without a backbone. Insects, spiders, and lobsters are invertebrates.



Fish, birds, reptiles, amphibians, and mammals are **vertebrates**, animals with backbones.

Make a FOLDABLES™ Study Guide

Make a Shutter Fold. Use it to summarize what you learned about classifying animals.

Think, Talk, and Write

1. **Main Idea** Name five groups of vertebrates.

2. **Vocabulary** What is an exoskeleton?

3. **Classify** What kind of animal is a zebra? How do you know?

4. **Critical Thinking** How do you think your bones affect your shape and the way you move?

5. **Test Prep** **All reptiles are animals that have**
   - **A** backbones and gills.
   - **B** lungs and legs.
   - **C** backbones and lungs.
   - **D** backbones and fins.

Math Link

Make a Graph
Research the number of bones different animals have in their bodies. Then put this information into a bar graph.

Art Link

Make an Animal Picture
Suppose you are a scientist who discovers a new creature. Draw a picture of the new creature. Label structures that could help classify it.

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DESERT BIRDS

Roadrunners are birds that live in southwestern deserts. Roadrunners run fast on their strong feet. They are black and white with long white-tipped tails. They hunt lizards, snakes, and insects during the day.

Elf owls live in southwestern deserts, too. They are the smallest owls. Unlike roadrunners, elf owls are active only at night. They have yellow eyes and very short tails. Their eyesight is excellent. They eat insects, lizards, and mice.

Descriptive Writing

A good description

- includes words that tell how something looks, sounds, smells, tastes, and/or feels
- uses details to create a picture for the readers
- may use words that compare and contrast, such as *like, similar,* and *different*

roadrunner

elf owl

Write About It

Descriptive Writing Choose two animals. Learn more about them. Then write a paragraph that describes how the animals are alike and different.

LOG ON e-Journal Write about it online at www.macmillanmh.com

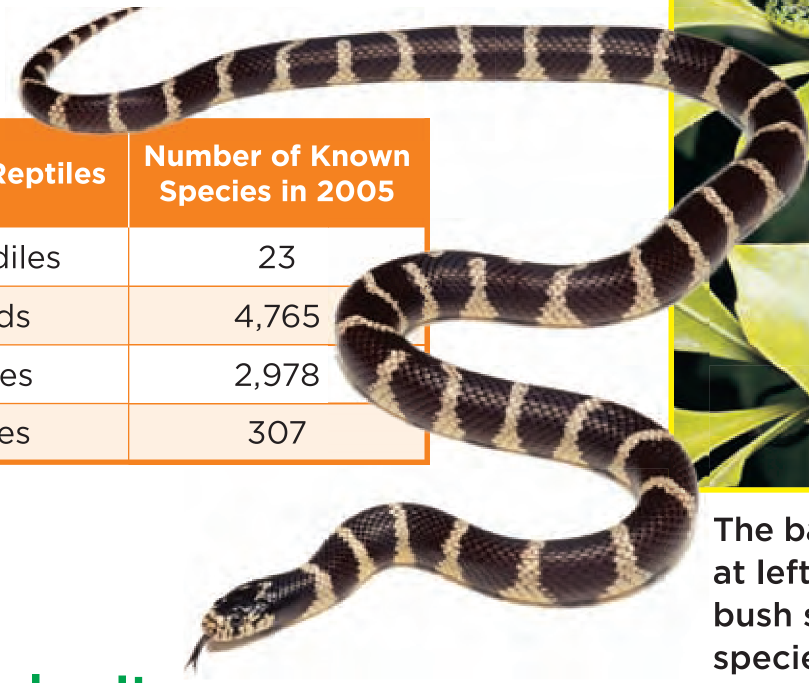
ELA WA-D. Write informational reports that include facts, details and examples that illustrate an important idea.

ANIMAL LINE-UP

Do all snakes look alike? Do all lizards? No! There are many kinds of snakes and lizards. Each kind is a little different from the others. Each kind is called a *species*. The table below lists the number of known species for four groups of reptiles.

Order Numbers

- To order numbers from greatest to least, first find the numbers with the most digits.
- Identify the place value of the digits. Compare the numbers with the highest place value to find out which number is larger.
- Then repeat this with the remaining numbers.



Kinds of Reptiles	Number of Known Species in 2005
crocodiles	23
lizards	4,765
snakes	2,978
turtles	307

The banded boa constrictor, at left, and the spotted bush snake, above, are two species of snakes.

Solve It

List these reptiles in order from greatest to least number of species. Which kinds of reptiles have more than 1,000 species? Which kind of reptile has the fewest species?

SI-3. Read and interpret simple tables and graphs produced by self/others.

Lesson 4

Animal Life Cycles

Look and Wonder

This butterfly is going through a big change. Do you know what it used to look like? All animals change as they get older. Do all animals change in the same ways?

LS-I. Compare the life cycles of different animals including birth to adulthood, reproduction and death (e.g., egg-tadpole-frog, egg-caterpillar-chrysalis-butterfly).

Explore **Inquiry Activity**

How does a caterpillar grow and change?

Make a Prediction

How does a caterpillar change as it grows? Write a prediction.

Test Your Prediction

1. **Observe** Look at the caterpillar. Draw a picture of it and label all the parts you can see. ⚠ **Be Careful.** Handle animals with care.
2. **Measure** Find the length of your caterpillar. Record the caterpillar's length on your drawing.
3. Put your caterpillar into the kit.
4. **Observe** Once a day, observe your caterpillar and draw a picture of it. Label any changes you observe. If you can measure the caterpillar's length without disturbing it, record the length each day.

Draw Conclusions

5. **Interpret Data** What small changes did the caterpillar go through? What big changes did you observe?
6. **Infer** What are the stages in a butterfly's life cycle?

Explore More

Experiment How do tadpoles change as they grow? Make a plan to test your ideas.

Materials


caterpillar

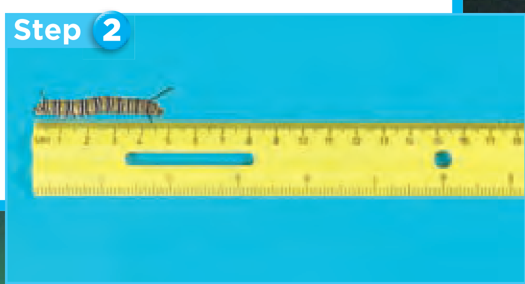

hand lens


ruler


caterpillar kit

Step 1

Step 2



SI-I. Select the appropriate tools and use relevant safety procedures to measure and record length and weight in metric and English units.

Read and Learn

Main Idea LS-I

Animals have different life cycles. Some animals are born looking like their parents. Others change greatly as they grow.

Vocabulary

metamorphosis, p. 59

egg, p. 59

larva, p. 59

pupa, p. 59

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Reading Skill

Sequence

First

Next

Last

What are some animal life cycles?

Did you know that a caterpillar is actually a young butterfly? A tadpole is a young frog. These animals go through big changes as they grow. Do all animals change in the same ways?

Different types of animals change in different ways. Some animals are born looking like their parents. Others are not. These animals might change shape or color as they grow. They may even grow new structures. The way an animal changes with age is part of its life cycle.

An animal is born. It grows. It reproduces as an adult. In time it dies. Its body breaks down and becomes part of the soil. It adds nutrients to the soil that other organisms need to grow.

Life Cycle of a Frog

Egg Frogs lay eggs in water.

Tadpole Young frogs, or tadpoles, hatch. Like fish, they swim and breathe with gills.

Becoming an Adult A tadpole starts to grow legs and lungs.

Adult Now the frog looks like its parents. It moves onto land and can reproduce.

Metamorphosis

Some animals change shape through a process called **metamorphosis** (met•uh•MAWR•fuh•sis). Amphibians and most insects go through metamorphosis. Their life cycle begins with an **egg**. Eggs contain food that young animals need. Most have a shell that protects the animal.

When the young animal has grown enough, it *hatches*, or breaks out of the egg. It looks different from adults of its kind. With time, it grows into an adult that can have its own young. Most amphibians and insects do not look after their young. The young can get food on their own.

Quick Check

Sequence Name the stages in a butterfly's life cycle.

Critical Thinking Compare a frog's life cycle to a butterfly's life cycle.

Life Cycle of a Butterfly

Egg A butterfly starts life as an egg.

Larva When an insect hatches it is called a **larva**. A butterfly larva is called a *caterpillar*.

Pupa The larva changes into a **pupa**. The pupa of a butterfly is called a *chrysalis*.

Adult The adult butterfly has two pairs of wings. Females can lay eggs.

How do reptiles, fish, and birds change as they grow?

Reptiles, fish, and birds have similar life cycles. Most of these animals lay eggs. Reptiles lay their eggs on dry land. Fish lay their eggs in water. Birds often build nests to protect their eggs. Most birds sit on their eggs until the eggs are ready to hatch.

An animal grows inside the egg. For a time it gets everything it needs to survive from the egg. When the young animal has grown enough, it hatches. Young reptiles, fish, and birds do not go through metamorphosis. They look similar to adults of their kind when they hatch.

Life Cycle of a Sea Turtle

Egg Females crawl to the beach to lay eggs in the sand.

Young Sea turtles hatch on the beach and quickly crawl to the ocean.

Adult Turtles grow to 140 kg (300 lbs). Females stay in the sea until they are ready to lay eggs.

In time, young reptiles, fish, and birds grow into adults. Now they can reproduce and have young of their own. Most reptiles and fish do not look after their young. The young can find food on their own. Birds often raise their young until the young can fly and find food for themselves.

Quick Check

Sequence What happens after a fish lays eggs?

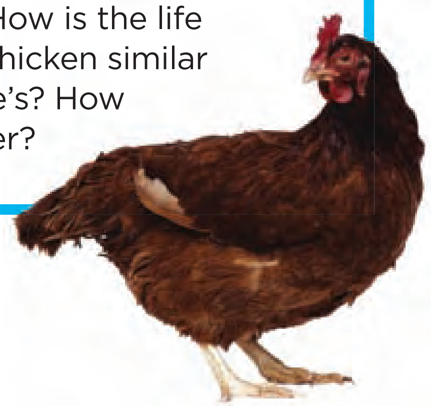
Critical Thinking How is a reptile's life cycle similar to a frog's? How does it differ?

Quick Lab

A Bird's Life Cycle

1. **Observe** Look at these three photos. Put them in order to show the life cycle of a chicken.

2. **Communicate** Describe a chicken's life cycle. How does a chicken change as it grows?



3. **Compare** How is the life cycle of a chicken similar to the turtle's? How does it differ?

Life Cycle of a Trout

Egg Fish eggs may float in water or sink to the bottom.

Young Fish hatch and begin to find food.

Adult Most fish continue to grow all their lives. Females may lay thousands of eggs each year!

What is the life cycle of a mammal?

Mammals do not hatch from eggs. Young mammals are born live. They look much like their parents from the start. Adult mammals feed and care for their young.

As they grow, young mammals lose fat and grow stronger. Their faces change to look more like adults. In time, they learn to survive on their own. They grow into adults that can reproduce and have their own young.

Quick Check

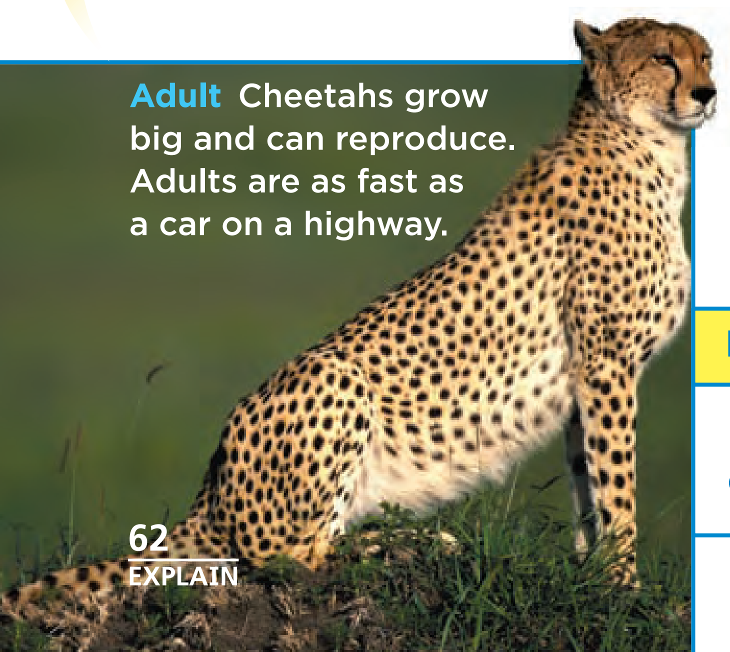
Sequence Which does a cheetah do first, reproduce or learn to hunt?

Critical Thinking How might growing bigger help an animal survive?

Life Cycle of a Cheetah

Cub Most female cheetahs have three to five cubs at once. They protect and feed the cubs.

Young Cheetahs learn and practice the skills they will need to hunt.



Adult Cheetahs grow big and can reproduce. Adults are as fast as a car on a highway.

Read a Diagram

How does a cheetah change as it grows?

Clue: Arrows help show a sequence.

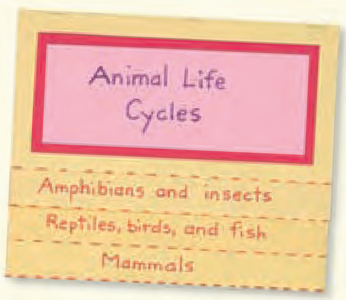
Lesson Review

Visual Summary

	Every type of animal has its own life cycle. **Amphibians** and most **insects** go through metamorphosis.
	Most **reptiles**, **birds**, and **fish** hatch from eggs. Reptiles and fish do not usually care for their young.
	**Mammals** are born live. They depend on their parents until they can get food on their own.

Make a FOLDABLES™ Study Guide

Make a Layered-Look Book. Use it to summarize what you learned about animal life cycles.



Think, Talk, and Write

1. **Main Idea** Describe the life cycles of two different animals.

2. **Vocabulary** What is metamorphosis?

3. **Sequence** Name three stages in a sea turtle's life cycle. Put them in order.

First

↓

Next

↓

Last

4. **Critical Thinking** Do you go through metamorphosis? How do you know?

5. **Test Prep** **An iguana's life cycle would be most like a**

A turtle's.
B cheetah's.
C fly's.
D bear's.

Writing Link

Write a Story
Choose an animal you know about. Pretend you are that animal. Describe how you change and grow as you get older.

Math Link

Solve a Problem
Female cheetahs usually give birth to a minimum of three cubs and a maximum of five cubs. What is the minimum and maximum number of cubs that five female cheetahs would have?

The Little Lambs

I live on a farm, so I see animals grow up. We have chickens, cows, and sheep. I like sheep the best. When they are born, they are very small. Their wool is curly and soft. They stay close to their parents. When they get bigger, they run and play. It is fun to watch them. Their wool grows longer. Soon, we will cut their wool to make yarn. Next year they will be adult sheep.

Personal Narrative

A good personal narrative

- tells a story from the writer's own experience
- expresses the writer's feelings
- tells the events in an order that makes sense
- uses time-order words, such as *first*, *then*, or *after that*

These little lambs will grow to look like their parents.

Write About It

Personal Narrative Have you ever seen a plant or animal grow and change? Write about your experience. Describe the changes. Write what you observed and how it made you feel.

LOG ON e-Journal Write about it online at www.macmillanmh.com

ELA WA-A. Write narrative accounts that develop character, setting and plot.

Math in Science

Graphing Life Spans

How long do animals live? A fruit fly is likely to live for only about a month. A Galapagos tortoise can live for 150 years! Each type of animal has its own life span. A *life span* is the amount of time an organism usually lives.

You can compare the life spans of different animals. Examine the life-span data in the table below. Use the data to make a bar graph comparing the animals' life spans.

Animal	Average Life Span*
blacktail deer	10 years
American robin	13 years
rat snake	23 years
fence lizard	4 years
American toad	15 years

* under ideal conditions

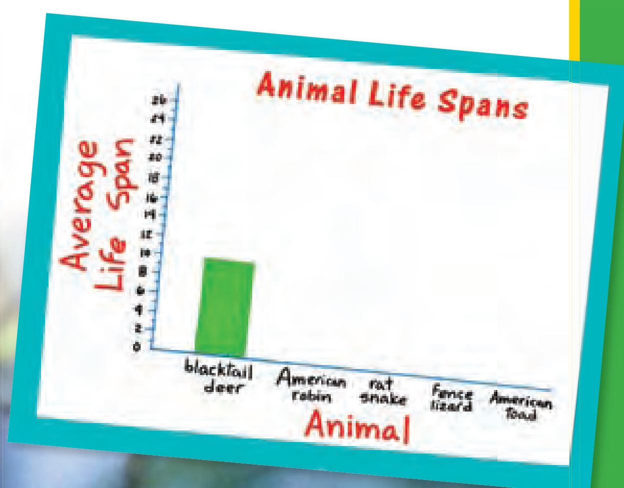
American robin

Make a Bar Graph

- Title your graph. Label the left side and the bottom.
- Next, list the animals along the bottom of the graph.
- Write numbers up the left side. Start with 0 and count to the longest life span.
- Draw a bar for each animal up to the number that shows its life span.

Solve It

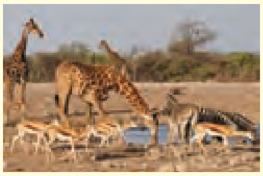
Make a bar graph using the data from the chart. Then use your bar graph to compare the life spans.



SI-3. Read and interpret simple tables and graphs produced by self/others.

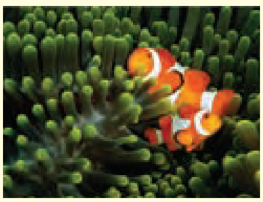
CHAPTER 1 Review

Visual Summary

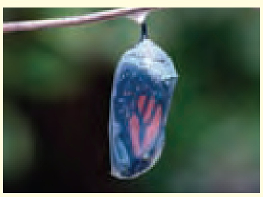


Lesson 1 All living things have certain characteristics and needs in common.

Lesson 2 Different kinds of animals have different structures that help them get what they need from their environment.



Lesson 3 Animals can be classified based on their structures and characteristics.



Lesson 4 Animals change as they grow. Different types of animals change in different ways.

Make a FOLDABLES™ Study Guide

Glue your lesson study guides to a large sheet of paper as shown. Use your study guide to review what you have learned in this chapter.

Vocabulary

Fill each blank with the best term from the list.

cells, p. 30	**organism**, p. 26
environment, p. 28	**metamorphosis**, p. 59
invertebrate, p. 47	**reproduce**, p. 27
mammal, p. 52	**shelter**, p. 40
egg, p. 59	**vertebrate**, p. 46

1. Animals often seek a safe place, or ________, to protect themselves.
LS-6
2. Each living thing is an ________.
LS-B
3. An animal with a backbone is called a ________.
LS-3
4. Living things ________ to make more of their own kind.
LS-I
5. A vertebrate that is born live is called a ________.
LS-I , LS-3
6. Some organisms, such as caterpillars, go through a ________ in which their body changes shape.
LS-I
7. An amphibian begins its life as an ________.
LS-I
8. Living things are made of one or more tiny ________.
LS-2
9. An animal without a backbone is called an ________.
LS-3
10. All the living and nonliving things that surround an organism are part of an ________.
LS-6

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Skills and Concepts

Answer each of the following in complete sentences.

11. **Main Idea and Details** What makes living things different from nonliving things?
LS-3

12. **Descriptive Writing** Describe the structures that different animals use to breathe.
LS-2

13. **Classify** Group the following animals as vertebrates or invertebrates: butterfly, cow, snail, goldfish, owl, spider.
LS-3

14. **Critical Thinking** How could the environment affect a bird's life cycle?
LS-I, LS-6

15. What is happening in the picture? What part of a life cycle does this show?
LS-I

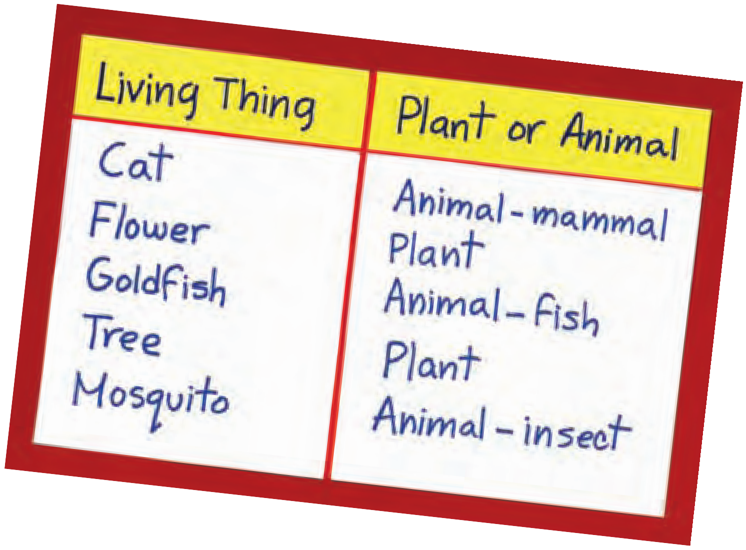
The Big Idea

16. How do living things get what they need to live and grow?
LS-A, LS-B

Performance Assessment

It's Alive!

- Make a list of all the living things you see around your home. Then make a list of the ones you see around school.
- Make a chart to classify the organisms you saw. Were they plants or animals? If you saw animals, what kind of animals were they?



- Where did you see the most living things? What kind of living thing was most common? Why do you think that was the case?

Ohio Activity

Make a life-cycle poster. Choose two very different animals, such as a cardinal and a ladybug. Do library research to learn about their life cycles. Create a poster that shows each animal's life cycle on onehalf of the poster. Illustrate each stage of the cycle with pictures. Explain each stage with words.

Ohio Benchmark Practice

1 To make food, plants need all of the following **except**

A sunlight.

B vitamins.

C air.

D water.

LS-A

2 The data table shows four different populations of snails over a three-year period.

Snail Population Each Year			
	Year 1	Year 2	Year 3
Population 1	20	25	28
Population 2	20	23	24
Population 3	20	27	34
Population 4	20	18	16

Which snail population is surviving **best** in its habitat?

A population 1

B population 2

C population 3

D population 4

SI-C

3 Mrs. Carroll's class studied worms. They did an experiment to test how much a worm ate in a week. The students' results were different from their predictions. What should they do?

A get new worms

B read more books about worms

C ask a gardener about worms

D do their experiment again

SI-B

4 What tool would you use to observe cells?

A graduated syringe

B microscope

C test tube

D forceps

SI-A

5 The way an organism grows and changes is its life cycle.

In your **Answer Document**, compare the life cycle of a cat with the life cycle of a fish. Identify one similarity and one difference.

Be sure to label any drawings. (2 points)

LS-A

6 A student is classifying photographs of animals and recording the results in the chart below. Which animal fits in the blank of the chart?

Vertebrates	Invertebrates
chameleon	spider
hawk	worm
whale	squid
toad	beetle
fish	

A salamander

B crocodile

C bear

D jellyfish

SI-C

7 How do animals use camouflage to survive?

A by standing out from their environment

B by imitating other animals

C by blending in with their environment

D by giving warning calls

LS-B

8 Gills and lungs are structures that help animals breathe.

In your **Answer Document,** identify one animal that has gills and one animal that has lungs.

Then, identify one animal that has neither gills nor lungs. Draw or describe how the animal breathes. (4 points)

LS-B

9 Which animal has an exoskeleton?

A snake

B lobster

C fish

D bird

LS-B

10 What stage of an animal's life cycle produces eggs?

A egg

B pupa

C adult

D larva

LS-A

CHAPTER 2

Survival in Ecosystems

The Big Idea

How do living things survive in their environments?

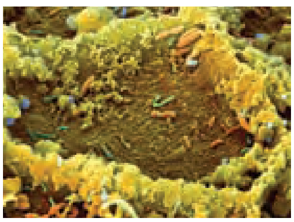
Vole eats a yew berry.

Key Vocabulary

ecosystem
the living and nonliving things that share an environment and interact (p. 74)

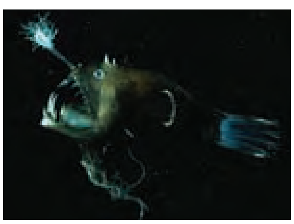
habitat
the home of a living thing (p. 75)

food chain
a series of organisms that depend on one another for food (p. 76)



decomposer
an organism that breaks down dead plant and animal material (p. 77)

food web
several food chains that are connected (p. 78)



adaptation
a body part or behavior that helps one kind of living thing survive in its environment (p. 100)

More Vocabulary

producer, p. 76

consumer, p. 77

climate, p. 86

soil, p. 86

desert, p. 88

forest, p. 90

ocean, p. 92

wetland, p. 94

camouflage, p. 100

nocturnal, p. 103

mimicry, p. 105

hibernate, p. 105

migrate, p. 107

LS-B. Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.

Lesson 1

Food Chains and Food Webs

Look and Wonder

A bald eagle can fly at 200 miles per hour when diving for a fish. Bald eagles depend on fish for food. They also eat turtles, ducks, and other small animals. What do other animals depend on for food?

Building block lesson for LS-B. Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.

Explore

Inquiry Activity

What kind of food do owls need?

Purpose

Find out what an owl eats by studying an owl pellet.

Procedure

1. Work with a partner. Put on plastic gloves. Place your owl pellet onto a paper plate.
2. **Predict** What do you expect to see inside the owl pellet? Write your prediction.
3. Using the tweezers, separate the objects in the owl pellet.
4. **Observe** What is in the owl pellet? Use the hand lens. Record your observations. ⚠ **Be Careful.** Wash your hands when you are done.

Draw Conclusions

5. **Interpret Data** What do the materials inside the owl pellet tell you about what an owl eats?
6. **Infer** What organisms might an owl eat? What might those organisms eat?

Explore More

Interpret Data Keep track of the things you eat in one day. Do most of your foods come from plants or animals?

Materials


plastic gloves


paper plate


owl pellet


tweezers


hand lens

Step 3

SI-5. Record and organize observations (e.g., journals, charts and tables).

Read and Learn

Main Idea LS-B

Food chains and food webs show how organisms in an ecosystem depend on each other.

Vocabulary

ecosystem, p. 74

habitat, p. 75

food chain, p. 76

producer, p. 76

consumer, p. 77

decomposer, p. 77

food web, p. 78

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Reading Skill

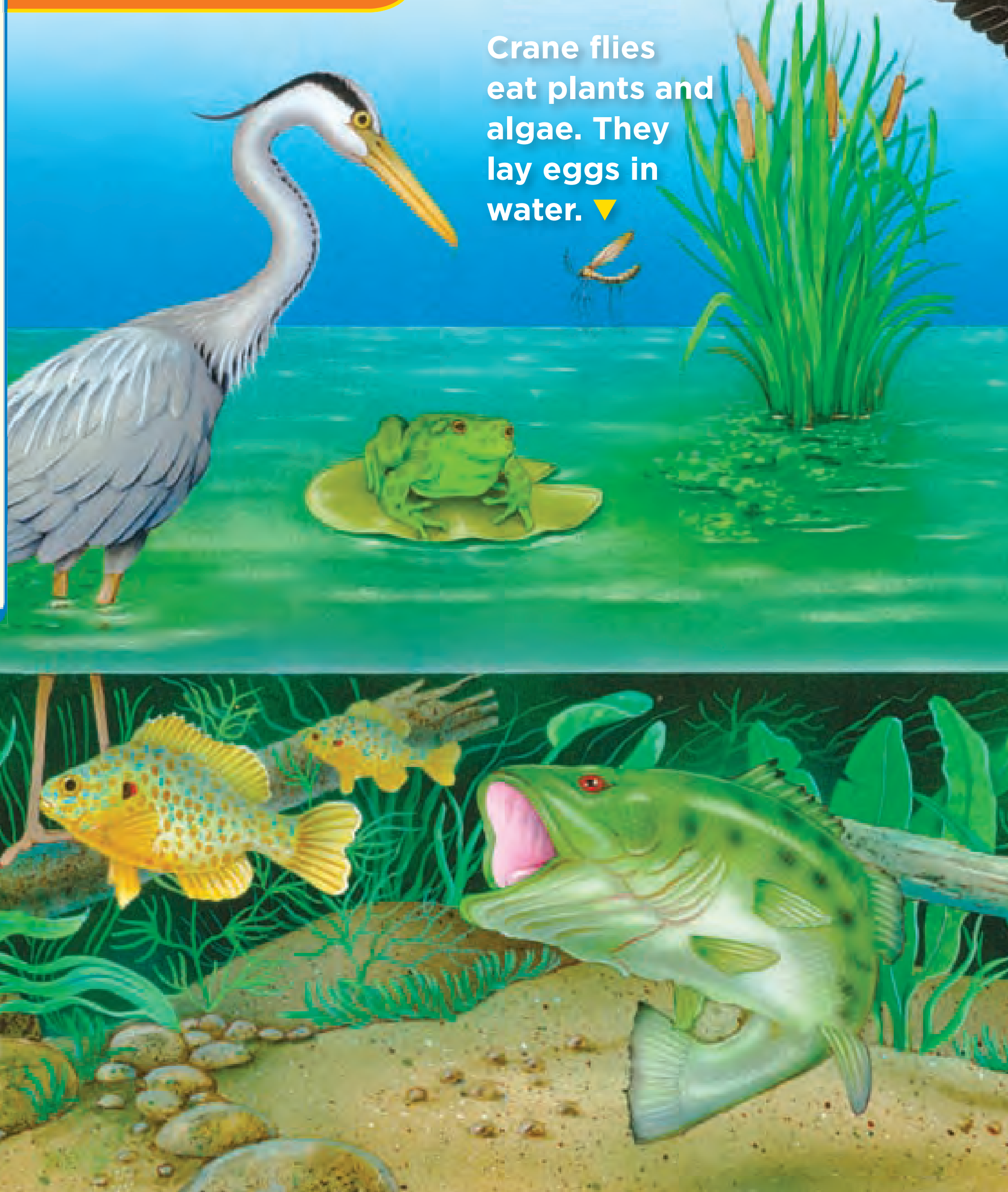
Infer

Clues	What I Know	What I Infer

What is an ecosystem?

Look at the diagram below. Can you see a frog ready to snap up an insect? How about a turtle resting in the Sun? Living things depend on each other. They also depend on nonliving things like sunlight. Living and nonliving things that interact in an environment make up an **ecosystem** (EK•oh•sis•tuhm). An ecosystem may be a pond, a swamp, or a field. It may be as small as a puddle or as big as an ocean.

A Pond Ecosystem



Big or small, ecosystems are made up of living and nonliving things. Frogs, birds, and plants are some living things in a pond. Sunlight, water, and soil are some nonliving things.

Different organisms live in different parts of an ecosystem. Fish live in the water. Water is their **habitat**, or home. A cattail's habitat is along the edge of a pond. Living things get food, water, and shelter from their habitats.

Quick Check

Infer Which pond animals could also survive in a land ecosystem?

Critical Thinking How might an ecosystem change if it suddenly became colder?

Cattails grow well in wet soil. Animals use them as food and shelter.

These turtles climb out of the water to warm up in the Sun.

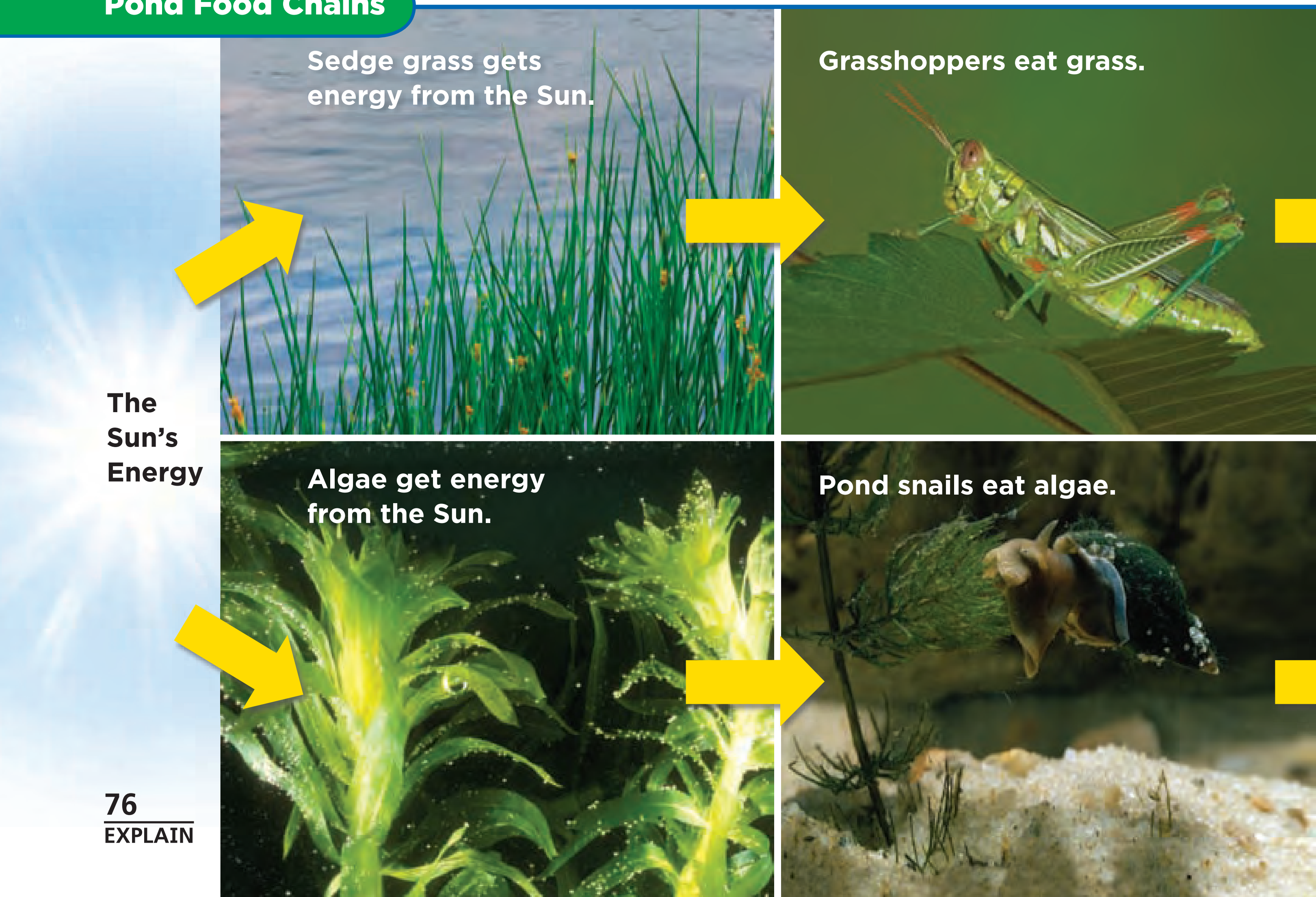
Pond snails slide along the bottom looking for plants and algae to eat.

What is a food chain?

All organisms need energy from food to live and grow. Most are a source of energy as well. They pass on energy to organisms that eat them. A **food chain** shows how energy passes from one organism to another in an ecosystem. The arrows in a food-chain diagram, like the ones below, show the flow of energy.

The first organism in a food chain is a producer (pruh•DEW•suhr). A **producer** is an organism that makes its own food. Green plants and algae are two examples. Most producers use energy from the Sun to make their own food. This means that the energy in most food chains starts with the Sun.

Pond Food Chains



The next organisms in a food chain are consumers (cuhn•SEW•muhrz). A **consumer** is an organism that eats other organisms. All animals are consumers. A food chain may have many consumers.

Next in the food chain are decomposers (dee•cuhm•POH•zuhrz). A **decomposer** is an organism that breaks down dead plant and animal material. Decomposers put nutrients back into the soil. Some worms and bacteria are decomposers.

Quick Check

Infer What might happen to grasshoppers and eagles if turtles were removed from the pond food chain?

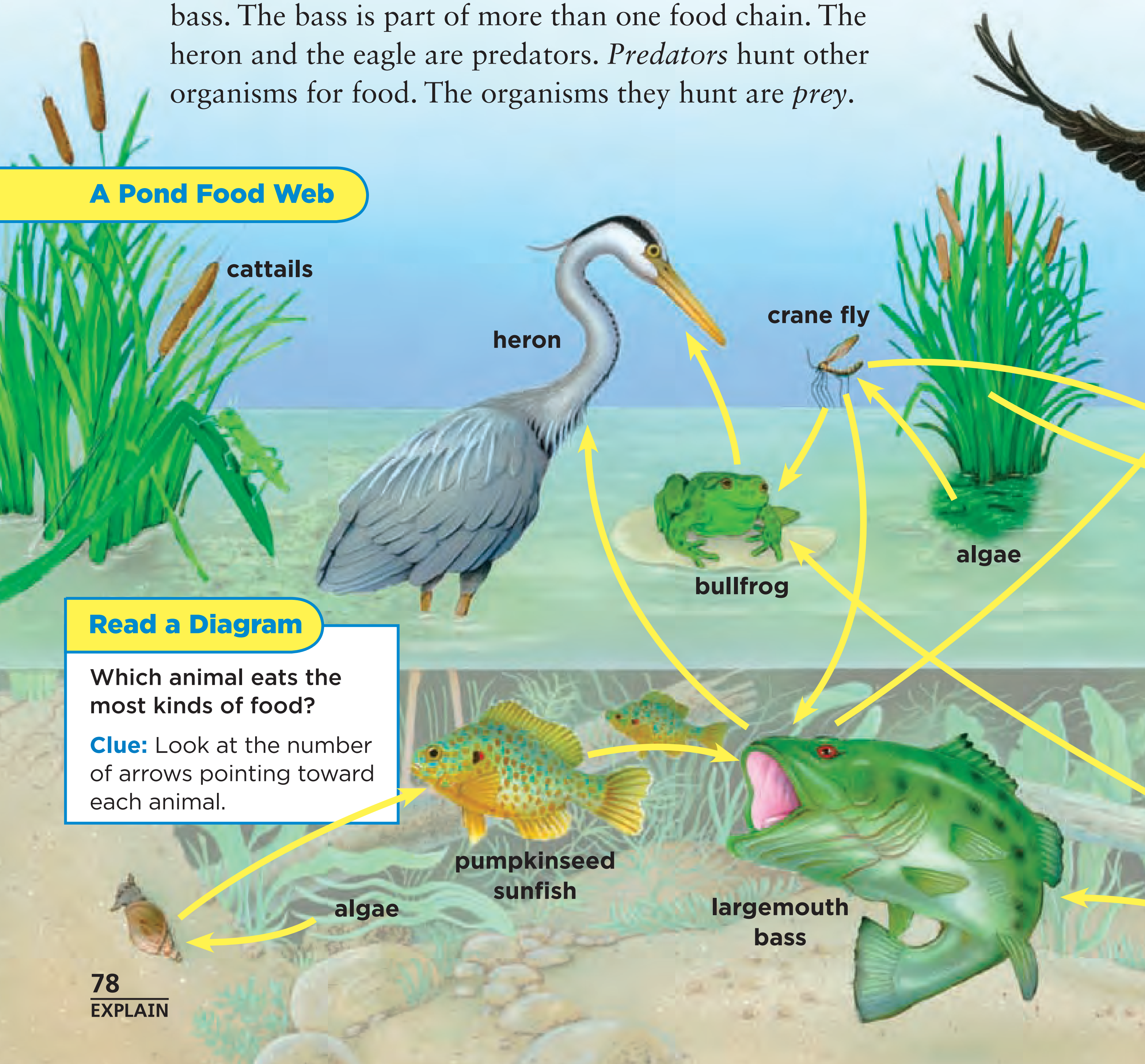
Critical Thinking How are these food chains alike?

What is a food web?

One morning a turtle eats a grasshopper. The next day, that same turtle eats a crayfish. Most animals eat several kinds of food. They are part of several food chains. Food chains can connect to form a **food web**.

The diagram below shows a pond food web. Look at the arrows from the largemouth bass to the heron and bald eagle. They show that herons and eagles eat bass. The bass is part of more than one food chain. The heron and the eagle are predators. *Predators* hunt other organisms for food. The organisms they hunt are *prey*.

A Pond Food Web



Read a Diagram

Which animal eats the most kinds of food?

Clue: Look at the number of arrows pointing toward each animal.

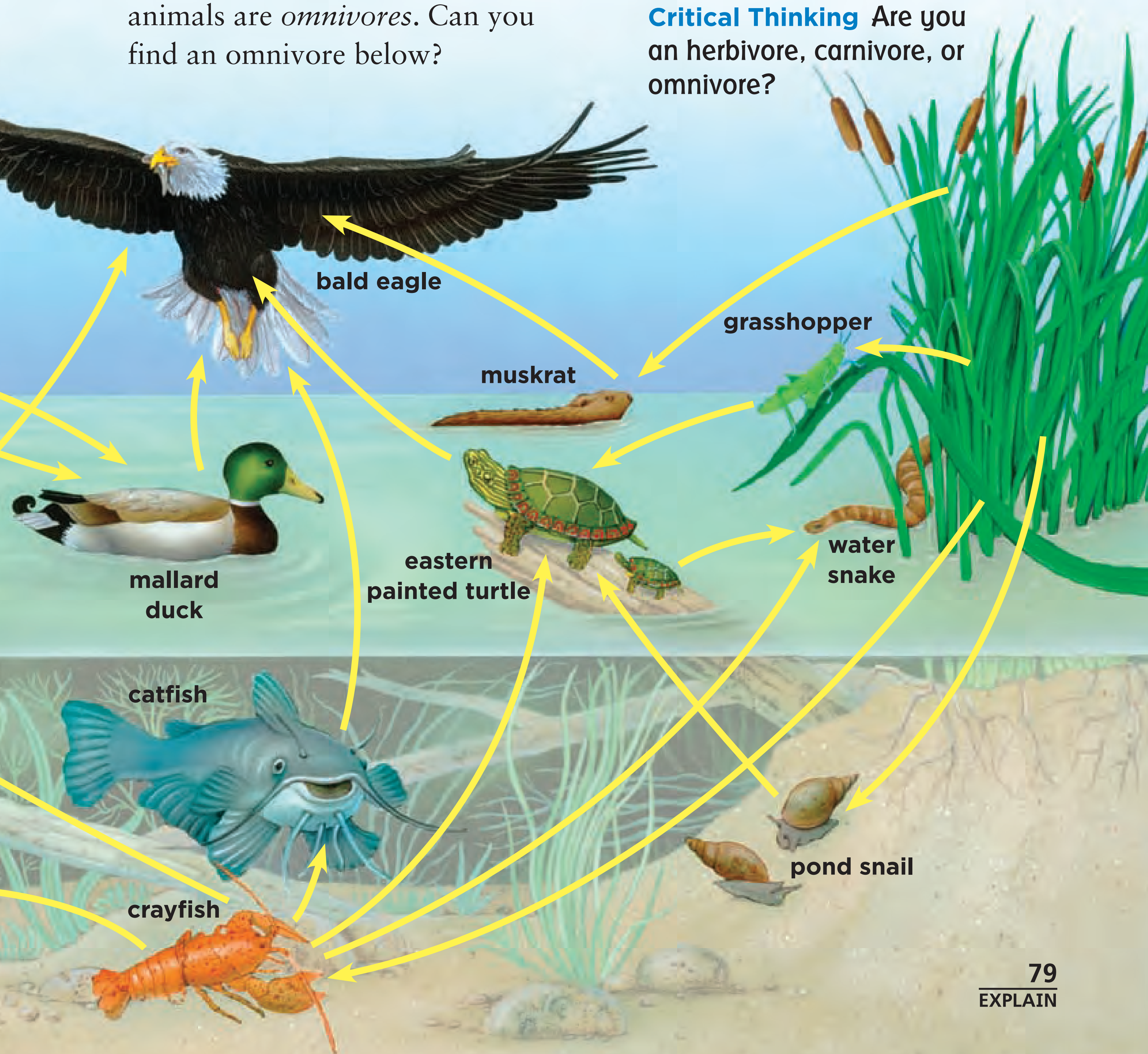
You can learn about living things by studying food webs. Below, you can see that the snail eats plants. Organisms that eat mostly plants are *herbivores*. Some animals, such as herons, eat mostly other animals. These organisms are *carnivores*. Animals that eat both plants and animals are *omnivores*. Can you find an omnivore below?

Food webs also show how organisms compete for food. Many animals eat crayfish. If snakes eat all the crayfish, the others might go hungry.

Quick Check

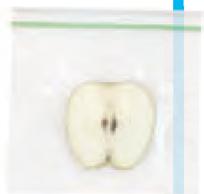
Infer How could a heron survive if there were no more frogs?

Critical Thinking Are you an herbivore, carnivore, or omnivore?



Quick Lab

Observe Decomposers

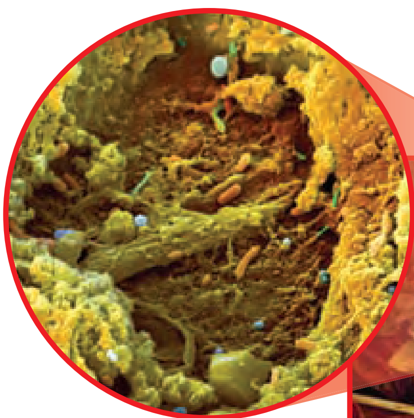


1. Put some apple pieces into a plastic bag. Seal the bag. ⚠ **Be Careful.** Do not open the sealed bag.
2. **Observe** Leave the bag in a warm, dark place for a week. Observe the pieces every day. Record the changes you see.
3. **Communicate** What happened to the pieces of apple? How did they change over time?
4. **Infer** What does this activity tell you about decomposers?

Why are decomposers important?

In a pond, dead plant and animal material drifts to the bottom. What keeps the pond from filling with dead organisms? Decomposers!

Decomposers are an important part of ecosystems. Decomposers feed on dead material. As they eat, they release nutrients into the water or soil. These nutrients help plants and other organisms grow. Worms, mold, mushrooms, and some insects and snails are decomposers. Many bacteria are decomposers, too.



▲ These tiny decomposers were magnified 2,700 times.

These leaves will make a good meal for decomposers. ▼

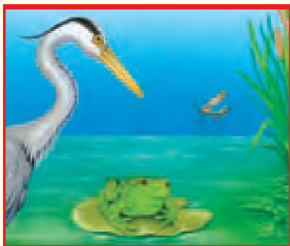
Quick Check

Infer How do decomposers help a pond ecosystem?

Critical Thinking What would happen if a forest had no decomposers?

Lesson Review

Visual Summary



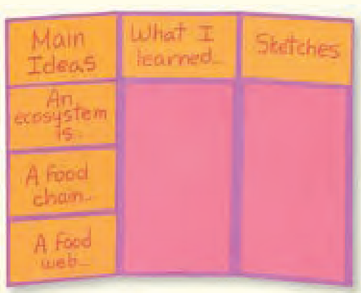
The living things in an **ecosystem** depend on each other to survive.

Food chains and **food webs** show how energy flows through an ecosystem.

Producers, consumers, and decomposers make up food chains and food webs.

Make a FOLDABLES™ Study Guide

Make a Trifold Book. Use it to summarize what you learned about food chains and food webs.



Think, Talk, and Write

1. **Main Idea** How are organisms connected in an ecosystem? How could you show this?

2. **Vocabulary** What is a consumer?

3. **Infer** How does it help an animal to be part of more than one food chain?

Clues	What I Know	What I Infer

4. **Critical Thinking** How do both plants and animals depend on decomposers?

5. **Test Prep** **Most producers get their energy from**

   A sunlight.
   B consumers.
   C predators.
   D rocks.

Writing Link

Writing That Compares
Choose two animals. Find out where they live and what they eat. Find out what eats them. Then compare the animals in an essay.

Art Link

Make a Poster
Research an ecosystem near your home. Make a poster to show how organisms in that ecosystem depend on one another.

Focus on Skills

Inquiry Skill: Communicate

You know that organisms get energy from food. Scientists study ecosystems to learn how different organisms get energy. Then they **communicate**, or share, their observations. Communicating helps people learn about the world.

▶ Learn It

When you **communicate**, you share information with others. Some ways you share information in science are by talking, writing, drawing, or making graphs and charts.

▶ Try It

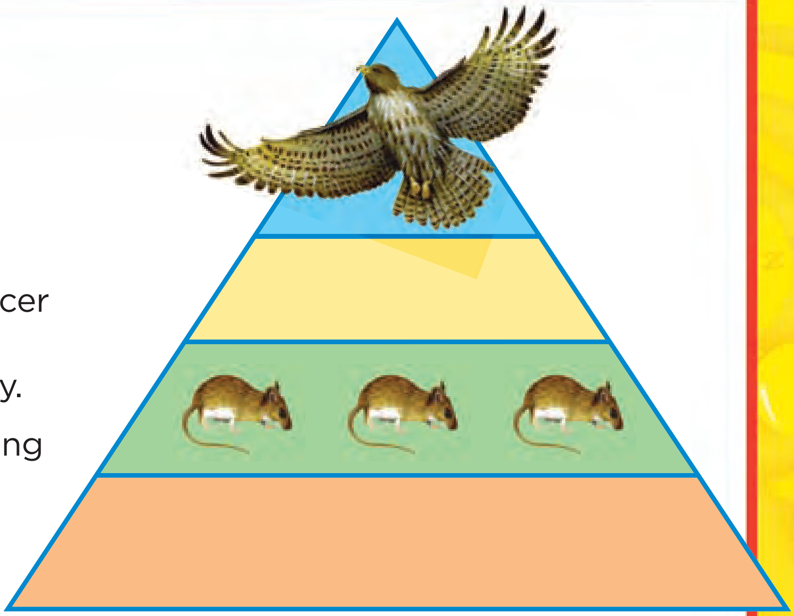
In this activity you will organize and **communicate** data about a grassland ecosystem. Look at the data table below. It shows how some organisms in a grassland get energy. It also tells how the organisms interact. A table is one way to communicate data. You will try some other ways.

Grassland Organisms

Organism	Where Organism Gets Energy
grass	Sun
snake	field mouse
hawk	snake
field mouse	grass

1. One way you can communicate the data is by making a food-chain diagram. The photographs on the next page show the start of a food-chain diagram. Copy this diagram. Complete it by adding the last three organisms in the correct order.

SI-6. Communicate scientific findings to others through a variety of methods (e.g., pictures, written, oral and recorded observations).



2. Next, communicate by making a food pyramid. Copy the pyramid shown and fill in the blank spaces.
3. Now, communicate by writing a paragraph. In your paragraph, classify each organism as a producer or consumer. Tell where each grassland organism gets its energy.
4. Did all three ways of communicating help you understand the data? Which way did you think worked best? Why?

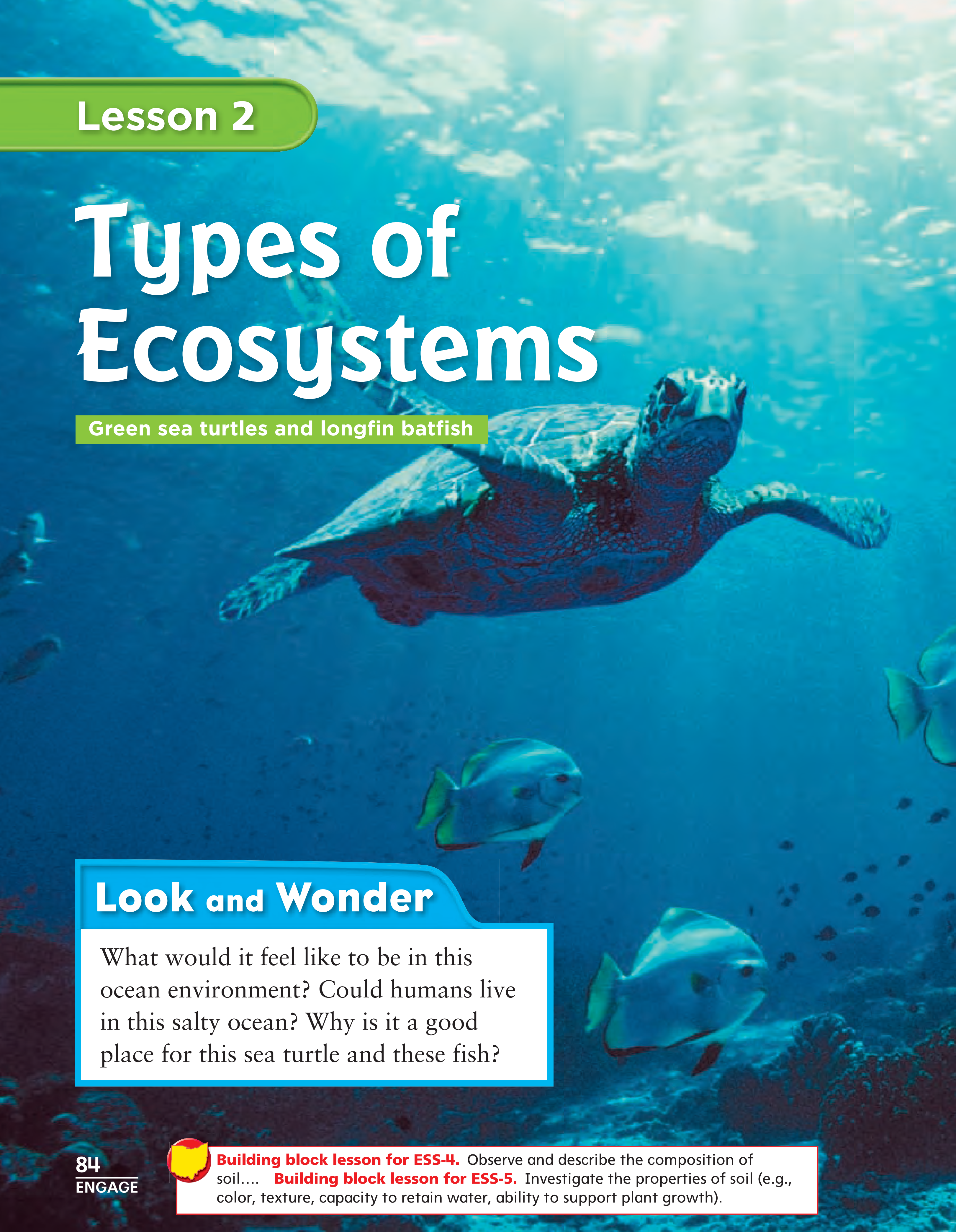
Sun

grass

snake

▶ Apply It

Think of a food chain from another ecosystem. **Communicate** information about this food chain to a partner. Draw a food-chain diagram to show where organisms in the ecosystem get energy. Now describe the food chain in words. Discuss what you learned.



Lesson 2

Types of Ecosystems

Green sea turtles and longfin batfish

Look and Wonder

What would it feel like to be in this ocean environment? Could humans live in this salty ocean? Why is it a good place for this sea turtle and these fish?

Building block lesson for ESS-4. Observe and describe the composition of soil.... **Building block lesson for ESS-5.** Investigate the properties of soil (e.g., color, texture, capacity to retain water, ability to support plant growth).

Explore

Inquiry Activity

Can ocean animals live and grow in fresh water?

Make a Prediction

Can brine shrimp grow in both fresh water and salt water? Write a prediction.

Test Your Prediction

1. Fill each jar with 480 mL of water. Put two tablespoons of sea salt in one jar. Label it *Salt Water*. Label the other jar *Fresh Water*.

Step 1

2. Add one teaspoon of brine shrimp eggs to each jar.
3. **Observe** Watch what develops in each jar over the next few days. Use a hand lens.

Draw Conclusions

4. **Interpret Data** In which jar did the brine shrimp eggs hatch? How could you tell?
5. **Infer** Can all ocean animals live and grow in fresh water? How do you know?

Explore More

Experiment Does temperature affect the hatching of brine shrimp eggs? Design an experiment to find out.

Materials


2 jars


measuring cup and water

sea salt


measuring spoon


brine shrimp eggs


hand lens

Step 3

SWK-I. Describe different kinds of investigations that scientists use depending on the questions they are trying to answer.

Read and Learn

Main Idea ESS-4, ESS-5

Earth has different ecosystems. They are classified by the type of climate, soil, plants, and animals they have.

Vocabulary

climate, p. 86

soil, p. 86

desert, p. 88

forest, p. 90

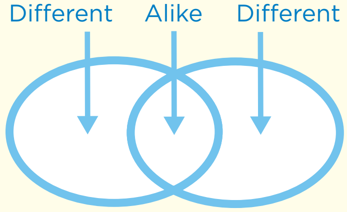
ocean, p. 92

wetland, p. 94

LOG ON e-Glossary at www.macmillanmh.com

Reading Skill

Compare and Contrast



This northern ecosystem is called a tundra. Caribou dig for food in the tundra's snow.

How do ecosystems differ?

If you could take a trip around the world, you would see that Earth has many kinds of ecosystems. Some are dry and sandy with almost no living things. Some are covered with trees or ice. Others are under water.

Each of Earth's land ecosystems has a certain kind of climate. **Climate** is the pattern of weather in a place over a long time. Some land environments have a warm and wet climate. Others are cold and dry. Some environments are dry at some times and wet at other times.

Different ecosystems have different types of soil. **Soil** is made of bits of rock and humus (HYEW•muhs). *Humus* is broken-down plant and animal material. It contains nutrients and soaks up rainwater. Soil rich in humus holds plenty of water and nutrients for plants to use.

Grasses grow well in grasslands. Grasses are food for animals such as these buffalo.

Earth's water ecosystems differ in many ways. Some have salt water. Some have fresh water. Water ecosystems may be warm or cool, shallow or deep.

Ecosystems also differ in the types of plants and animals they have. Grasslands are covered in grass while forests are filled with trees. Oceans are filled with fish that can live only in salt water. Ponds are filled with fish that can live only in fresh water.

Ponds are fresh water ecosystems filled with plants, algae, and animals.

Quick Check

Compare and Contrast What are some ways in which ecosystems differ?

Critical Thinking Describe the ecosystem in which you live.

What is a desert?

A wave of heat blasts your body. You take a deep breath and dry air stings your nose. Dust from the sandy ground covers your shoes. You are in the Sonoran Desert. It is one of the largest deserts in North America.

A **desert** is an ecosystem that has a dry climate. Less than 25 centimeters (10 inches) of rain falls in a desert each year. Several centimeters of rain may fall within a few days. Then for months there could be no rain at all.

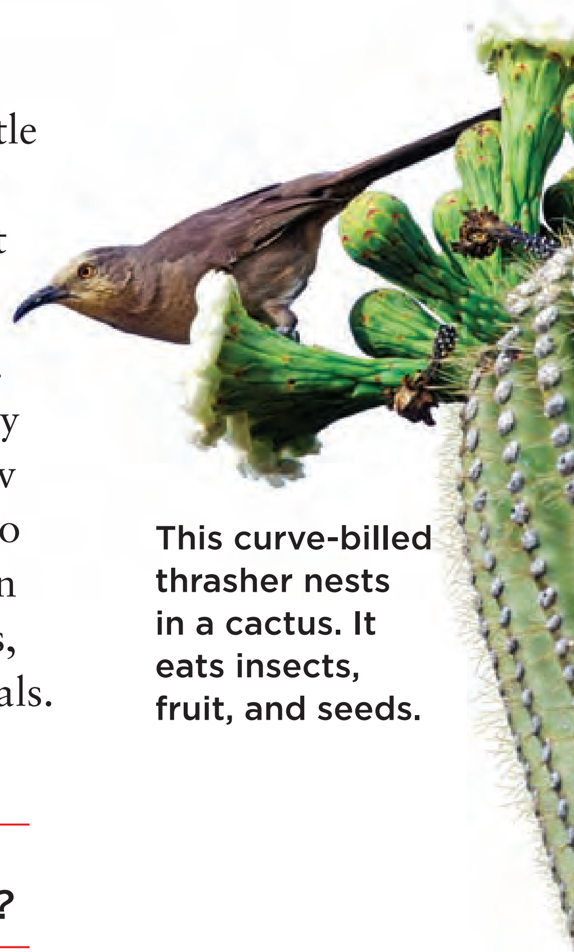
Temperatures in most deserts vary widely between day and night. During the day, heat from the Sun warms the land and air. After the Sun sets, the temperature drops quickly.

This collared lizard hunts insects and other lizards in the Sonoran Desert.

Saguaro National Park in Arizona is in the Sonoran Desert.

The soil in a desert is mostly sand. There is little humus to soak up rainwater. Rainwater trickles down through the sand. It goes deeper than most plants' roots can reach.

Few plants and animals can survive in deserts. Desert soil has little water and nutrients for many plants. Desert plants that do survive usually grow far apart. Most desert animals find shady spots to rest from the warm Sun. They hunt at night when temperatures are cooler. Jackrabbits, rattlesnakes, and cactus wrens are some common desert animals.



This curve-billed thrasher nests in a cactus. It eats insects, fruit, and seeds.

Quick Check

Compare and Contrast How do a desert's daytime and nighttime temperatures compare?

Critical Thinking Why do deserts generally have few plants?

FACT Not all deserts are hot. Deserts, such as Antarctica, can be dry and cold.

What is a forest?

It is dark and damp. Tall trees surround you. Raindrops drip from above. Birds sing. You are in the Amazon Rain Forest.

A **forest** is an ecosystem that has many trees. Different types of forests can be found in different parts of the world.

Tropical Rain Forests

A *tropical rain forest* is a forest that is hot and damp. This climate helps many living things grow. A tropical rain forest has more kinds of living things than any other land environment. Monkeys live in trees along with brightly colored birds, insects, and reptiles.

Tropical rain forests are warm all year long. They get twice as much rain as Hawaii and Louisiana, the rainiest states in the U.S.

The soil in a tropical rain forest is not very rich in nutrients. Rain forest plants quickly absorb any nutrients in the soil.

This tropical forest is warm and damp all year. Toucans eat fruit from rain-forest trees and other plants.

Temperate Forests

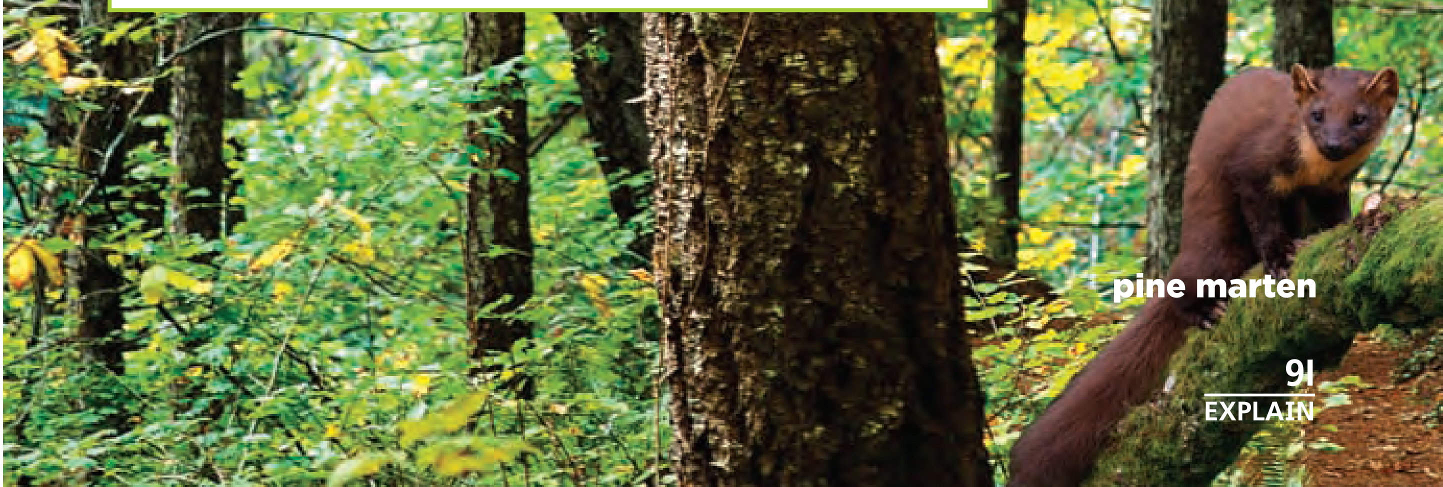
Temperate forest ecosystems are found in North America, Europe, and Asia. Bears, deer, foxes, and many other animals find homes in these forests. Unlike tropical rain forests, *temperate forests* have different weather during different seasons. Winters are cold and dry. Summers are warm and wet.

Temperate forests get enough rain for large trees to grow. However, they get less than half as much rain as tropical rain forests. The soil in a temperate forest is rich in humus. It has a lot of nutrients and soaks up plenty of water.

Quick Check

Compare and Contrast Which forest gets more rain, a tropical rain forest or a temperate forest?

Critical Thinking How do nutrients get added to rain-forest soil? What happens to those nutrients?



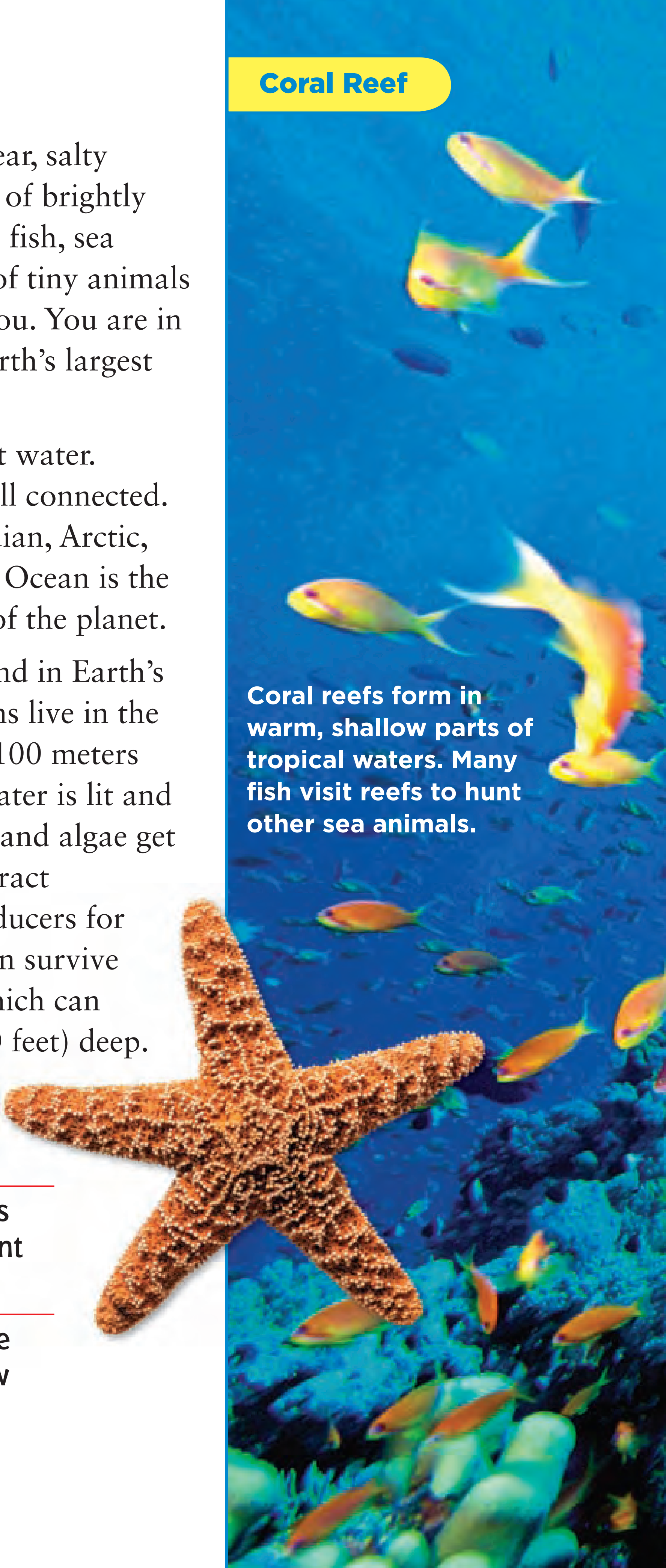
Trees in a temperate forest can survive a cold winter. Pine martens search the forest floor for squirrels, beetles, and other small animals to eat.

What is an ocean?

You are swimming in warm, clear, salty water. Before your eyes is a world of brightly colored animals. There are striped fish, sea stars, and sponges. A ridge made of tiny animals called coral stretches out before you. You are in a coral reef, a beautiful part of Earth's largest ecosystem—the ocean.

An **ocean** is a large body of salt water. Earth has five oceans, which are all connected. These are the Atlantic, Pacific, Indian, Arctic, and Southern Oceans. The Pacific Ocean is the largest. It covers about one third of the planet.

Billions of living things are found in Earth's oceans. Almost all ocean organisms live in the shallow waters that are less than 100 meters (about 330 feet) deep. Here the water is lit and warmed by the Sun. Green plants and algae get enough sunlight to grow. They attract animals that depend on these producers for food and shelter. Few creatures can survive in the cold, dark ocean depths, which can be more than 1,500 meters (4,900 feet) deep.



Coral Reef

Coral reefs form in warm, shallow parts of tropical waters. Many fish visit reefs to hunt other sea animals.

Quick Check

Compare and Contrast How is the bottom of the ocean different from the surface?

Critical Thinking Why do more ocean organisms live in shallow water than in deep water?

Quick Lab

Water Temperatures

1. Fill two jars each with 200 mL of salt water. Label one jar *Sunlight* and put it in a sunny place. Label the other jar *No Sunlight* and put it in a very dark place.
2. **Observe** Measure the water temperature in each jar with a thermometer later in the day. Which jar is warmer?

3. **Infer** The two jars model two parts of the ocean. What are those parts? How are they different?

Read a Photo

How do the animals in this coral reef differ?

Clue: The coral growing from the sea floor is a type of animal.

What is a wetland?

You slowly paddle your canoe through dark, muddy water. Tall trees tower above you. Frogs croak and insects buzz. You are in a wetland.

A **wetland** is an ecosystem where water covers the soil for most of the year. Wetlands are often found along the edges of rivers, lakes, ponds, and oceans. They may have fresh or salt water.

Wetlands are important in several ways. Many kinds of animals live there. Soils are usually full of minerals that help plants grow. Wetlands help prevent land from flooding by collecting water. Wetland plants even help clean dirty water.

▲ Alligators in a wetland find fish, snakes, frogs, and turtles to eat.

Quick Check

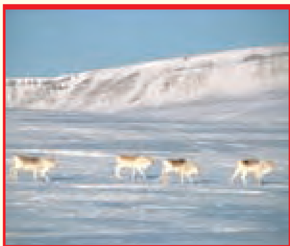
Compare and Contrast How is a wetland like an ocean? How is it different?

Critical Thinking How could draining the wetlands affect living things?

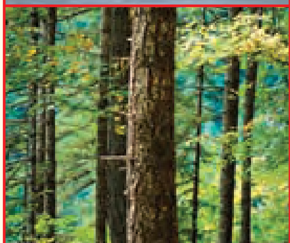
This land is wet, but it may dry up for part of the year.

Lesson Review

Visual Summary



Earth's ecosystems differ by the types of living and nonliving things they have.



Deserts and **forests** are types of land ecosystems.

Oceans and **wetlands** are types of water ecosystems.

Make a FOLDABLES™ Study Guide

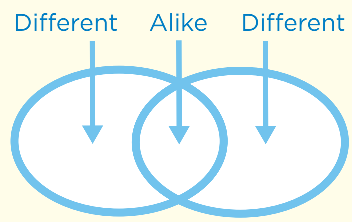
Make a Trifold Book. Use it to summarize what you learned about ecosystems.

Think, Talk, and Write

1. **Main Idea** What are some ways land ecosystems differ?

2. **Vocabulary** What is a wetland?

3. **Compare and Contrast** How is a forest different from a desert? How are the two ecosystems similar?



4. **Critical Thinking** You have a plant and you need to choose an ecosystem for it. What do you need to know about the plant before you decide where it belongs?

5. **Test Prep** **The soil in a tropical rain forest is poor because**
   - **A** it is too sandy.
   - **B** it has no oxygen.
   - **C** it needs fertilizer.
   - **D** plants use up all the nutrients.

Writing Link

Write a Description
Choose one type of ecosystem. Imagine that you are hiking or boating through that environment. Describe what you see, hear, and feel.

Social Studies Link

Do Research
Research the kinds of ecosystems that are found in your state. Draw a map of your state showing the different ecosystems.

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

Meet Ana Luz Porzecanski

Grasslands, known as pampas, are common in South America. That is where Ana Luz Porzecanski, a scientist at the American Museum of Natural History, grew up.

Ana studies birds of the pampas. Some of the birds she studies are called *tinamous* (TIN•uh•mooz). Their brown and gray feathers help them blend in with the tall grass, shrubs, and bushes. This helps them hide from predators, such as foxes and hawks, that eat the birds or their eggs.

How does Ana find tinamous if they are so well hidden? She listens for their songs. Each kind of tinamou has a different song. Sometimes she has to sing or play a recording of their song to get the birds to answer back. It takes time, patience, and a little luck.

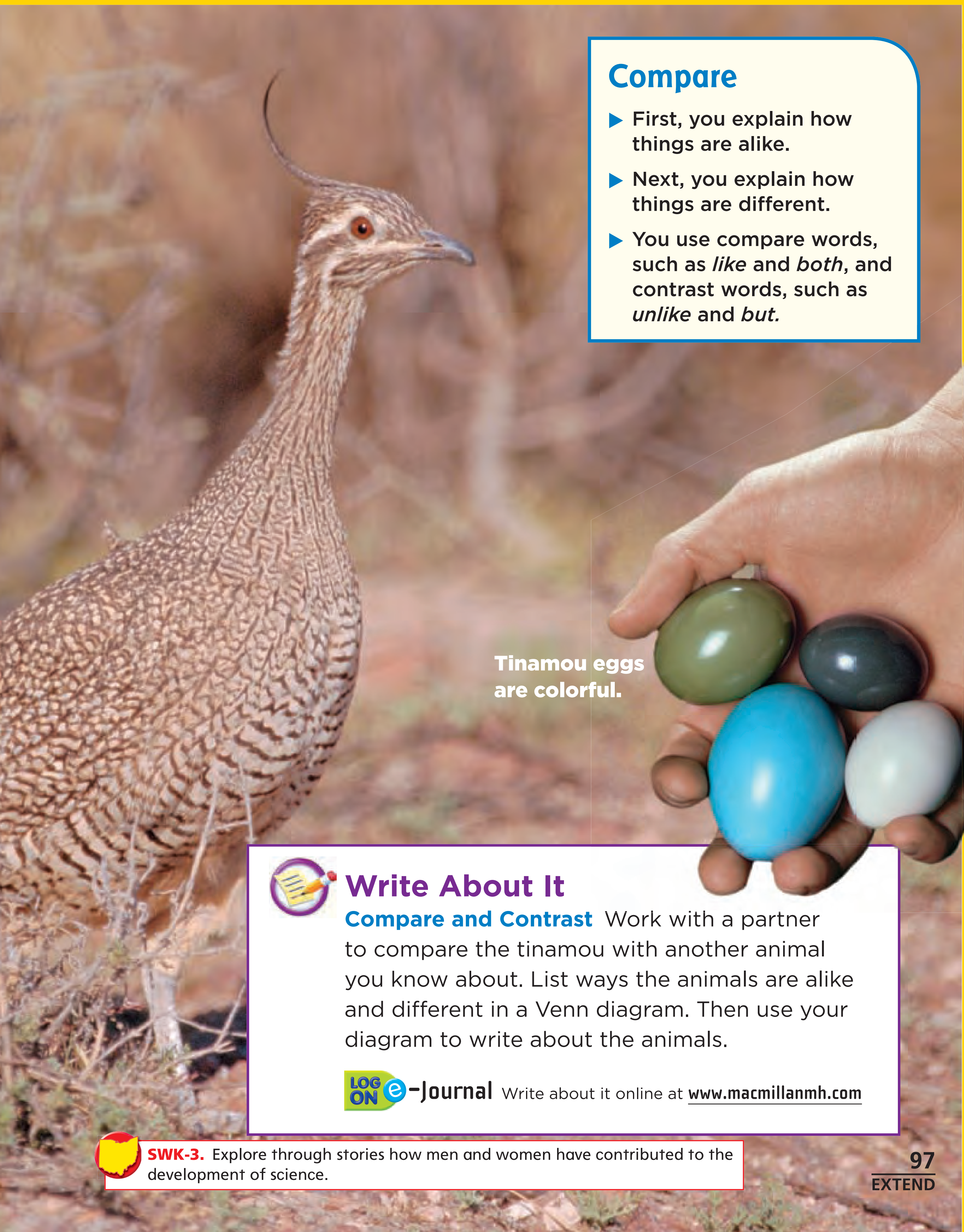
The tinamous are hard to see, but their shiny green, turquoise, or purple eggs really stand out. Ana wants to know why the eggs are so colorful. Why do you think the tinamous have such colorful eggs?

▲ **Ana is an ornithologist. That is a scientist who studies birds.**

American Museum of Natural History

Compare

- First, you explain how things are alike.
- Next, you explain how things are different.
- You use compare words, such as *like* and *both*, and contrast words, such as *unlike* and *but.*



Tinamou eggs are colorful.

Write About It

Compare and Contrast Work with a partner to compare the tinamou with another animal you know about. List ways the animals are alike and different in a Venn diagram. Then use your diagram to write about the animals.

LOG ON e-Journal Write about it online at www.macmillanmh.com

SWK-3. Explore through stories how men and women have contributed to the development of science.

Lesson 3

Adaptations

Look and Wonder

These walruses sleep on a bed of ice. Do you think they feel chilly? How do the walruses keep warm in such a cold place?

LS-2. Relate animal structures to their specific survival functions (e.g., obtaining food, escaping or hiding from enemies).

Does fat help animals survive in cold environments?

Form a Hypothesis

Can fat help keep your finger warm in cold water? Write a hypothesis. Start with "If my finger has a layer of fat, then . . ."

Test Your Hypothesis

1. Use a paper towel to spread vegetable fat over one index finger. Try to coat it completely. Leave your other index finger uncovered.
2. **Predict** What will happen when you put both index fingers in a bowl of ice water?
3. **Experiment** Put one index finger into the ice water. Ask a partner to time how long you can keep your finger in the water. Repeat with your other index finger. Record the data in a chart.
4. Trade roles with your partner and repeat steps 1 through 3.

Draw Conclusions

5. **Interpret Data** Which finger could you keep in the ice water longer? Why? Did your results support your hypothesis?
6. **Infer** Walruses have a layer of fat under their skin. How does this help them survive?

Explore More

Experiment How could you measure how well fat keeps things warm? Could you use thermometers? Make a plan and test it.

Materials

vegetable fat


paper towel


ice water


stopwatch

Step 1

Step 3

SI-5. Record and organize observations (e.g., journals, charts and tables).

Read and Learn

Main Idea LS-2

Plants and animals have adaptations that help them survive in different environments.

Vocabulary

adaptation, p.100

camouflage, p.100

nocturnal, p.103

mimicry, p.105

hibernate, p.105

migrate, p.107

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Reading Skill

Predict

What I Predict	What Happens

Technology SCIENCE QUEST

Explore adaptations with the Secret Agents.

How are living things built to survive?

An insect buzzes through a forest. A frog flicks out its sticky tongue. It catches and swallows the insect whole. The frog's sticky tongue is an adaptation. An **adaptation** is a structure or behavior that helps an organism survive in its environment.

Some adaptations help living things obtain food. Sharp claws help animals such as bears and lions hunt, for example. Flat teeth help animals such as horses chew grass.

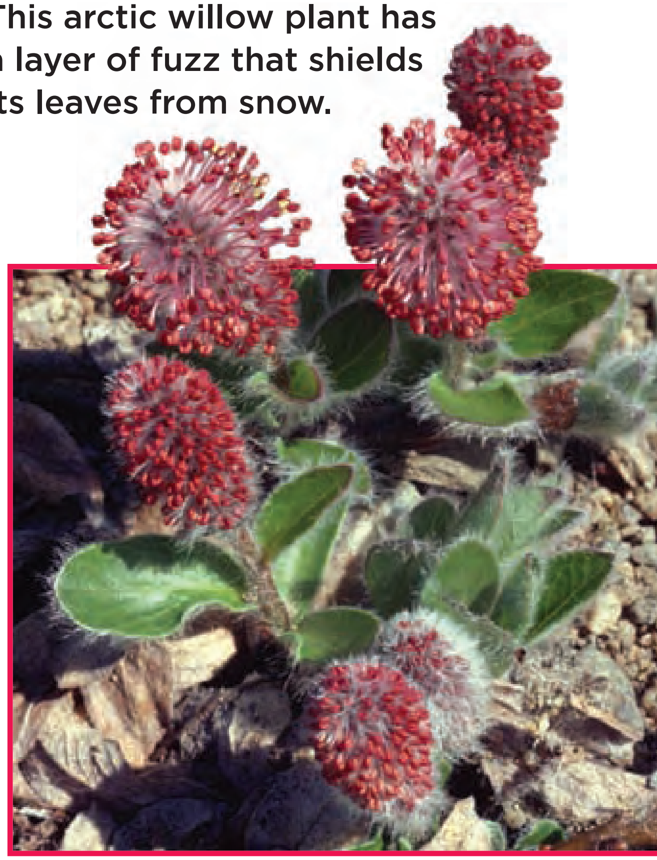
Some adaptations help living things stay safe. For example, some animals hide from enemies by blending into their environment. Blending in is an adaptation called **camouflage** (KAM•uh•flahzh). Camouflage can also help animals sneak up on their prey. A polar bear's white fur blends in with the snow and ice. This helps it hunt seals without being seen.

The frog's sticky tongue helps it catch flies for food.

Can you see the snake? Camouflage may make it invisible to a hungry hawk flying overhead.

Some adaptations help living things survive in certain climates. Plants near the North Pole may have fuzzy leaves. This keeps frost and snow away from the leaf's surface. Sea lions, walruses, and other animals in cold climates have a layer of *blubber*, or fat, under their skin. This blubber is an adaptation that helps keep them warm. Animals store more blubber in winter than in summer.

This arctic willow plant has a layer of fuzz that shields its leaves from snow.



Quick Check

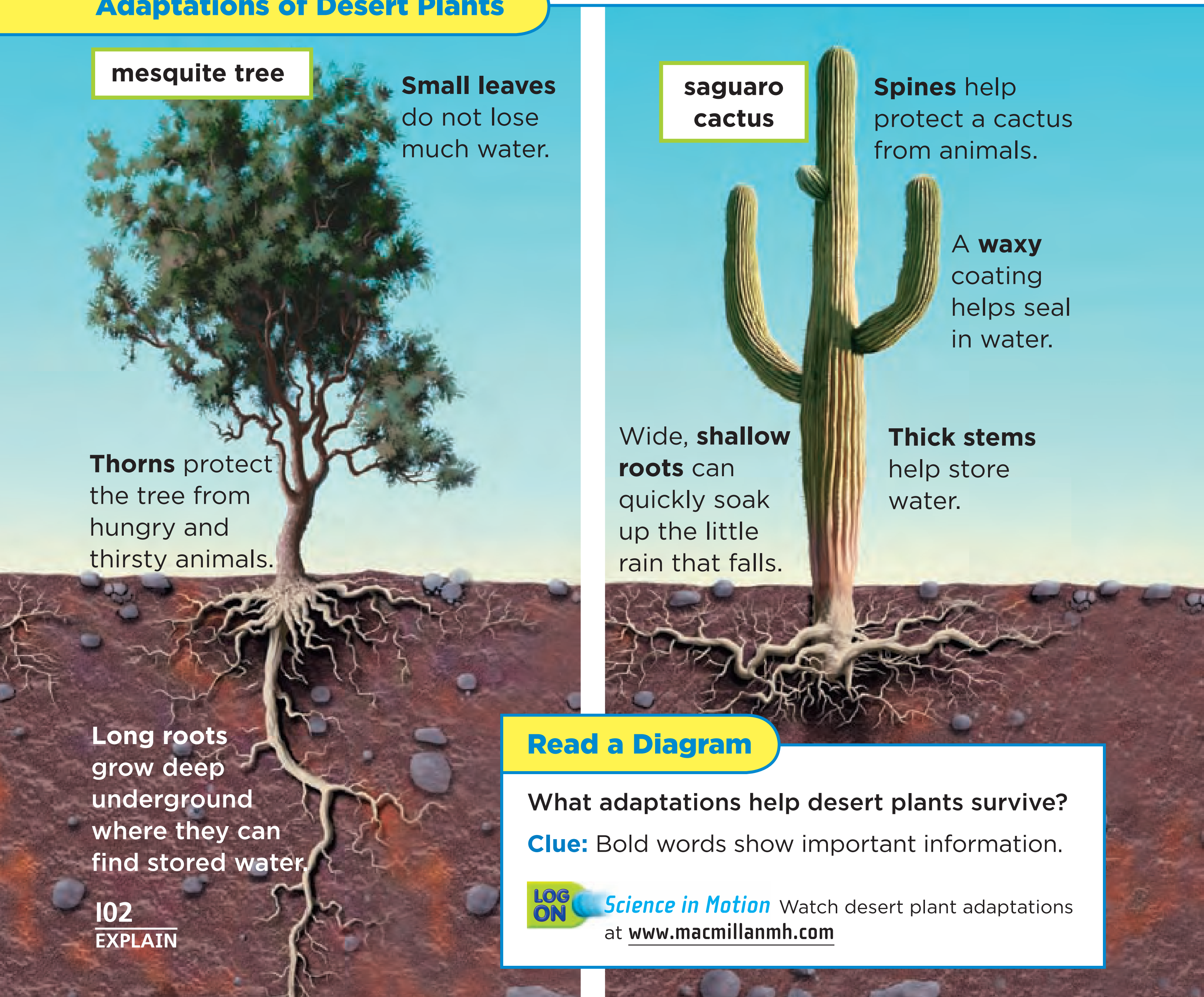
Predict Could different types of animals have similar adaptations?

Critical Thinking Why don't all animals have the same adaptations?

What adaptations help desert plants and animals survive?

Not all living things can survive in a desert. Organisms that do survive have adaptations that help them live in a dry climate. Desert plants have adaptations for taking in and storing water, for example. Their roots may spread wide to soak up rainwater from a large area. Special stems can help store water. Desert animals eat plants to get water. Spines and thorns protect plants from thirsty animals.

Adaptations of Desert Plants



Read a Diagram

What adaptations help desert plants survive?

Clue: Bold words show important information.

LOG ON *Science in Motion* Watch desert plant adaptations at www.macmillanmh.com

▲ **This bat is nocturnal. It sleeps in the daytime when the desert is hot. At night, it feasts on fruit.**

Many desert animals, such as rattlesnakes and coyotes, are nocturnal (nok•TUR•nuhl). **Nocturnal** means they are active at night. They sleep during the day. They come out at night when the desert is cooler.

Large ears and thin bodies help animals, such as the jackrabbit, stay cool. As warm blood flows through an animal's ears, it loses heat. The bigger the ears, the more heat is given off. Pale-colored body coverings keep animals from absorbing too much heat.

Quick Check

Predict Could an animal with a lot of blubber live in a hot desert?

Critical Thinking Would a desert jackrabbit survive better with large or small ears? Why?

Quick Lab

Storing Water

1. **Make a Model** Wet two paper towels. Then wrap one in wax paper. This models a plant that has waxy skin. Use the uncovered towel to model a plant that does not have waxy skin.

2. Place your models in a sunny window.
3. **Observe** How do the paper towels feel later in the day?
4. **Infer** How does waxy skin help desert plants survive?

▲ **Warm blood flows to the jackrabbit's ears and releases some of its heat.**

▲ The “drip tip” at the end of each leaf helps rainwater flow off the leaf.

What adaptations help forest plants and animals survive?

In a forest, tall trees grow toward sunlight. Smaller plants grow in shade under the trees. Animals may find food high in trees or on the dark forest floor. Adaptations help forest organisms survive.

Forest Plants

In tropical rain forests, plants on the forest floor get a lot of rain and not much sunlight. Too much water can damage leaves and branches. Some rain forest leaves have grooves and “drip tips” that help rainwater flow off. These leaves are often large. They catch the little sunlight that shines through the trees.

In temperate forests, winters are cold and dry. There is not much sunlight for trees to make food. Some trees lose their leaves in fall as the temperature drops. This adaptation helps trees save energy.

These leaves can no longer make food. They fall off and make way for new leaves to grow in the spring.

Forest Animals

Some forest animals blend in by looking like other, very different organisms. This adaptation is called mimicry. **Mimicry** is when one living thing imitates another in color or shape. Like camouflage, mimicry helps an organism stay safe in its environment. It can also help an organism hunt without being seen.

Skunks are temperate forest animals that have unusual ways of staying safe. Skunks spray a stinky chemical if a predator gets too close. This chemical can also sting a predator's eyes.

When winter comes in a temperate forest, food may be difficult to find. Animals like the dormouse survive by hibernating. **Hibernate** means to go into a deep sleep. While hibernating, animals use less energy and do not need to eat. Hibernating is an adaptation that helps some animals survive when seasons change.

Quick Check

Predict What does a predator usually do when a skunk gives its warning?

Critical Thinking How is mimicry different from camouflage?

▲ Can you find the insect in this photo? The thorn-mimic treehopper on the right looks like the thorn on the left.

▲ Dormice curl up when they hibernate. That helps to keep them warm.

When in danger, a skunk gives a warning by raising its tail before spraying. ▶

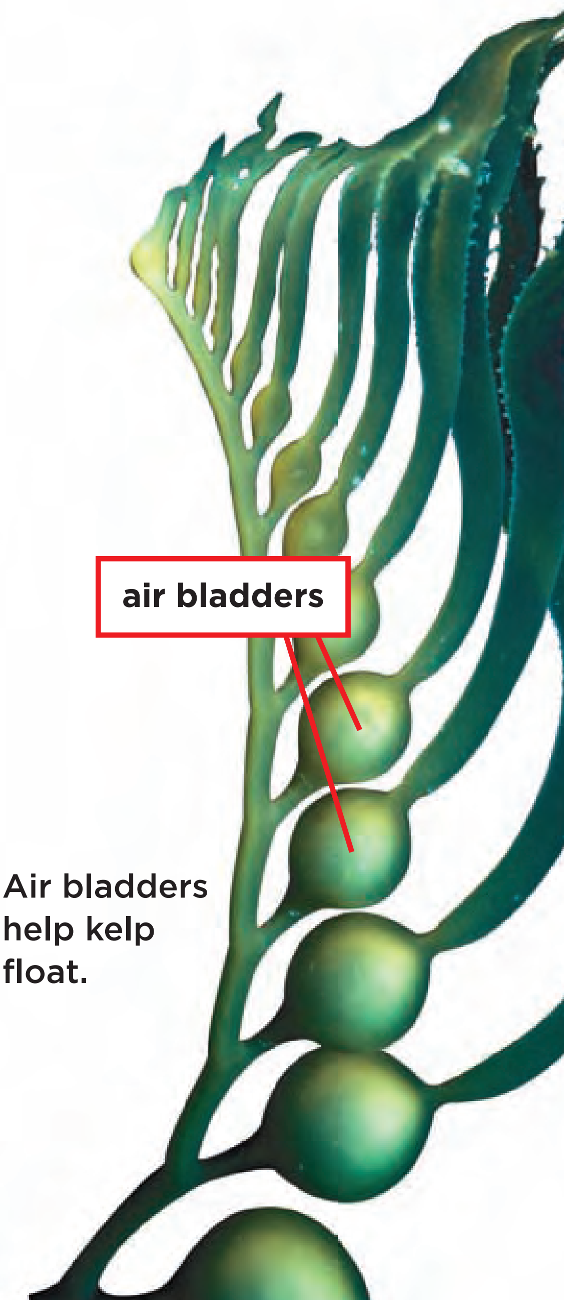
Kelp is a kind of algae. Kelp makes up this seaweed forest.

What adaptations help ocean plants and animals survive?

Oceans are home to millions of living things. Each has adaptations that help it survive in an ocean's salty water. While salt water would kill most organisms, ocean organisms need salt water. They could not survive in the fresh water of lakes or ponds.

Ocean Algae

The seaweed you see floating in the ocean are plantlike organisms called *algae*. Like plants, algae use sunlight to make their own food. Most algae have leaflike structures that take in sunlight. Some have rootlike structures that attach to the ocean floor. These algae can only live in shallow water where they can get sunlight. Other algae have no roots. This adaptation allows them to drift near the water's sunlit surface. Balloonlike structures called air bladders help some algae float.



Air bladders help kelp float.

Sperm whales swim thousands of kilometers when they migrate.

Ocean Animals

Ocean animals have adaptations for moving and living in water. A dolphin's fins and tail help it move. A fish's gills help it breathe.

Some ocean animals migrate from one part of the ocean to another in different seasons. **Migrate** means to move from one place to another. Animals may migrate when their environment gets too cold or when food or water is hard to find.

It is extremely cold and dark deep in the ocean. Few organisms have adaptations for living there. The angler fish is one. It has a growth on top of its head that lights up. The light attracts other animals. They swim close, and the angler fish attacks.

▲ The angler fish has a lighted "fishing pole" to attract prey in deep, dark ocean water.

Quick Check

Predict Would the angler fish's adaptation work in sunlit, shallow water? Why or why not?

Critical Thinking How are algae similar to plants?

What are adaptations to a wetland?

Wetland organisms need to be adapted to survive changes. One day their environment may be underwater, the next day it could be soggy or dry.

Wetland Plants

Plants in wetlands must have a way to survive changing water levels. Mangroves live in wetlands along rivers and oceans. Their roots spread out to get a firm grip on the muddy ground.

Wetland Animals

Wetland animals have ways to survive dry seasons. Walking catfish live in wetland ponds that may dry up. The catfish can use its fins to move over land to another body of water.

The walking catfish can breathe oxygen from the air for short periods.

Quick Check

Predict Could grassland plants survive in a wetland? Why or why not?

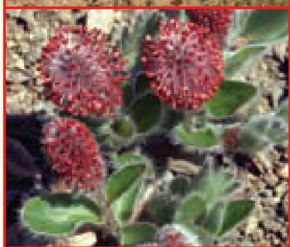
Critical Thinking Think of an adaptation that would let a goldfish survive in a wetland.

Mangroves are one of the few land plants that can survive in salt water.

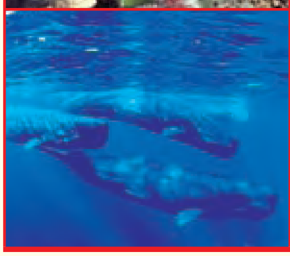
Lesson Review

Visual Summary

Adaptations are structures or behaviors that help an organism survive in its environment.



Some **plant adaptations** include fuzzy leaves, pointed leaves, and shallow roots.



Some **animal adaptations** include camouflage, mimicry, migrating, and hibernating.

Make a FOLDABLES™ Study Guide

Make a Three-Tab Book. Use it to summarize what you learned about adaptations.

Think, Talk, and Write

1. **Main Idea** Describe three adaptations that help plants or animals survive.

2. **Vocabulary** What does nocturnal mean?

3. **Predict** What might happen to an arctic willow plant if you moved it to a tropical rain forest?

What I Predict	What Happens

4. **Critical Thinking** Compare two or more organisms from this lesson. Explain how the organisms are alike and different.

5. **Test Prep** **Why do some animals migrate?**
   - **A** to escape prey
   - **B** to avoid cold weather
   - **C** to find their families
   - **D** to make a change

Math Link

Find Distance
The American robin migrates from Iowa to Alaska. It travels about 40 miles in one day. How far can it fly in five days?

Social Studies Link

Migration Map
Research to find out where one type of animal migrates. Draw a map to show the migration path.

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

Be a Scientist

Materials

yellow paper

brown paper

scissors

stopwatch

Structured Inquiry

How does camouflage help some animals stay safe?

Form a Hypothesis

Which is easier to find, an animal that blends into its environment or an animal that does not blend in? Form a hypothesis. Start with "If an animal blends into its environment, then . . ."

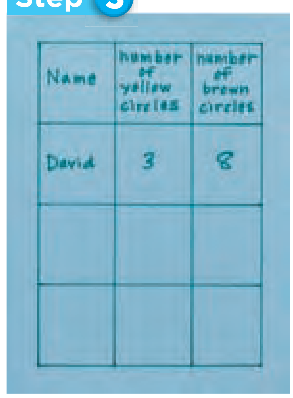
Test Your Hypothesis

1. Cut out 20 yellow circles and 20 brown circles.
2. **Experiment** Spread out the circles on yellow paper to model animals with and without camouflage. Then ask a classmate to pick up as many circles as he or she can in 10 seconds.

Step 2

3. **Communicate** How many of each color circle did your classmate pick up? Use a chart to record the results.
4. Repeat steps 1 and 2 with two other classmates.

Step 3



Draw Conclusions

5 **Interpret Data** Did your classmates pick up more yellow or brown circles? Which circles were harder to find?

6 **Infer** How does camouflage help animals stay safe?

Guided Inquiry

How do pale colors help some animals survive?

Form a Hypothesis

How do pale body coverings affect a desert animal's temperature? Write a hypothesis.

Test Your Hypothesis

Design a plan to test your hypothesis. Use the materials shown. Write the steps you plan to follow.

Materials

Draw Conclusions

Did your results support your hypothesis? Why or why not? Share your results with your classmates.

Open Inquiry

What other questions do you have about plant and animal adaptations? Discuss with classmates the questions you have. How might you find the answers to your questions?

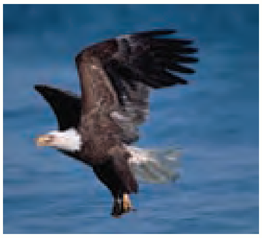
Remember to follow the steps of the scientific method.

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

SI-6. Communicate scientific findings to others through a variety of methods (e.g., pictures, written, oral and recorded observations).

CHAPTER 2 Review

Visual Summary



Lesson 1 Food chains and food webs show how organisms in an ecosystem depend on each other.

Lesson 2 Earth has different ecosystems. They are classified by their climate, soil, plants, and animals.

Lesson 3 Plants and animals have adaptations that help them survive in different environments.

Make a FOLDABLES™ Study Guide

Glue your lesson study guides to a piece of paper as shown. Use your study guide to review what you have learned in this chapter.

Vocabulary

Fill each blank with the best term from the list.

adaptation, p. 100	**ecosystem**, p. 74
camouflage, p. 100	**food chain**, p. 76
climate, p. 86	**forest**, p. 90
decomposer, p. 77	**nocturnal**, p. 103
desert, p. 88	**producer**, p. 76

1. An ecosystem that has many trees is called a ________.
LS-B

2. In an ecosystem a ________ shows how energy passes from one organism to another.
LS-B

3. An animal that is active at night is ________.
LS-2

4. A special structure or behavior that helps an organism survive in an environment is an ________.
LS-2

5. An organism that makes its own food is called a ________.
LS-B

6. Plants often grow far apart in the dry climate of the ________.
LS-B

7. An adaptation called ________ helps an animal blend in with its environment.
LS-B

8. Living and nonliving things interacting in their environment make up an ________.
LS-B

9. An organism that breaks down dead plants and animals is called a ________.
LS-B

10. The pattern of weather in a place over a long time is its ________.
ESS-D

Skills and Concepts

Answer each of the following in complete sentences.

11. **Infer** Is it possible to have more than one producer in a food chain? Could there be more than one consumer?
LS-B

12. **Writing That Compares** How is a pond ecosystem like a wetland? How is it different? Write about as many similarities and differences as you can.
LS-B

13. **Communicate** Make a chart with two columns: Plants and Animals. Record the foods you eat during one day, putting each in the correct column. If a food contains plant and animal material, list it in both columns.
LS-B

14. **Critical Thinking** Imagine you are taking care of a plant and an animal from a pond ecosystem. What kind of environment would you create for them to live in?
LS-B

15. What would you need to survive in the cold environment shown below?

LS-2, LS-6

The Big Idea

16. How do living things survive in their environments?
LS-B

Performance Assessment

A New Organism

Examples of Ecosystems

grassland

rain forest

ocean

- Choose an ecosystem. Make up a new kind of organism that could live in this ecosystem. What adaptations would your organism have? How would it behave? How would it get food?
- Make a poster showing your organism in its habitat. Label and describe its adaptations. Tell how the adaptations help it survive. Draw a food-chain diagram that includes your organism.

Ohio Activity

Research information on Ohio organisms, including where they live and what they eat.

Draw a diagram showing some organisms in an Ohio ecosystem. Show the relationship between animals and their food.

Do research on a predator of your choice. What kinds of senses does it have? How do they help it hunt? How do its senses help it?

Write a report based on your research.

Ohio Benchmark Practice

1 **Which statement is true of soil rich in humus?**

A Soil rich in humus is porous and does not hold water or nutrients.

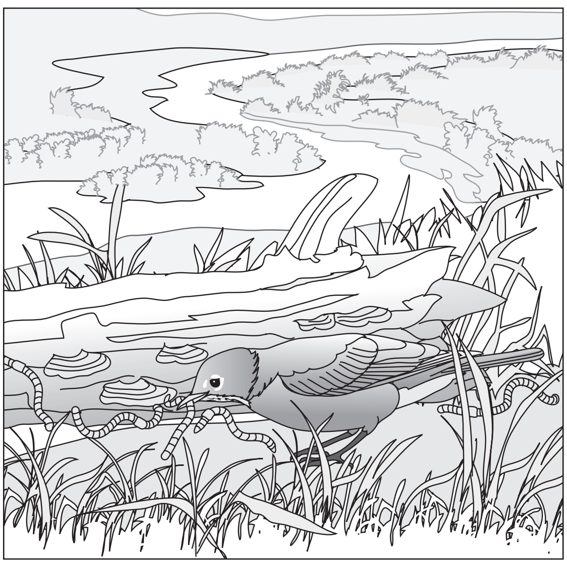
B Soil rich in humus contains fertilizer.

C Soil rich in humus is sandy and is usually found in the desert.

D Soil rich in humus holds water and nutrients for plants to use.

ESS-C

Use the following picture to answer question 2.



2 **In your Answer Document, identify the organism that is both a consumer and a decomposer.**

Then, explain why the organism is classified as both a consumer and a decomposer. (2 points)

LS-B

3 **Why are most desert animals nocturnal?**

A Deserts have sandy soil.

B Deserts are cooler at night.

C Deserts get very little rain.

D Deserts are very dusty.

LS-B

4 **Which statement is not true about living things and habitats?**

A Living things use habitats to get food and water.

B Living things use habitats for hiding and sleeping.

C Living things use habitats to navigate forests.

D Living things use habitats for shelter.

ESS-C

5 **What do the large ears of the jackrabbit help it do?**

A run fast

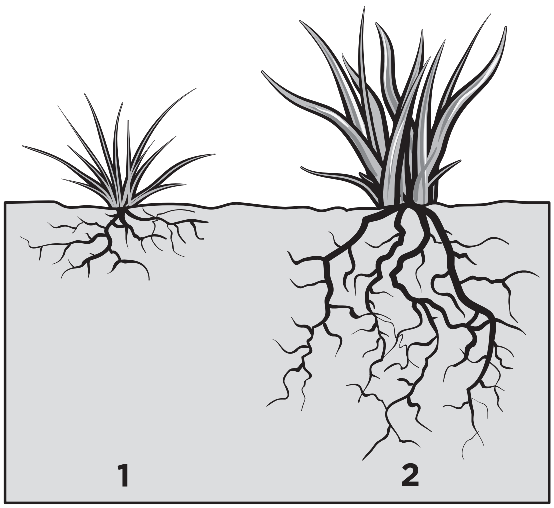
B hear well

C stay cool

D blend in

LS-B

6 Which of the plants below would survive **best** in a desert habitat, and why?



A plant 1, because of its shallow roots

B plant 1, because of its deep roots

C plant 2, because of its shallow roots

D plant 2, because of its deep roots

LS-B

7 Where would you be **most likely** to find animals with thick fur and a lot of blubber?

A a desert

B a grassland

C a forest

D a tundra

LS-B

8 What adaptation is an insect using when it looks like part of a tree?

A hibernation

B camouflage

C mimicry

D migration

LS-B

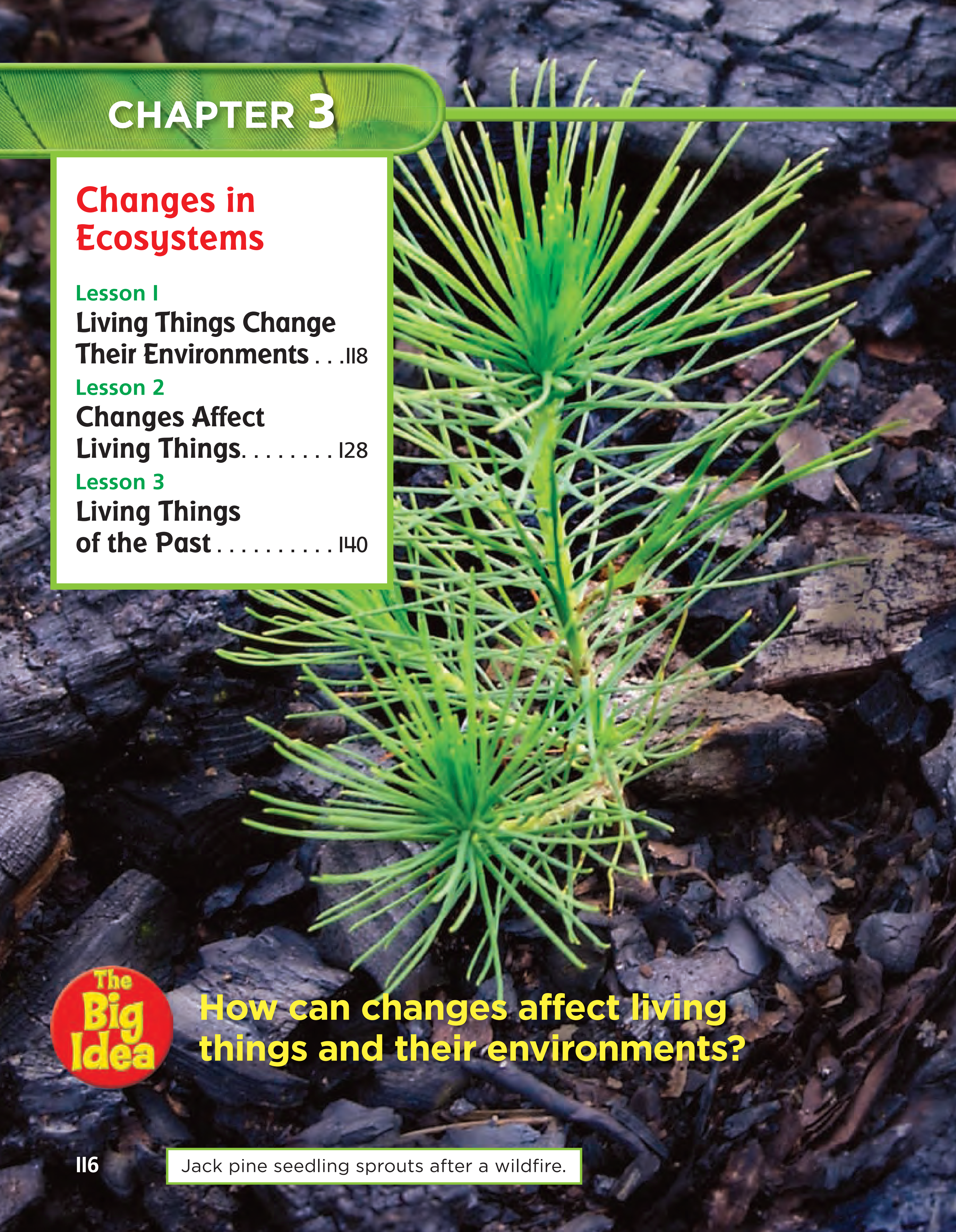
9 A class observed a pond food web. The students made a table of their observations.

What Eats What	
Organism	**Food Eaten**
snail	algae
turtle	algae, snails
sunfish	snails
bass	turtles, sunfish

In your **Answer Document**, draw a food web with three of these organisms.

When drawing the food web, be sure to include the producer. Identify the names of each organism and draw arrows to trace the energy flow among the organisms. (4 points)

LS-B



CHAPTER 3

Changes in Ecosystems

The Big Idea

How can changes affect living things and their environments?

Jack pine seedling sprouts after a wildfire.

Key Vocabulary

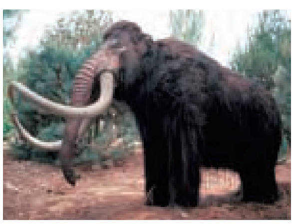
resource
a substance in the environment that helps an organism survive (p. 120)

competition
the struggle among organisms for water, food, or other needs (p. 121)

pollution
what happens when harmful materials get into water, air, or land (p. 122)

endangered
when one kind of organism has very few of its kind left; close to becoming extinct (p. 136)

fossil
the trace or remains of something that lived long ago (p. 142)



extinct
when one kind of organism has died out everywhere on Earth (p. 142)

More Vocabulary

reduce, p. 124

reuse, p. 124

recycle, p. 124

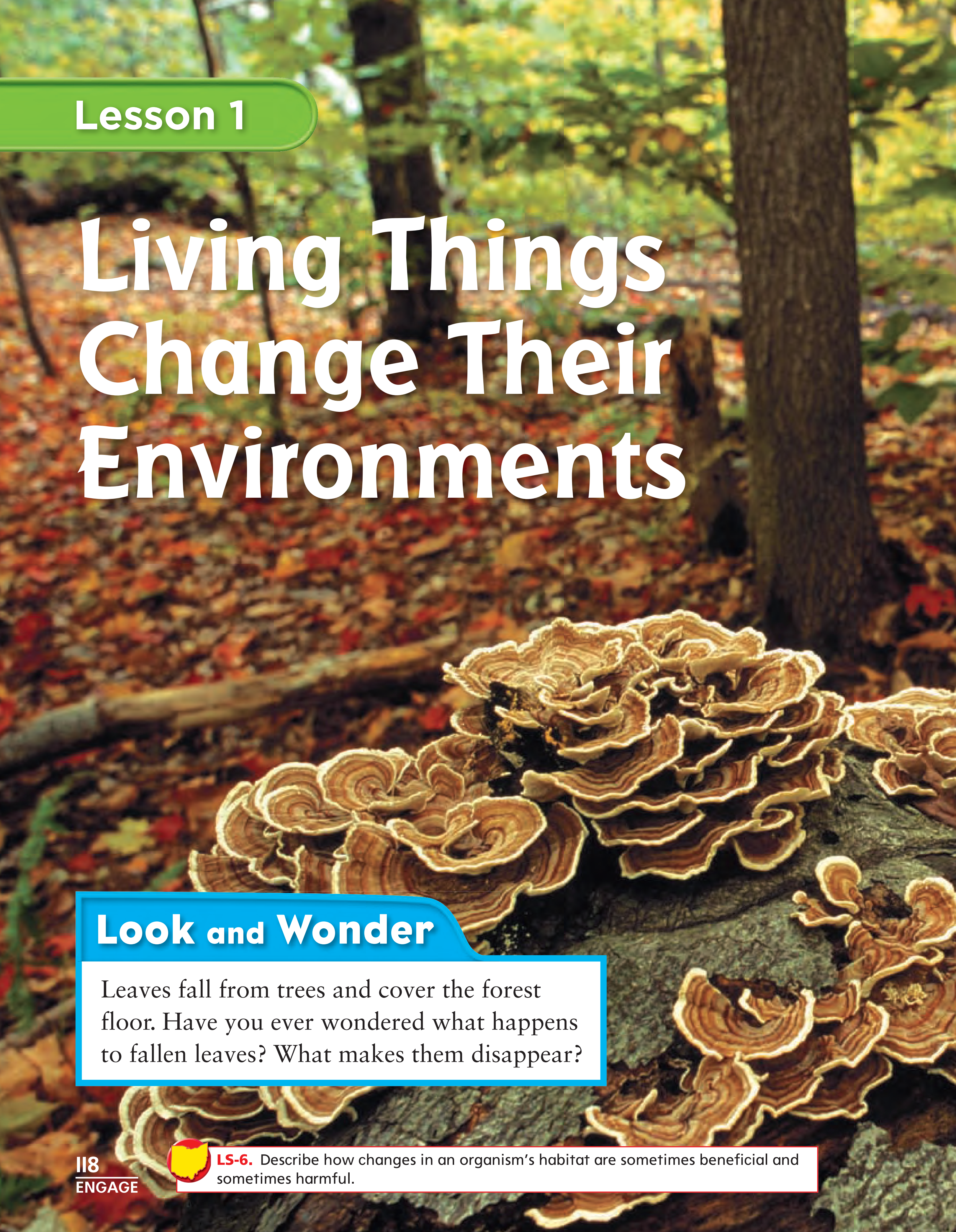
flood, p. 130

drought, p. 130

population, p. 134

community, p. 134

LS-C. Compare changes in an organism's ecosystem/habitat that affect its survival.



Lesson 1

Living Things Change Their Environments

Look and Wonder

Leaves fall from trees and cover the forest floor. Have you ever wondered what happens to fallen leaves? What makes them disappear?

LS-6. Describe how changes in an organism's habitat are sometimes beneficial and sometimes harmful.

Explore

Inquiry Activity

How can worms change their environment?

Purpose

All living things change their environments as they get food, water, shelter, and other needs. In this activity, find out how worms change their environment.

Procedure

1. **Make a Model** Put some soil in a plastic container. Then put small stones and leaves on top of the soil. This models a forest floor.
2. Place live worms on the "forest floor."
3. **Predict** What will the worms do? Make a short list of the things you might see the worms do.
4. **Observe** Check the worms, soil, leaves, and stones every three to four days. Keep the soil moist. Record your observations.

Draw Conclusions

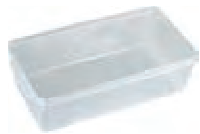
5. **Infer** What happened to the leaves over time?
6. **Communicate** How do worms change the environment in which they live?

Explore More

Experiment How do other living things change their environments? Make a plan to test your ideas. Then try your plan.

Materials


moist soil


plastic container


stones


leaves


worms

Step 1

Step 2

SI-5. Record and organize observations (e.g., journals, charts and tables).

Read and Learn

Main Idea LS-6

Living things change their environments as they meet their needs. These changes can be helpful or harmful to their environments.

Vocabulary

resource, p. 120

competition, p. 121

pollution, p. 122

reduce, p. 124

reuse, p. 124

recycle, p. 124

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Reading Skill

Predict

What I Predict	What Happens

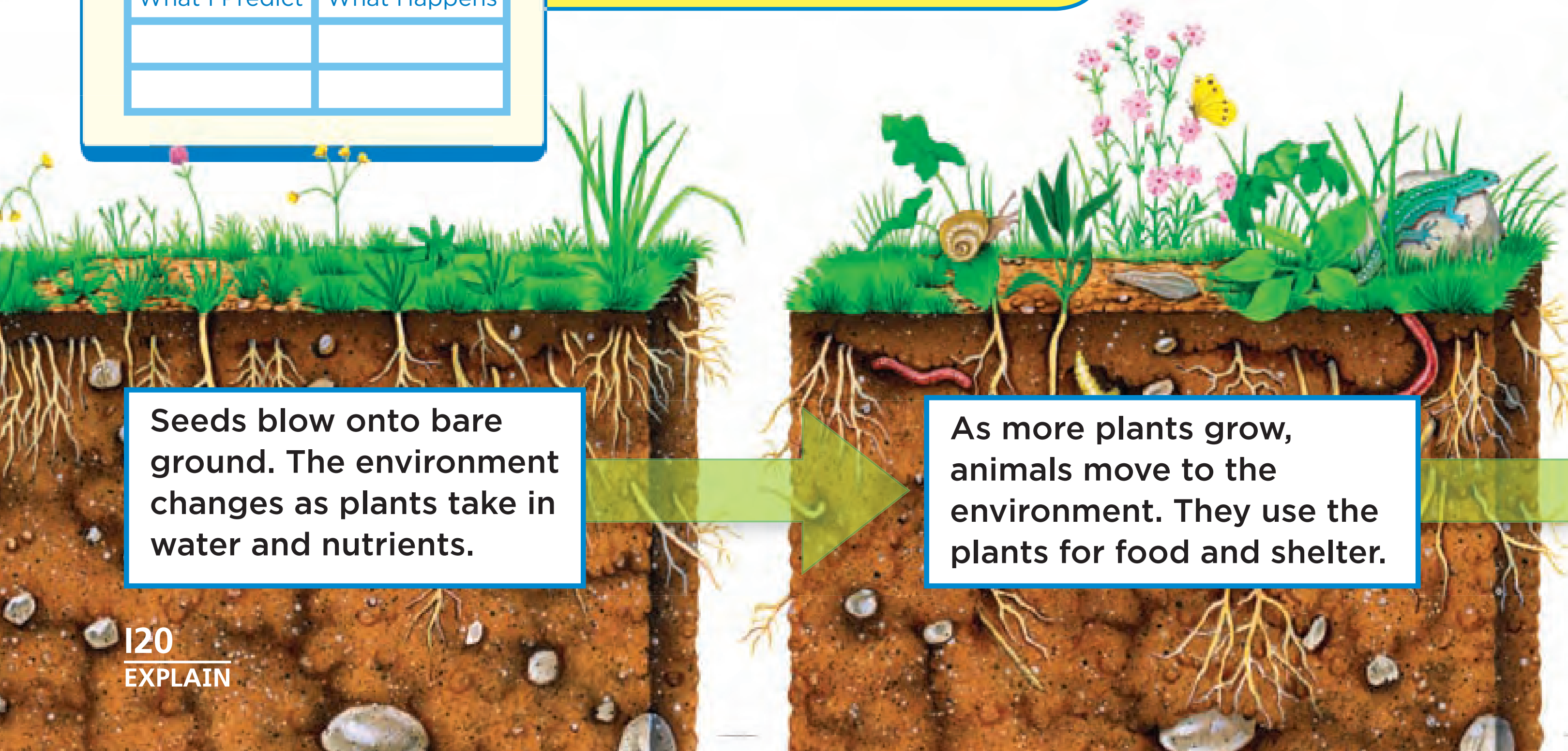
How do living things change their environments?

Every living thing changes its environment as it meets its needs. A spider spins a web to catch insects for food. A bird builds a nest for shelter. A plant takes water from the soil. These actions change an environment in small ways.

Other living things make bigger changes to their environments. For example, bacteria, worms, and fungi break down leaves and other dead material. These decomposers return valuable nutrients to the soil. Later, plants can use those nutrients to grow.

All of these living things are trying to get resources. A **resource** is something that helps an organism survive. Food, water, air, space, sunlight, and shelter are some resources.

A Changing Environment



Seeds blow onto bare ground. The environment changes as plants take in water and nutrients.

As more plants grow, animals move to the environment. They use the plants for food and shelter.

Every environment has a limited amount of resources. As a result, living things must compete for them. **Competition** (kahm•pi•TISH•uhn) is the struggle among living things for resources. Competition can be a major cause of environmental change. The diagram below shows how one environment changes over time.

Quick Check

Predict How would a forest change if a big tree fell?

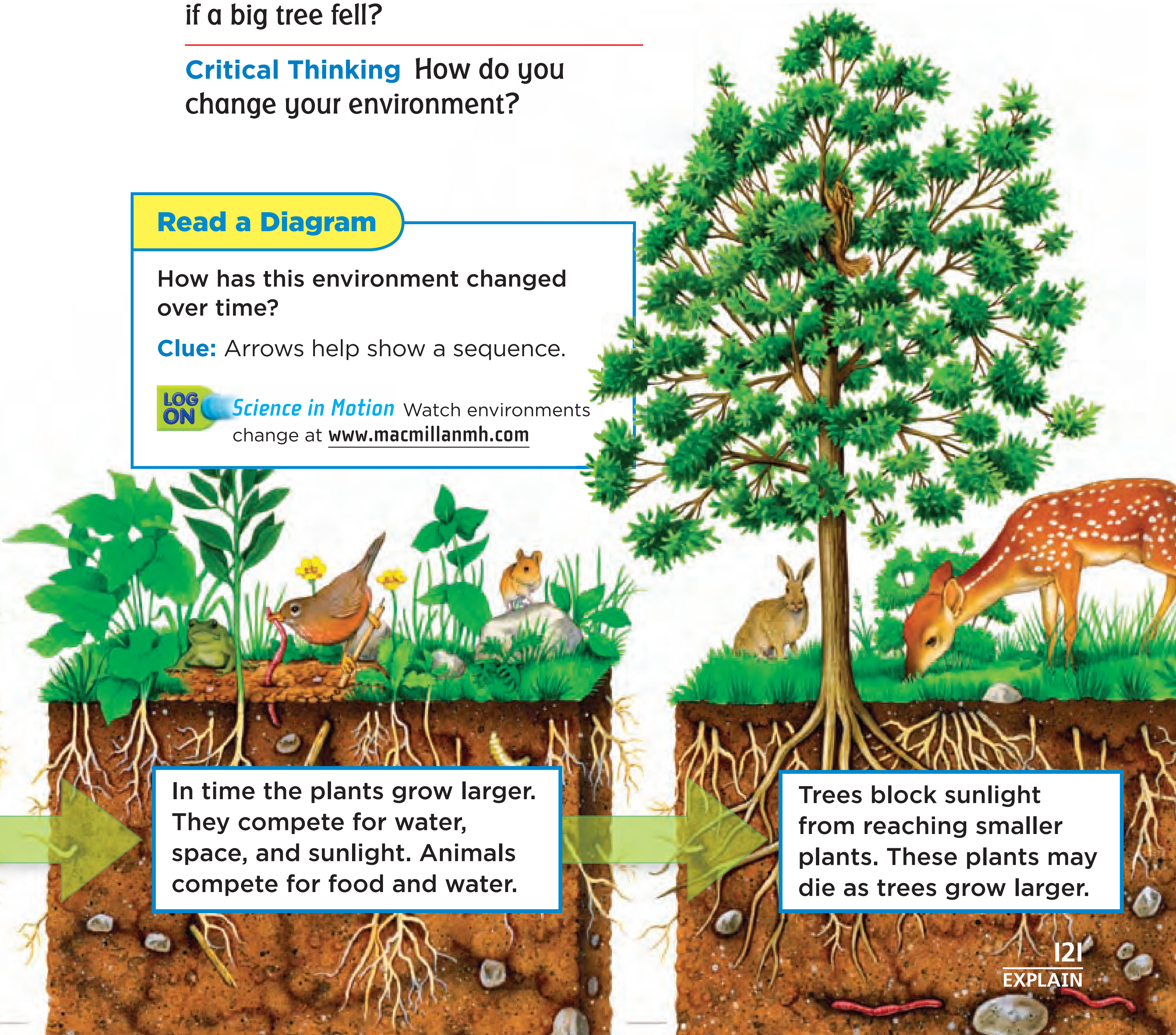
Critical Thinking How do you change your environment?

Read a Diagram

How has this environment changed over time?

Clue: Arrows help show a sequence.

LOG ON *Science in Motion* Watch environments change at www.macmillanmh.com



▲ The garbage on this beach is a form of land pollution.

How do people change their environments?

People change their environments more than any other organism. Changes, such as planting trees, are helpful. However, other changes can be harmful.

Pollution

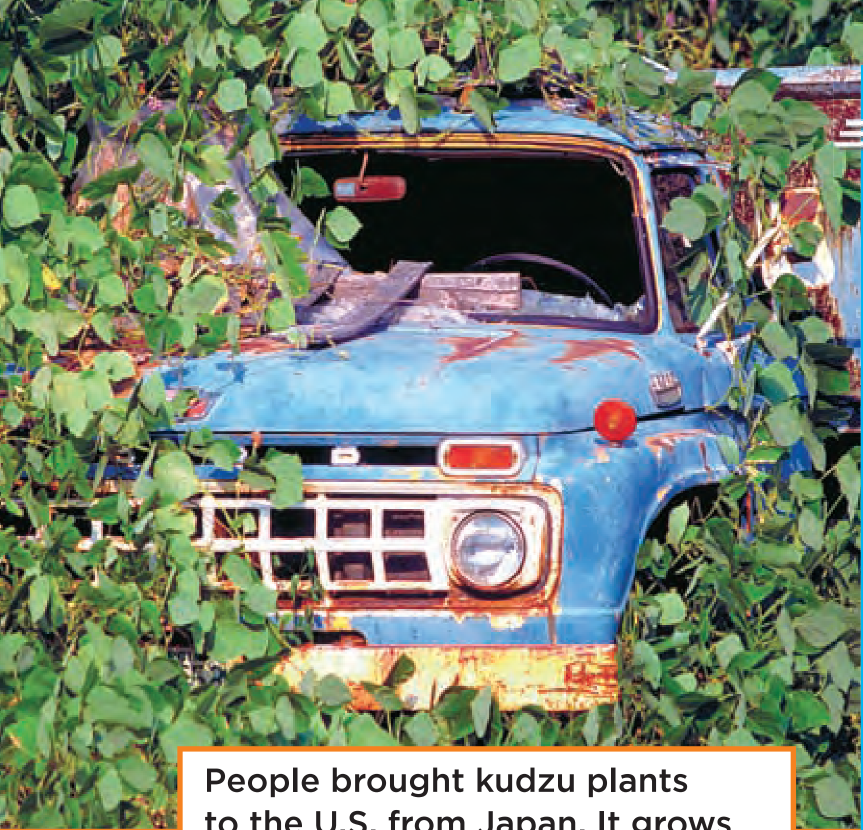
People can harm their environments by creating pollution. **Pollution** happens when harmful materials get into the air, land, or water. Cars can pollute the air. Trash pollutes the water and land.

Clearing Land

Sometimes, people change natural areas when they build shops and homes. In the past, people drained wetlands and built over them. Wetlands help filter water, so pollution increases without them.

People also cut down trees to make wood products. If forests are removed, living things can be left without a home. Soil can wear away without tree roots to hold it in place.

Sometimes trees are cut down to make wood products.



People brought kudzu plants to the U.S. from Japan. It grows over almost everything in sight.

Quick Lab

Model Pollution

1. **Observe** Look at the shell of a hard-boiled egg. Is it hard or soft? Why do you think the egg has this type of shell?
2. **Make a Model** Fill a large cup with vinegar. This models polluted land or water. Place your egg inside of the cup.

3. **Observe** Look at the egg throughout the day. Study the shell of the egg. Do you notice any differences in the egg or its shell?
4. **Infer** After being placed in vinegar, can the shell still protect the egg?
5. **Predict** What may happen to eggs near polluted land or water?

Creating Competition

Sometimes people bring new organisms into an environment. These new organisms may harm the environment by competing for limited resources. For example, kudzu plants were brought to America from Japan. Kudzu can grow rapidly. It takes water and nutrients that other plants need.

The new organisms may not be eaten by many animals in their new environment. This lets them reproduce very quickly. If this happens, the new organisms can use up most of the limited resources in an environment.

Quick Check

Predict What might happen to plants and animals if their environment is harmed?

Critical Thinking How does pollution affect people?

This house was built from reused bottles.

How can people protect their environments?

People can help protect their environments. One thing people can do is practice the 3 *Rs*—reduce, reuse, and recycle. To **reduce** means to use less of something. To **reuse** means to use something again. To **recycle** means to turn old things into new things. When you practice the 3 *Rs*, you produce less trash and cut down on pollution.

People can also help their environments by planting trees. Trees help environments in many ways. Trees clean the air and provide homes for animals. Their roots help keep soil from washing or blowing away. By planting a tree, you help keep your environment healthy.

Quick Check

Predict How might recycling paper protect your environment?

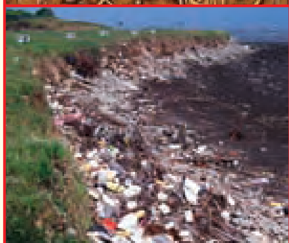
Critical Thinking List some things you can reuse.

Recycling is one way that people can help protect their environments.

Lesson Review

Visual Summary

Living things change their environments as they meet their needs.

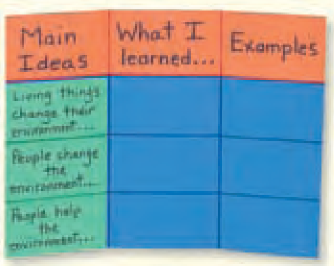


People change their environments more than any other living thing.

People can help their environments by practicing the 3 *R*s.

Make a FOLDABLES™ Study Guide

Make a Trifold Book. Use it to summarize what you learned about environments and change.



Think, Talk, and Write

1. **Main Idea** What are some ways in which plants and animals change their environments?

2. **Vocabulary** What is competition?

3. **Predict** What might happen if people don't practice the 3 *R*s?

What I Predict	What Happens

4. **Critical Thinking** What are some things you could reduce your use of?

5. **Test Prep** **People can do all of the following to help the environment EXCEPT**
   - **A** recycle.
   - **B** pollute.
   - **C** reuse.
   - **D** plant trees.

Math Link

Make a Bar Graph
Keep track of the paper, metal, plastic, and food scraps that you throw away in one week.
Make a bar graph that shows how many of each item you threw away during that week.

Art Link

Make a Poster
Make a poster about the things people can do to help the environment. Include things you learned from this lesson as well as things you already knew.

Focus on Skills

Inquiry Skill: Use Numbers

The average American changes his or her environment by producing about 2 kilograms (4 pounds) of trash every day! We can never get rid of trash completely. However, we can cut down on the amount we create by practicing the 3 *Rs*. Do students in your school practice the 3 *Rs*? Find out the same way scientists do—**use numbers** to record data.

▶ Learn It

When you **use numbers**, you present data in a way that people can clearly understand. Basic math skills, such as counting and ordering numbers, help to collect and organize information. Often, scientists gather and record data by asking questions or by having people fill out surveys. Then they use numbers to put the data into a chart or graph. You can do it, too.

▶ Try It

In this activity, you will gather data and **use numbers** to find out how much trash is thrown out by students in your school. You cannot survey the whole school, but you can do a mini-survey.

1. Choose five students to survey in the lunchroom.
2. Ask each student questions about how many pieces of trash from lunch he or she threw away today. Ask about the containers used. Will anything be reused?

SI-5. Record and organize observations (e.g., journals, charts and tables).

3 Use a table like the one shown below to organize your data.

Student's Name	Pieces Reused	Pieces Recycled	Pieces Thrown Away	Total Pieces of Trash
Total				

Now use numbers to answer the following questions.

- Did every student throw out some trash or packaging material?
- How many pieces of trash did the students recycle? How many pieces did they reuse?
- How many pieces of trash did these five people create altogether?

Apply It

Use numbers to combine your data with those of your classmates. Add to find the totals for each column. Then make a bar graph to show the results.

Do you predict these same students will throw out more or less trash tomorrow? Plan another survey. Then use numbers to compare the new results to your first results just as scientists do!

Lesson 2

Changes Affect Living Things

Look and Wonder

Plants need rain in order to grow. Can they get too much rain? How are living things affected when there is a flood?

LS-6. Describe how changes in an organism's habitat are sometimes beneficial and sometimes harmful.

Explore

Inquiry Activity

How can a flood affect plants?

Form a Hypothesis

What happens to plants when they get too much water? Write a hypothesis.

Test Your Hypothesis

1. Label three plants *A, B,* and *C*. Water plant *A* once a week with 60 mL of water. Water plant *B* every day with 60 mL of water. Water plant *C* every day with 120 mL of water.
2. **Predict** Which plant will grow to be the tallest? Record your prediction.
3. **Observe** Monitor your plants every few days. Measure how tall they grow. Record how they look with words and pictures.

Draw Conclusions

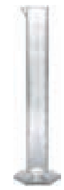
4. **Interpret Data** How did the plants change over time? Which plant grew the tallest? Which do you think is the healthiest?
5. **Infer** What happens to some plants when there is a flood?

Explore More

Interpret Data Compare your results with a classmate. Should you change your work based on someone else's results? Explain.

Materials

3 identical plants



graduated cylinder and water

ruler

Step 1

Step 3

SWK-2. Keep records of investigations and observations and do not change the records that are different from someone else's work.

Read and Learn

Main Idea LS-6

Natural disasters and diseases can change environments. Living things respond to these changes in different ways.

Vocabulary

flood, p. 130

drought, p. 130

population, p. 134

community, p. 134

endangered, p. 136

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Reading Skill

Cause and Effect

Cause → Effect

Technology SCIENCE QUEST

Explore how environments change with the Secret Agents.

What are some ways environments change?

You learned some ways that living things change their environments. Environments can be changed in other ways, too. Natural disasters and diseases can change an environment.

A flood is one type of natural disaster. A **flood** happens when dry land becomes covered with water. Heavy rains and other storms can cause a flood. Floods change an environment by washing away soil and plants. They can cause animals to lose their habitats.

A drought is the opposite of a flood. A **drought** (DROWT) happens when there is no rain for a long time. Without rain, rivers and lakes can dry up. Soil can also dry out. Living things need water to survive, so droughts can harm living things.

Before a drought set in, this area was a lake. Many living things once made their homes here.

Wildfires can destroy natural environments like this forest.

▲ New plants can grow after a fire.

Droughts can lead to wildfires. If a dry part of a forest or grassland is struck by lightning, a wildfire can start. Wildfires can harm plants and the habitats of many animals. Smoke from the fires pollutes the air.

Environments can also be changed by diseases. Many things, such as bacteria, mold, and mildew, can cause diseases. Some diseases spread easily and harm many living things. An entire forest, for example, may eventually be destroyed if one tree catches a disease.

The black spots on these rose leaves are a sign of a disease. ▼

Quick Check

Cause and Effect What can cause sudden changes in an environment?

Critical Thinking Can living things return to an environment after a natural disaster?

FACT Wildfires can help some plants.

How do organisms respond to changes?

Environmental changes can affect living things. For example, each year some grasslands in Africa go through a dry season. When this happens, plants and animals get less water. Watering holes can dry up. Tall grasses may dry out. Living things respond to these changes in different ways.

When an environment changes, some living things must move. They must find a new habitat in which to live. Elephants, for example, migrate in search of water and grasses.

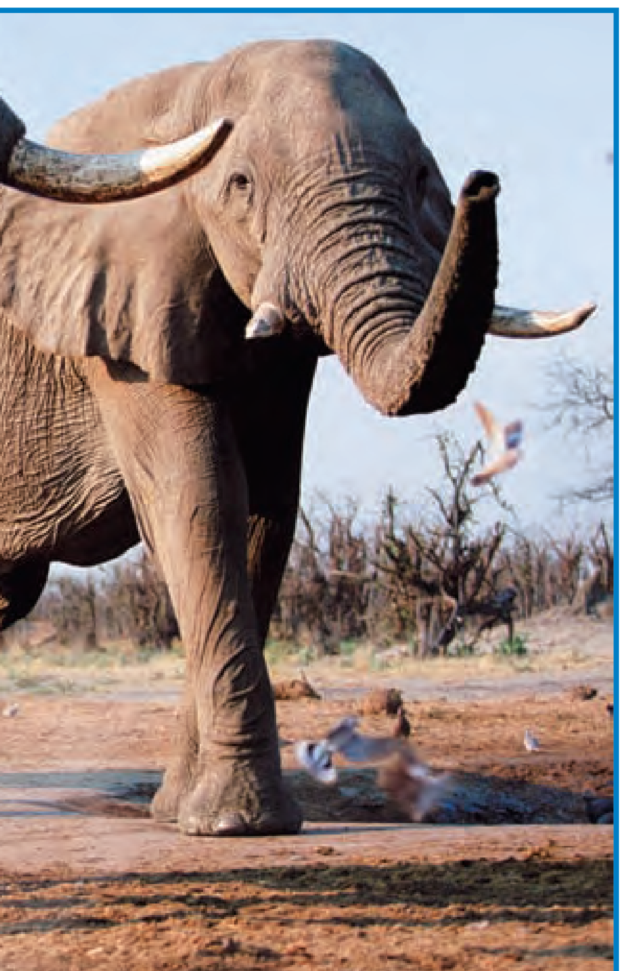
▲ Animals, such as these springbok, depend on watering holes.

Some living things adjust in order to survive. Predators may hunt different prey or eat whatever is available. Some animals may hunt at night if it makes it easier to find food.

Other living things have adaptations that help them survive changes. Some frogs and fish are adapted to burrow into mud when their environment becomes too dry. They go into a deep sleep and do not eat. They come out when the environment is wet again.

Living things that are not able to travel or change could die. Plants, such as savanna grasses, cannot move to new places. Without rain, these grasses begin to dry up. If the drought lasts for too long, they may die.

▲ Many frogs are adapted to burrow underground when their environment becomes dry.



Quick Check

Cause and Effect What environmental changes might cause an animal to move to another place?

Critical Thinking What might happen to an elephant if its habitat suddenly becomes too cold?

◀ In a dry season, these African elephants migrate. They find a new habitat that can provide water, food, and shelter.

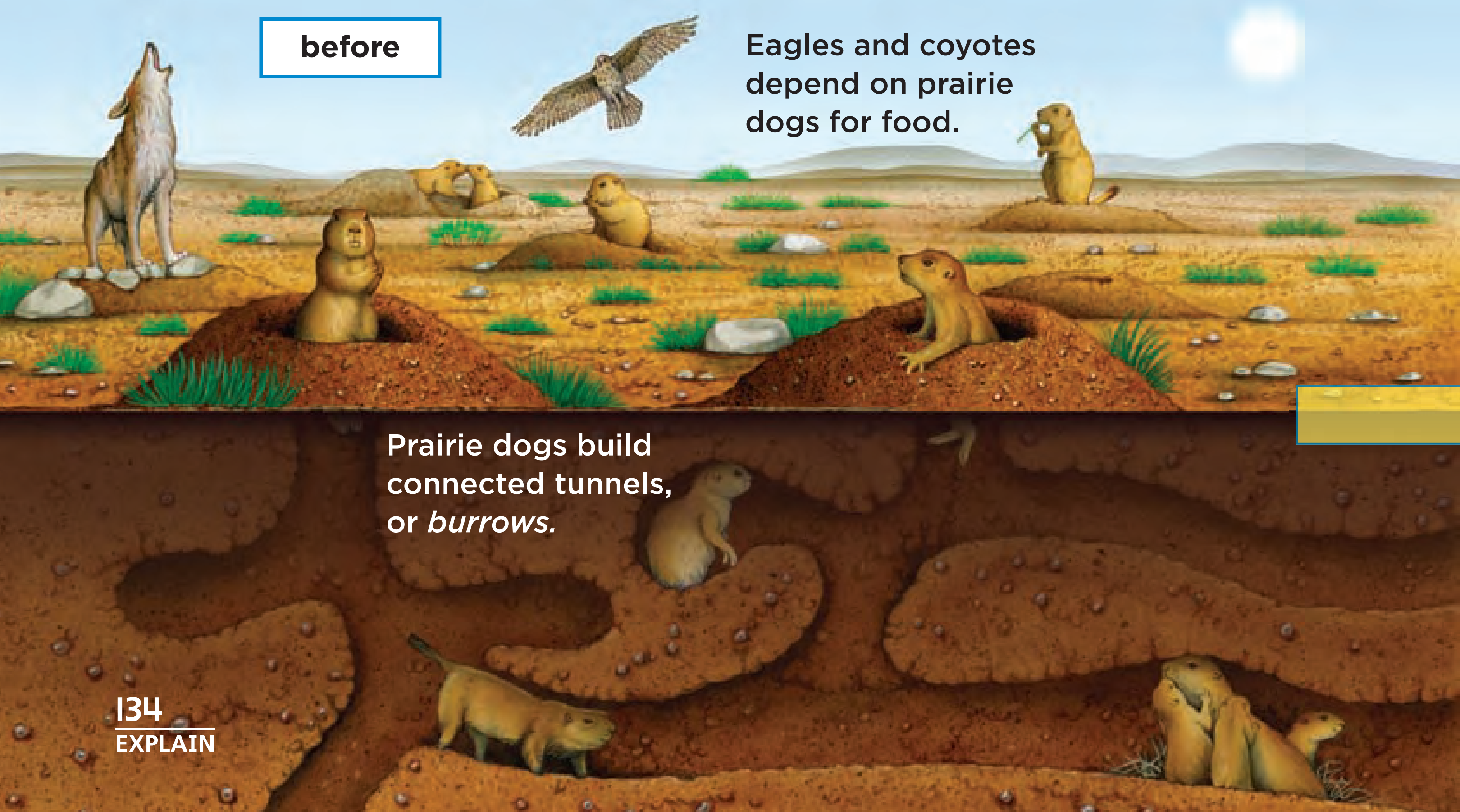
How do environmental changes affect an entire community?

Underneath the grasslands of the central United States lies an unseen world! Beneath the grasses is a complex system of tunnels. Prairie dogs build these tunnels and live in them. They come to the surface to eat grasses.

Prairie dogs are one population (pahp•yuh•LAY•shuhn) in a prairie. A **population** is all the members of one kind of organism in an ecosystem. All the coyotes are another population.

Populations in an ecosystem depend on each other. Burrowing owls and snakes make homes in the tunnels that prairie dogs leave behind. Eagles and coyotes feed on prairie dogs. If anything happens to prairie dogs, the whole community (kuh•MYEW•ni•tee) is affected. A **community** is all the populations in an ecosystem.

A Prairie Community



Sometimes, prairie dogs are harmed by disease. If the disease spreads, many prairie dogs could die. Animals that eat prairie dogs would lose a food source. Mice and snakes might not find homes.

The loss of prairie dogs could help some living things. Grasses may grow taller and thicker. Other animals may move into the area to feed on the new grasses.

Quick Check

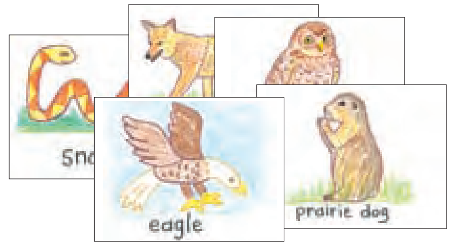
Cause and Effect **How could a disease that kills prairie dogs harm coyotes that live nearby?**

Critical Thinking **What might happen to prairie dogs if eagles left the ecosystem?**

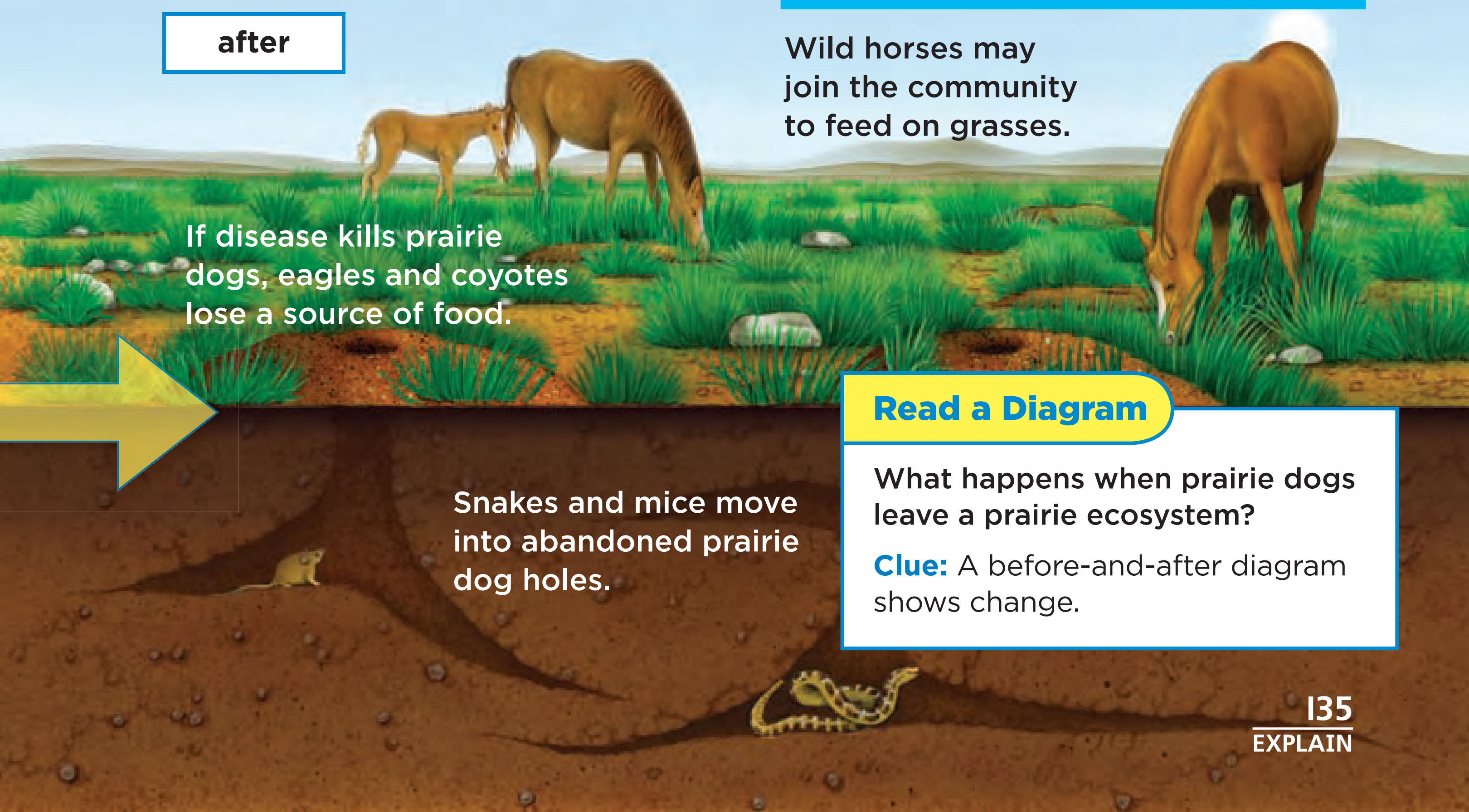
Quick Lab

A Changing Ecosystem

1. Make five character cards. Label the cards: prairie dog, snake, burrowing owl, eagle, and coyote.



2. Paste the cards onto a large sheet of paper.
3. Draw an arrow from each animal to the organisms it depends upon for food or shelter.
4. **Infer** What would happen if prairie dogs disappeared?
5. **Infer** What would happen if eagles disappeared?



Read a Diagram

What happens when prairie dogs leave a prairie ecosystem?

Clue: A before-and-after diagram shows change.

How does a living thing become endangered?

When an environment changes, organisms must migrate or adjust to their new surroundings in order to survive. Those organisms that cannot migrate or adjust may become endangered (en•DAYN•juhrd). An organism is **endangered** when there are only a few living members of its kind left.

Saharan cypress trees are endangered. They are found in the mountains of the Saharan Desert. Scientists think that Saharan cypress trees are adapted for a wet climate. Yet, their environment has become dry. Saharan cypress trees are endangered because they cannot adjust to the hot, dry weather.

Organisms can also become endangered as a result of people. Bengal tigers are endangered because hunters have killed many of them for their fur. Panda bears are also endangered, partly because people are destroying their forest habitat.

▲ Dragon trees may become endangered. Their environment is drying out.

Bengal tigers are hunted for their fur. ▼

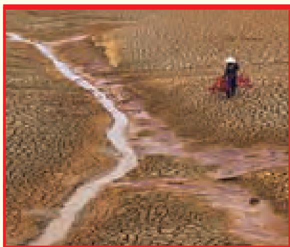
Quick Check

Cause and Effect What can cause an organism to become endangered?

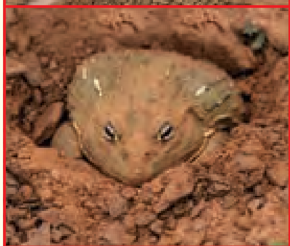
Critical Thinking How can people help protect endangered organisms?

Lesson Review

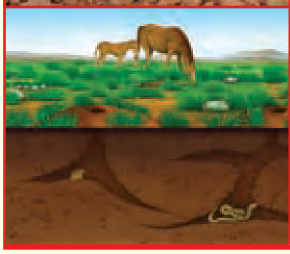
Visual Summary



Natural disasters and disease can cause environments to change.



When environments change, living things may be harmed. Others may move or adjust.



Changes to one group of living things can affect other living things.

Make a FOLDABLES™ Study Guide

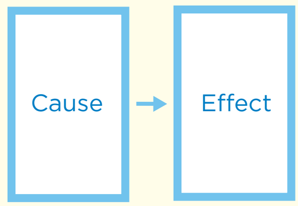
Make a Three-Tab Book. Use it to summarize what you learned about how changes affect organisms.

Think, Talk, and Write

1. **Main Idea** What are some ways in which living things respond to environmental changes?

2. **Vocabulary** What does the word endangered mean?

3. **Cause and Effect** What are some of the effects of a drought?



4. **Critical Thinking** Why should people take special care when they change a natural environment by building or farming? Explain.

5. **Test Prep** **All of these are natural disasters EXCEPT**
   - **A** wildfires.
   - **B** floods.
   - **C** mold.
   - **D** droughts.

Writing Link

Write an Essay
Learn about an environment that has recently changed. Then make a cause-and-effect chart. List what caused the environment to change and what happened as a result. Use your chart to write an essay.

Social Studies Link

Research Mount St. Helens
Use research materials to find out about Mount St. Helens. How did the eruption change the environment around Mount St. Helens? Make a poster or write a report.

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Save the Koala Bears

I believe it is very important to save the koala bears. We cannot let them die. Eucalyptus forests are where koala bears live and find food. People cut down these forests. They build new houses. Today, the forests are getting smaller. It is harder for koalas to find food. The death of one kind of animal can hurt other plants and animals around it. That is why it is important to save the koala bear.

Persuasive Writing

Good persuasive writing

- clearly states an opinion
- uses reasons to convince the reader to agree
- organizes the reasons in a logical order
- includes opinion words such as *I believe*

Koala bears live in Australia. They eat leaves from eucalyptus trees.

Write About It

Persuasive Writing Choose an endangered animal you care about. Research to find out why this animal is in trouble. Write a paragraph to convince readers that this animal should be saved. Be sure to end with a strong argument.

LOG ON e-Journal Write about it online at www.macmillanmh.com

SUBTRACTING LARGE NUMBERS

Whooping cranes are endangered. There are very few of them left in the wild. Like many endangered animals, whooping cranes are protected. That means that people cannot hunt them or harm their habitat.

Look at the information in the chart. It shows how some living things grow in number when they are protected.

Subtract Multi-Digit Numbers

- First, subtract the ones. Regroup if necessary.

$$\begin{array}{r} 3\overset{3}{\cancel{4}}\overset{11}{\cancel{1}} \\ -\ \ 16 \\ \hline 5 \end{array}$$

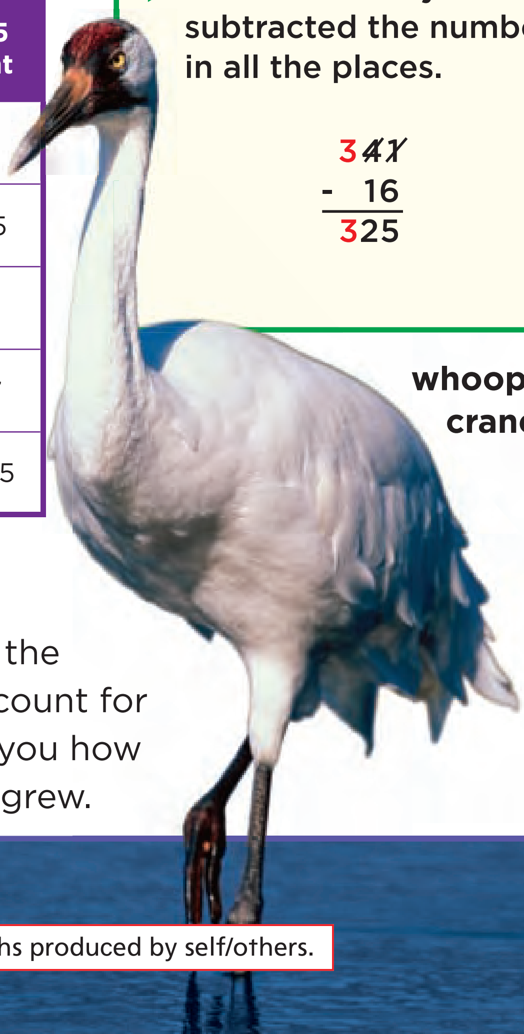
- Then, subtract the tens. Regroup if necessary.

$$\begin{array}{r} 3\overset{3}{\cancel{4}}\cancel{1} \\ -\ \ 16 \\ \hline 25 \end{array}$$

- Continue until you have subtracted the numbers in all the places.

$$\begin{array}{r} 3\cancel{4}\cancel{1} \\ -\ \ 16 \\ \hline 325 \end{array}$$

Name of Animal	Year of Original Count	Original Count	2005 Count
whooping crane	1941	16	341
snow leopard	1960	1,000	6,105
California condor	1986	17	200
giant panda	1965	1,000	1,817
humpback whale	1966	20,000	35,105



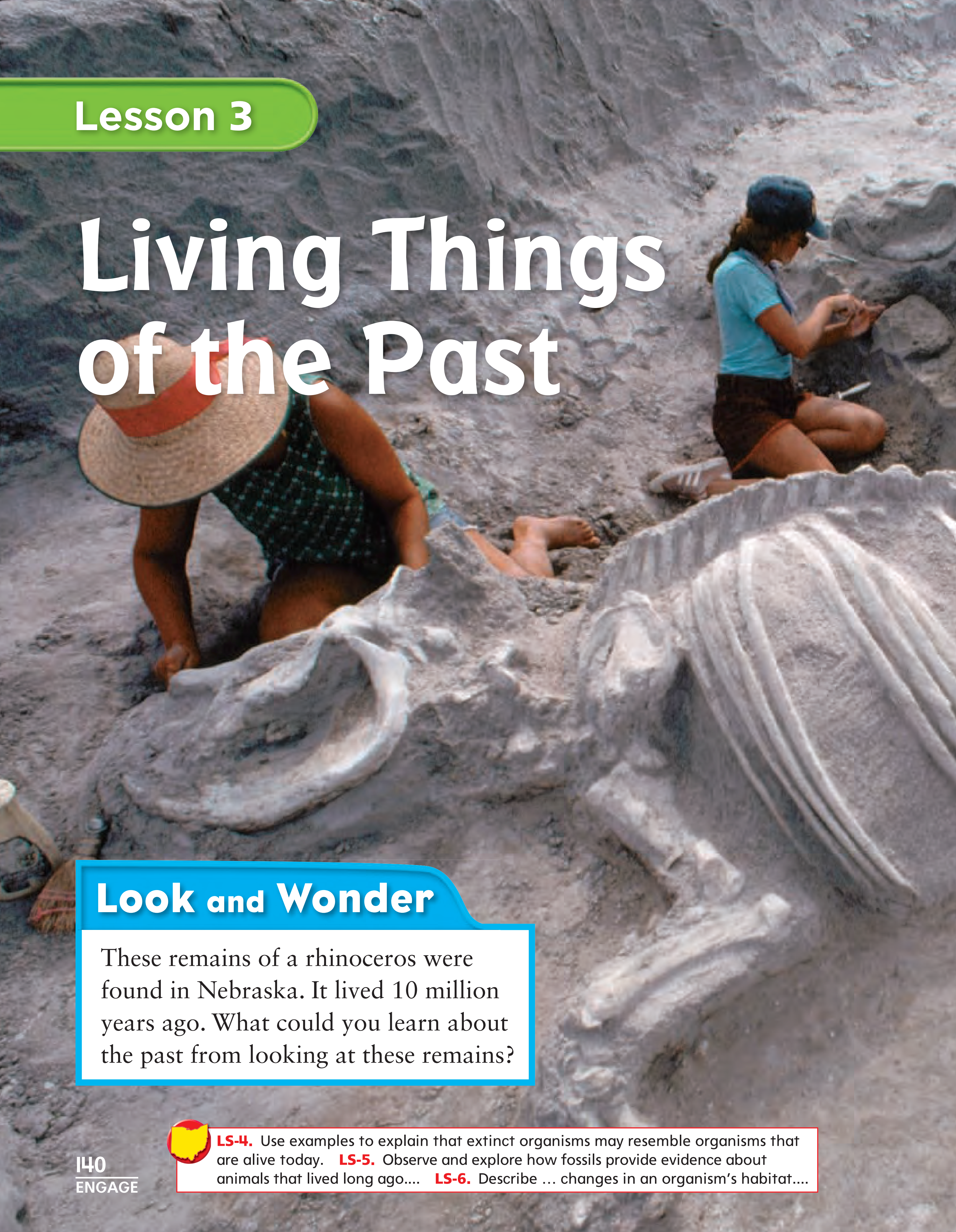
whooping crane

Solve It

Use the chart above. Subtract the original count from the 2005 count for each kind of animal. This tells you how much each animal population grew.

Lesson 3

Living Things of the Past



Look and Wonder

These remains of a rhinoceros were found in Nebraska. It lived 10 million years ago. What could you learn about the past from looking at these remains?

LS-4. Use examples to explain that extinct organisms may resemble organisms that are alive today. **LS-5.** Observe and explore how fossils provide evidence about animals that lived long ago.... **LS-6.** Describe … changes in an organism's habitat....

Explore

Inquiry Activity

How do fossils tell us about the past?

Purpose

Find out how fossils can teach about the past.

Procedure

1. Mix a little glue and water in a measuring cup.
2. **Make a Model** Pour a thin layer of colored sand into a paper cup. Add a "fossil" object. Cover the object with sand of the same color. Add a little water and glue to "set" this layer. This models a fossil in rock.
3. Repeat step 2 with different objects and different colors of sand. Make three layers in all. Allow the layers to dry.
4. **Observe** Trade cups with another group. Carefully peel the paper cup away. Use the brush to find the fossils. Start at the top layer. Work your way down.
5. **Communicate** Record in a table the order in which each fossil object was found.

Draw Conclusions

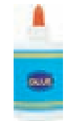
6. **Interpret Data** Which fossil was buried first? Last? Which fossil is oldest?
7. **Infer** What can layers of rock tell us about Earth's past?

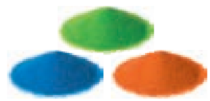
Explore More

How else could you model a fossil? Make a plan and try it.

Materials


measuring cup and water


glue


colored sand


paper cup


"fossil" objects


brush

Step 4

Step 5

Layer	Fossil
top	
middle	
bottom	

SI-6. Communicate scientific findings to others through a variety of methods (e.g., pictures, written, oral and recorded observations).

Read and Learn

Main Idea LS-4, LS-5, LS-6

We can study fossils to learn about ancient plants and animals and their environments.

Vocabulary

fossil, p.142

extinct, p.142

LOG ON e-Glossary at www.macmillanmh.com

Reading Skill

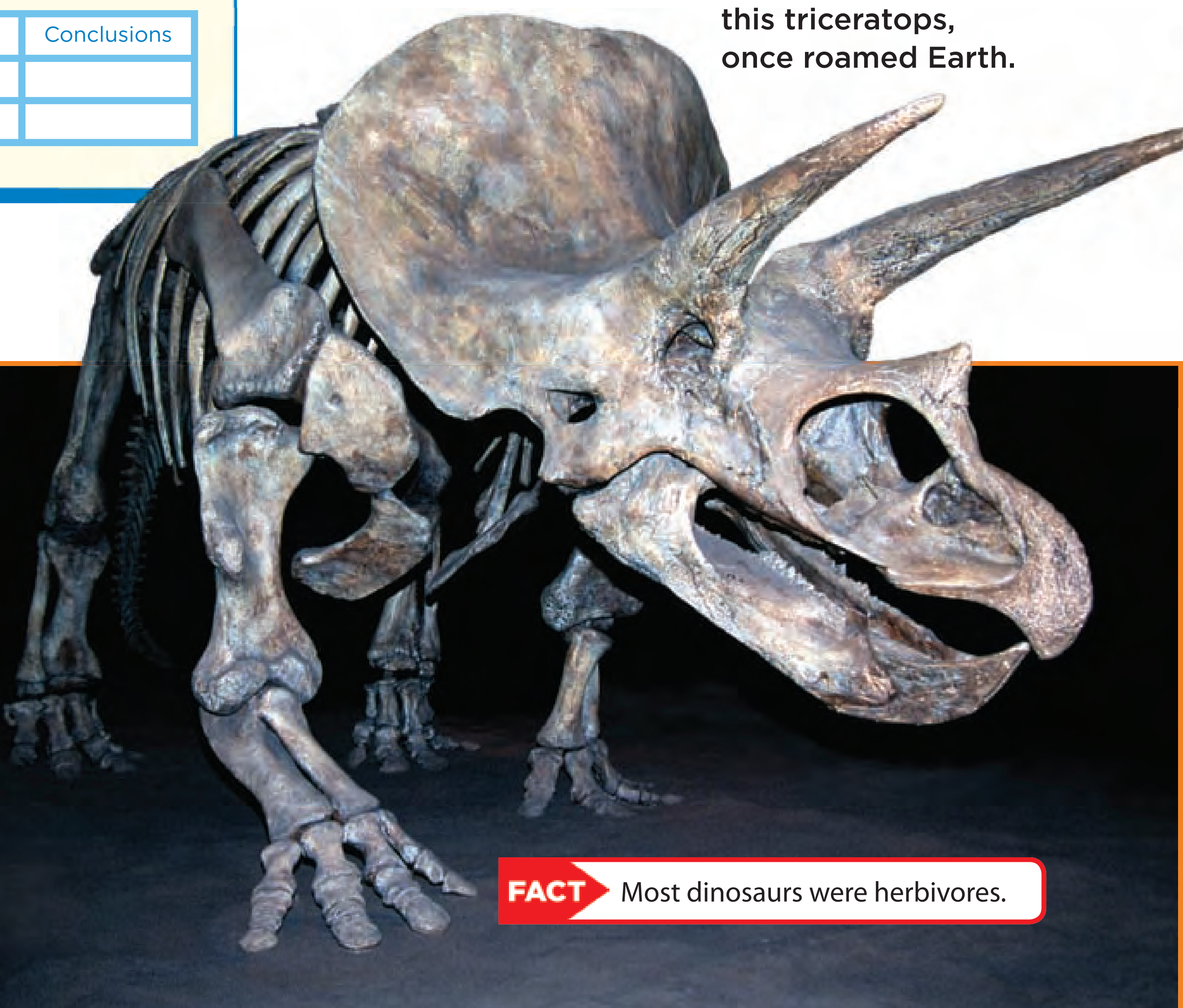
Draw Conclusions

Text Clues	Conclusions

What can happen if the environment suddenly changes?

Did you know that dinosaurs once lived in North America? Millions of years ago, dinosaurs may have been roaming through the land that is now your town! All that is left of dinosaurs today is their fossils (FOS•uhls). **Fossils** are the remains of organisms that lived long ago.

Many scientists think that dinosaurs became extinct (ek•STINGKT) after a meteor hit Earth a long time ago. A living thing is **extinct** when there are no more of its kind alive.



Dinosaurs, such as this triceratops, once roamed Earth.

FACT Most dinosaurs were herbivores.

After the dinosaurs, large animals such as saber-toothed cats made their homes in North America. These animals lived more than ten thousand years ago, during the Ice Age. Huge sheets of ice covered much of the land at that time. Then the climate changed. Temperatures began to rise, and the ice started to melt. The animals that the cats fed on could not survive. The cats lost their main food source. In time, the cats became extinct.

Saber-toothed cats had large front teeth. They used the teeth to pierce the thick skin of animals that they ate.

Some plants and animals are becoming extinct even today. Some scientists think that up to 100 kinds of organisms become extinct each day! In 1996 a type of mammal called the red gazelle became extinct. It was hunted too often by humans. The St. Helena Olive tree used to grow on an island off the coast of Africa. It became extinct in 2004 because of disease and dry weather.

Quick Check

Draw Conclusions What are some reasons that living things become extinct?

Critical Thinking If high temperatures cause polar ice to melt, what might happen to polar bears?

The St. Helena Olive tree, shown here, became extinct in 2004.

How can we learn about things that lived long ago?

You can learn about plants and animals that lived long ago by studying fossils. Some fossils give clues about a living thing's size and shape. The large skeleton of a *Tyrannosaurus rex* tells us that the animal was about 5 meters (16.4 feet) tall.

Fossils can also tell us what an animal ate. Animals with pointed teeth were probably meat eaters. Animals with flat teeth were probably plant eaters.

Other fossils can show how an animal moved. A fossil with fins shows that the animal could move through water. A fossil with wings shows that the animal could fly.

An ancient shark called a megalodon (MEG•uh•luh•don) used this tooth to pierce flesh.

The flat tooth of a woolly mammoth was used to grind leaves and grasses.

◀ This pterodactyl (ter•uh•DAK•tuhl) fossil shows that ancient reptiles may be related to modern birds.

Scientists also use fossils to find out how Earth and living things have changed over time. Many fish fossils are found on land. This means that millions of years ago, this land was covered with water. Over time, the land rose above the water. Fossils remained in the rock and soil that had been under water.

How deep a fossil is buried gives clues about when an organism lived. Fossils found closest to the surface are usually youngest. Fossils found in deeper layers are older.

Quick Check

Draw Conclusions What does a fossil with fins tell you about that animal?

Critical Thinking Why do you think scientists study fossils?

Plant fossils tell us where plants grew in the past.

Quick Lab

Fossil Mystery

1. **Make a Model** Choose a favorite animal. Then use the key below to make fossil marks for your animal on some modeling clay.

If your animal is a . . .	then shape the clay into a . . .
mammal	circle
bird	square
amphibian	rectangle
reptile	triangle
fish	ball

2. Use the key below to make more fossil marks.

If your animal . . .	then mark your clay with . . .
lives in water	fins
lives on land	feet
lives both in water and on land	fins and feet
is a carnivore	pointed teeth
is an herbivore	flat teeth
is an omnivore	pointed and flat teeth

3. Trade your model fossil with the person sitting to your right.

4. **Infer** What can you learn about the animal that your classmate chose? How do scientists use fossils to learn about extinct animals?

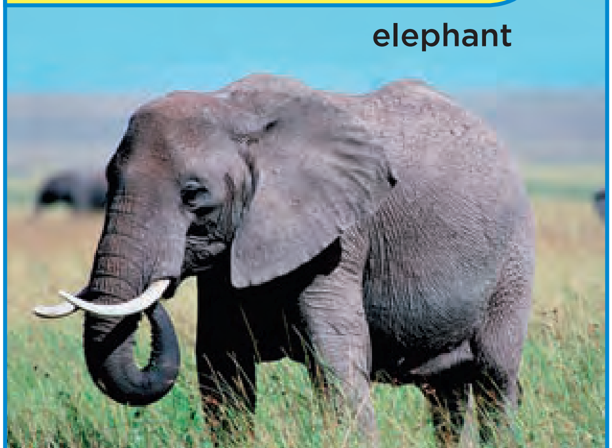
How are living things of today similar to those that lived long ago?

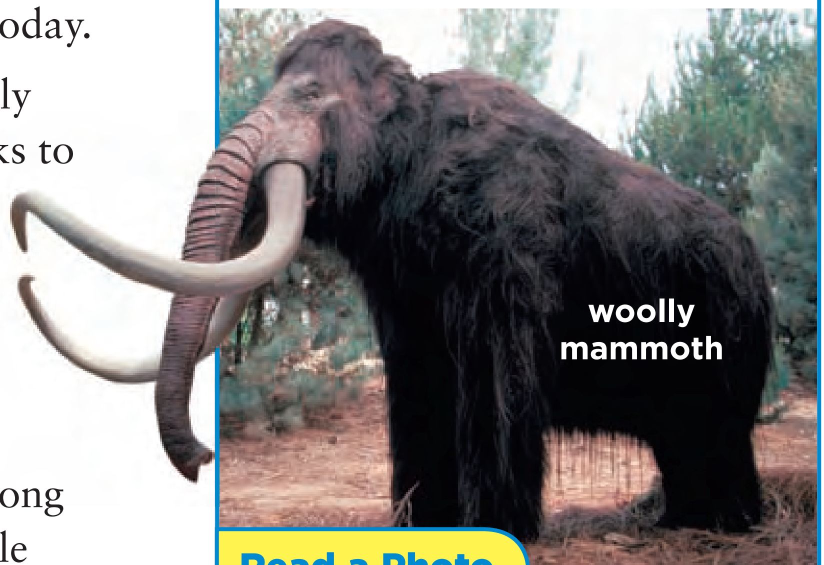
The woolly mammoth became extinct thousands of years ago. Fossils tell us that it had a large trunk and tusks. Yet, fossils cannot tell us how this animal used its body parts. Instead, scientists learn how ancient animals used their body parts by studying similar animals living today.

Elephants are similar to woolly mammoths. They use their trunks to grasp and smell. As a result, scientists think that the woolly mammoth used its trunk in similar ways.

Many organisms living today look similar to those that lived long ago. Some modern birds resemble ancient reptiles. Eagles look very similar to flying reptiles called pterodactyls. Pterodactyls had long wingspans and large beaks. Scientists think pterodactyls used their beaks and claws to catch fish just like eagles!

Connecting with the Past





Read a Photo

What do the woolly mammoth and elephant have in common? What is different about them?

Clue: Compare the features of the animals in the photos above.

Quick Check

Draw Conclusions Why do scientists study elephants when they want to learn more about woolly mammoths?

Critical Thinking How are organisms of the past similar to organisms living today?

Lesson Review

Visual Summary

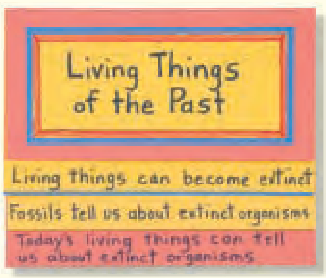
Living things can become extinct when their environment suddenly changes.

Fossils tell us about living things and environments of the past.

You can learn about extinct organisms by studying organisms of today.

Make a FOLDABLES™ Study Guide

Make a Layered-Look Book. Use it to summarize what you learned about living things of the past.



Think, Talk, and Write

1. **Main Idea** What can happen to living things when their environment suddenly changes?

2. **Vocabulary** What is a fossil?

3. **Draw Conclusions** What are some reasons an animal may become extinct?

Text Clues	Conclusions

4. **Critical Thinking** Why do people study fossils?

5. **Test Prep** **All fossils**
   - **A** are living things.
   - **B** are found only in cold places.
   - **C** are the remains of living things.
   - **D** were created millions of years ago.

Writing Link

Write a Report
Use research materials to learn about woolly mammoths. When did they live? What was their environment like? Write a report to share what you learn.

Math Link

Estimate
The bottom of a fossil bed has a fern plant that is 400 million years old. The top has a 300-million-year-old fern fossil. Between the two layers is a scorpion fossil. About how old do you think the scorpion fossil is?

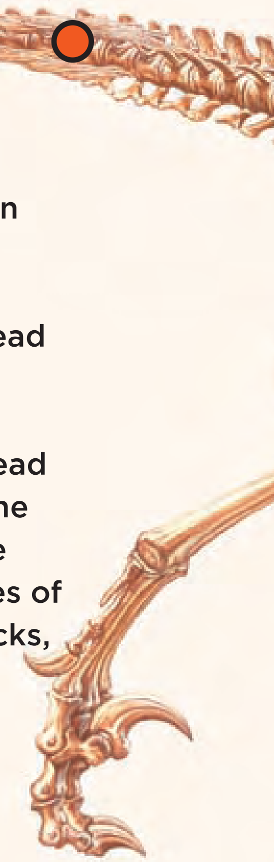
Looking at DINOSAURS

Dinosaurs were once common on Earth. Many dinosaurs became extinct millions of years ago. New evidence is helping scientists find out how dinosaurs lived and why they might have disappeared. Take a look at how ideas about dinosaurs have changed based on new evidence.

1842

1923

1995



Dinosaurs Are Named

In 1842 British scientist Richard Owen named the group of large, extinct reptiles "dinosauria." The name came from Greek words meaning "fearfully great lizard." People once thought dinosaurs' strange bones came from dragons or giants.

Dinosaur Nests Are Found

In 1923 American scientists Roy Chapman and Walter Granger found dinosaur nests in the Gobi desert in China. The nests prove that dinosaurs laid eggs.

Dinosaurs Don't Drag Their Tails

In 1995 the American Museum of Natural History changed its *T. rex* skeleton. Instead of standing upright, the new skeleton is displayed with its head low and its tail off the ground. This change was based on studies of fossils, dinosaur tracks, and how different animals move.

SWK-3. Explore through stories how men and women have contributed to the development of science.

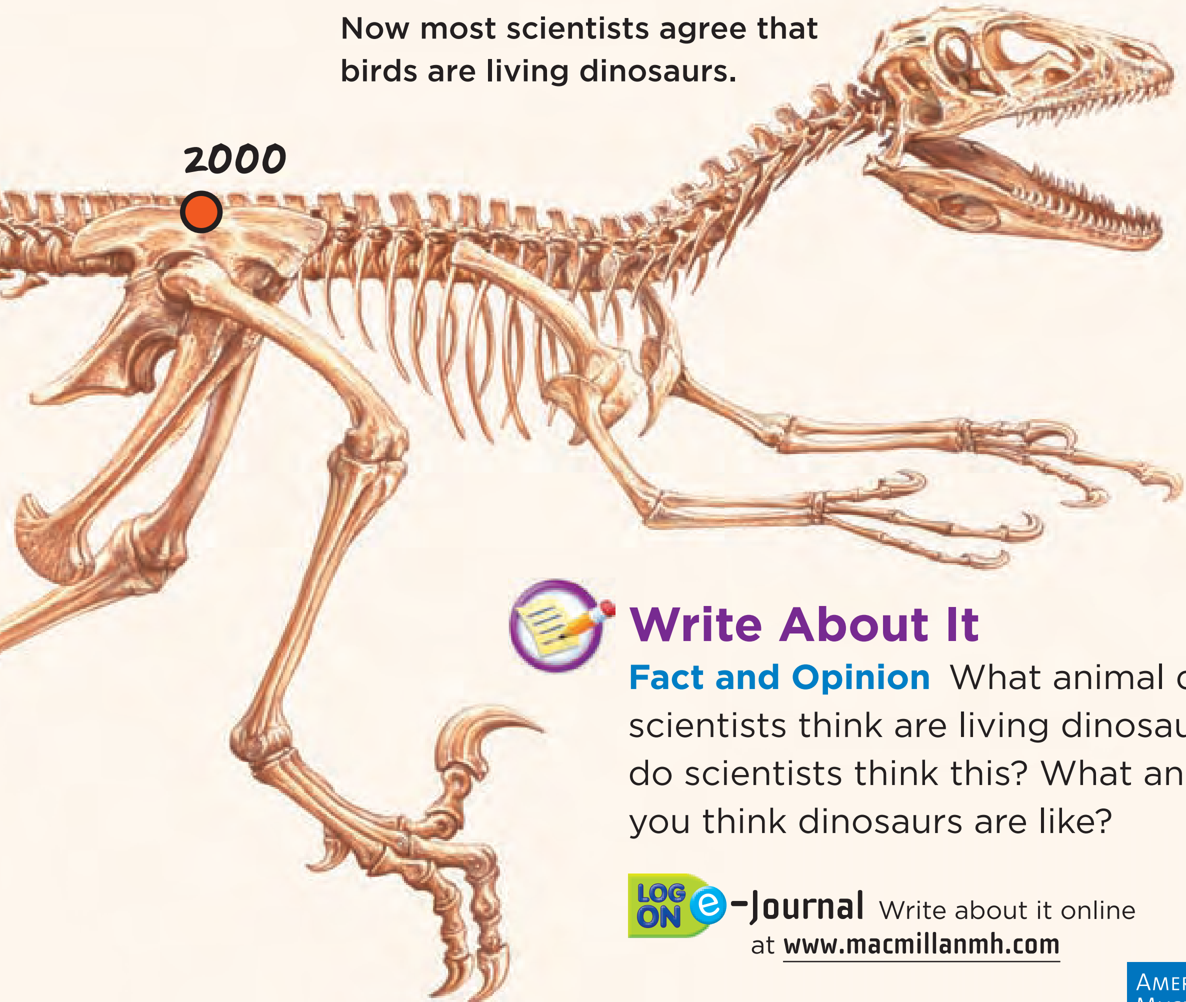
Fact and Opinion

- A fact is a true statement that you can prove.
- An opinion is how you feel about something.

Dinosaurs Have Feathers
In 2000 a team of Chinese and American scientists found a 130-million-year-old fossil dinosaur covered with feathers. Now most scientists agree that birds are living dinosaurs.

Today
Scientists continue to find new fossils. They use new tools to discover more about dinosaurs.

2000



Write About It

Fact and Opinion What animal do scientists think are living dinosaurs? Why do scientists think this? What animal do you think dinosaurs are like?

LOG ON e-Journal Write about it online at www.macmillanmh.com

American Museum of Natural History

CHAPTER 3 Review

Visual Summary

Lesson 1 Living things change their environments as they meet their needs. These changes can be helpful or harmful.

Lesson 2 Diseases and natural disasters can change environments. Living things respond to these changes in different ways.

Lesson 3 We can study fossils to learn about ancient plants and animals and their environments.

Make a FOLDABLES™ Study Guide

Glue your lesson study guides to a piece of paper as shown. Use your study guide to review what you have learned in this chapter.

Vocabulary

Fill each blank with the best term from the list.

drought, p. 130	**pollution**, p. 122
endangered, p. 136	**recycle**, p. 124
extinct, p. 142	**reduce**, p. 124
flood, p. 130	**resource**, p. 120
fossil, p. 142	**reuse**, p. 124

1. If you ________ your old aluminum cans, companies can make them into new cans.
ST-2, ST-3
2. When there is little or no rain for a long time, a ________ occurs.
LS-C
3. Food is an example of a ________ that living things need to survive.
LS-B
4. You could ________ a water bottle by filling it up with water again.
ST-2
5. Heavy rains can cause a ________ if water covers dry land.
6. A kind of organism is ________ when there are no more left alive.
LS-4
7. When harmful materials are put into an environment, it is called ________.
LS-6
8. By taking shorter showers, you ________ how much water you use.
ST-2, ST-3
9. A kind of organism is ________ when there are only a few of those organisms left.
LS-C
10. Scientists can use a ________ to learn more about a living thing from the past.
LS-4, LS-5

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Skills and Concepts

Answer each of the following in complete sentences.

11. **Predict** How might cutting down trees in the rain forest affect people living there?
LS-6

12. **Persuasive Writing** Write an advertisement that convinces people to visit a museum's new fossil exhibit. Include information about why fossils are important.
LS-4, LS-5

13. **Use Numbers** In 1963 there were only 417 pairs of bald eagles in the United States. In 2006 there were 7,066 pairs. How many more pairs were there in 2006?

14. **Critical Thinking** Cardinals live in forests. What may happen to a cardinal if a wildfire burns its forest habitat?
LS-6

15. What modern animal does this fossil resemble? What traits do both animals have in common?

The Big Idea

16. How can changes affect living things and their environments?
LS-C

Performance Assessment

Conservation Cards

- Make three cards that show how people can protect the environment. Make one card for each of the 3 *Rs*.
- On the top of each card, write either Reduce, Reuse, or Recycle. Under the word, write a plan that helps people conserve resources. Then add a drawing to show how your plan works.
- On the back of the card, explain how your plan helps the environment.
- Share your cards with the class. Together, brainstorm ways to put your plans into action.

Ohio Activity

Choose an area near your home, such as a park or a playground. Conduct research to learn how this habitat has changed. How have these changes affected the plants and animals that live there?

Ohio Benchmark Practice

1 **A student is analyzing a list of threatened and endangered species in Ohio.**

Animal	**Status**
copperbelly water snake	threatened
gray wolf	endangered
Lake Erie water snake	threatened
bald eagle	threatened

Based on the table, what species can the student infer is in danger of becoming extinct?

A copperbelly water snake

B gray wolf

C Lake Erie water snake

D bald eagle

LS-C

2 **What can a drought lead to?**

A floods

B wildfires

C new plant growth

D heavy rains

ESS-C

3 **What word describes fossils found in deeper layers of rock?**

A older

B younger

C larger

D smaller

LS-C

4 **Which of the following best explains how dinosaurs became extinct?**

A A meteor hit Earth.

B Ice sheets covered Earth.

C Ocean levels rose.

D Humans killed them.

LS-C

5 **Changes in ecosystems can be harmful or helpful to organisms that live there.**

In your Answer Document, draw or describe what would happen if mosquitoes were removed from an ecosystem.

Identify one helpful result and one harmful result of this change. (2 points)

LS-C

6 **Which of the following is an example of a present-day animal and an ancient animal that look similar?**

A wolf and tiger

B hummingbird and eagle

C elephant and woolly mammoth

D dragon and lizard

LS-C

7 **A student planted bean seeds in two containers. In container 1 he planted two seeds. In container 2 he planted five seeds. He placed the same amount of soil in each container, and he gave each the same amount of water. After 4 weeks he measured the height of the bean plants in both containers. The following chart shows his results.**

Container	Number of Seeds Planted	Average Plant Height
1	2	25 centimeters
2	5	16 centimeters

According to his results, which most likely affected the growth of the plants in container 2?

A predators

B consumers

C competition

D pollution

SI-C

8 **Humans often cut down forests for wood.**

In your Answer Document, identify two ways this can have a harmful effect on the forest ecosystem. (2 points)

LS-C, ESS-C

9 **How can a flood change an environment?**

A A flood can wash away plants and soil.

B A flood can cause plants to grow very quickly.

C A flood can dry out rivers and lakes.

D A flood can cause a wildfire.

LS-C

10 **Fossils show events that happened on Earth long ago. Which choice shows the correct order of events, from earliest to latest?**

A Dinosaurs lived on Earth; the Ice Age began; saber-toothed cats became extinct.

B The Ice Age began; dinosaurs became extinct; saber-toothed cats lived on Earth.

C The Ice Age ended; dinosaurs lived on Earth; saber-toothed cats became extinct.

D Saber-toothed cats lived on Earth; the Ice Age ended; dinosaurs became extinct.

LS-C

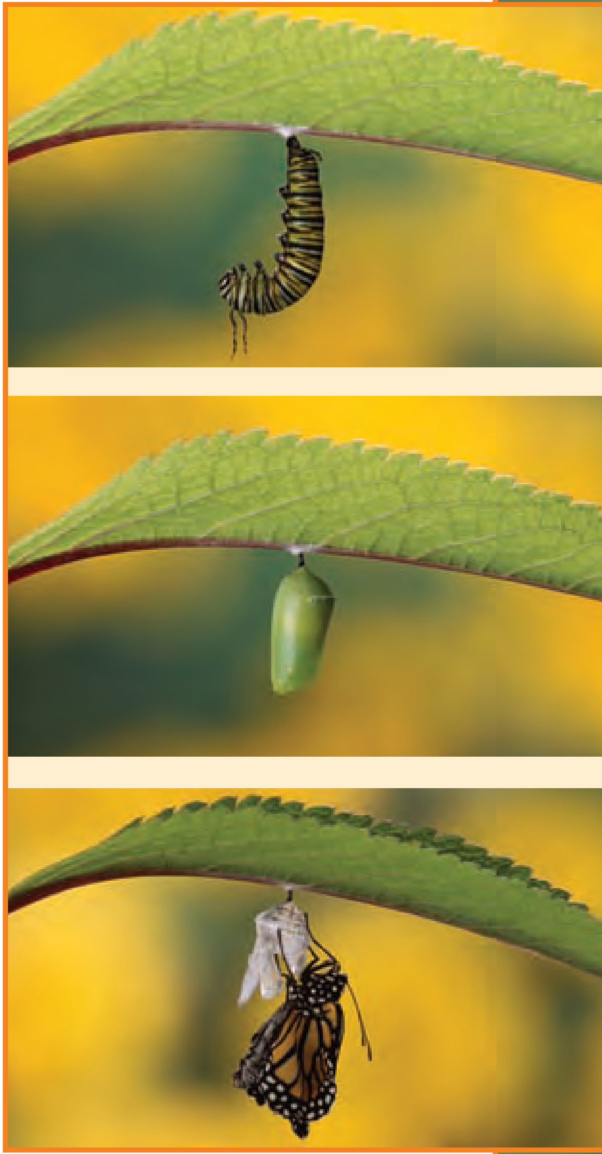
Literature

Poem

Monarch Butterfly

by Marilyn Singer

Wait I can wait
For the fullness of wings
For the lift   For the flight
Wait I can wait
A moment less
A moment more
I have waited much longer before
For the taste of the flower
For the feel   For the sight
Wait I can wait
For the prize of the skies
For the gift of the air
Almost finished
Almost there
Almost ready
to rise



After about two weeks, a monarch butterfly comes out of its chrysalis.

Write About It

Response to Literature This poem describes a caterpillar changing into a butterfly. All living things change as they grow. Write a poem about how you have changed as you have grown. Write about some exciting things you are waiting for.

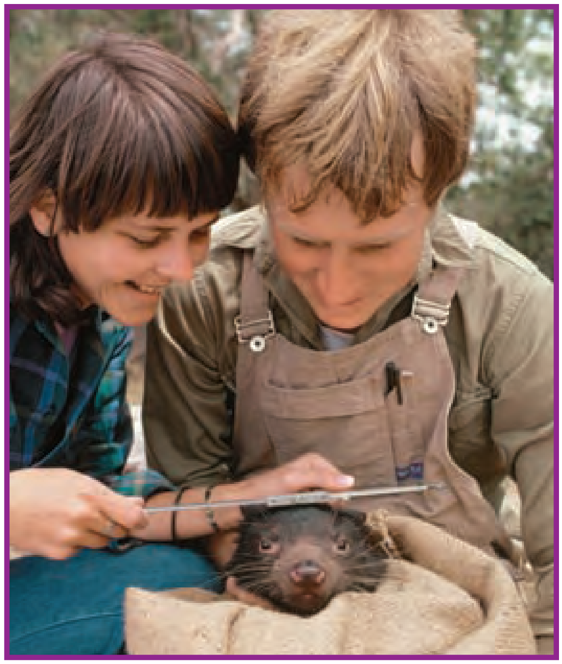
LOG ON e-Journal Write about it online at www.macmillanmh.com

Wildlife Manager

Do you like to learn about plants and animals? Do you want to help keep environments clean and healthy? Then one day you might become a wildlife manager.

Wildlife managers help take care of animals and their environments. They keep track of the plants and animals in places such as wildlife parks. They look for ways to help living things. They also teach people about wildlife and why it is important to take care of environments.

To become a wildlife manager, you must care about environments and living things. Plan to study science in high school and college. You will also need a degree in a field such as biology or environmental science.



▲ Animal rescue workers measure a Tasmanian devil.

▲ A park ranger places a satellite collar on a polar bear to track its movements.

Here are some other Life Science careers:

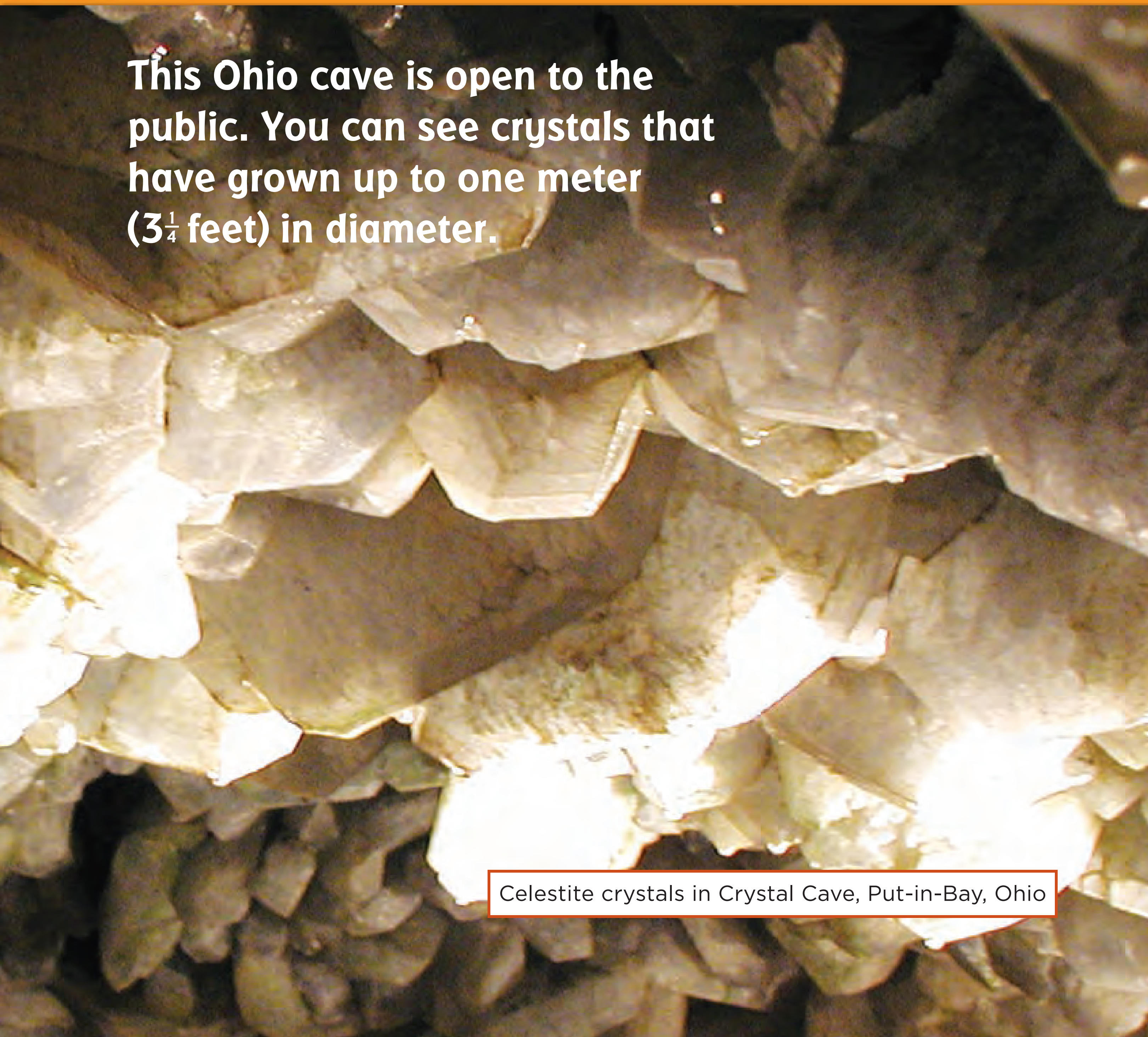
- emergency medical technician
- animal rescue worker
- gardener
- park ranger

SWK-4. Identify various careers in science. **SWK-5.** Discuss how both men and women find science rewarding as a career and in their everyday lives.

LOG ON e-Careers at www.macmillanmh.com

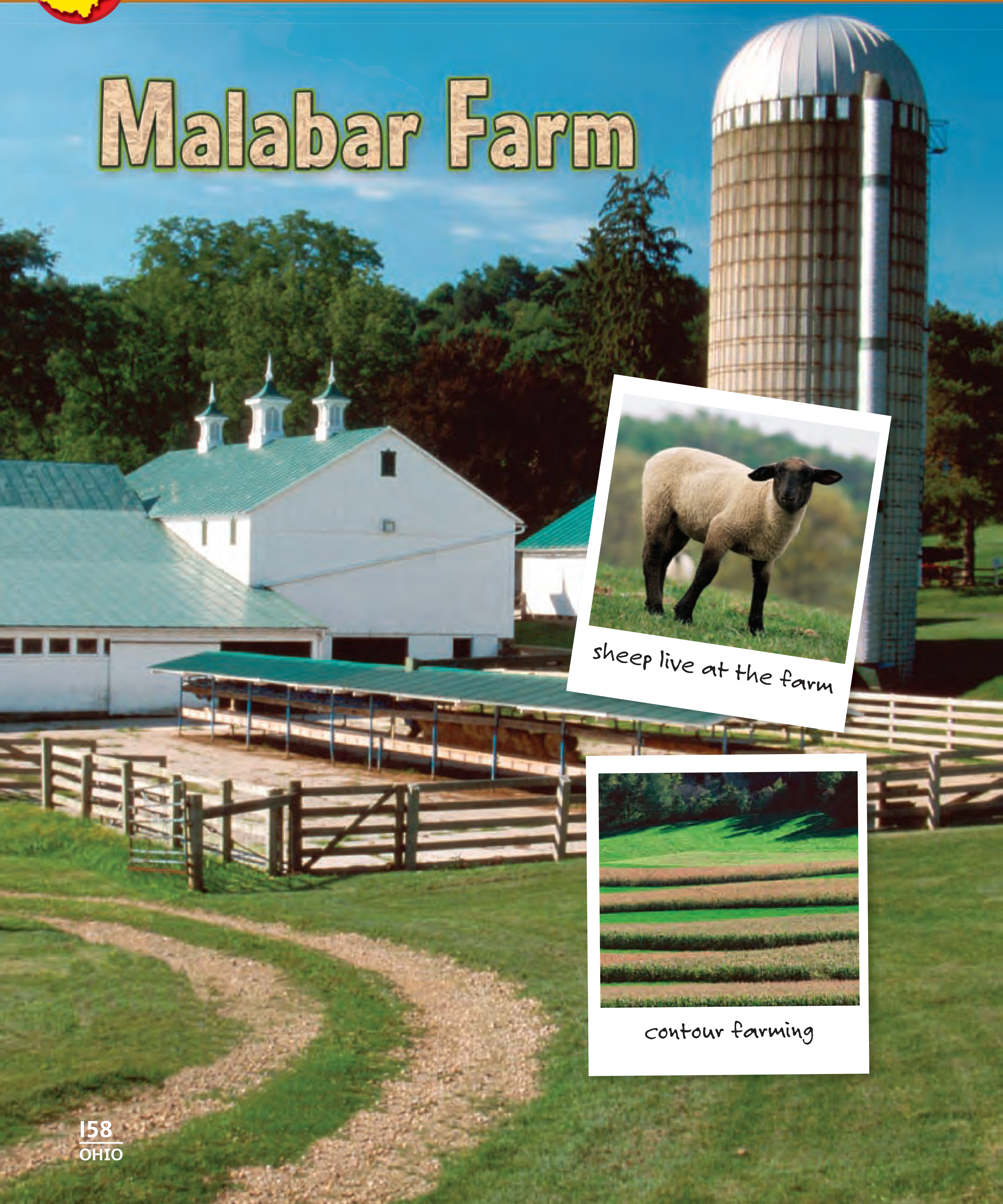
Earth and Space Sciences

This Ohio cave is open to the public. You can see crystals that have grown up to one meter (3$\frac{1}{4}$ feet) in diameter.



Celestite crystals in Crystal Cave, Put-in-Bay, Ohio

Malabar Farm



sheep live at the farm

contour farming

Smart Farming

Louis Bromfield started Malabar Farm in 1939. Now a state park, Malabar Farm grows crops on its fertile land. The farm also houses livestock including chickens, cattle, and sheep. It is important for Malabar Farm to farm in ways that protect its land.

Nutrients for the Soil

Ohio contains hundreds of different kinds of soils. Even the same farm in Ohio may contain different types of soils. The soil in many parts of Ohio is good for growing food plants. It is rich in the nutrients that plants need.

Malabar Farm maintains its soil in many ways. Plowing fields a certain way keeps soil in place. For example, contour farming helps prevent soil from being washed away. Planting grass in ditches also holds soil in place. Sometimes farmers plow remains of plants into the soil. This returns nutrients to the land.

Think, Talk, and Write

Critical Thinking How can farmers ensure their fields will be productive for years to come?

ESS-6. Investigate that soils are often found in layers and can be different from place to place.

Ohio

A CLOSER LOOK

Main Idea

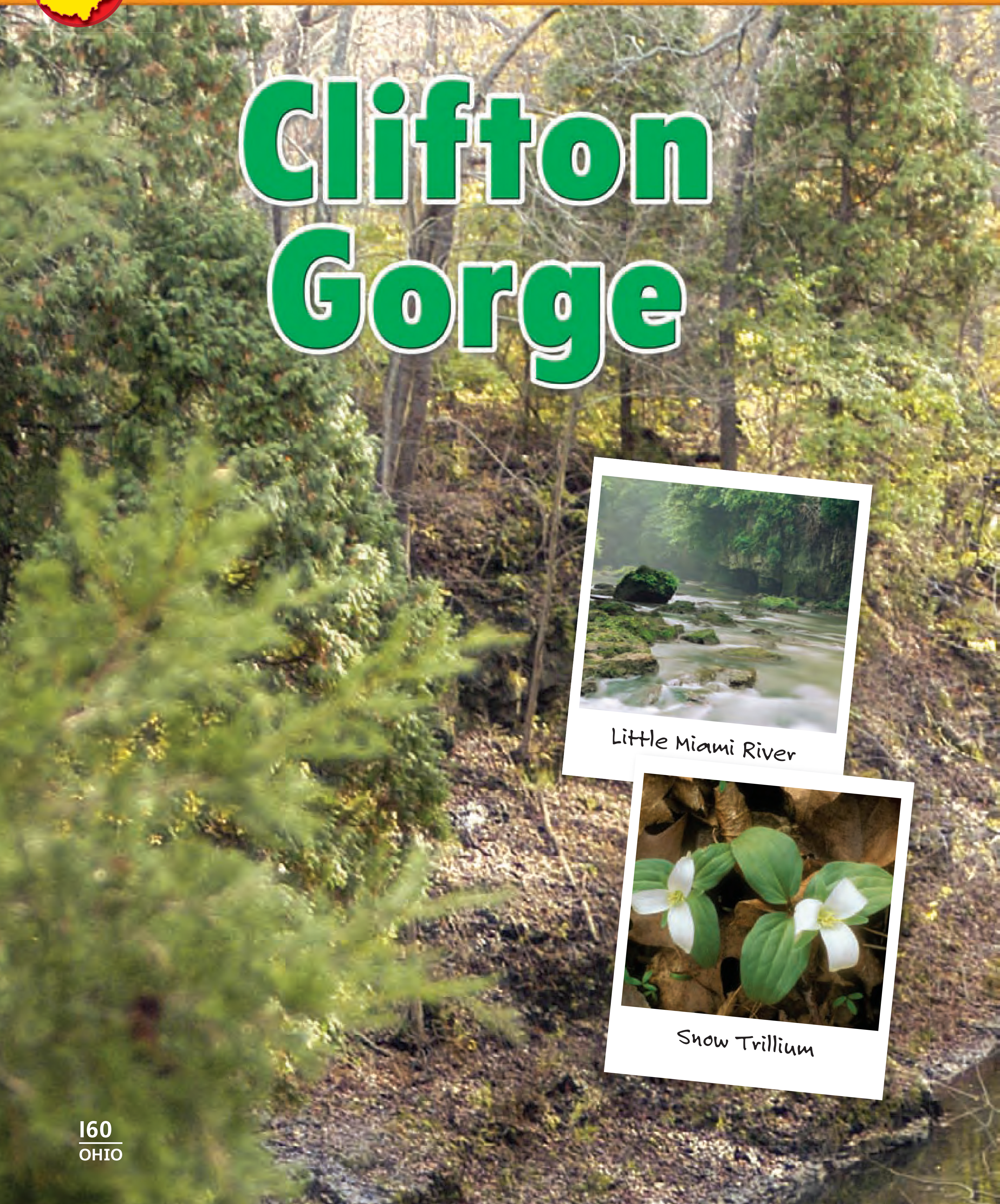
Farmers need to take care of their land so it continues to be a resource.

Activity

Make a Model Model a field using soil, an aluminum pan, and plastic plants to investigate the role of plants in preventing erosion.

- Make part of the field lower than the rest. Place plastic plants in the lower area.
- Prop the higher end of the pan on a book. Pour water into the higher end of the pan.
- What happens to the lower areas of soil? Do the plastic plants help hold the soil in place? Explain your answer.

Clifton Gorge



Little Miami River

Snow Trillium

The Effects of Glaciers

The land in Ohio has changed over many years. Warm, shallow seas used to cover a layer of soft rock. The seas were home to many shelled organisms. When the seas dried up, many layers of shells were left behind. The shells formed layers of hard rock.

After the hard rock formed, glaciers covered much of the land. Melting water from these glaciers formed a river. The river cut through the layers of rock. Over 10,000 years the flowing water formed Clifton Gorge.

An Isolated Place

The climate warmed, and the glaciers melted. The inside of the gorge stayed cool. Because of the cool climate, living things like the snow trillium survived in the gorge. The snow trillium is seen in only a few other places in Ohio.

Unusual rock formations are seen in Clifton Gorge. The river that formed the gorge cut a space out of soft rock. The upper layers of hard rock then slumped down over the space, creating unique rock formations.

Think, Talk, and Write

Critical Thinking Why is Clifton Gorge unique?

Ohio

A CLOSER LOOK

Main Idea

Clifton Gorge formed from many years of erosion.

Activity

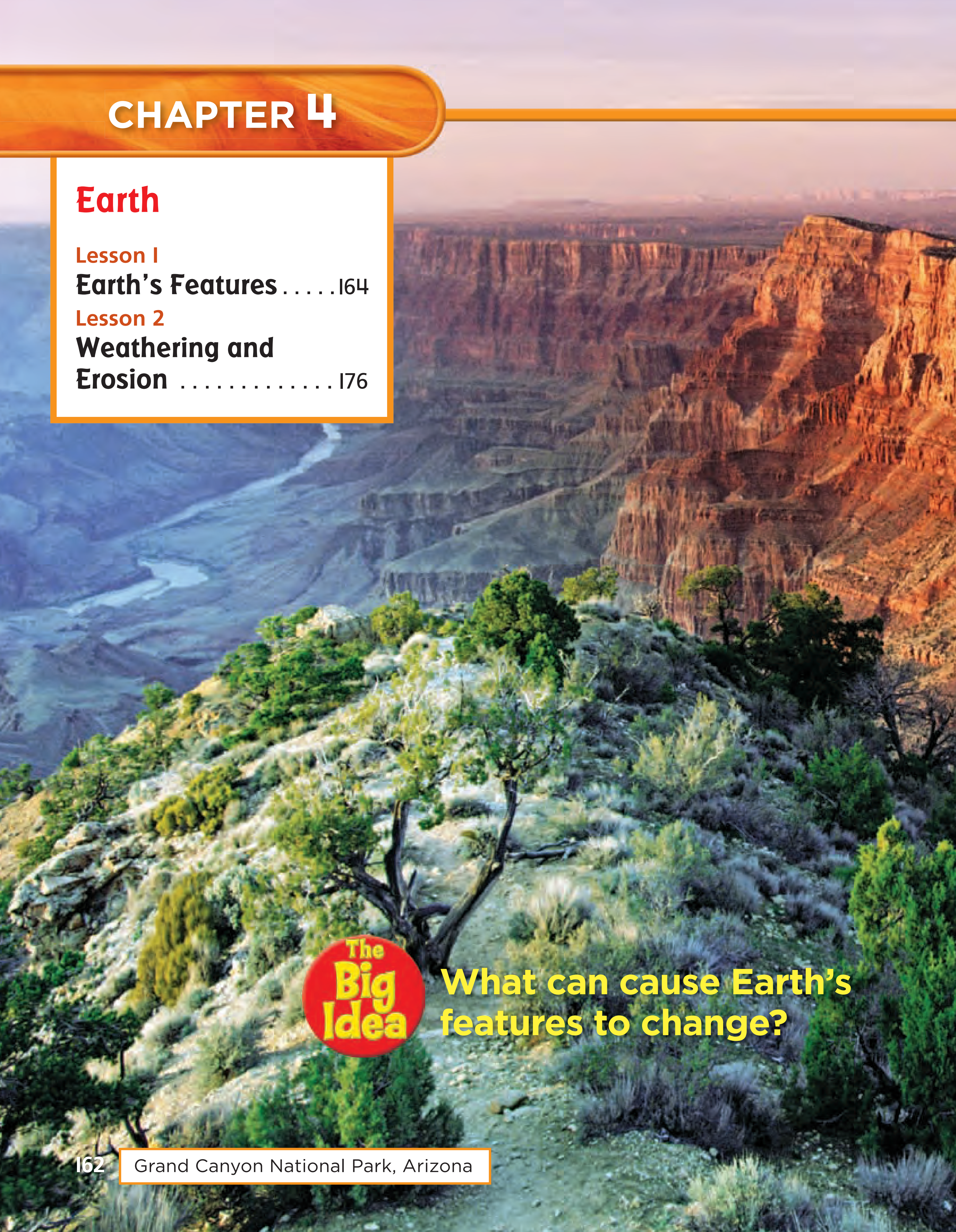
Infer The formation of Clifton Gorge occurred over millions of years. What do you think Clifton Gorge will look like in another million years?

- Think about the rock that makes up Clifton Gorge.
- Record possible things that could happen to the rock to change the shape of the gorge.
- Compare your answers with a partner.

ESS-1. Compare distinct properties of rocks (e.g., color, layering and texture).
ESS-2. Observe and investigate that rocks are often found in layers.

CHAPTER 4

Earth



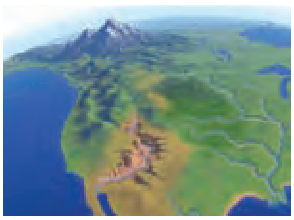
The Big Idea What can cause Earth's features to change?

Grand Canyon National Park, Arizona

Key Vocabulary

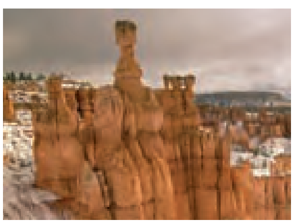
ocean
a large body of salt water (p. 166)

continent
a great area of land (p. 167)

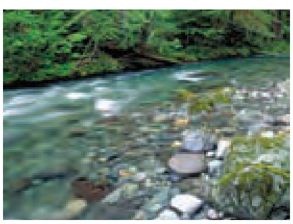


landform
a feature of land on Earth's surface (p. 168)

mantle
the layer of Earth below the crust (p. 172)



weathering
the breaking down of rocks into smaller pieces (p. 178)



erosion
the movement of weathered rock (p. 180)

More Vocabulary

crust, p. 172

core, p. 172

glacier, p. 180

deposition, p. 180

ESS-B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

Lesson 1

Earth's Features

Boardman State Park, along the Oregon coast

Look and Wonder

Both land and water cover Earth's surface. Which one covers more of Earth?

Building block lesson for ESS-3. Describe that smaller rocks come from the breakdown of larger rocks through the actions of plants and weather.

Explore

Inquiry Activity

Does land or water cover more of Earth's surface?

Make a Prediction

Do you think that there is more land or more water on Earth's surface? Write your prediction.

Test Your Prediction

1. Make a table like the one shown for 10 spins.
2. **Experiment** Slowly spin a globe. Do not look at it. Touch your finger to the globe to stop it.
3. **Observe** Did your finger stop on land or water? Record the information on the chart.
4. Repeat steps 2 and 3 nine more times.
5. **Use Numbers** How many times did you touch water? How many times did you touch land?

Draw Conclusions

6. **Infer** Is there more land or more water on Earth? How do your results compare with the results of others?

Explore More

Experiment Which covers more of Earth, rivers or oceans? Make a plan to find out.

Materials

globe

Step 1

Spin	Land	Water
1		
2		
3		
4		

Step 2

SI-2. Discuss observations and measurements made by other people.

Read and Learn

Main Idea ESS-3

Earth's surface has many land and water features.

Vocabulary

ocean, p.166

continent, p.167

landform, p.168

crust, p.172

mantle, p.172

core, p. 172

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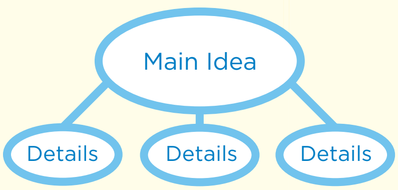
Reading Skill

Main Idea and Details



Technology SCIENCE QUEST

Explore Earth's features with the Secret Agents.

What covers Earth's surface?

If you could see Earth from space, it would look mostly blue. That is because almost three fourths of Earth is covered by water. Most of this water is in oceans (OH•shuhnz). **Oceans** are large bodies of salt water.

Rivers, streams, glaciers, and ponds are some other water features on Earth. These water features are made up of fresh water. *Fresh water* is water that is not salty. Lakes are another water feature. Most lakes are made up of fresh water. Some are made up of salt water.

Earth also has seven great areas of land called **continents** (KON•tuh•nuhnts). North America is the continent you live on.

A map can show Earth's land and water features. To read a map, look at its key. A *key* shows what a map's colors and shapes mean. Can you find North America on the map below?

Quick Check

Main Idea and Details What covers Earth's surface?

Critical Thinking About how much of Earth is covered by land?

Ocean water covers most of Earth.

FACT The oceans are really one big ocean.

What are some of Earth's land and water features?

There are many land and water features on Earth. Land features are called **landforms** (LAND•fawrmz). This diagram shows a few of Earth's features.

Features of Earth

1. A *mountain* is the tallest landform. It often has steep sides and a pointed top.
2. A *valley* is the low land between hills or mountains.
3. A *canyon* is a deep valley with steep sides. Rivers often flow through them.
4. A *plain* is land that is wide and flat.
5. A *lake* is water that is surrounded by land.
6. A *river* is a large body of moving water.
7. A *plateau* (pla•TOH) is land with steep sides and a flat top. It is higher than the land around it.
8. A *coast* is land that borders the ocean.
9. A *peninsula* is land surrounded by water on three sides.
10. An *island* is land with water all around it.

Quick Check

Main Idea and Details What are landforms?

Critical Thinking How could you tell a mountain from a plain?

Quick Lab

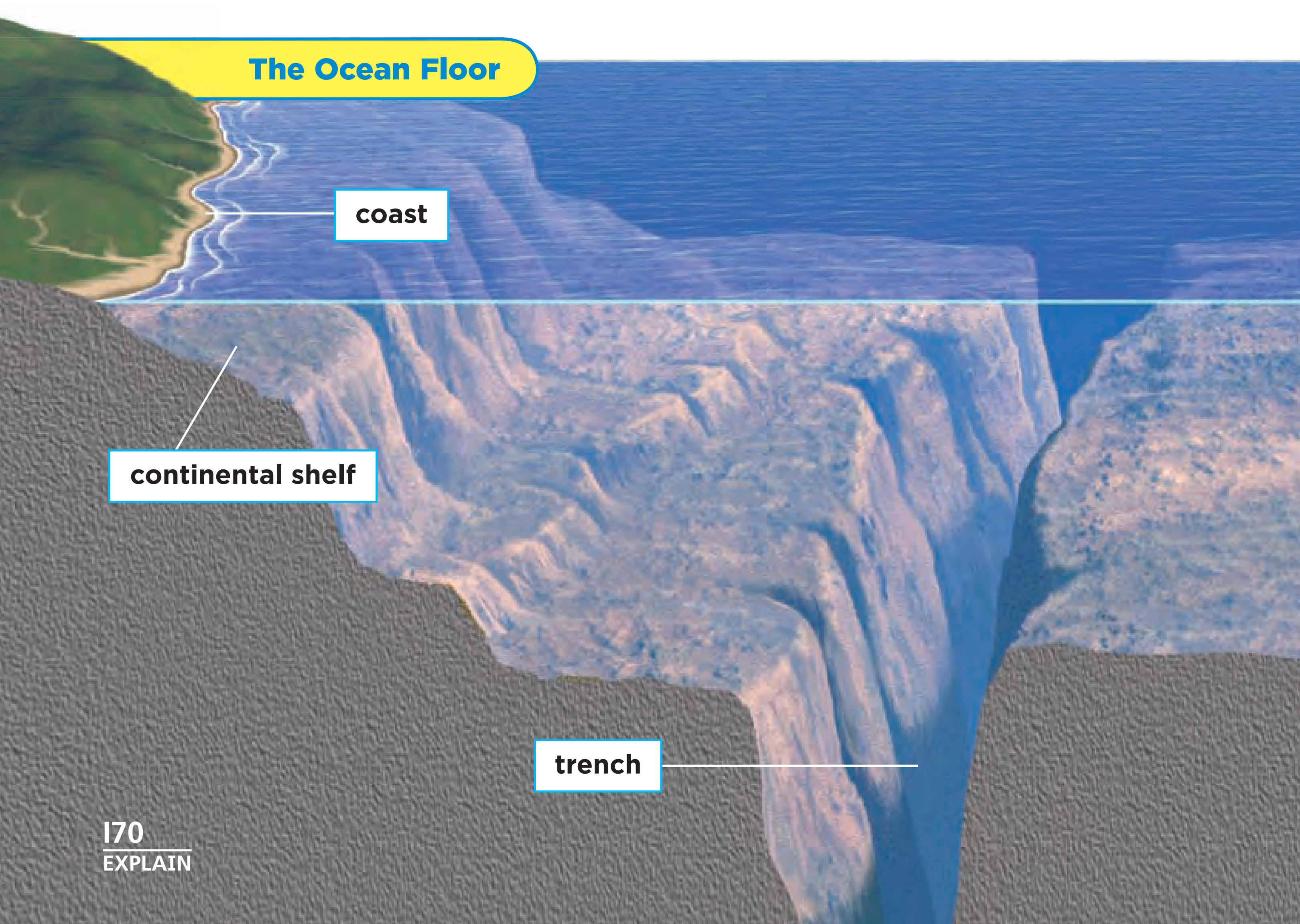
Your State's Features

1. **Make a Model** Draw a map of your state. Decide how to show your state's land and water features. Then make a key and complete the map.
2. **Observe** Where is your town or city located? Draw a large dot there. Which landforms and water features are found in your town or city? How do these features compare with those found in other parts of your state?

What land features are in the oceans?

Did you know that there is land below the ocean? The land below the ocean is called the *ocean floor*. If you could travel there, you would find mountains, valleys, and canyons. You would even see plains.

The ocean floor is a continuation of the continents. The ocean floor begins at a coast where dry land borders the water. Here you find a continental shelf. A *continental shelf* is like a huge plateau. It lies under the ocean at the edge of a continent. About 80 kilometers (50 miles) away from the coast, the continental shelf slopes down steeply.



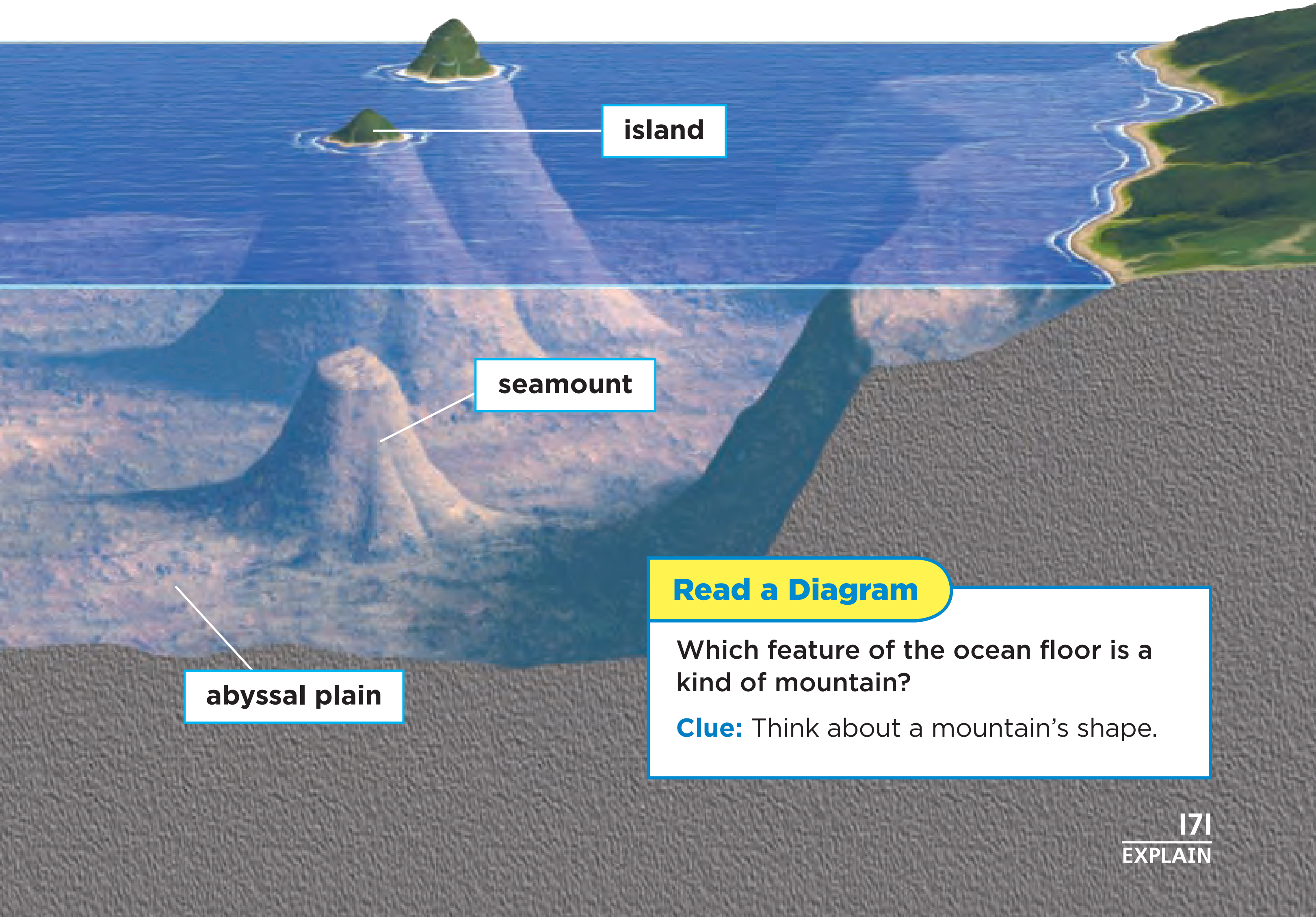
An abyssal plain (uh•BIS•uhl PLAYN) begins a little farther out. An *abyssal plain* is wide and flat. It stretches thousands of kilometers across the ocean.

A trench is another feature you might recognize. A *trench* is a canyon on the ocean floor. Trenches are the deepest parts of the ocean floor. The deepest trench is the Mariana Trench in the Pacific Ocean. It is almost 11 kilometers (7 miles) deep.

Quick Check

Main Idea and Details How is the ocean floor like the land of the continents?

Critical Thinking What do you think you would find on the abyssal plain? Hint: Think about what covers a river's bottom.



Read a Diagram

Which feature of the ocean floor is a kind of mountain?

Clue: Think about a mountain's shape.

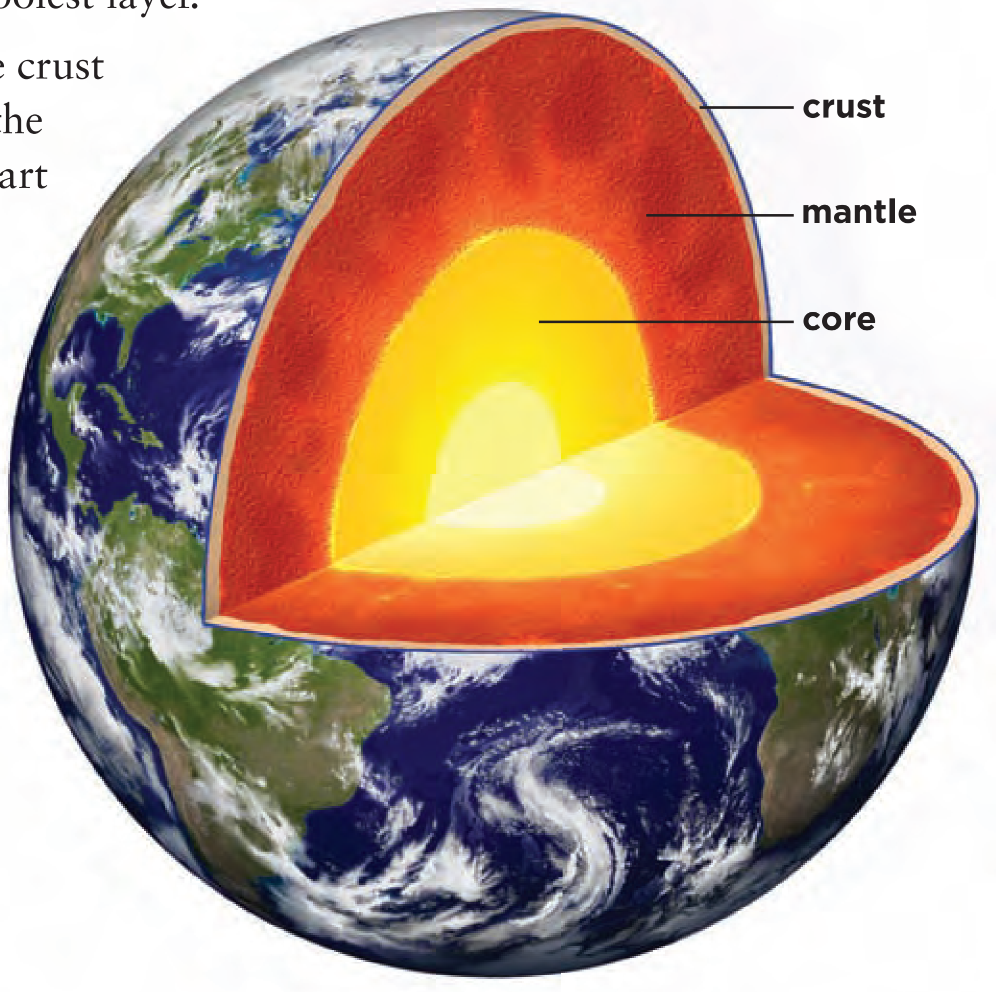
What are the layers of Earth?

Have you ever eaten a hard-boiled egg? If so, you know that an egg has several layers. It has a thin shell, a white part, and a yolk.

Like an egg, Earth has several layers. The continents and ocean floor make up Earth's outermost layer, called the **crust**. The crust is Earth's thinnest and coolest layer.

The layer below the crust is the **mantle**. Part of the mantle is solid rock. Part is nearly melted rock that is soft and flows. It is a lot like putty.

At the center of Earth is the core. The **core** is the deepest and hottest layer of Earth. The *outer core* is melted rock. The *inner core* is solid rock.



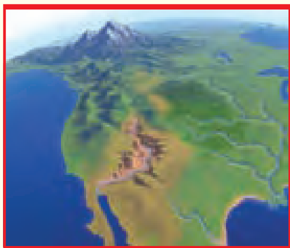
Quick Check

Main Idea and Details What is Earth's deepest layer called?

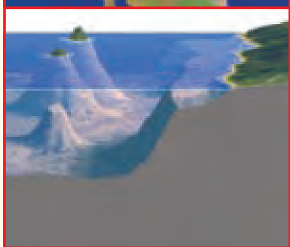
Critical Thinking Which of Earth's layers is like the shell of an egg? Why?

Lesson Review

Visual Summary



Earth has many **land features** and **water features**. Most of Earth is covered by water.



The ocean floor has features similar to Earth's land features.

Earth is made up of three main **layers**—the crust, the mantle, and the core.

Make a FOLDABLES™ Study Guide

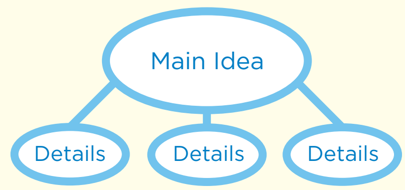
Make a Layered-Look Book. Use it to summarize what you learned about Earth's features.

Think, Talk, and Write

1. **Main Idea** What do you find on Earth's surface?

2. **Vocabulary** Which landform is a deep, narrow valley with steep sides and a river flowing through it?

3. **Main Idea and Details** What are the layers of Earth?



4. **Critical Thinking** Where would you be if you were at the deepest place on Earth's crust?

5. **Test Prep** **All of the following are landforms EXCEPT**
   - **A** an island.
   - **B** a canyon.
   - **C** a plain.
   - **D** a river.

Math Link

Compare Numbers

Here are the lengths of some coastlines in miles. Write the states in order from shortest coastline to longest coastline.

Oregon: 296	South Carolina: 187
Georgia: 100	New York: 127
New Jersey: 130	Maryland: 31

Social Studies Link

Do Research

Some people use stories, called *myths*, to explain how mountains formed. Research a myth that tells how mountains formed. Write a report about the myth.

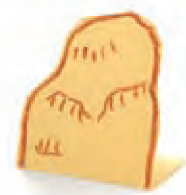
Focus on Skills

Inquiry Skill: Make a Model

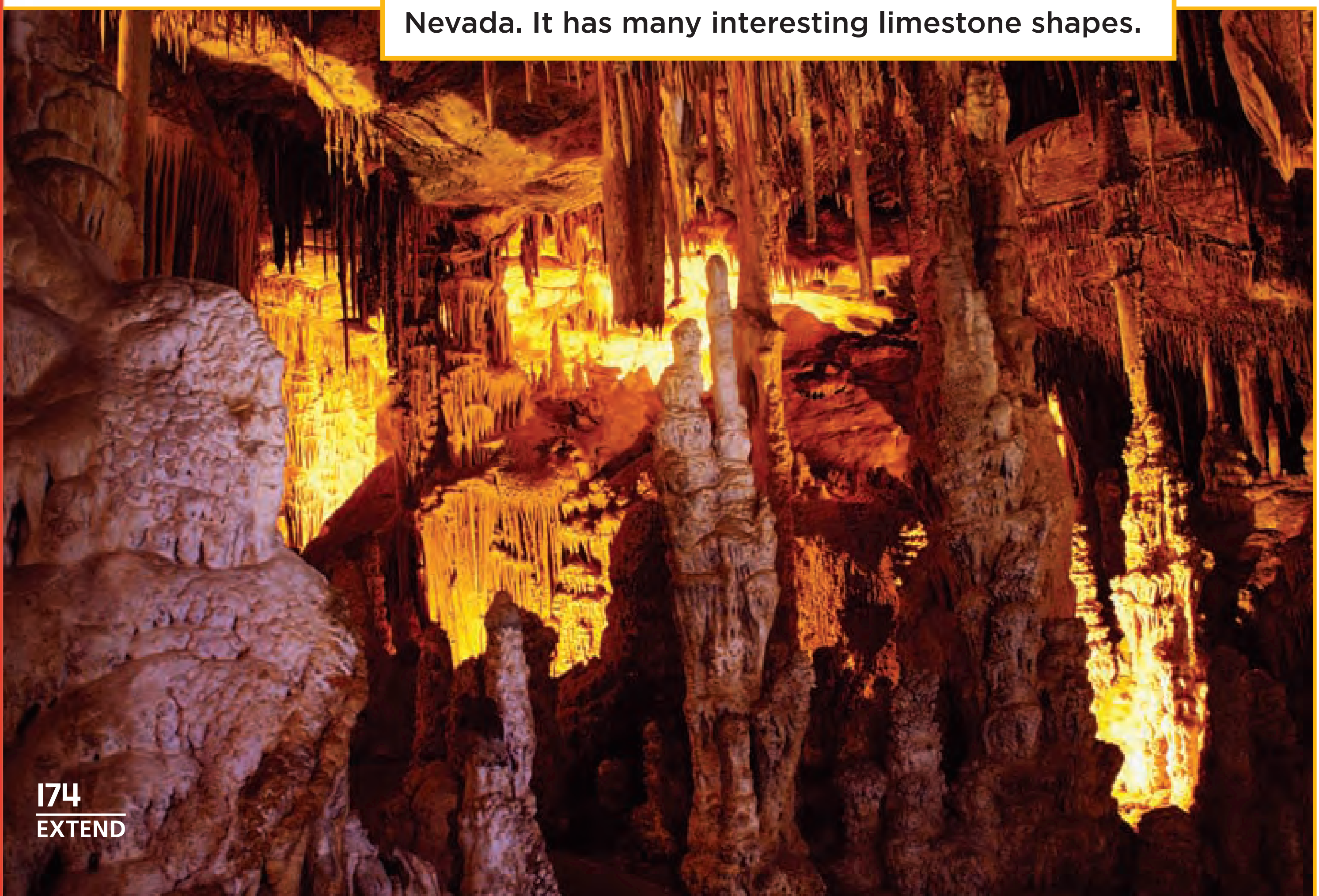
You just learned about many landforms. Some of them are found on land. Some lie under the ocean. In some places a limestone cave forms below the ground. It forms when water seeps into the ground and changes rock. This can take millions of years. You can **make a model** to show a cave.

▶ Learn It

When you **make a model**, you build something to represent, or stand for, a real object or event. A model may be bigger or smaller than the real thing. Models help you learn about objects or events that are hard to observe directly. Maps and globes are two examples of models.



This underground landform is Lehman Caves in Nevada. It has many interesting limestone shapes.



▶ Try It

In this activity, you will **make a model** of a cave.

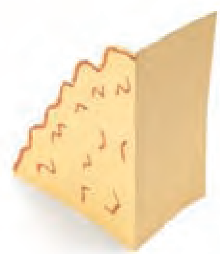
Materials **ruler, scissors, tan or white construction paper, crayon, shoe box or other small box, clear tape**


Step 4

1. Cut a piece of construction paper so that it is a little smaller than the size of the back wall of the box.

⚠ **Be Careful.**

2. On the paper draw limestone rocks like the ones shown. Tape the paper to the box's back wall.
3. Draw more limestone rocks on another piece of construction paper. Draw a flap for each rock.
4. Cut out each rock and its flap. Bend the flap for each rock. Tape the flap of the rock inside the box. Use the photo to help you.



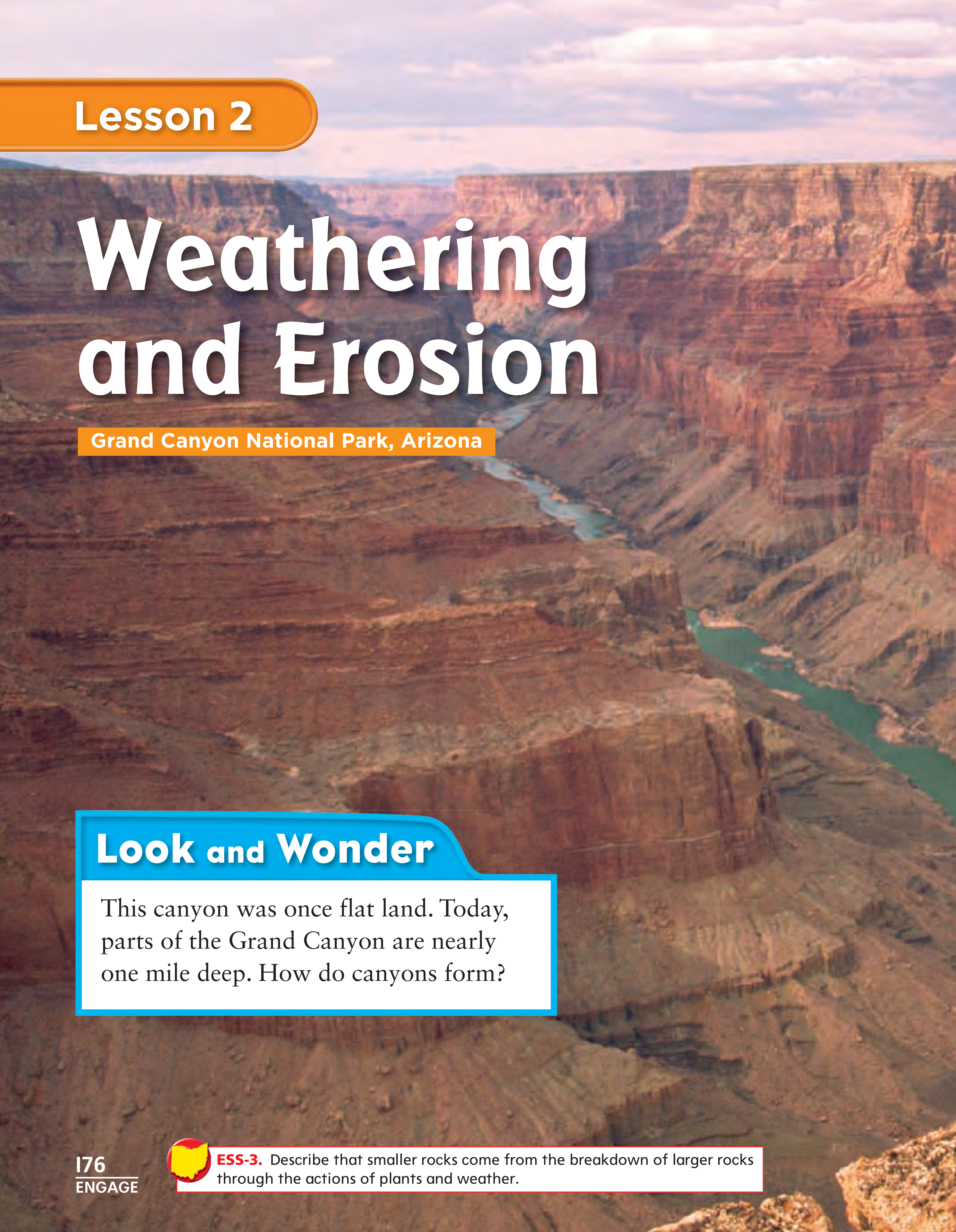
Now use your model to answer these questions:

- How would you describe the shapes of rocks in a limestone cave?
- Where do the rocks form?

▶ Apply It

Make a model of a landform that you learned about. It may be a landform on the ocean floor or one on land. What details do you want to show? Which materials will you use to help you model these details?

SI-4. Identify and apply science safety procedures. **SI-6.** Communicate scientific findings to others through a variety of methods (e.g., pictures, written, oral and recorded observations).



Lesson 2

Weathering and Erosion

Grand Canyon National Park, Arizona

Look and Wonder

This canyon was once flat land. Today, parts of the Grand Canyon are nearly one mile deep. How do canyons form?

ESS-3. Describe that smaller rocks come from the breakdown of larger rocks through the actions of plants and weather.

Explore

Inquiry Activity

How can rocks change in moving water?

Form a Hypothesis

What happens to rocks when they move around in water? Write a hypothesis in the form, "If I shake rocks in water, then . . ."

Test Your Hypothesis

1. **Measure** Label three jars *A*, *B*, and *C*. Put the same number of similar-sized rocks in each jar. Using the measuring cup, fill each jar with the same amount of water. Put a lid on each jar.
2. Let jar *A* sit. Do not shake it.
3. **Use Variables** Shake jar *B* hard for 2 minutes. Then let the jar sit.
4. **Use Variables** Shake jar *C* hard for 5 minutes. Then let the jar sit.
5. **Observe** Use a hand lens to observe the rocks in each jar. What happened? Did the results support your hypothesis?

Draw Conclusions

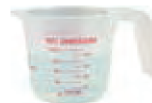
6. **Infer** How can rocks change in moving water?

Explore More

Experiment Would the results be the same if different rocks were used? Make a plan and try it.

Materials

sandstone rocks



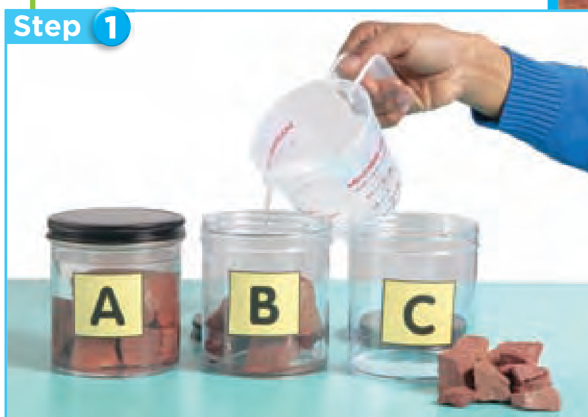
measuring cup

3 plastic jars with lids

stopwatch

hand lens

Step 1



Step 3

SI-5. Record and organize observations (e.g., journals, charts and tables).

Read and Learn

Main Idea ESS-3

Weathering and erosion usually cause slow changes to Earth's surface.

Vocabulary

weathering, p.178

erosion, p.180

glacier, p.180

deposition, p.180

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Reading Skill

Draw Conclusions

Text Clues	Conclusions

What is weathering?

You may think that hard rocks cannot change or break, but they do. Large rocks break into smaller rocks. Small rocks break down into sand and soil. The breaking down of rocks into smaller pieces is called **weathering** (WETH•uhr•ing). Weathering usually happens so slowly that you do not see it. The weathering of rocks can take millions of years.

What causes weathering? Running water, wind, rain, and temperature changes are some things that break down rocks.

Running water and wind pick up small rocks. These rocks scrape against other rocks. This scraping slowly wears away rocks.

This rock, called a ventifact, has been weathered by wind.

▲ These hoodoos have been worn mostly by water that freezes and then thaws inside cracks in the rocks.

This tree continues to break this rock apart. ▼

Rain and melting snow can enter the small cracks in rocks. When the water freezes, it *expands*, or takes up more space. This widens the cracks. Then the ice thaws and becomes liquid water again. Over time, repeated freezing and thawing breaks rocks apart.

Living things can cause weathering. Plants may grow in the cracks of rocks. Their roots eventually split rocks apart. When animals dig in the ground, they can uncover buried rocks. The uncovered rocks can then begin to weather.

Quick Check

Draw Conclusions A sidewalk crack got wider during a cold winter. Why?

Critical Thinking Explain how people can cause weathering.

▲ The rocks in this stream were carried here by moving water.

What is erosion?

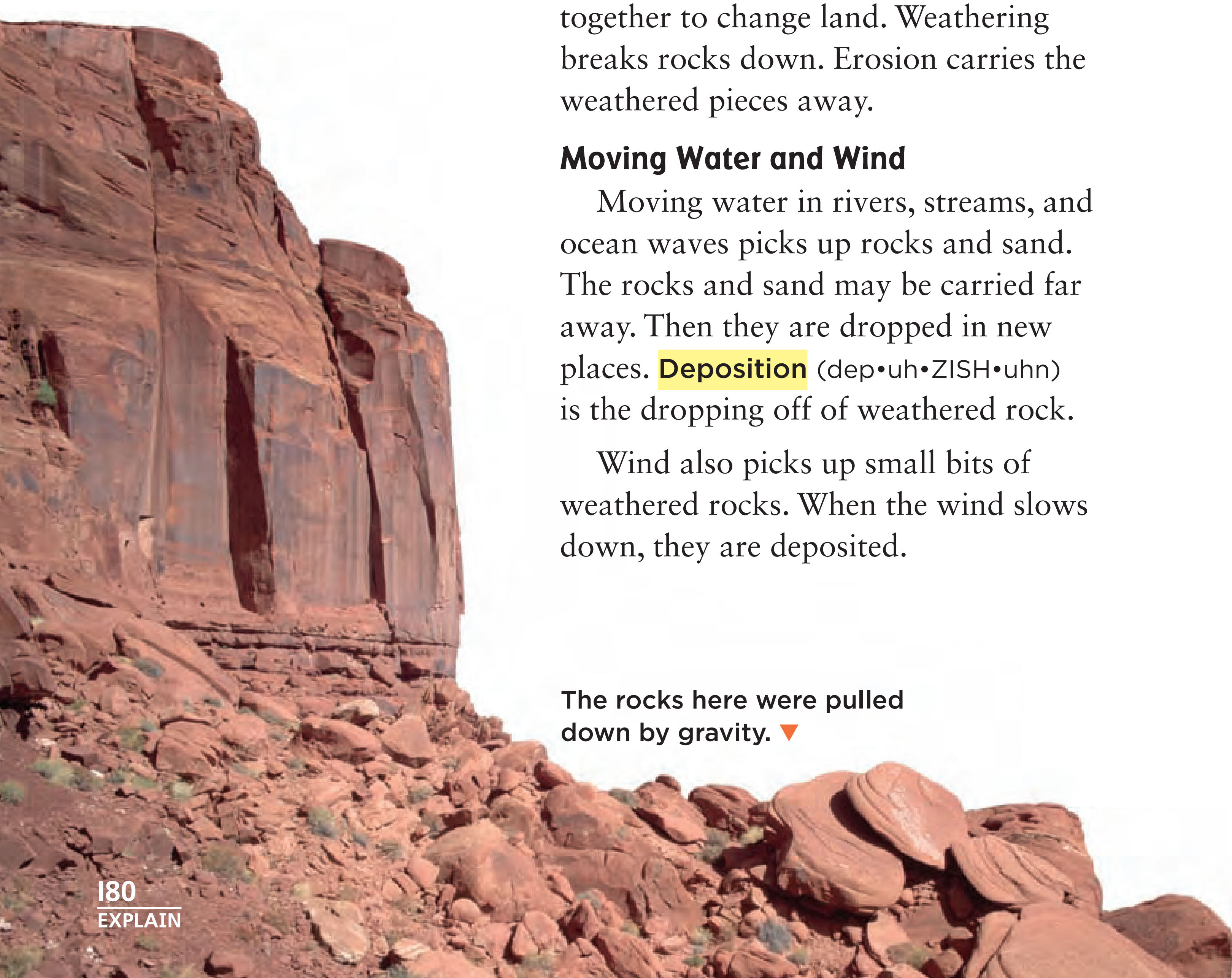
Once rocks break apart, they are moved to other places. **Erosion** (i•ROH•zhuhn) is the movement of weathered rock. Moving water, wind, and glaciers (GLAY•shuhrz) all cause erosion. A **glacier** is a mass of ice that moves slowly across the land. Gravity also causes erosion. Gravity pulls weathered materials downhill.

Erosion usually happens very slowly. Weathering and erosion work together to change land. Weathering breaks rocks down. Erosion carries the weathered pieces away.

Moving Water and Wind

Moving water in rivers, streams, and ocean waves picks up rocks and sand. The rocks and sand may be carried far away. Then they are dropped in new places. **Deposition** (dep•uh•ZISH•uhn) is the dropping off of weathered rock.

Wind also picks up small bits of weathered rocks. When the wind slows down, they are deposited.



The rocks here were pulled down by gravity. ▼

Glaciers

As it moves, a glacier picks up and carries away rocks of all sizes. The ice at the bottom of a glacier freezes onto rocks. As the glacier moves, it tears rocks out of the ground. A glacier can move rocks the size of a house. As a glacier melts, it drops off the rocks in a new place.

Quick Check

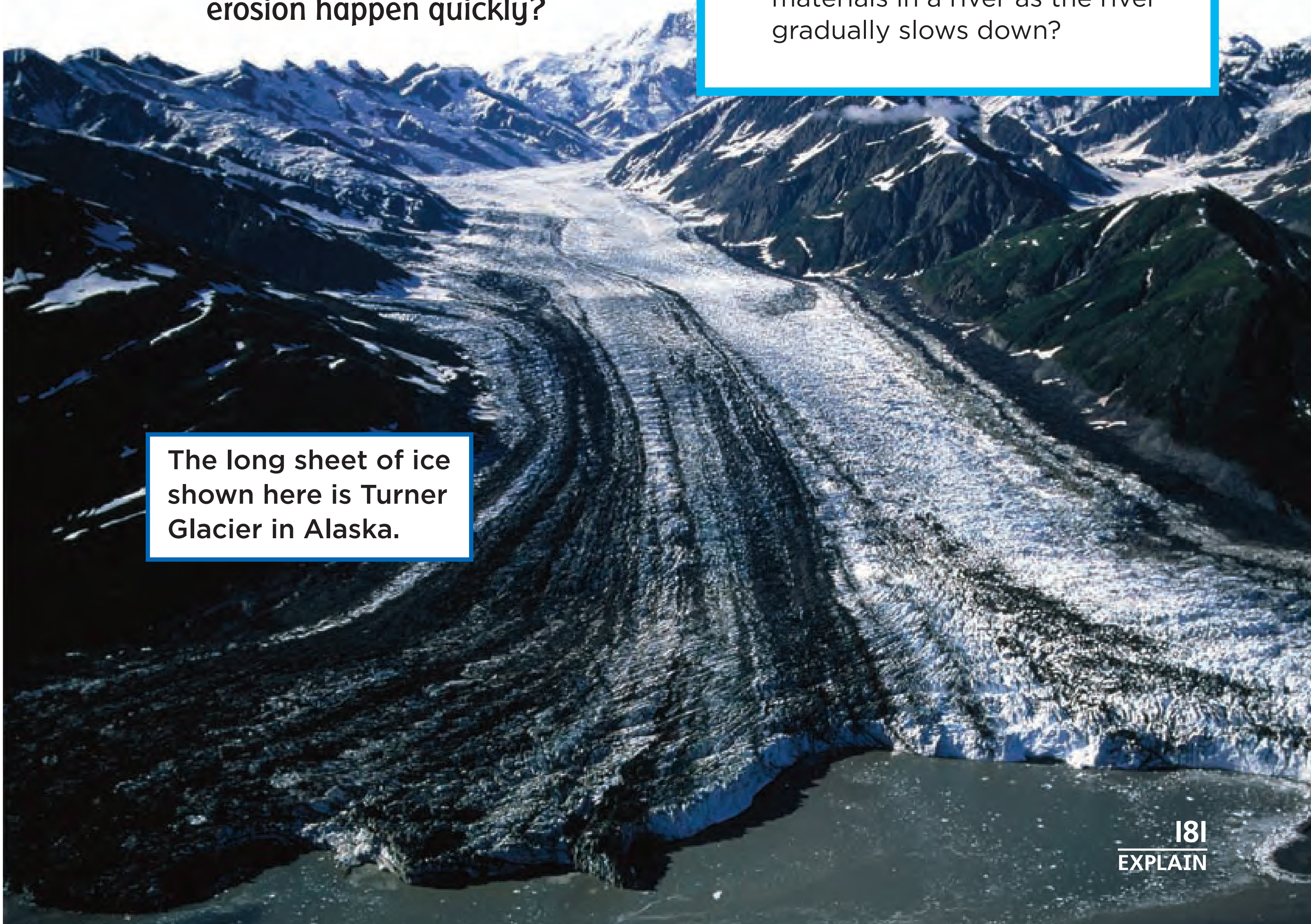
Draw Conclusions What causes erosion?

Critical Thinking When might erosion happen quickly?

Quick Lab

Materials Settle

1. **Make a Model** Pour one cup each of sand, soil, and pebbles into a jar. Fill the jar almost to the top with water. Seal the jar tightly.
2. Shake the jar 10 times. Then let it sit. Draw what you see.
3. **Interpret Data** In which order do the materials settle?
4. **Infer** What happens to eroded materials in a river as the river gradually slows down?



The long sheet of ice shown here is Turner Glacier in Alaska.

Building a Canal

▲ In 1913 the Culebra Mountain in Panama was carved out to build the Panama Canal.

Read a Photo

How did people change the land here?

Clue: Compare the "after" photo with the "before" photo.

How can people change the land?

People change the land, too. Some changes are very small, like digging a hole in your backyard. Other changes are much larger.

In some places trees are cut to build roads, stores, and homes. If trees are not replanted, soil can wash away. In other places ponds and swamps are drained. The dry soil left behind can blow away. In still other places, land is dug up to reach valuable rocks.

Quick Check

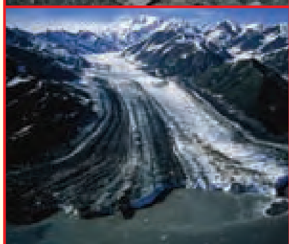
Draw Conclusions What effect might planting trees have on the land?

Critical Thinking How are people changing the land where you live?

Lesson Review

Visual Summary

Weathering breaks down larger rocks into smaller rocks.



Erosion is the movement of weathered rock from one place to another.

People can cause **changes to land**.

Make a FOLDABLES Study Guide

Make a Trifold Book. Use it to summarize what you learned about weathering and erosion.

Think, Talk, and Write

1. **Main Idea** Which two things usually change the land very slowly?

2. **Vocabulary** What is erosion?

3. **Draw Conclusions** What happens to eroded rocks and soil once they are dropped off?

Text Clues	Conclusions

4. **Critical Thinking** How do weathering and erosion together change land?

5. **Test Prep** **All of the following may cause weathering to rocks EXCEPT**
   - **A** ice.
   - **B** light.
   - **C** wind.
   - **D** plants.

Writing Link

Write a Story
Suppose you are a small rock in a stream. Write a story about what happens to you due to weathering and erosion.

Social Studies Link

River Deltas
Do research about river deltas. Find out what they are and how they form. What are some famous deltas? Write your findings in a report.

Missing Noses

Rocks are constantly changed by weathering and erosion. However, not all weathering happens the same way.

What happened to the noses on these statues? Did someone break them off? No, something else happened.

It all started when certain gases were released into the air. Many of these gases came from cars, trucks, and factories. The gases combined with rainwater. A weak acid formed. The acid rain chemically changed the minerals in the rock. This is called chemical weathering. The rock broke down. Then rain washed the changed minerals away.

One day, this ancient place could weather and erode completely. All it takes is rain, gases in air, and lots of time.

Expository Writing

Good expository writing

- has a topic sentence that tells the main idea
- supports the main idea with facts and details
- draws a conclusion based on the facts

Write About It

Expository Writing Write a paragraph to describe other causes of weathering. Remember to start with a topic sentence and to end with a conclusion.

LOG ON e-Journal Write about it online at www.macmillanmh.com

The Acropolis in Greece is over 2,500 years old. ▼

Estimate a Glacier's Change

Sometimes a glacier reaches the ocean and floats on top of it. This long, thin mass of floating ice is called an ice tongue.

The Mertz Glacier has a tongue. Since 1963, melting has caused the glacier's tongue to get longer. It "grows" about 0.9 kilometer each year. If this rate stays the same, about how much should the tongue grow over the next 5 years?

Make Estimations

- An estimate is a number that tells about how much or how many. To estimate the tongue's growth, first round 0.9 to the nearest whole number.
  0.9 kilometer (km) rounds to 1.0 kilometer (km).
- To estimate the change over 5 years, multiply the amount of change per year by the number of years.

  1 km per year x 5 years = 5 km

  The glacier's tongue will grow about 5 kilometers in 5 years.

▲ The Mertz Glacier's tongue is about 72 kilometers long.

Solve It

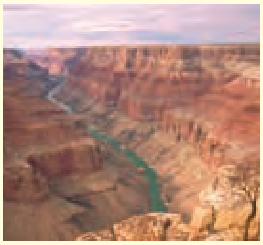
About how much should the glacier's tongue grow in 20 years? If the tongue grows longer than you estimated, what might this tell you about the rate at which the tongue is growing?

M M-5. Estimate and measure length, weight and volume (capacity), using metric and U.S. customary units, accurate to the nearest $\frac{1}{2}$ or $\frac{1}{4}$ unit as appropriate.

CHAPTER 4 Review

Visual Summary

Lesson 1 Earth's surface has many features.



Lesson 2 Weathering and erosion usually cause slow changes to Earth's surface.

Make a FOLDABLES™ Study Guide

Glue your lesson study guides on a sheet of paper as shown. Use your study guides to review what you have learned in this chapter.

Vocabulary

Fill each blank with the best term from the list.

continent, p. 167	**erosion**, p. 180
core, p. 172	**landform**, p. 168
crust, p. 172	**weathering**, p. 178

1. Each of the seven great land areas on Earth is called a ________.
ESS-B
2. The breaking down of rocks into smaller pieces is called ________.
ESS-3, ESS-4
3. A mountain is an example of a ________.
ESS-B
4. The movement of weathered rock by such things as wind, moving water, and glaciers is known as ________.
ESS-B
5. Earth's deepest, hottest layer is the ________.
ESS-B
6. Earth's cool, thin top layer is called the ________.
ESS-B

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

Skills and Concepts

Answer each of the following in complete sentences.

7. **Expository Writing** Describe what the ocean floor looks like.
ESS-B

8. **Make a Model** Suppose you want to show the difference between a plateau and a mountain. Explain how you could build a model to show the difference.
ESS-B

9. How can erosion be caused by a stream or a river?
ESS-4

The Big Idea

10. What can cause Earth's features to change?
ESS-B

Performance Assessment

The Changing Earth

Find out how a recent event changed Earth's surface.

- Research a recent natural event that happened somewhere in the world. It could be an earthquake, a flood, a landslide, or a volcanic eruption.
- Find out when and where the event occurred. What caused the event to take place? Did it change the land? How did it affect the people, other living things, or buildings in the area?
- Write a short news report presenting the information you found.

Ohio Activity

As you travel through Ohio, you will notice many different landforms. You can see valleys, plains, lakes, and rivers. Make a three-dimensional model of Ohio using different colors of modeling clay. Make flags out of toothpicks and paper to identify each landform.

Ohio Benchmark Practice

1 A student conducted an experiment to find out which type of soil eroded fastest. The soil types were in pans, each propped up at the same angle. She slowly poured water over each soil type. She poured until all of the soil had eroded. Then she recorded her findings in the chart below.

Soils	
Type of Soil	**Time to Erode**
sandy soil	20 seconds
topsoil	40 seconds
clay soil	60 seconds

Which one of the following **best** describes her results?

A Clay soil eroded the fastest.

B Sandy soil eroded the fastest.

C Topsoil eroded the slowest.

D Sandy soil eroded the slowest.

SI-B

2 People can change the land in many ways. Each of the following is a way that people change the land **except**?

A cutting down trees

B digging holes

C draining ponds

D driving cars

ESS-C

3 Each of the following can cause weathering **except**?

A wind

B water

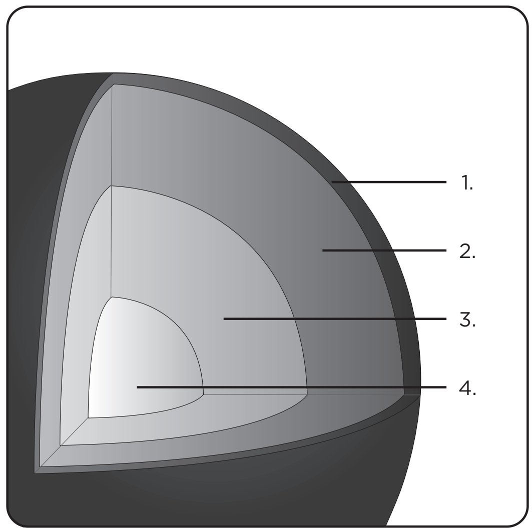
C Earth's core

D living things

ESS-B

4 A student is analyzing the diagram below that shows the Earth's layers. The student must label the four layers of the diagram.

Based on the drawing, how should the student label layer three?



A mantle

B inner core

C crust

D outer core

ESS-B

5 Weather can cause the breakdown of larger rocks into smaller rocks.

In your **Answer Document** identify one way living things can break down rock.

Then, describe evidence of this process. (2 points)

ESS-B

6 **The rocks and sand along the side of this stream are an example of which process?**

A deposition

B transport

C erosion

D weathering

ESS-B

7 **A student completed an experiment only once. The results did not turn out as he expected. What should he do next?**

A do the experiment again

B change his prediction to fit the results

C change his results to fit the prediction

D conclude it was a good experiment

SWK-B

8 **A student is brainstorming a list of land features that can be found in the ocean. Which item on her list is incorrect?**

Ocean Floor Land Features

- trench
- continental shelf
- seamount
- plateau

A trench

B continental shelf

C seamount

D plateau

ESS-B

9 **Erosion is the movement of weathered rock. Which of the following does not cause erosion?**

A glaciers

B gravity

C wind

D planting trees

ESS-B

10 **Suni will be doing an experiment with sand, soil, and rocks. She wants to find out which materials will settle first when shaken.**

In your Answer Document, hypothesize the order in which sand, soil, and rocks will settle when shaken.

Then, describe or draw how the student can set up an investigation of her hypothesis. (2 points)

SWK-B

CHAPTER 5

Using Earth's Resources

The Big Idea

What things used by people come from Earth?

Rice growing in the Kathmandu Valley, Nepal

Key Vocabulary

mineral
a solid, nonliving substance found in nature (p. 194)

soil
a mixture of minerals, weathered rocks, and other things (p. 206)

natural resource
a material on Earth that is necessary or useful to people (p. 210)

fossil
the trace or remains of something that lived long ago (p. 216)

fuel
a material that is burned for its energy (p. 218)

renewable resource
a resource that can be replaced or used again and again (p. 219)

More Vocabulary

rock, p. 196

igneous rock, p. 197

sediment, p. 198

sedimentary rock, p. 198

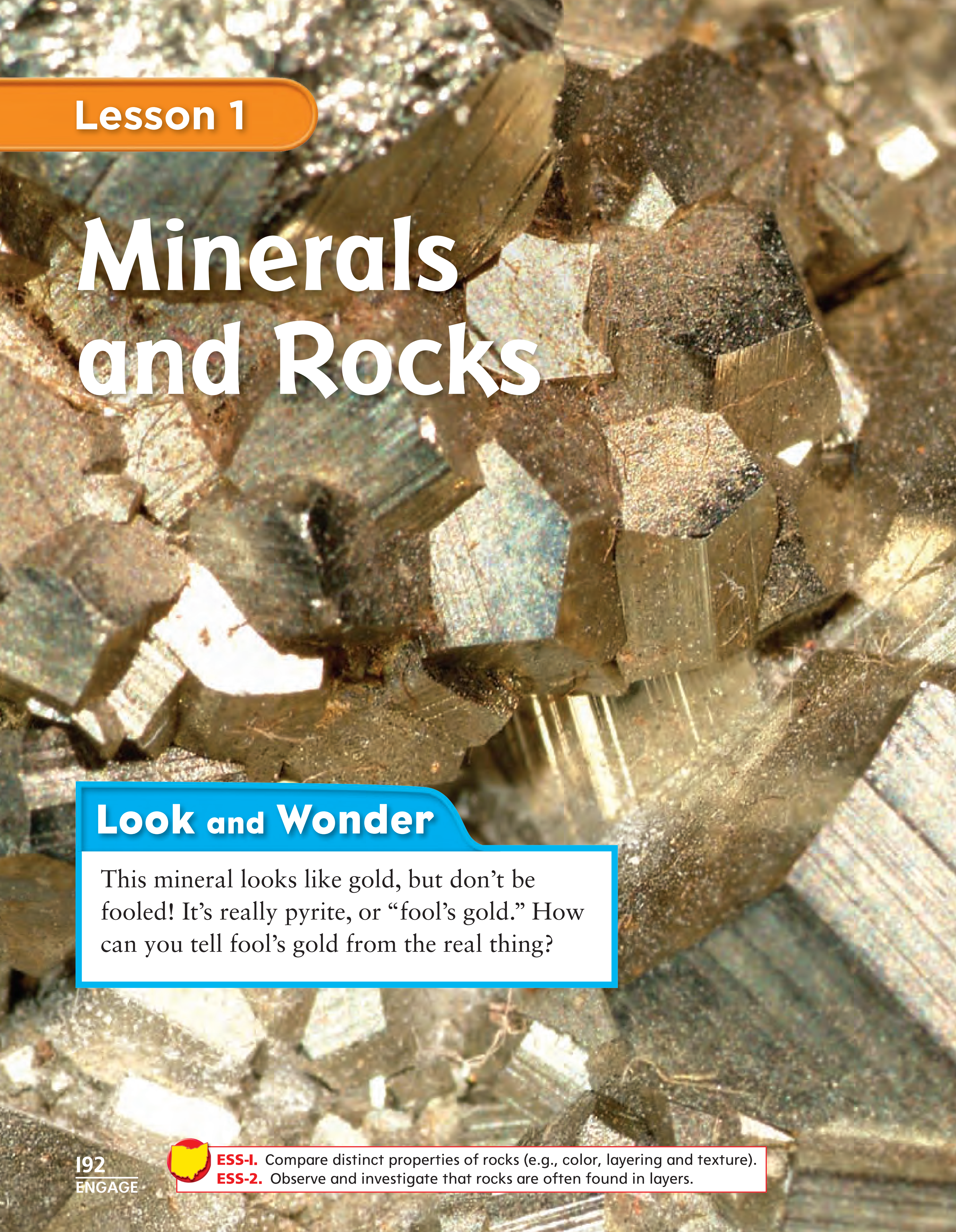
metamorphic rock, p. 199

humus, p. 206

nonrenewable resource, p. 219

solar energy, p. 220

ESS-C. Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.



Lesson 1

Minerals and Rocks

Look and Wonder

This mineral looks like gold, but don't be fooled! It's really pyrite, or "fool's gold." How can you tell fool's gold from the real thing?

ESS-1. Compare distinct properties of rocks (e.g., color, layering and texture).
ESS-2. Observe and investigate that rocks are often found in layers.

Explore **Inquiry Activity**

How do a mineral's color and mark compare?

Make a Prediction

Some minerals leave a mark behind when you rub them on a white tile. Is the mark left behind always the same color as the mineral?

Test Your Prediction

1. Make a table like the one shown.

Mineral Color	Color Left Behind

2. **Observe** Look at one mineral. Record its color in the table.
3. **Experiment** Rub the mineral across the tile. What color is left behind? Record the color in the table.
4. Repeat steps 2 and 3 for each mineral.

Draw Conclusions

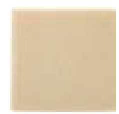
5. **Interpret Data** How did the colors and marks of the minerals compare?
6. **Infer** When might you use mineral marks to help you tell minerals apart?

Explore More

Experiment Are some minerals harder than others? Make a plan to find out. Then try it.

Materials

minerals



white tile

Step 3

SI-3. Read and interpret simple tables and graphs produced by self/others.

Read and Learn

Main Idea ESS-I, ESS-2

Rocks are made of minerals. Rocks are classified as igneous, sedimentary, or metamorphic.

Vocabulary

mineral, p. 194

rock, p. 196

igneous rock, p. 197

sediment, p. 198

sedimentary rock, p. 198

metamorphic rock, p. 199

LOG ON e-Glossary at www.macmillanmh.com

Reading Skill

Classify

What are minerals?

Many common substances found on Earth are made of minerals (MIN•uhr•uhlz). A **mineral** is a solid, nonliving substance found in nature. Table salt, gold, and iron are minerals. The graphite in your pencil is a mineral, too. Minerals are the building blocks of rocks. They are found underground and in soil. They are even in the ocean and on the ocean floor.

There are more than 3,000 different kinds of minerals. Each mineral has its own properties. You can use the properties of minerals to tell them apart.

Color

It is easy to observe a mineral's color. Most minerals come in just one color. However, some, like quartz, come in many colors. Some, like gold and pyrite, are the same color. You cannot use color alone to identify a mineral.

▼ Minerals come in many colors.

turquoise

feldspar

quartz

Streak

Streak is another property used to identify minerals. *Streak* is the color of the powder left when a mineral is rubbed across a white tile. A mineral's streak may or may not be the same as the mineral's color.

Luster

Luster describes how light bounces off a mineral. Some minerals are shiny like metal. Others are not. Luster is another property used to identify a mineral.

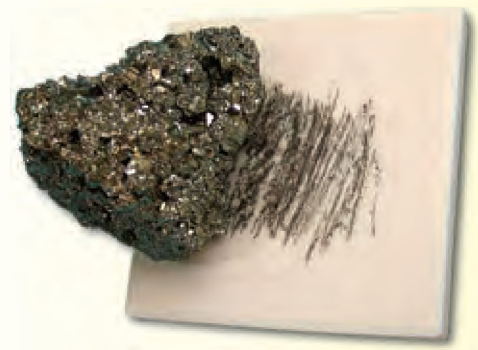
Hardness

The *hardness* of a mineral describes how easily it can be scratched. Some minerals, like talc and gypsum, are soft. They can be scratched with a fingernail. Other minerals, like quartz, are much harder. Not even a steel file can scratch quartz.

Quick Check

Classify What are some properties that help you identify a mineral?

Critical Thinking Is wood a mineral? Explain your answer.



▲ Pyrite may look like gold, but its streak is different. Pyrite's streak is greenish-black. Gold's streak is yellow.

▲ Mica can have a pearly luster.

▲ Diamond is the hardest mineral. No other mineral or object can scratch it.

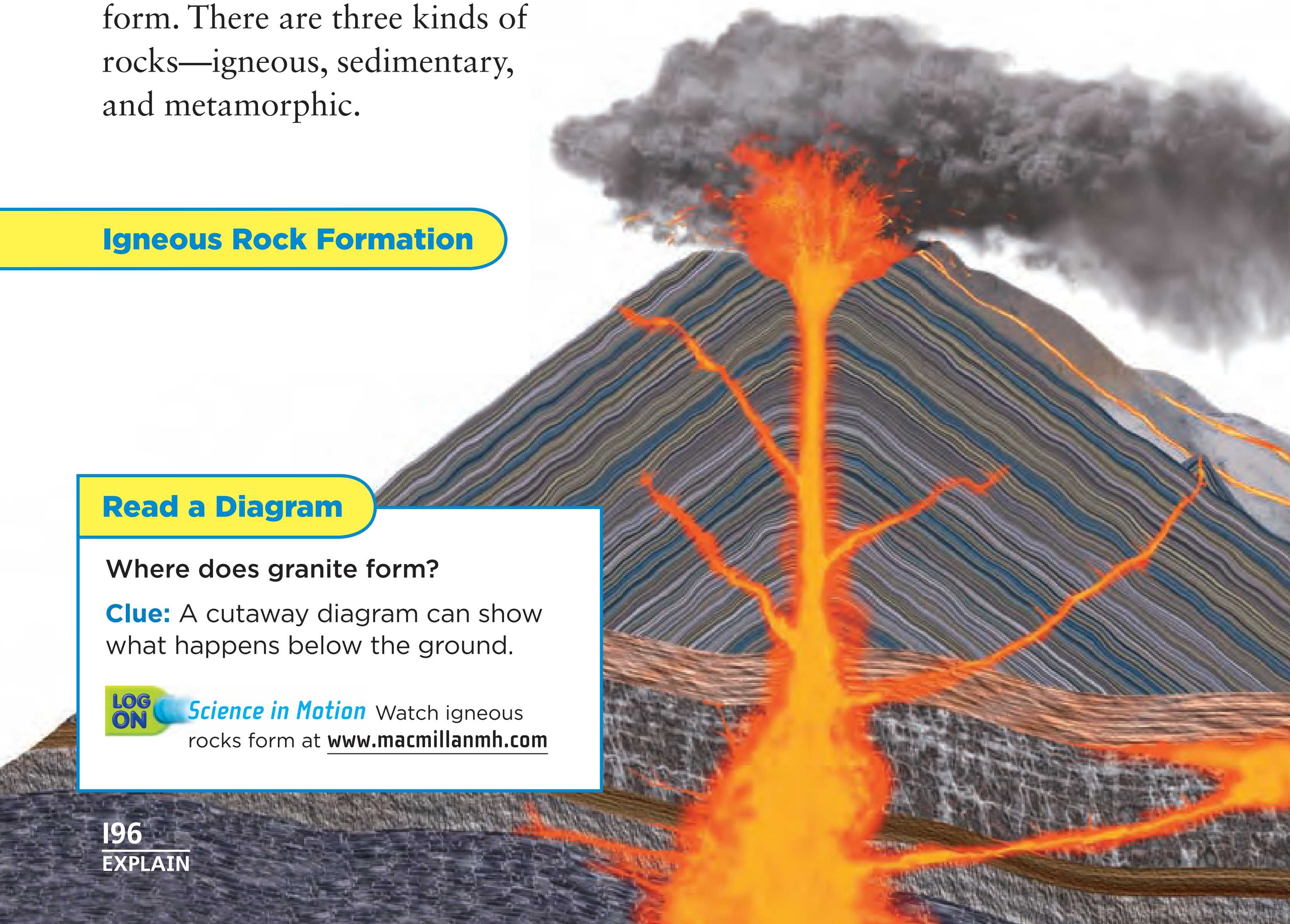
What are rocks?

A **rock** is a nonliving material made of one or more minerals. There are hundreds of different types of rocks. Some rocks, like granite (GRAN•it), are made of several minerals. Some rocks, like limestone, are made mostly of one mineral. A rock's color gives clues about the minerals that make it up.

Rocks are made of mineral pieces called grains. To a person who studies rocks, a rock's *texture* (TEKS•chuhr) is how its grains look. Some rocks have large grains you can easily see. These rocks have a coarse texture. Some rocks have grains that are too small to see. These rocks have a fine texture.

Rocks are classified by how they form. There are three kinds of rocks—igneous, sedimentary, and metamorphic.

Igneous Rock Formation



Read a Diagram

Where does granite form?

Clue: A cutaway diagram can show what happens below the ground.

LOG ON *Science in Motion* Watch igneous rocks form at www.macmillanmh.com

Igneous Rocks

An **igneous rock** (IG•nee•uhs) forms when melted rock cools and hardens. Inside Earth, melted rock called *magma* cools and hardens very slowly. A rock with large mineral grains forms. Granite is an example.

Melted rock that flows onto Earth's surface is called *lava*. Lava cools and hardens quickly. A rock with small mineral grains forms. Basalt is an example.

Quick Check

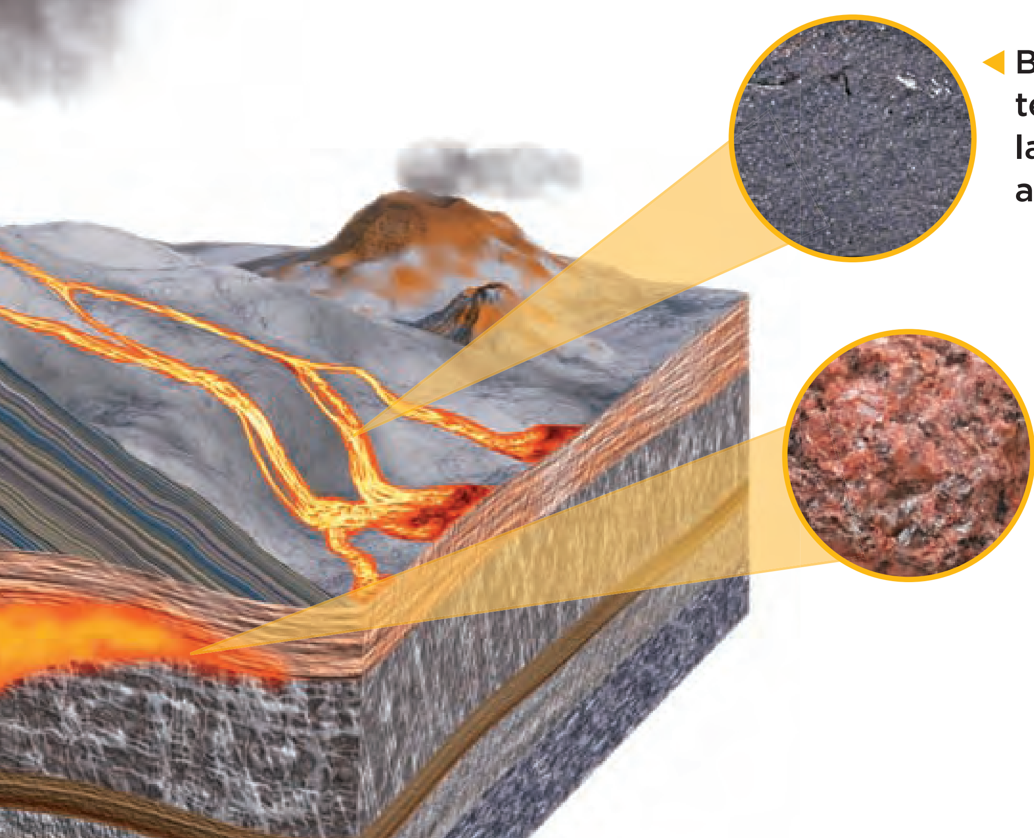
Classify What kind of rock is basalt?

Critical Thinking What is the difference between a mineral and a rock?

Quick Lab

Classify Rocks

1. **Observe** Use a hand lens to observe a few igneous rocks. What color are they? Are their grains large or small? Do they have a coarse texture or a fine texture?
2. **Classify** Put the rocks into groups that are alike.
3. **Infer** Which of the rocks do you think formed below Earth's surface? Which formed above Earth's surface? Explain why.



Basalt has a fine texture. It forms when lava cools quickly above Earth's surface.

Granite has a coarse texture. It forms when magma cools slowly beneath Earth's surface.

What are sedimentary and metamorphic rocks?

Some rocks are formed from sediment (SED•uh•muhnt). **Sediment** is tiny bits of weathered rock or once-living animals or plants. A **sedimentary rock** (sed•uh•MEN•tuh•ree) is a kind of rock that forms from layers of sediment. Sandstone, shale, and limestone are some kinds of sedimentary rocks.

▲ Shale is a sedimentary rock made up of bits of layered materials.

Sedimentary rocks form where weathered and eroded materials are dropped. This often happens at the bottom of rivers, lakes, and oceans. Over time, sediment piles up. The top layers press on layers below. They squeeze the water and air from the lower layers and press the sediment together. In time the sediment becomes cemented together and forms rock.

▲ Fossils are often found in the sedimentary rock limestone. Limestone can form from the remains of once-living things.

◀ Sandstone is sedimentary rock that forms from tiny particles of sand.

A third kind of rock is metamorphic (met•uh•MAWR•fik) rock. A **metamorphic rock** is a rock that has been changed by heating and squeezing.

Deep inside Earth, rocks heat up and "bake." They also get squeezed by the weight of the rocks above them. All this heating and squeezing can cause a rock's minerals to change into new minerals. A new rock forms with properties that are different from the original rock.

Quick Check

Classify What kinds of rocks are limestone and gneiss?

Critical Thinking What kinds of rocks can change into metamorphic rocks?

Metamorphic Rocks

▲ Gneiss is a metamorphic rock. It forms from granite.

▲ Slate is a metamorphic rock. It forms from shale.

▲ Phyllite is a metamorphic rock. It forms from the metamorphic rock slate.

How do we use minerals and rocks?

Did you write with a pencil today? If so, you used the mineral graphite. Did you eat any food with salt? If so, you ate the mineral halite. Many of the things we use every day come from minerals. Telephone wires are made with the mineral copper. Some baseball bats are made with the mineral aluminum. Gold, silver, and iron are minerals we use for jewelry. In fact, most of the metals we use come from minerals. Minerals are even used to make glass, chalk, and toothpaste.

Other minerals, such as diamonds, topazes, and rubies, are *gems*. People value gems for their beauty.

Rocks are also useful. They are used for building roads, houses, and statues. Limestone is used to make cement. Coal is burned for heat.

▲ Rubies and diamonds are gems.

▲ Marble is a hard rock. It weathers very slowly.

▼ Calcium, a mineral in milk, helps to keep your bones strong.

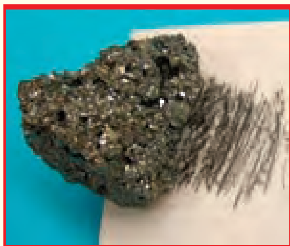
Quick Check

Classify Is salt a gem?

Critical Thinking What minerals have you used today?

Lesson Review

Visual Summary



Properties such as color, hardness, luster, and streak are used to tell **minerals** apart.

Igneous, sedimentary, and metamorphic **rocks** form in different ways.

People **use minerals and rocks** for many things.

Make a FOLDABLES™ Study Guide

Make a Three-Tab Book. Use it to summarize what you learned about minerals and rocks.

Think, Talk, and Write

1. **Main Idea** What makes igneous, sedimentary, and metamorphic rocks different from each other?

2. **Vocabulary** What is a mineral?

3. **Classify** How could you classify granite, sandstone, basalt, and limestone?

4. **Critical Thinking** Explain the relationship between rocks and minerals.

5. **Test Prep** **Which of the following is a sedimentary rock?**
   A sandstone
   B basalt
   C diamond
   D granite

Writing Link

Write a Poem
Write a poem about an igneous, sedimentary, or metamorphic rock. Tell how the rock formed or describe how it looks. Be sure to include a title.

Art Link

Make Rock Art
Find something you can decorate with rocks, such as a box. Collect small rocks of different colors and sizes. Glue the rocks to your box.

Marble Memorials

The Lincoln Memorial and the Jefferson Memorial both honor a past American President. These two marble buildings are in Washington, D.C. Both have a statue of a President inside them.

The Lincoln Memorial has the shape of a rectangle. It has white columns. The Jefferson Memorial has columns, too, but it is round.

Descriptive Writing

A good description

- uses details to create a picture for the reader
- includes words that compare, such as *both*, *like,* and *too*
- includes words that contrast, such as *but* and *unlike*

Lincoln Memorial

Jefferson Memorial

Write About It

Descriptive Writing Choose two objects made from rock. Write a paragraph that describes and compares them.

LOG ON e-Journal Write about it online at www.macmillanmh.com

ELA WA-D. Write informational reports that include facts, details and examples that illustrate an important idea.

Finding Fractions

This table shows the different rocks in a rock collection.

My Rock Collection

Igneous	Sedimentary	Metamorphic
2 basalt	1 coquina	1 schist
3 granite	2 sandstone	1 slate

Fractions

- To find a fraction, use the total number of rocks as the denominator. Use the number of rocks for a particular kind of rock as the numerator.
- Example: What fraction of igneous rocks in the collection are granite?

  3 ← granite rocks

  5 ← number of igneous rocks
- Example: What fraction of rocks in the collection are metamorphic?

  2 ← metamorphic rocks

  10 ← total number of rocks


granite


coquina


schist


sandstone

Solve It

What fraction of rocks in the collection are igneous rocks? What fraction of sedimentary rocks in the collection are sandstone?

SI-3. Read and interpret simple tables and graphs produced by self/others.

Lesson 2

Soil

Prairie dogs in their burrow

Look and Wonder

Plants, animals, and people could not live without soil. What is in soil? Why is it important to many living things?

ESS-4. Observe and describe the composition of soil.... **ESS-5.** Investigate the properties of soil.... **ESS-6.** Investigate that soils are often found in layers and can be different from place to place.

What makes up soil?

Purpose

Find out what soil is made of.

Procedure

1. Use a spoon to spread out the soil on the plate.

2. **Observe** Use the hand lens to observe the soil. Is soil made of small bits of stuff? What is the shape and color of these small particles? Wash your hands. Record what you see.

3. **Communicate** Talk with others about what the tiny bits in soil may be.

Draw Conclusions

4. **Infer** What kinds of things make up this soil?

Explore More

Experiment Is all soil the same? Make a plan to find out. Then try out your plan.

Materials

plastic spoon

soil

paper plate

hand lens

SI-2. Discuss observations and measurements made by other people.

Read and Learn

Main Idea ESS-4, ESS-5, ESS-6

Soil is made up of weathered rocks, minerals, and once-living things. Many living things need soil to survive.

Vocabulary

soil, p. 206

humus, p. 206

natural resource, p. 210

LOG ON e-Glossary at www.macmillanmh.com

Reading Skill

Problem and Solution

Problem → Steps to Solution → Solution

What is soil?

Soil is a mixture of minerals, weathered rocks, and other things. It has bits of decayed plants and animals called **humus** (HYEW•muhs). Humus looks dark. It adds nutrients to soil. Plants then use these nutrients. Humus works like a sponge to soak up rainwater and keep the soil moist. Water, air, and living things are also found in soil.

Living Things in Soil

If you dig away a chunk of soil, you might see roots. A plant's roots take in water and minerals from the soil. They also hold the soil in place and help slow erosion.

You might also see animals living in soil. Animals such as ants, earthworms, and moles break up soil. Their burrows help air and water get into the soil.

Ants and earthworms are just a few of the organisms that live in soil.

FACT Most living things in soil are too small to see with just your eyes.

How Soil Forms

The making of soil starts with weathering. Weathering causes rocks to break down into smaller and smaller pieces. The tiny bits of weathered rock build up into layers. Living things die and decay in the weathered material and become humus. Over time, layers of soil form. The top layer is called *topsoil*. Topsoil is dark and has the most humus and minerals. Below the topsoil is *subsoil*. This layer is lighter in color and has less humus. Below the subsoil is *bedrock*, or solid rock.

Soil takes a long time to form—up to 1,000 years for just 1 centimeter! That is why people try to prevent soil erosion. They add minerals and humus to soil to keep it healthy.

The Layers of Soil

Each layer of soil has a different amount of rock and humus.

Read a Diagram

Which layer of soil is found between topsoil and bedrock?

Clue: Labels give information.

Quick Check

Problem and Solution What do people do to try to solve the problem of keeping soil healthy?

Critical Thinking How is soil a habitat?

▲ This red soil is rich in iron.

▲ This dark soil is rich in humus.

How are soils different?

Different soils are found in different places. They are made up of different rocks and minerals. They have different amounts of humus in them, too. Some soils have thick layers of topsoil. These soils are rich in humus. They are good for growing plants. Some soils have thin layers of topsoil. These soils have little humus. They are not as good for growing plants.

Soil Color

Like rocks, soils differ in color and texture. A soil's color depends on what is in it. Soil rich in humus looks dark brown or black. Soil with a lot of calcite (KAL•site) in it looks white. Soil with hematite (HEM•uh•tite) in it looks red. That is because hematite contains iron.

Soil Texture

Soil texture describes how big the pieces, or grains, of soil are. *Sandy soil* has a lot of small grains called sand. *Silty soil* has grains smaller than sand called silt. *Clay soil* has the smallest grains called clay. *Loam* is soil made up of a mixture of sand, silt, and clay.

Soil texture affects how much water soil can hold. Clay soil holds a lot of water. Sandy soil holds very little water. Many plants grow best in loam. It is neither too wet nor too dry.

Quick Lab

Classify Soils

1. **Observe** Look at the two soils in plastic bags. How are they alike? How are they different?
2. **Observe** Use a hand lens to look closely at each soil. Which soil has larger grains?
3. **Classify** Which soil is sandy soil? Which is clay soil? How do you know?


clay soil


sandy soil


loam

Quick Check

Problem and Solution What if plants could not grow well in your neighborhood? What might be the problem? How might you solve it?

Critical Thinking A cactus plant grows best in dry soil. Which soil would be best for a cactus?

Why is soil important?

Soil is a natural resource (NACH•uhr•uhl REE•sawrs). A **natural resource** is a material on Earth that is necessary or useful to people. Without soil, most plants could not grow. People and animals would not have food to eat. There would be no cotton to make clothes. There would be no wood to build houses or burn for heat. There would be fewer medicines.

It is important to keep soil healthy. It is also important to prevent soil erosion. We can farm in ways to help keep soil from eroding. We can keep soil healthy by keeping it clean. We can put nutrients into the soil for plants to use.

▲ The bark and leaves of the willow tree were once used to make aspirin.

Quick Check

Problem and Solution How can people keep soil healthy and prevent soil erosion?

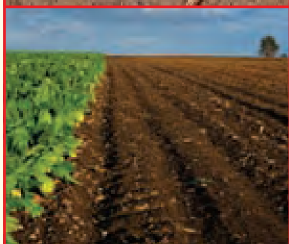
Critical Thinking Are rocks and minerals natural resources? Why or why not?

Contour farming helps prevent soil erosion.

Lesson Review

Visual Summary

Soil is mostly made up of weathered rocks, minerals, and once-living things.



Soils have different colors and textures. They also hold different amounts of water.

Soil is a natural resource that is important to many living things.

Make a FOLDABLES™ Study Guide

Make a Trifold Book. Use it to summarize what you learned about soil.

Think, Talk, and Write

1. **Main Idea** List some things that make up soil.
2. **Vocabulary** What is humus?
3. **Problem and Solution** What problems might occur if we do not protect soil?

Problem
↓
Steps to Solution
↓
Solution

4. **Critical Thinking** Can soil form below Earth's surface? Explain your answer.
5. **Test Prep** **Which helps soil hold water?**
   - **A** humus
   - **B** air
   - **C** bedrock
   - **D** animals

Math Link

Solve a Problem
Suppose it takes 1,000 years for 1 centimeter of soil to form. How long would it take 5 centimeters of soil to form?

Health Link

Medicines from Plants
Research a medicine that people get from plants. If possible, find out what kind of soil the plant grows best in. Share your findings with the class.

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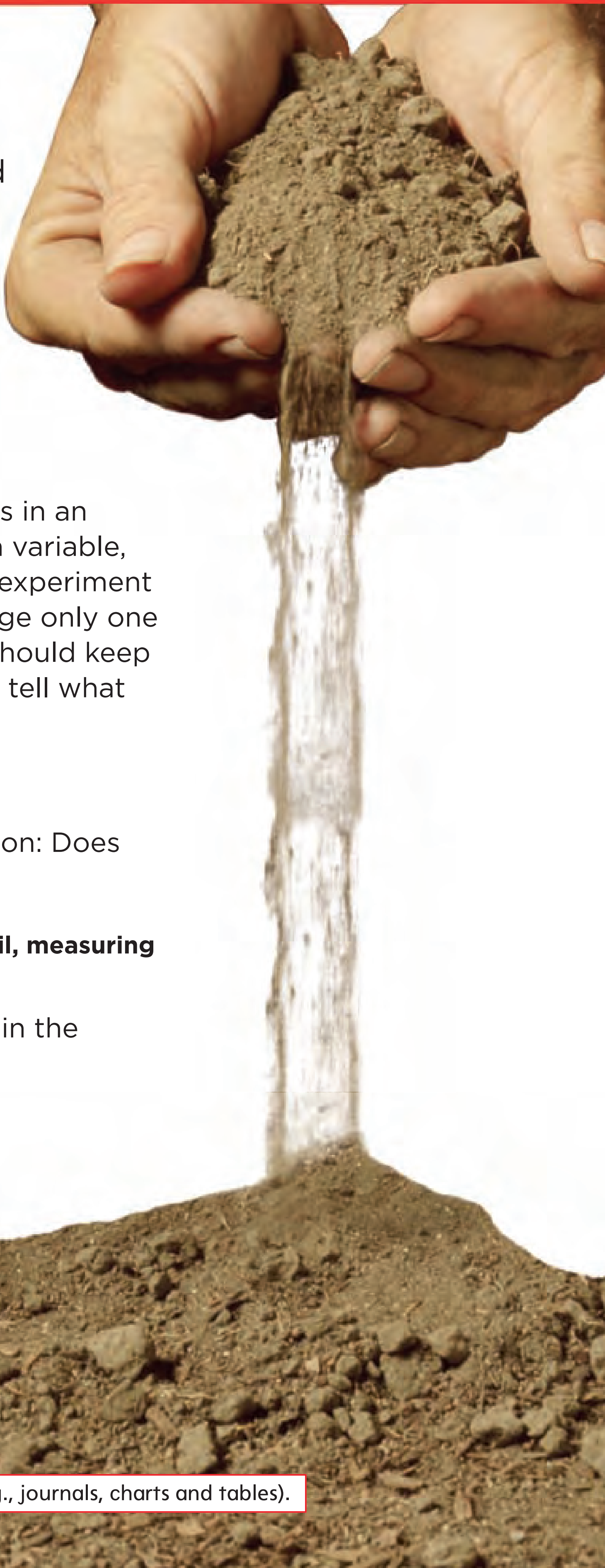
Focus on Skills

Inquiry Skill: Use Variables

Soils differ from place to place. They contain different amounts of humus and are made up of different kinds of rocks. Do all soils hold the same amount of water? To answer this question, you can **use variables** to test how water moves through different soils.



▶ Learn It

When you **use variables**, you identify things in an experiment that can be changed. Soil type is a variable, for example. The amount of soil you use in an experiment is also a variable. It is important that you change only one variable at a time when you experiment. You should keep all other variables the same. That way you can tell what caused the results.

▶ Try It

You will **use variables** to answer this question: Does sandy soil or potting soil hold more water?

Materials **pencil, 4 disposable cups, potting soil, measuring cup, water, sandy soil, watch or clock**

1. Use a pencil point to poke three tiny holes in the bottom of a cup.
2. Put 250 mL of potting soil into the cup. Pack the soil firmly.
3. Fill a measuring cup with 100 mL of water.

SI-5. Record and organize observations (e.g., journals, charts and tables).

4. Hold the cup of potting soil over an empty cup without holes. Slowly pour the water over the soil. Wait for two minutes. Write your observations in a table like the one shown.
5. Pour the water that drained out into the measuring cup. Record the volume in your table.
6. Repeat steps 1–5 using sandy soil in place of potting soil. Record the results.
7. Which soil held more water? How did changing the variable change the results?

Variable	My Observations	Volume that Drained

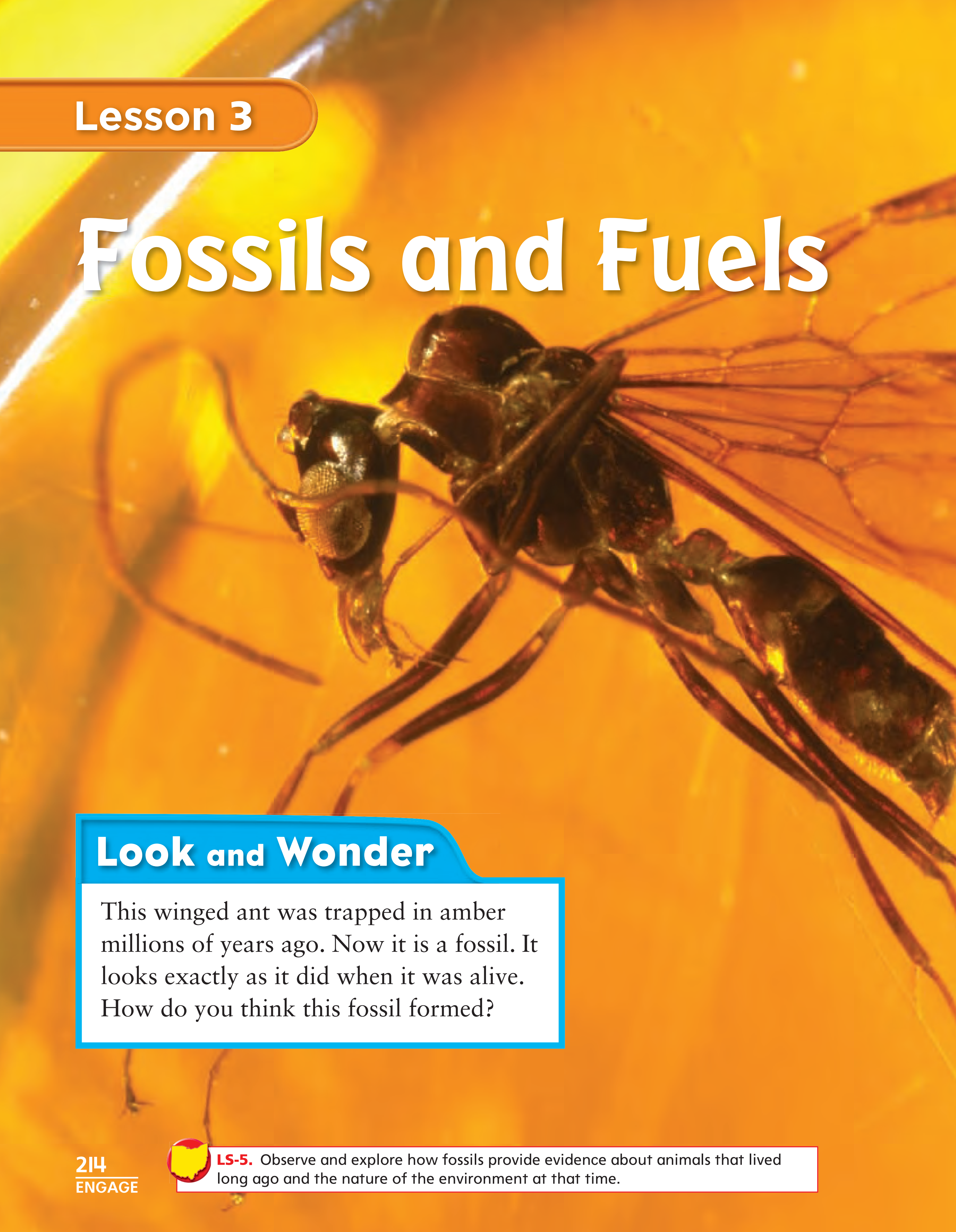
▶ Apply It

Now **use variables** to experiment more. Choose one of the following variables to test. List the variable in a table and record the results of your experiment. Did changing the variable change the results? If so, how?

- Do not pack the potting soil firmly.
- Mix clay into the sandy soil.
- Mix larger rocks into the potting soil.
- Poke larger holes in the cups.

Lesson 3

Fossils and Fuels



Look and Wonder

This winged ant was trapped in amber millions of years ago. Now it is a fossil. It looks exactly as it did when it was alive. How do you think this fossil formed?

LS-5. Observe and explore how fossils provide evidence about animals that lived long ago and the nature of the environment at that time.

Explore

Inquiry Activity

How do some fossils form?

Purpose

Find out how some living things of the past become fossils.

Procedure

1. **Make a Model** Hold a spoon over a paper towel. Squeeze a small amount of glue onto the spoon. Let the glue set for 10 minutes. This models sticky tree resin.
2. **Make a Model** Place a thin apple slice on top of the glue. This models an organism trapped in tree resin. Slowly add more glue until the apple slice is completely covered.
3. **Use Variables** Put the spoon on a paper towel. Place another apple slice next to the spoon.
4. **Observe** Look at the apple slices throughout the day. Record any changes you observe.

Draw Conclusions

5. **Interpret Data** Compare the two apple slices. What differences do you notice?
6. **Infer** What caused any differences you observed?
7. **Infer** How do some fossils form?

Explore More

Experiment Could an organism become a fossil in ice? Make a plan to find out.

Step 2

Materials

plastic spoon

paper towel

glue

2 apple slices

SI-5. Record and organize observations (e.g., journals, charts and tables).

These stone models of bones were once real dinosaur bones.

Read and Learn

Main Idea LS-5

Fossil fuels come from living things of long ago. They are nonrenewable sources of energy.

Vocabulary

fossil, p. 216

fuel, p. 218

renewable resource, p. 219

nonrenewable resource, p. 219

solar energy, p. 220

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Reading Skill

Draw Conclusions

Text Clues	Conclusions

How are fossils formed?

A **fossil** (FOS•uhl) is the trace or remains of something that lived long ago. Shells, bones, skin, leaves, and footprints can become fossils.

Fossils give clues as to what Earth was like in the past. For example, Pennsylvania contains many fern fossils. Modern ferns grow in warm, moist areas such as tropical rain forests. Fern fossils found in Pennsylvania suggest it once had a warmer climate.

Imprints, Molds and Casts

Sometimes living things leave marks, or *imprints*, in materials like mud. In time the materials may harden into rock.

This imprint of a dinosaur's foot was left in mud. The mud turned to solid rock.

FACT People did not live when dinosaurs did.

Some fossils are actual organisms trapped in amber, tar, or ice. Others look like actual plant or animal remains but are not. They are stone models in sedimentary rock. A stone model forms when sediment buries an organism that has died. Slowly, water with minerals seeps into the hard parts of the organism. Minerals replace the hard parts of the organism, forming stone.

Shells buried in mud often leave fossils called molds. A *mold* is an empty space in rock. A mold forms after the shell decays. Later, minerals seep into the space and harden. They form a copy of the mold's shape called a *cast*. A cast is similar to a stone model.

Quick Check

Draw Conclusions What kinds of fossils show most what actual organisms were like?

Critical Thinking What can we learn from fossils?

Quick Lab

Model Imprints

1. Break a small chunk of clay into two pieces. Roll each piece to form a ball.
2. **Make a Model** Take one clay ball. Press the front of your thumb into it. Take the other clay ball. Press the back of your thumb into it.

3. **Communicate** Switch clay balls with someone. How are the imprints like yours? How are they different?
4. **Infer** What can we learn by comparing fossil imprints?

The fossil on the right is the mold. The fossil on the left is the cast. ▶

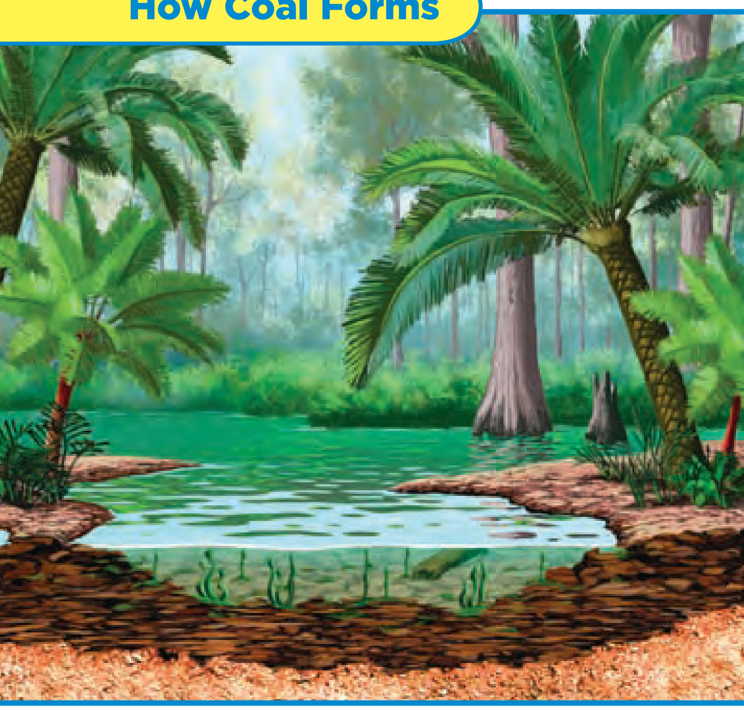
What are fossil fuels?

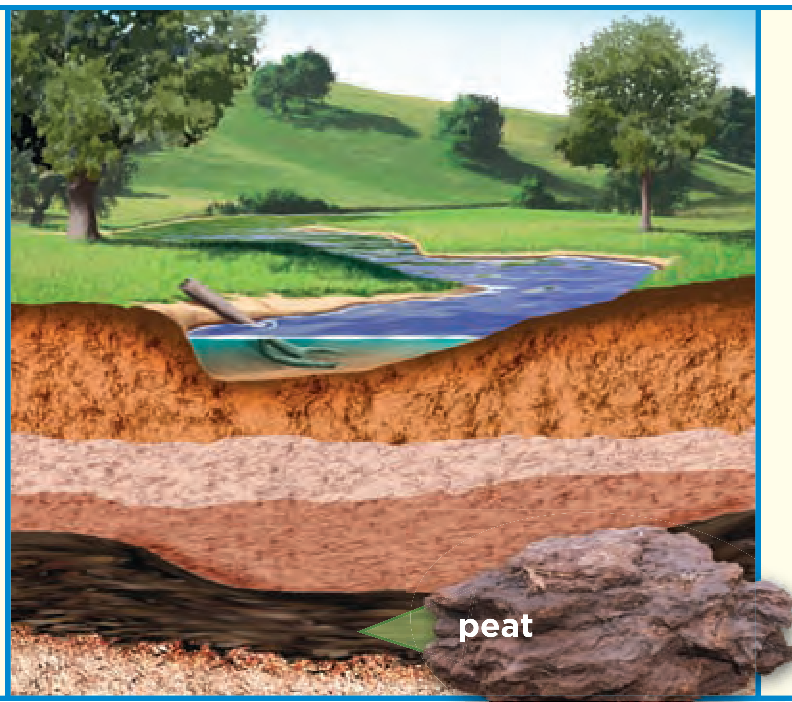
The energy to heat homes and run cars and airplanes comes from fuels. A **fuel** is a material that is burned for its energy. Coal, oil, and natural gas are fossil fuels. A *fossil fuel* is a fuel that forms from the remains of ancient plants and animals. Fossil fuels can be used to make electricity.

Oil is a fossil fuel found in rocks deep below Earth's surface. People use huge drills to dig deep underground for oil. Pumps are used to bring oil to the surface.

This drill in Hobbs, New Mexico, pumps oil to Earth's surface.

How Coal Forms



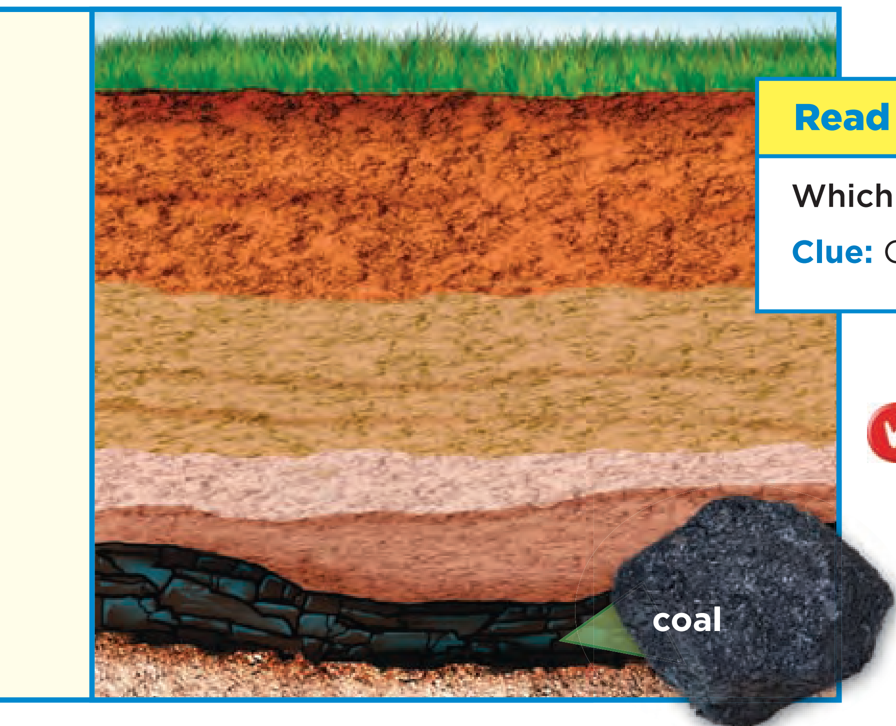


1. Millions of years ago, swamps covered large parts of Earth's land. Over time, the swamp plants died.

2. Layers of decayed plants formed a fuel called ***peat.*** Then the peat was buried under sediment.

Fossil fuels are natural resources. Plants, animals, water, and air are, too. Plants, animals, water, and air can be replaced. New plants are grown. New animals are born or hatched. Rain and snow bring more water. Plants put oxygen back into the air. Plants, animals, water, and air are renewable resources (ri•NEW•uh•buhl REE•sawr•ses). A **renewable resource** is a resource that can be replaced or used again and again.

Fossil fuels, however, are nonrenewable (non•ri•NEW•uh•buhl). A **nonrenewable resource** is a resource that cannot be replaced or reused easily. Fossil fuels take millions of years to form. Once they are used up, they are gone forever.



③ The sediment turned into sedimentary rock. Slowly the peat changed into the sedimentary rock *coal*.

Read a Diagram

Which fuel forms before coal forms?

Clue: Captions give information.

Quick Check

Draw Conclusions Why should we be careful not to use up fossil fuels?

Critical Thinking What are other nonrenewable resources?

What are some other sources of energy?

Fossil fuels are just one source of energy. A *source* is where something comes from. Fossil fuels are nonrenewable. They can be used up. For this reason, we need to use renewable sources of energy.

Solar energy is a renewable source of energy. **Solar energy** is energy from the Sun. Moving water and wind are also renewable sources of energy. Underground heat is, too. Solar energy, moving water, wind, and underground heat can all be used to make electricity.

▲ Someday you may drive a car powered by solar energy.

Quick Check

Draw Conclusions Why are the Sun, wind, and moving water good sources of energy to use?

Critical Thinking Where might be some good places to use wind for making electricity?

Underground heat is used to make electricity in Iceland.

Lesson Review

Visual Summary

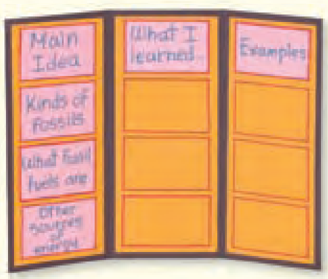
There are different **kinds of fossils**. Each forms in a different way.

Fossil fuels are nonrenewable sources of energy.

The Sun, wind, and moving water are some **renewable sources of energy**.

Make a FOLDABLES Study Guide

Make a Trifold Book. Use it to summarize what you learned about fossils and fuels.



Think, Talk, and Write

1. **Main Idea** What sources of energy do we use?

2. **Vocabulary** What is a fossil? Give two examples.

3. **Draw Conclusions** Is it possible to use up fossil fuels? Explain.

Text Clues	Conclusions

4. **Critical Thinking** How do you use fossil fuels?

5. **Test Prep** **Which one of the following is a nonrenewable resource?**

A water
B air
C plants
D coal

Math Link

Write a Number Sentence
Ultrasaurus was about 30 meters long. Triceratops was about 8 meters long. How much longer was Ultrasaurus than Triceratops? Write the number sentence that shows how you solved the problem.

Social Studies Link

Your State Fossil
Do research about your state fossil. Tell how the fossil formed. What was the organism like? Write this information in a report.

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Turning the Power On

People use a lot of energy. We need it to power our cars, to heat our homes, and to run many of the machines we use each day. The energy sources we use most—coal and oil—are nonrenewable resources. They will be used up one day and will be gone forever. Other energy sources are renewable. The time line shows how people have developed renewable sources of energy.

1882

Hydropower Energy The first plant in the U.S. opened in Wisconsin. River current was used to turn a turbine to produce electricity.

1890

Wind Energy Wind turbines were invented in Denmark. They used the energy of the wind to produce electricity.

1904

Geothermal Energy Heat energy from geysers was used in Italy. Steam from this hot water that shoots up from the ground was used to turn turbines to produce electricity.

ST-2. Describe ways that using technology can have helpful and/or harmful results. **ST-3.** Investigate ways that the results of technology may affect the individual, family and community.

Renewable energy sources can be replaced in a short time. The renewable energy sources used most often are hydropower (water), wind, geothermal, solar, and biomass. No matter what energy source you use, it is important to conserve energy.

Draw Conclusions

When you draw conclusions,

- you explain the answer to a question
- you use what you already know
- you look for clues in the article

1941

Solar Energy Russell Ohl invented a solar cell. It used light from the Sun to produce electricity.

1985

Biomass Energy This energy source was first used in California. Materials such as dead trees, leftover crops, and animal waste were burned to produce heat, steam, and electricity.

Write About It

Draw Conclusions Why is it important for people to use renewable energy sources? Use what you already know and what you read in the article to draw a conclusion.

LOG ON e-Journal Write about it online at www.macmillanmh.com

American Museum of Natural History

CHAPTER 5 Review

Visual Summary

Lesson 1 Rocks are made of minerals. Rocks are classified as igneous, sedimentary, or metamorphic.

Lesson 2 Soil is made up of weathered rocks, minerals, and once-living things. Many living things need soil to survive.

Lesson 3 Fossil fuels come from living things of long ago. They are nonrenewable sources of energy.

Make a FOLDABLES™ Study Guide

Glue your lesson study guides to a piece of paper as shown. Use your study guide to review what you have learned in this chapter.

Vocabulary

Fill each blank with the best term from the list.

fossil, p. 216

humus, p. 206

igneous rock, p. 197

metamorphic rock, p. 199

minerals, p. 194

natural resource, p. 210

sediment, p. 198

solar energy, p. 220

1. A rock that is changed by heating and squeezing is a ________. ESS-I

2. Imprints are one type of ________. LS-5

3. Rocks are made up of one or more ________. ESS-I

4. Energy from the Sun is called ________. LS-B

5. Soil is an example of a ________. ESS-5

6. The decayed plants and animals in soil are known as ________. ESS-4

7. Rock that forms when melted rock cools and hardens is ________. ESS-I

8. Tiny bits of weathered rock or once-living animals or plants make up ________. ESS-4

Skills and Concepts

Answer each of the following in complete sentences.

9. **Draw Conclusions** Scientists are developing fuels from plants such as corn. What kind of fuels would they be—renewable or nonrenewable? Explain.
ESS-C
10. **Descriptive Writing** Think of a sedimentary rock you learned about. Describe it.
ESS-I, ESS-2
11. **Use Variables** You want to find the best materials for filtering dirty water. You make one filter from paper and another from rock and sand. You observe as you pour dirty water through them. Which variables changed? Which were the same?
SWK-I
12. **Critical Thinking** What can fossils tell us about early environments on Earth?
LS-5
13. Which layer of soil has the most humus in it? Why?
ESS-5

The Big Idea

14. What things used by people come from Earth?
ESS-C

Performance Assessment

Make a Poster

- Make a poster encouraging conservation of at least three different kinds of natural resources.
- Explain how people use each natural resource. Why do they need it?
- Suggest ways people can conserve each of these resources.

Ohio Activity

Discuss ideas about using Earth's resources, then also act on your ideas.

Be the first to initiate a tree-planting day for a park in your neighborhood. Start a recycling program at your school. Adopt a schoolyard to keep clean. Set an example by reducing, reusing, and recycling.

It's important to take a stand. It's also important to know about the stand you are taking. Learn as much as you can about issues that affect the environment.

Ohio Benchmark Practice

1 What kind of rock forms when sand is pressed together in layers?

A metamorphic rock

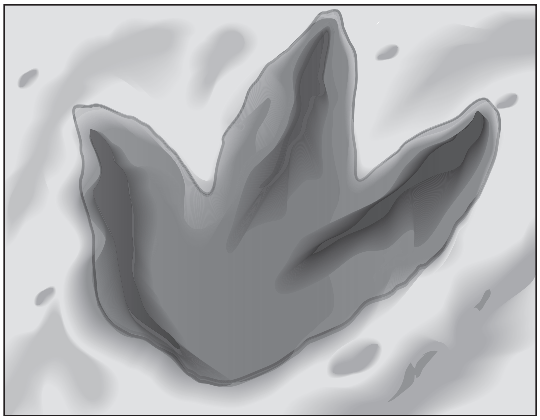
B igneous rock

C sedimentary rock

D weathered rock

ESS-C

2 The picture shows a dinosaur footprint in rock.



In your **Answer Document**, describe or draw a different fossil.

Then, describe how the fossil formed. (2 points)

LS-C

3 Which layer of soil is found above bedrock?

A topsoil

B calcite

C subsoil

D hematite

ESS-C

4 Which is an example of a fossil fuel?

A oil

B wind

C electricity

D moving water

ESS-C

5 Soils differ in color depending on what they are made of. What are black soils rich in?

A bedrock

B humus

C subsoil

D sand

ESS-C

6 **What happens in the water cycle after water on Earth is warmed by the Sun?**

A It melts and flows back into lakes, rivers, and oceans.

B It evaporates and rises into the air.

C It freezes and falls to Earth as snow.

D It boils and condenses to form clouds.

ESS-C

7 **Which mineral is softest?**

Mohs Hardness Scale	
Mineral	**Hardness**
gypsum	2
calcite	3
quartz	7
diamond	10

A gypsum

B calcite

C quartz

D diamond

SI-B

8 **Which properties are most helpful for identifying minerals?**

A size and ability to float

B luster and streak

C weight and color

D crystal shape and width

ESS-C

9 **Why should we prevent soil erosion?**

A Soil is a fossil fuel.

B Soil erosion causes pollution.

C Soil takes a long time to form.

D Soil erosion is a source of energy.

ESS-C

10 **Kyla wants to know about the soil in her garden. What information can you give her?**

In your Answer Document, identify two ways that soil can be different from place to place.

Then, describe one property of soil and how it supports, or helps, plant growth. (4 points)

ESS-C

Literature

Magazine Article

Liv and Ann each pulled a sled that weighed 267 pounds on their journey across Antarctica.

from *Time for Kids*

One Cool Adventure

February 23, 2001

Whew! They made it! On February 11, former teachers Ann Bancroft of the U.S. and Liv Arnesen of Norway reached the Ross Ice Shelf in Antarctica. They became the first women to cross Antarctica's land mass on skis! It took the explorers 90 days to ski and parasail across 1,688 miles of ice. They kept going despite bitter cold, injuries, ripped sails and broken sleds.

▲ Liv Arnesen and Ann Bancroft

The pair had hoped to cross the Ross Ice Shelf, but lack of wind forced them to shorten their trek. They flew back to McMurdo Station to catch a ship before icy waters made the trip home dangerous.

Write About It

Response to Literature This article tells about the first women to cross Antarctica on skis. What do you know about Antarctica or other places on Earth? Suppose you took a trip around the world. What kinds of things might you see? Write about it.

LOG ON e-Journal Write about it online at www.macmillanmh.com

Careers in Science

Mapmaker

Do you like working on puzzles with small pieces? Are you good at giving directions or describing places? You might think about becoming a mapmaker.

Scientists who make maps have many different skills. Some gather data about the geography of an area. Others make three-dimensional models of landforms. Still others use data and models to draw the maps with computerized mapping programs.

There are things you can do right now to prepare for this job. Learn about Earth's land and water. Play games that require you to solve a problem. In high school take math, science, and computer classes. Then, get a college degree.

▲ This scientist is gathering data about landforms.

Here are some other Earth Science careers:

- oceanographer
- miner
- jewelry designer
- geologist

This surveyor is using a *transit*. The information he records will help him map an area.

SWK-4. Identify various careers in science.

LOG ON e-Careers at www.macmillanmh.com

Ohio

Physical Sciences

Only $\frac{1}{10}$ of an iceberg can be seen above water.

National Museum of the UNITED STATES AIR FORCE

a plane at the museum

Gemini spacecraft

▲ National Museum of the United States Air Force near Dayton, Ohio

Aircraft Museum

The National Museum of the United States Air Force is located at Wright-Patterson Air Force Base near Dayton. It is the world's largest and oldest military aircraft museum. It was founded in 1923.

There are displays of the first airplanes that flew. Another display shows airplanes used by presidents to travel. There is a space section with spacecraft, rocket engines, and satellites. Another part has many special aircraft. Some of the aircraft in the museum are the only ones of their kind.

High Speed

One plane, the F-107A could fly at high speeds. It also could turn over while it was flying fast. Another plane, the North American XB-70 Valkyrie, could fly as fast as 2,056 mph! The Ryan X-13 Vertijet could take off vertically with its nose pointing to the sky. It would then fly horizontally like other planes. Finally, it would return to vertical flight with its nose pointing up for landing.

Think, Talk, and Write

Critical Thinking What are some different ways a plane can fly?

PS-2. Describe an object's motion by tracing and measuring its position over time.

Ohio

A CLOSER LOOK

Main Idea

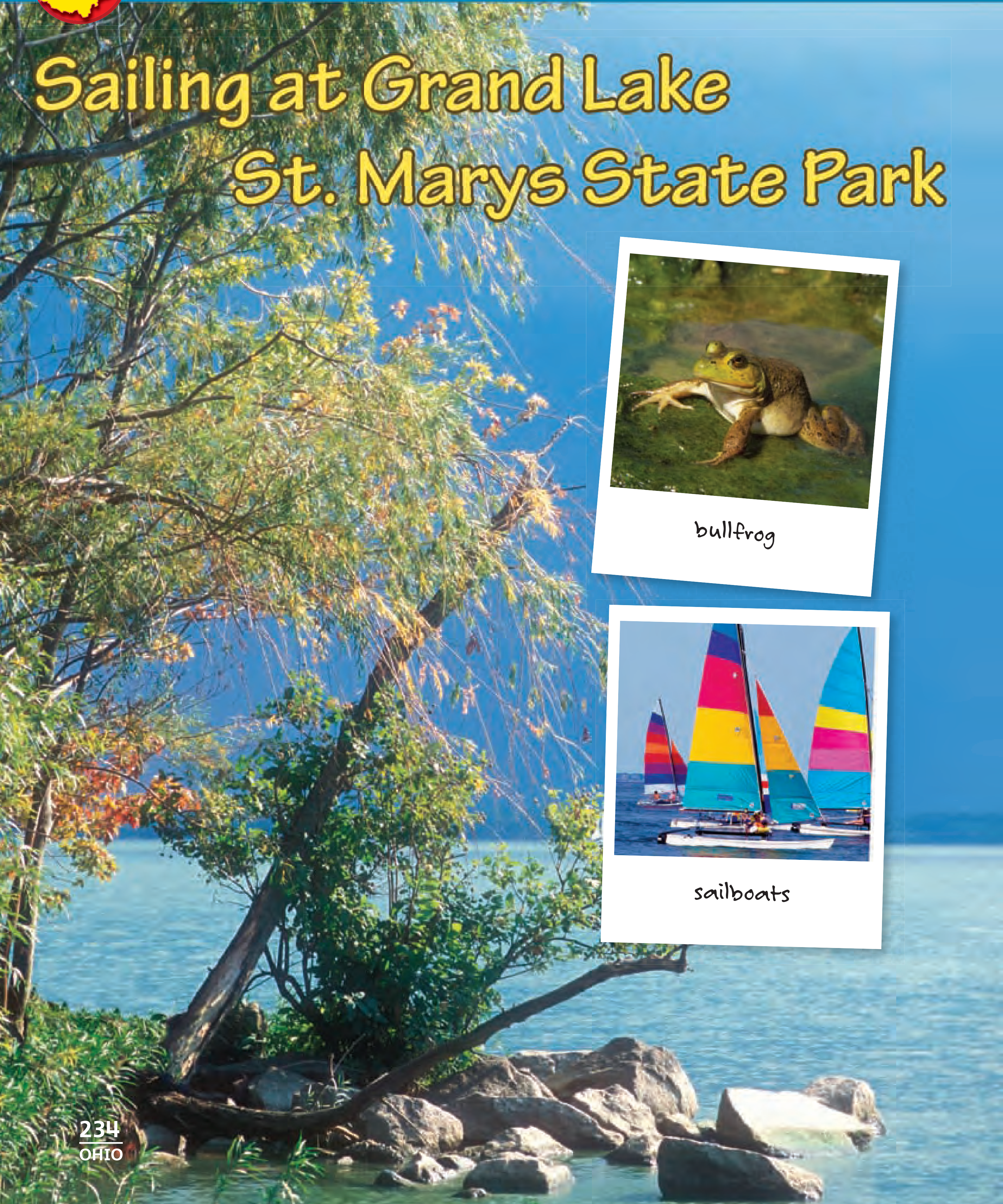
Describe an object's motion and speed.

Activity

Observe Look at a bird flying in the sky.

- Describe the bird's motion in the sky. How fast do you think the bird is flying? What would you have to know to find out?
- On a piece of paper, describe the path the bird flew in the sky. Compare your description to a classmates' description. What are some of the words you used?

Sailing at Grand Lake St. Marys State Park



bullfrog

sailboats

Summer at the Park

Grand Lake St. Marys State Park is a popular place during the summer. People go there to picnic, swim, fish, and hike. People also take their sailboats out on the lake.

Using Wind Power

Sailing a sailboat is not easy. The wind blows into the sails and pushes the boat across the water. If the wind is too weak, the boat will not move. If the wind is too strong, the boat might tip over! The sailboat does not always have to go the same direction the wind is blowing. A skilled sailor knows how to move the sails to change course.

On windy days, people will race their sailboats. The sails' bright colors look like rainbows on the lake. Some sailboats are small and hold only one or two people. Some are very large, and require many people to move all the sails. All sailboats need one thing, though—wind!

Think, Talk, and Write

Critical Thinking Although you cannot see the wind, how can you tell if it is blowing?

PS-4. Predict the changes when an object experiences a force (e.g., a push or pull, weight and friction).

Ohio

A CLOSER LOOK

Main Idea

Wind can make things move.

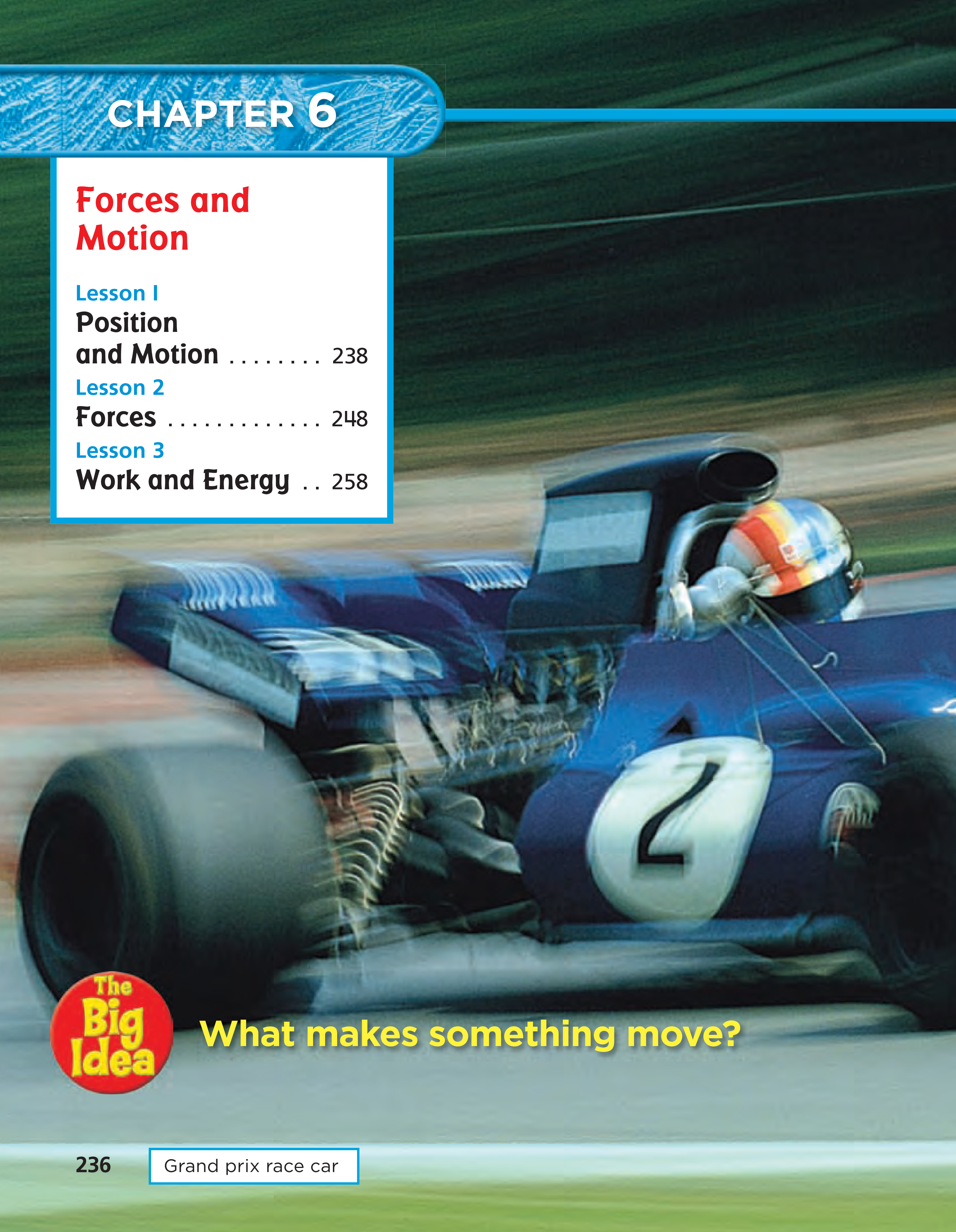
Activity

Compare Look at pictures of different things being moved by the wind.

- How could the wind's force be helpful? How could it be harmful?
- Invent a machine that runs on wind. Draw it.

CHAPTER 6

Forces and Motion



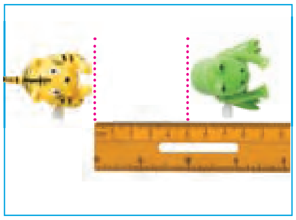
The Big Idea

What makes something move?

Grand prix race car

Key Vocabulary

position
the location of an object (p. 240)



distance
the amount of space between two objects or places (p. 241)

motion
a change in position (p. 242)

force
a push or pull; a force can make an object move (p. 250)

work
what is done when a force changes an object's motion (p. 260)

energy
the ability to do work; energy is what makes motion possible (p. 262)

More Vocabulary

speed, p. 244

magnet, p. 252

gravity, p. 253

weight, p. 253

friction, p. 254

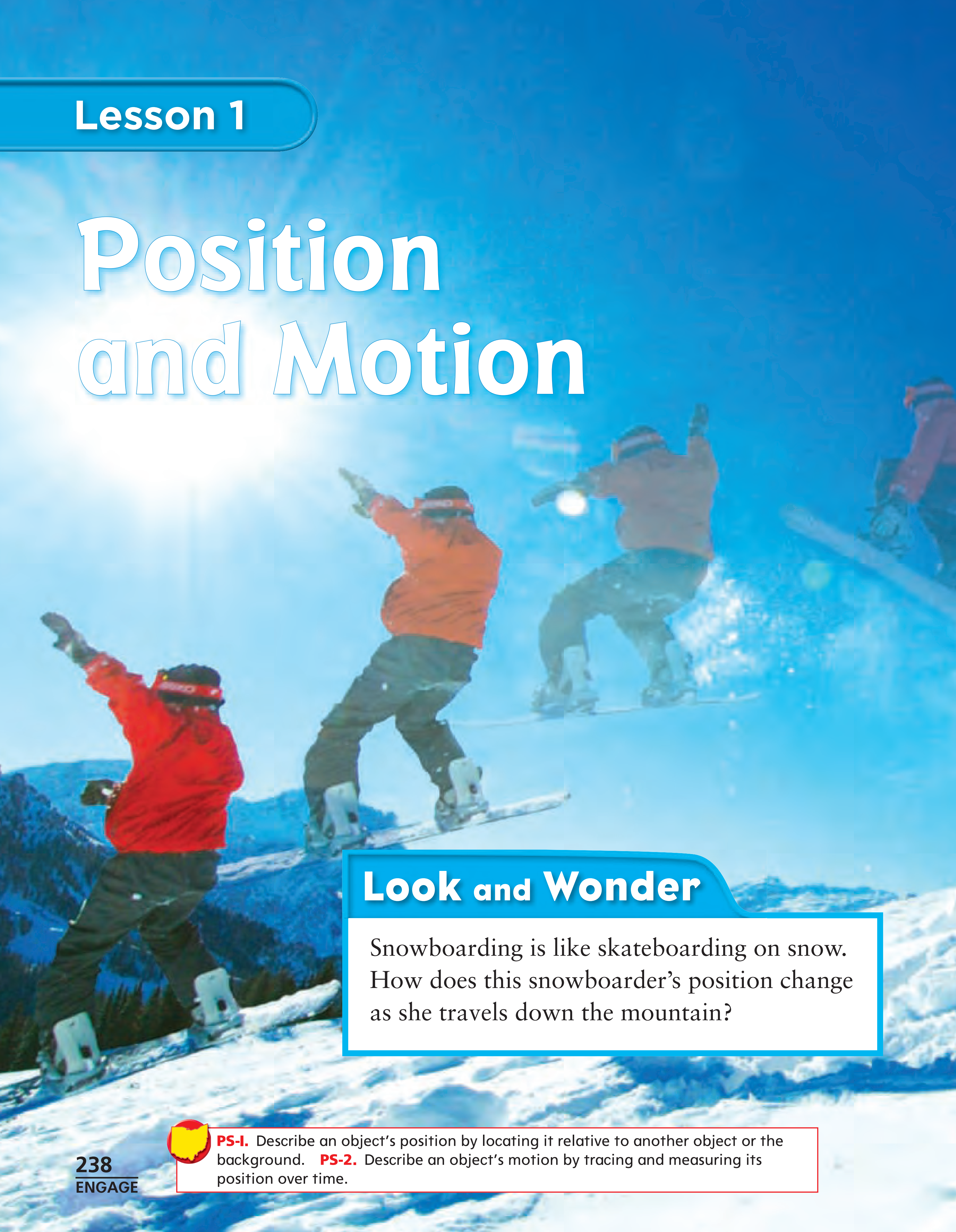
kinetic energy, p. 262

potential energy, p. 262

PS-C. Describe the forces that directly affect objects and their motion.

Lesson 1

Position and Motion



Look and Wonder

Snowboarding is like skateboarding on snow. How does this snowboarder's position change as she travels down the mountain?

PS-1. Describe an object's position by locating it relative to another object or the background. **PS-2.** Describe an object's motion by tracing and measuring its position over time.

Explore

Inquiry Activity

How can you describe an object's position?

Purpose

Find out ways to describe a block's position.

Procedure

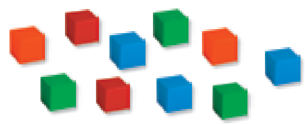
1. Sit opposite a partner at a table. Prop up a notebook between the two of you.
2. One partner, "the builder," uses the blocks to make a building. Make sure the other partner, "the copier," cannot see the building.
3. **Communicate** The builder tells the copier how to make the same building. Make a list of the words you use.
4. **Observe** Remove the notebook. Are the buildings the same? Switch roles and try the activity again.

Draw Conclusions

5. What words did you use to describe your building?
6. **Infer** Could you describe the position of each block without comparing it to other blocks around it?

Materials

notebook



two sets of 10 colored blocks

Step 2

Explore More

Communicate

How could you direct someone from your home to your school?

Step 3

SI-6. Communicate scientific findings to others through a variety of methods (e.g., pictures, written, oral and recorded observations).

Read and Learn

Main Idea PS-1, PS-2

An object is in motion when its position changes.

Vocabulary

position, p. 240

distance, p. 241

motion, p. 242

speed, p. 244

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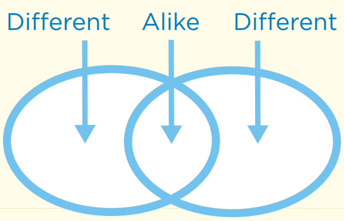
Reading Skill

Compare and Contrast



How can you describe position?

Look at the children below. Where is the boy in the red shirt? He is next to the girl in the pink shirt. He is under the girl wearing the blue overalls. When you describe where something is, you describe its position (puh•ZISH•uhn). **Position** is the location of an object.

You can describe something's position by comparing it to the position of other things. Words such as *over*, *under*, *left*, *right*, *on top of*, *beneath*, and *next to* give clues about position. You could say that a mouse is under a table or that a cat is on top of a shelf. When we describe the position of something, we compare it with objects around it.

How can you describe the position of the girl in the pink shirt?

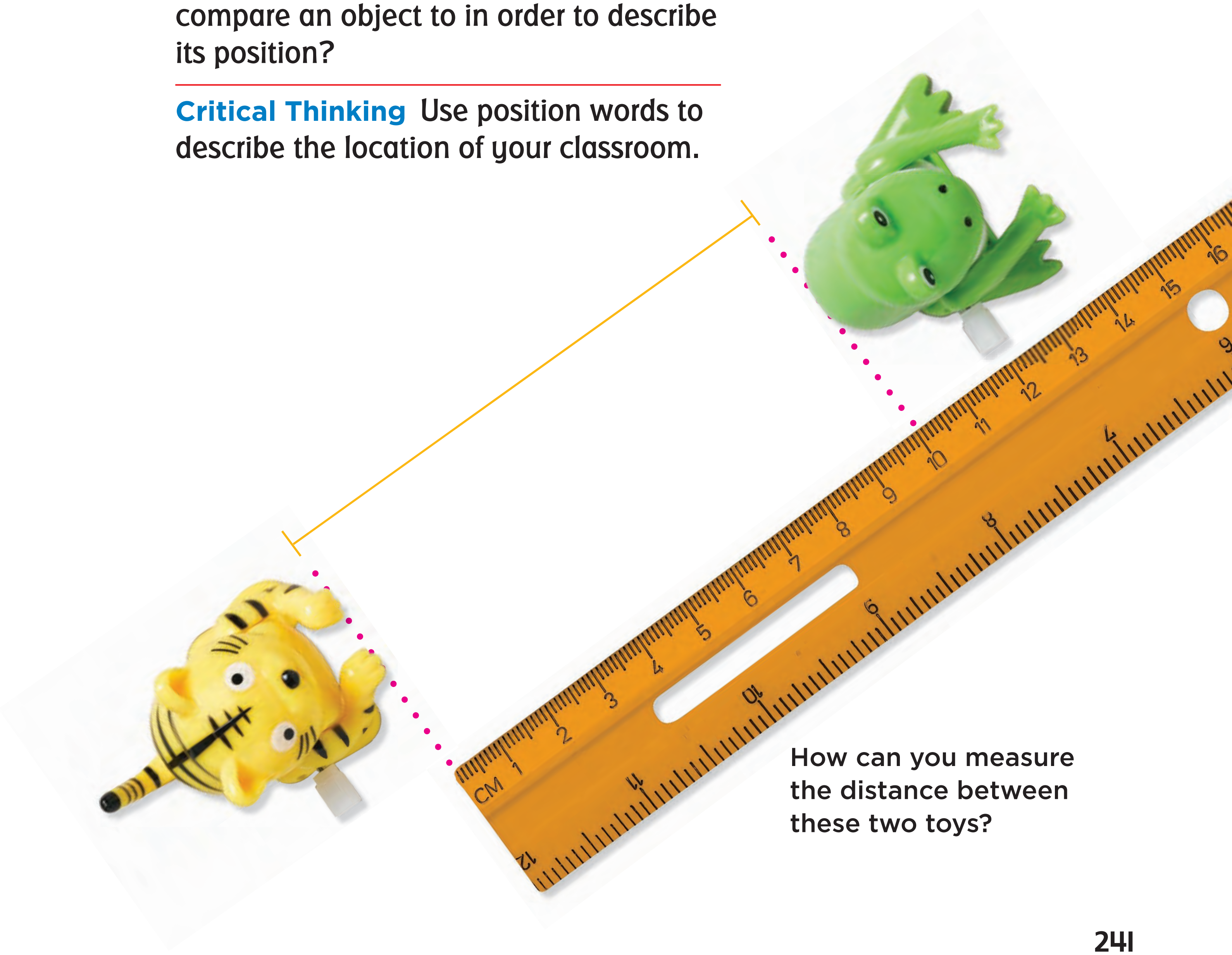
Distance

You can also describe something's position by measuring its distance (DIS•tuhns) from other objects. **Distance** is the amount of space between two objects or places. Distance can be measured in inches, yards, or miles. In the metric system, distance is often measured in centimeters, meters, or kilometers. You can use a ruler or meterstick to measure distances. The distance between the two toys shown below is 10 centimeters.

Quick Check

Compare and Contrast What must you compare an object to in order to describe its position?

Critical Thinking Use position words to describe the location of your classroom.

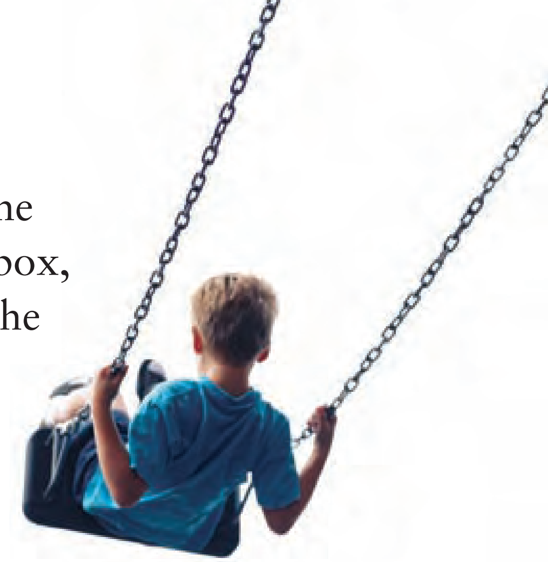


How can you measure the distance between these two toys?

What is motion?

Look at the pictures of the mouse below. In the first box, the mouse is on a rock. In the second box, it is between the two rocks. What happened to the mouse? It moved. You know that the mouse moved because its position changed. While an object is changing position, it is in motion (MOH•shuhn). **Motion** is a change in position.

Objects can move in different ways. Look at the chart on the next page. The runner moves forward in a straight line. The figure skater spins round and round on the ice. The snowboarder moves down the hill in a zigzag. A zigzag is a path with short, sharp turns from one side to another. The skateboarder moves back and forth in the pipe. Straight line, round and round, zigzag, and back and forth are types of motion.



▲ A swing moves back and forth.

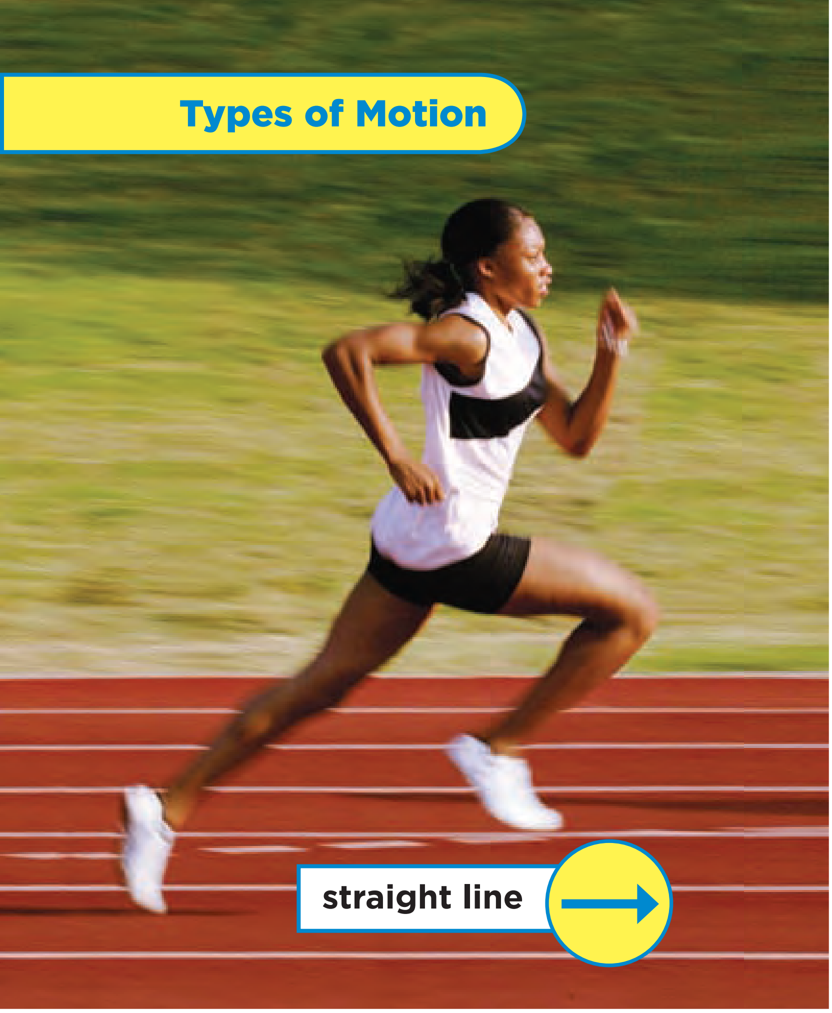
▼ How can you tell that the mouse has moved?

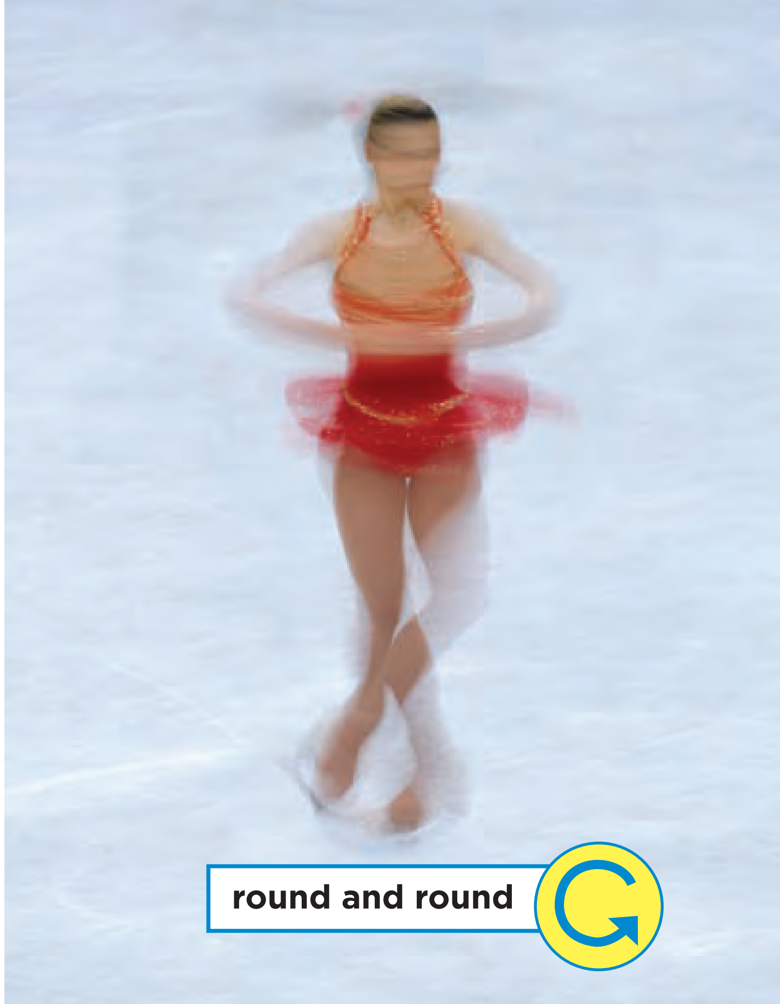
Quick Check

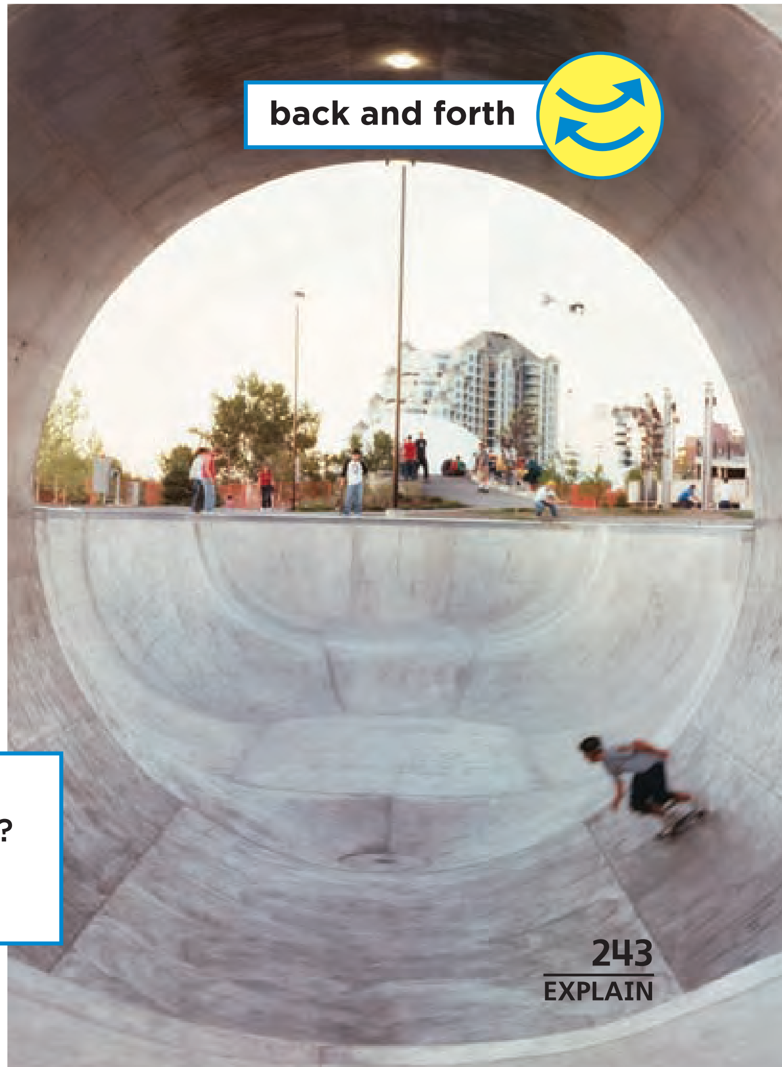
Compare and Contrast How are zigzag and back and forth motions similar?

Critical Thinking List some objects that move round and round.

Types of Motion







Read a Chart

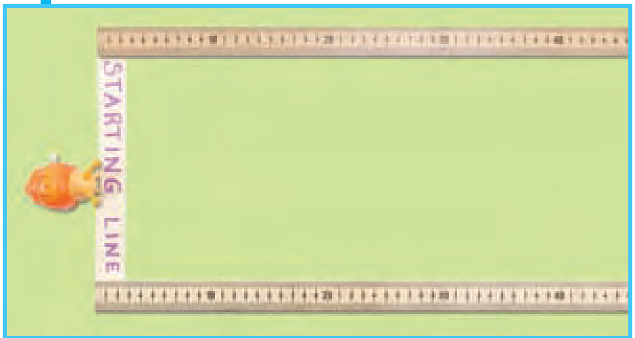
What are some ways objects can move?

Clue: Arrows can show directions.

Quick Lab

Measure Speed

1. Set up a racetrack as shown below.



2. **Measure** Wind up a wind-up toy. Place it at the starting line and let it go. Have a partner use a stopwatch to time the toy's trip. Measure how far the toy travels. Record your measurements.
3. **Communicate** Make a drawing to show how the toy moved.
4. **Use Numbers** How far did the toy travel? How fast did it travel? What two measurements do you need to find the toy's speed?

What is speed?

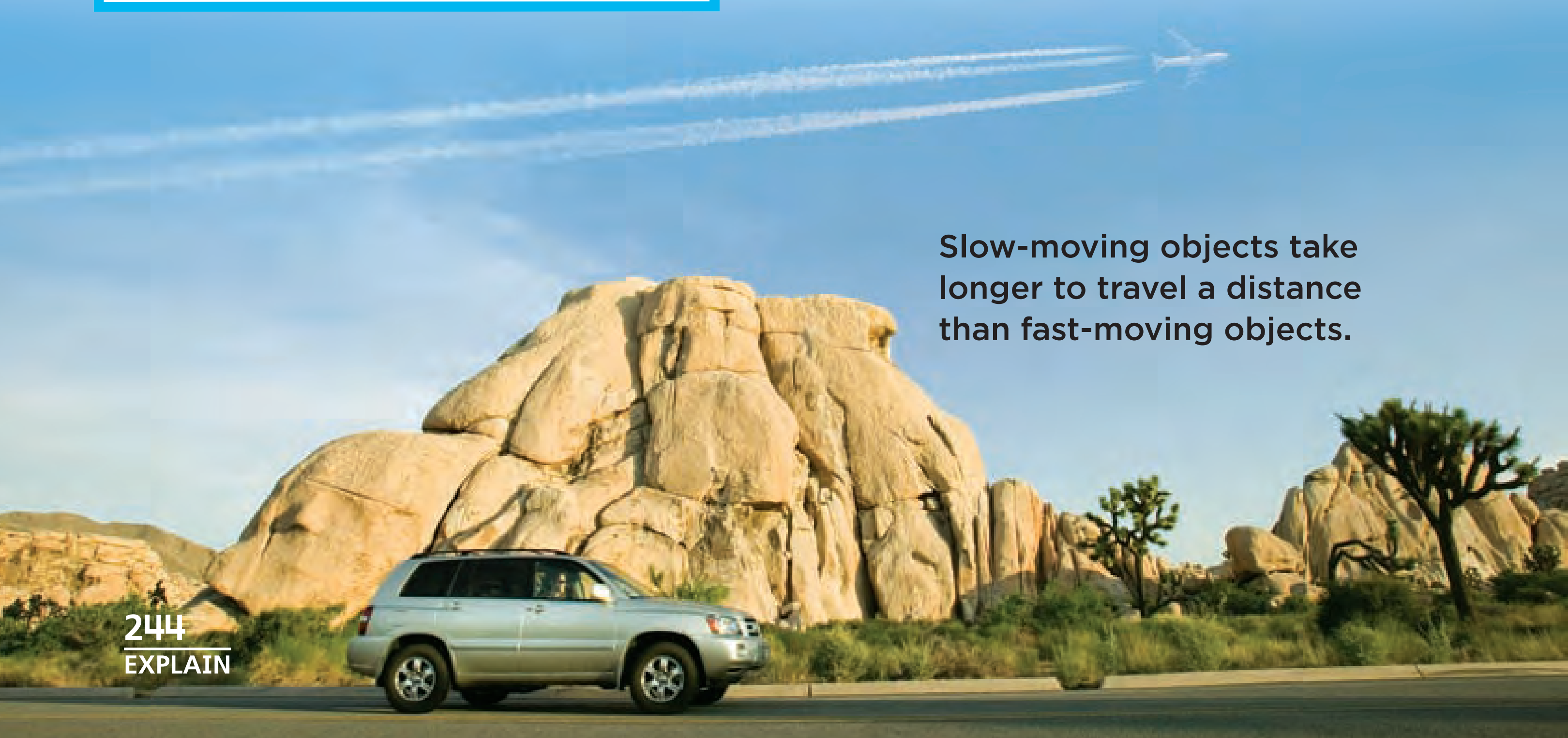
Some things move faster than others. A cheetah moves faster than a snail. **Speed** describes how quickly an object moves. An object's speed tells how far it will move in a certain amount of time.

You can measure the speed of an object. You need to know how far the object traveled. You also need to know how much time it took for the object to travel that distance. If a car traveled 50 kilometers in an hour, its speed was 50 kilometers per hour.

Quick Check

Compare and Contrast Which is faster, a plane or car? Explain.

Critical Thinking A red car moves faster than a green car. Both move for three seconds. Which car moves farther? Why?



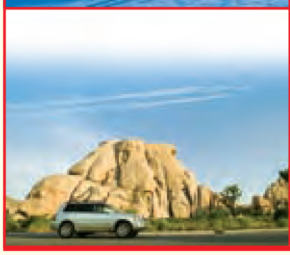
Slow-moving objects take longer to travel a distance than fast-moving objects.

Lesson Review

Visual Summary

Position is the location of an object.

When an object's position changes, the object is in **motion**. Objects can move in different ways.



Speed describes how quickly an object moves.

Make a FOLDABLES™ Study Guide

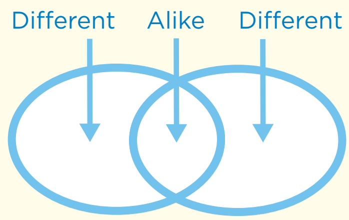
Make a Three-Tab Book. Use it to summarize what you learned about position and motion.

Think, Talk, and Write

1. **Main Idea** How can you tell if an object has moved?

2. **Vocabulary** What is the position of an object?

3. **Compare and Contrast** How is zigzag motion like back and forth motion? How are they different?



4. **Critical Thinking** Suppose you rode a bike at 10 kilometers per hour for three hours. How far would you travel?

5. **Test Prep** **Which tool measures distance?**
   - **A** stopwatch
   - **B** thermometer
   - **C** pan balance
   - **D** meterstick

Writing Link

Write a Description
Hold a ball in your hand. Drop it. How does the ball move? Then toss the ball to a friend. How does the ball move? Describe the different ways the ball moves.

Math Link

Make a Graph
Use research materials to find the speed of five objects. Organize this information into a chart. Then make a bar graph. Is it easier to compare data using a chart or a bar graph? Explain your answer.

Travel Through Time

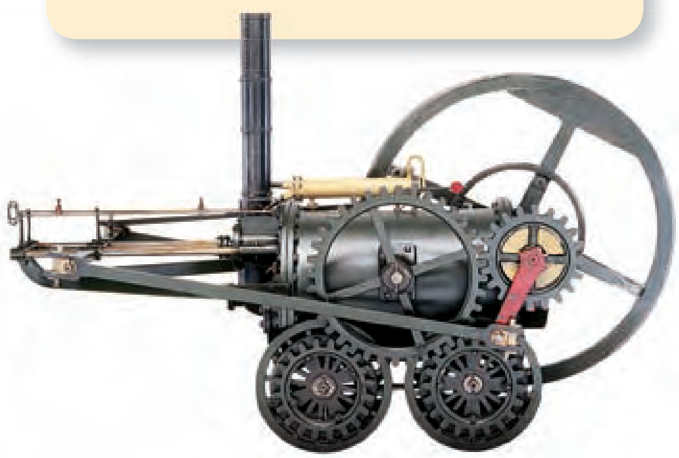
People have always wanted to travel. They found ways to travel within their state, across the country, and throughout the world. People have even traveled into space. The time line below shows some of the first machines that helped people travel to distant places.

1884

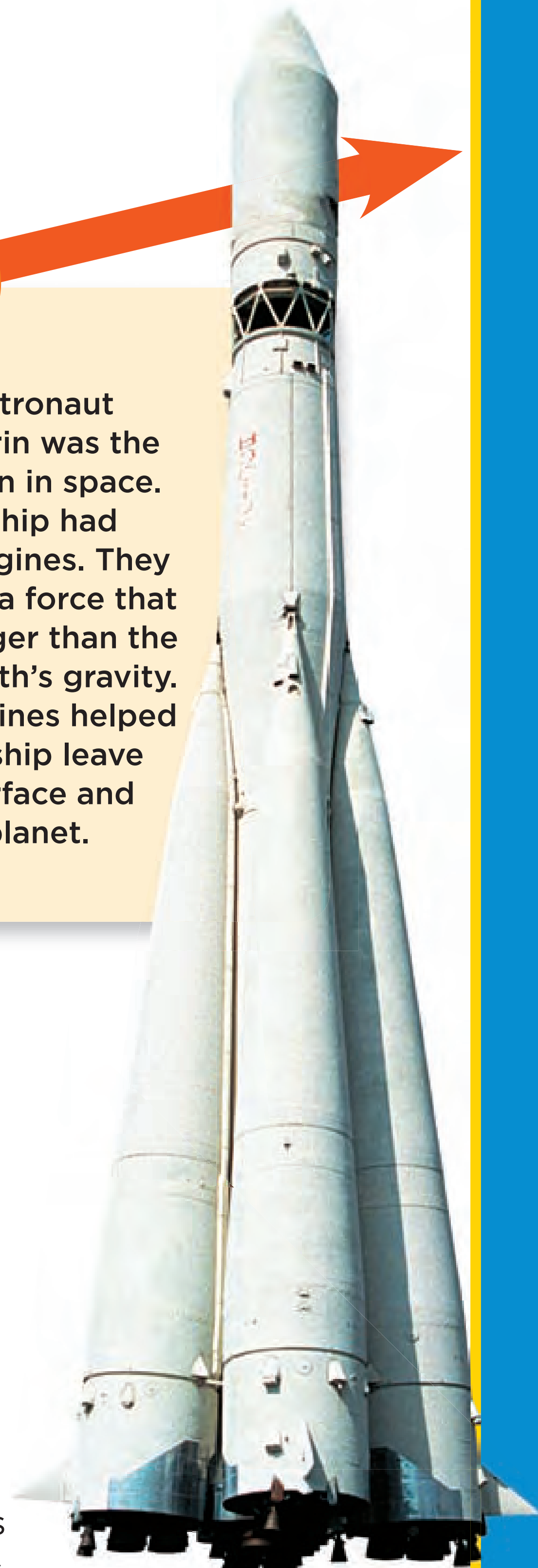
In Germany Karl Friedrich Benz built the first car to run on gasoline. It worked similarly to the cars you see on the road today. However, his car had only three wheels!

1804

In England Richard Trevithick built the first steam engine for a train. The steam engine helped people travel great distances. It also helped them get to their destinations more quickly.



SWK-3. Explore through stories how men and women have contributed to the development of science.



1903

Wilbur and Orville Wright constructed the first motorized airplane that flew and landed safely. Their airplane's engine ran on gasoline. It flew for 12 seconds over 36 meters (120 feet).

1961

Russian astronaut Yuri Gagarin was the first person in space. His spaceship had special engines. They produced a force that was stronger than the pull of Earth's gravity. These engines helped the spaceship leave Earth's surface and orbit the planet.

Problem and Solution

A problem and solution

- gives a problem
- tells how to solve the problem

Write About It

Problem and Solution How have machines helped people learn about distant places? Read the article again. Then write about ways machines have helped people solve problems.

LOG ON e-Journal Write about it online at www.macmillanmh.com

ST-I. Describe how technology can extend human abilities (e.g., to move things and to extend senses).

Lesson 2

Forces

Look and Wonder

Wind can push sailboats to move great distances. What would happen to these sailboats if the wind blew harder?

PS-3. Identify contact/noncontact forces that affect motion of an object (e.g., gravity, magnetism and collision).

How can pushes affect the way objects move?

Form a Hypothesis

What will happen to an object if you increase the force you use to push it? Write a hypothesis. Start with "If I push an object with more force, then . . ."

Test Your Hypothesis

1. Stack three books on the floor. Then lean a piece of cardboard against the top book to make a ramp. Tape down the edge along the floor.
2. **Observe** Place a toy car at the bottom of the ramp. Hold a tennis ball at the top of the ramp. Then let the ball go so that it pushes the toy car. What happens?
3. **Measure** Find out how far the car travels.
4. **Use Variables** Add 3 more books to the stack. The ball pushes the car with more force when you increase the height of the ramp. Repeat steps 2 and 3.

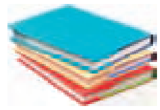
Draw Conclusions

5. **Infer** What caused the car to move?
6. **Interpret Data** When did the car travel farther?
7. **Infer** How does the amount of force you use to push an object affect how far the object travels?

Explore More

Experiment What would happen if you added a weight to the toy car and repeated the activity?

Materials


six books


cardboard


masking tape


toy car


tennis ball


ruler


Step 1


Step 2

PS-4. Predict the changes when an object experiences a force (e.g., a push or pull, weight and friction).

Read and Learn

Main Idea PS-3, PS-4

Forces can change an object's motion.

Vocabulary

force, p. 250

magnet, p. 252

gravity, p. 253

weight, p. 253

friction, p. 254

e-Glossary at www.macmillanmh.com

Reading Skill

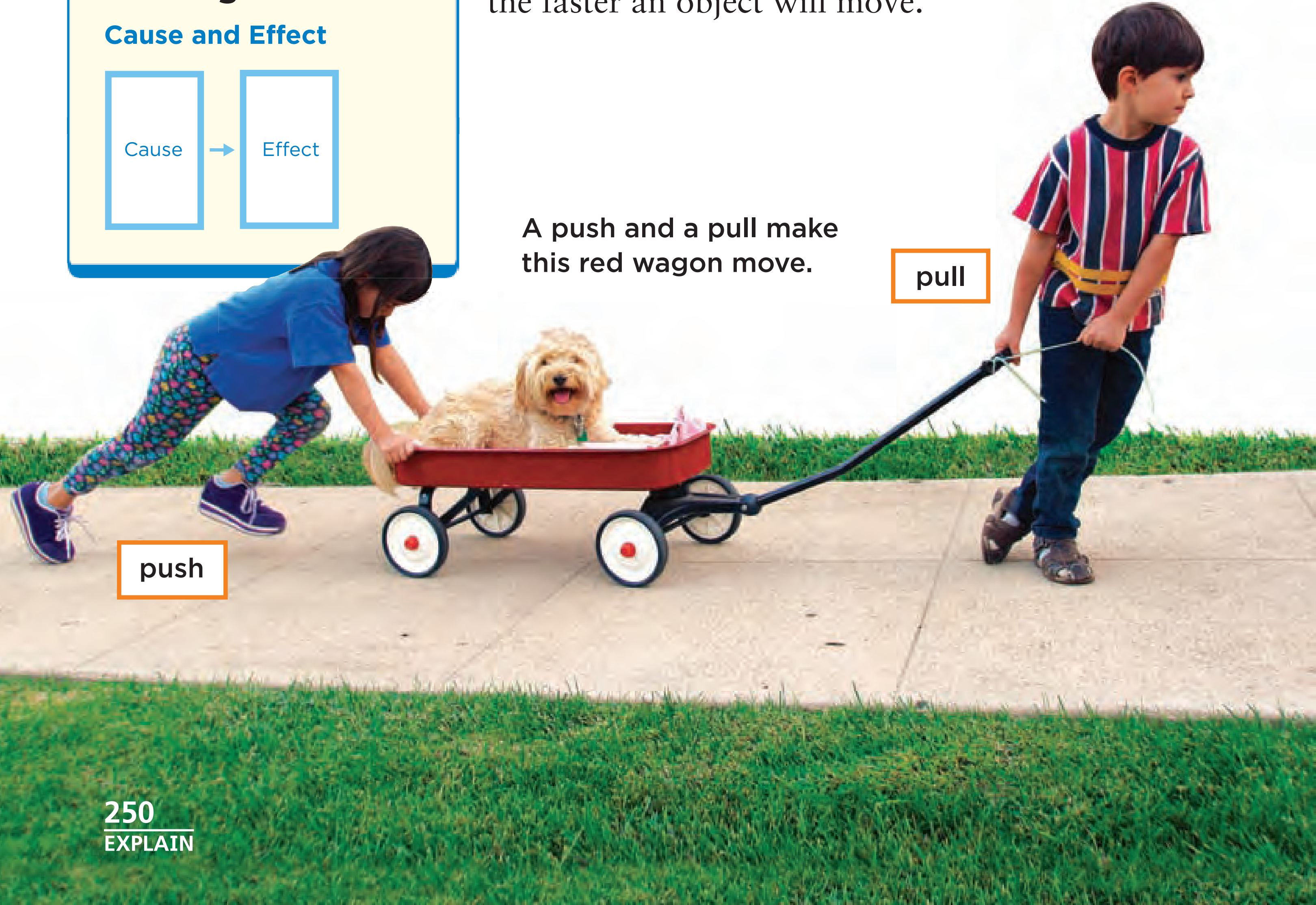
Cause and Effect

Cause → Effect

What are forces?

Objects do not move by themselves. You have to apply a force (FAWRS) to make them start moving. A **force** is a push or a pull. You use forces to move things all the time. When you pull on a door handle or push a wagon, you apply a force to make something move.

Forces can be large or small. The force a crane uses to lift a truck is huge. The force your hand uses to lift a feather is tiny. It takes more force to move heavy objects than light objects. Forces also affect an object's speed. The more force you use, the faster an object will move.



A push and a pull make this red wagon move.

Changes in Motion

Forces can change the motion of objects. They can make objects start moving, speed up, slow down, or stop moving. They can make objects change direction, too.

Forces can change a soccer ball's motion. A goalie applies a force to throw the ball to a teammate. The ball starts to move. The teammate applies another force when he kicks the ball. The ball changes direction. Each time a force is applied the motion of the ball changes. When a goalie catches the ball, the ball's motion is stopped.

A change in an object's motion is the result of all the forces that are acting on the object. Think of the game tug of war. When both sides pull equally on the rope, the forces are balanced. Nothing moves. If one side pulls harder, the forces become unbalanced. Now the rope moves. There is a change of motion.

Quick Check

Cause and Effect How can forces affect an object's motion?

Critical Thinking What happens when you kick a moving ball?

Changes in Motion

1. The goalie throws the ball to start its motion.

2. This player kicks the ball, changing its speed and direction.

3. The goalie catches the soccer ball, stopping its motion.

Read a Photo

How have forces changed the motion of this soccer ball?

Clue: Captions give information.

What are types of forces?

When the bat hits the ball, the ball changes direction.

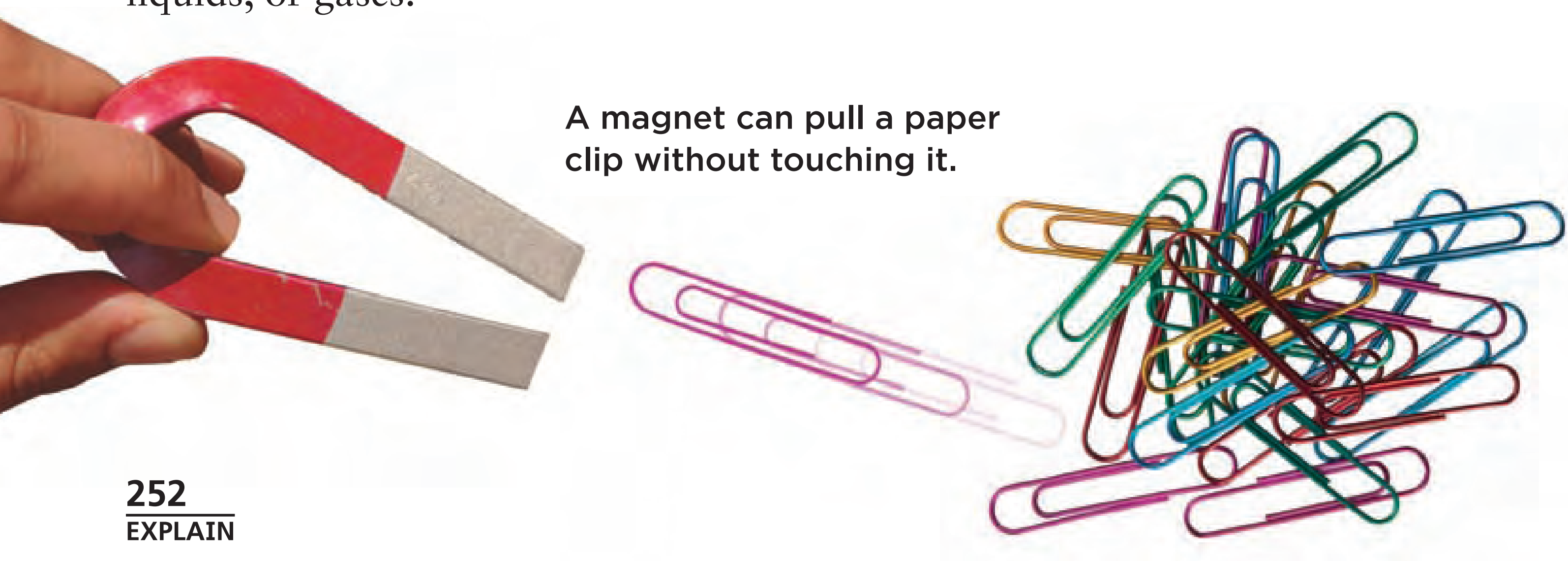
There are many types of forces. The forces you are probably most familiar with are contact forces. *Contact forces* happen between objects that touch. Think about a baseball game. The pitcher must touch the ball to throw it to home plate. A bat must touch the ball to change its direction. When two objects hit each other, a collision results. A collision is a type of contact force.

Some forces can act on an object without touching the object. These are *noncontact forces*. Magnetism and gravity are examples.

Magnetism

When you bring two magnets together, they may *attract*, or pull on, each other. They may also *repel*, or push away from, each other. The force that causes this to happen is called *magnetic force*. A **magnet** is any object with a magnetic force.

Magnets can attract or repel each other. They can also attract things made of certain metals like iron. Magnets can attract or repel objects through solids, liquids, or gases.



A magnet can pull a paper clip without touching it.

Gravity

You cannot see gravity, but it is what keeps you on Earth. **Gravity** is a pulling force between two objects, such as you and Earth. Gravity pulls objects together. When you jump up, Earth's gravity pulls you down. Gravity pulls through solids, liquids, or gases.

How much gravity does it take to keep you on Earth? The answer is your weight (WAYT). An object's **weight** is a measure of the pull of gravity on it. The more mass an object has, the more gravity pulls on it.

Quick Check

Cause and Effect What effect does gravity have on objects?

Critical Thinking How can you pick up metal paper clips without touching them?

Quick Lab

Observe Gravity

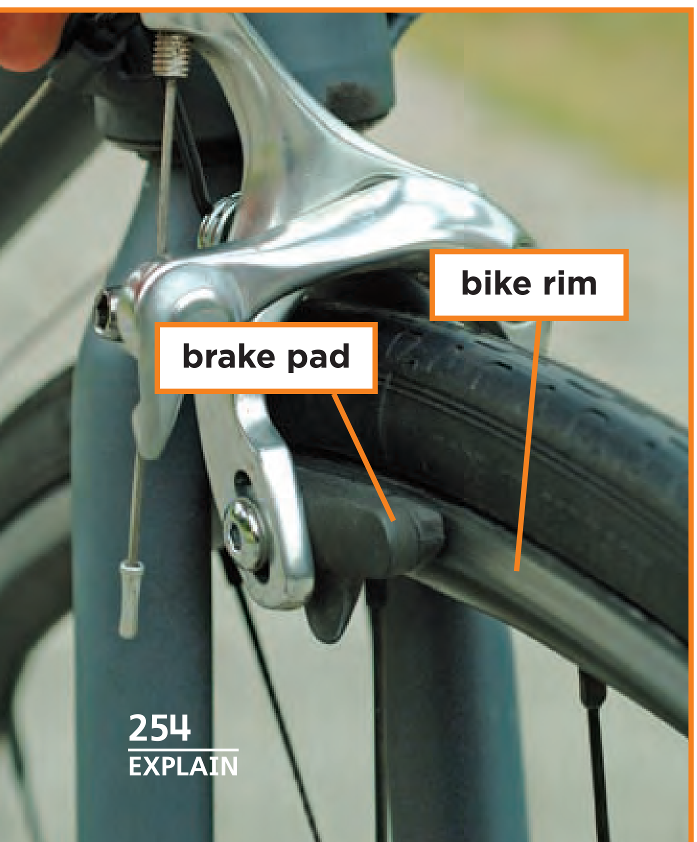
1. **Predict** Does gravity act the same on all objects? Would it act the same on two plastic bottles that have the same volume but different mass?
2. Hold an empty plastic bottle in one hand. Hold an identical bottle full of water in the other hand. Hold each bottle away from your body.

3. **Observe** Describe what you feel. Is each bottle pulled toward Earth with the same force?
4. **Infer** Is the amount of gravity on the two bottles the same? How could you tell?

Gravity is pulling these skydivers to Earth.

▲ This water slide is smooth and has little friction.

Friction between the brake pad and the bike rim stops the bike. ▼



What is friction?

A block slides on the floor. It then slows down and stops. Why does this happen? A force called friction (FRIK•shuhn) is acting on the block. **Friction** is a force that occurs when one object rubs against another. It pushes against moving objects and causes them to slow down.

Different surfaces produce different amounts of friction. Rough surfaces, such as sandpaper, usually produce a lot of friction. Smooth surfaces, such as ice, usually produce less friction.

People use slippery things to reduce friction. Oil is often put on moving parts of machines to reduce friction. People use rough or sticky things to increase friction. The brakes on a bike use rubber pads to increase friction. When you squeeze the brake handles, the brake pads press against the rim of the wheel. The friction between the pads and rim cause the bike to stop.

Quick Check

Cause and Effect What happens when you squeeze a hand brake on a bicycle?

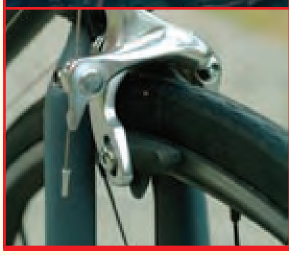
Critical Thinking How can you tell that friction is a force?

Lesson Review

Visual Summary

A force is a push or a pull. Forces can change the motion of objects.

Contact, magnetism, and gravity are different types of forces.



Friction is a force that occurs when one object rubs against another.

Make a FOLDABLES™ Study Guide

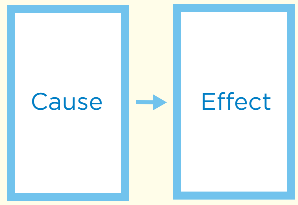
Make a Trifold Book. Use it to summarize what you learned about forces.

Think, Talk, and Write

1. **Main Idea** How can forces affect an object?

2. **Vocabulary** What is friction? Talk about it.

3. **Cause and Effect** You are swinging on a swing. What force causes you to slow down as you go up?



4. **Critical Thinking** How can friction help keep you safe?

5. **Test Prep** **Which is an example of a contact force?**

   A a magnet attracting a paper clip

   B two magnets repelling each other

   C a bat hitting a ball

   D gravity pulling on a leaf

Math Link

Order Numbers

Weigh five objects on a spring scale. Measure their weight in newtons, the unit of force in the metric system. Organize your data in a bar graph from least weight to greatest weight.

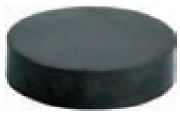
Health Link

Use Your Muscles

You use your muscles when you push or pull things. Find out about some of the muscles in your body. What do your muscles do? How do your muscles help you move?

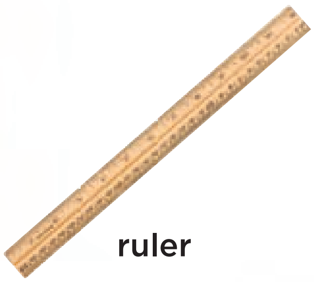
Be a Scientist

Materials



magnet

paper clips



ruler

Structured Inquiry

How does distance affect the pull of a magnet on metal objects?

Form a Hypothesis

You know that some metal objects, such as paper clips, are attracted to magnets. What happens when you change the distance between a magnet and a pile of paper clips? How does this affect the magnet's pull on the paper clips? Write a hypothesis. "If you move a magnet closer to a pile of paper clips, then . . ."

Test Your Hypothesis

1. Gather a pile of paper clips on your desk. Stand up a ruler near the paper clips.
2. **Experiment** Hold a magnet as shown below. Slowly lower the magnet until it is only 1 cm above the pile.

3 **Measure** Move the magnet away from the pile. Remove the paper clips and count how many stuck to the magnet. Record the data in a table.

4 Repeat steps 1–3, holding the magnet 2 cm and 3 cm away from the pile of paper clips. Record your data.

Step 3

Distance	Number of Paper Clips
1 cm	
2 cm	
3 cm	

Draw Conclusions

5 **Use Numbers** At what distance did the magnet pick up the most paper clips?

6 **Interpret Data** Does a magnet's pull on objects get greater or smaller as the magnet moves away from the objects?

Guided Inquiry

Can magnetic force pass through an object?

Form a Hypothesis

Can a magnetic force pass through different objects, such as wood, plastic, paper, or foil? Write a hypothesis.

Test Your Hypothesis

Design a plan to test your hypothesis. List the materials you will use. Write down the steps you plan to follow.

Draw Conclusions

Did any of the objects block magnetic force? Did any of the objects make the magnetic force stronger or weaker? Share your results with your classmates.

Open Inquiry

What other questions do you have about magnets? For example, what common objects are attracted to magnets? Design an experiment to find out.

Remember to follow the steps of the scientific process.

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

PS-4. Predict the changes when an object experiences a force (e.g., a push or pull, weight and friction).

Lesson 3

Work and Energy

Look and Wonder

This tugboat is pulling a large container ship to the dock. Is this tugboat doing work? Why or why not?

PS-4. Predict the changes when an object experiences a force (e.g., a push or pull, weight and friction).

Explore

Inquiry Activity

What is work?

Make a Prediction

How do you know when work is being done?

Test Your Prediction

1. Make a table like the one shown below. Perform each action listed in the table.

Actions	Is It Work?	Why or Why Not?
pick up a book		
think about a problem		
slide a chair		
press feet against floor		
push against wall		

2. **Classify** Decide whether each action was work. Ask yourself if you got something done.

Draw Conclusions

3. **Communicate** Explain why you classified each action the way you did. Record this information in the table.
4. **Infer** What do you think work is?

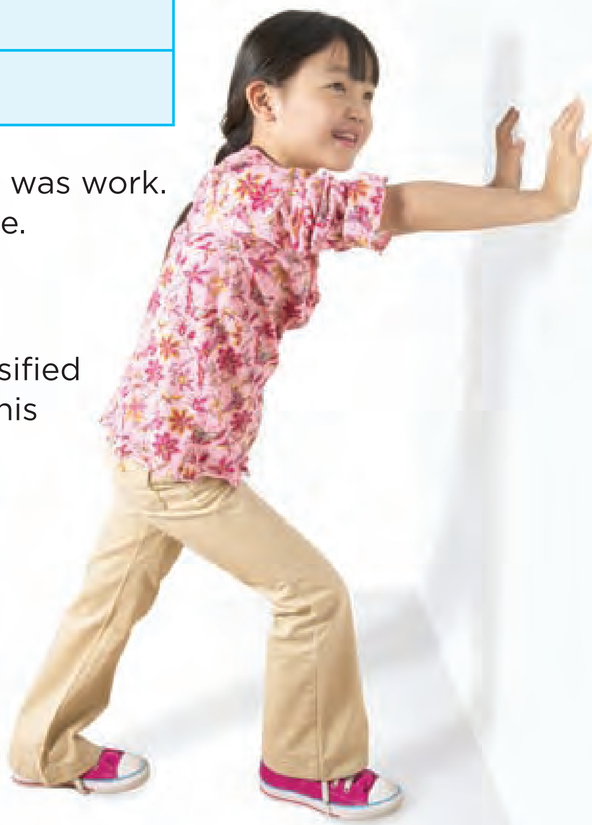
Explore More

Experiment Perform other actions at home. Try to find actions where you do different amounts of work.

Materials

book

chair



SI-5. Record and organize observations (e.g., journals, charts and tables).

Read and Learn

Main Idea PS-4

Work is done when a force changes an object's motion. Energy is the ability to do work.

Vocabulary

work, p. 260

energy, p. 262

kinetic energy, p. 262

potential energy, p. 262

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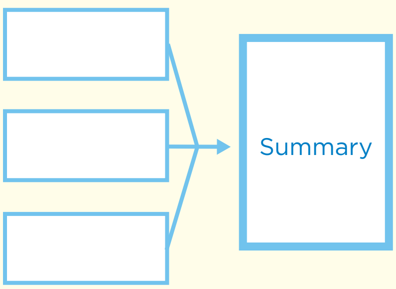
Reading Skill

Summarize



What is work?

Do you know what work is? You might say that you do work every day at school. In science work has a special meaning. **Work** is done when a force moves an object or changes an object's motion. This means that picking up a book is work. A force changes the book's motion. Work is done when a book falls to the floor. Gravity changes the book's motion. Gravity does the work. Pushing on a wall is not work. No matter how hard you push, the wall does not move.

Work can be easy or hard. Picking up a small pebble is work. Lifting a large boulder is, too. In both examples a force is used to move an object.

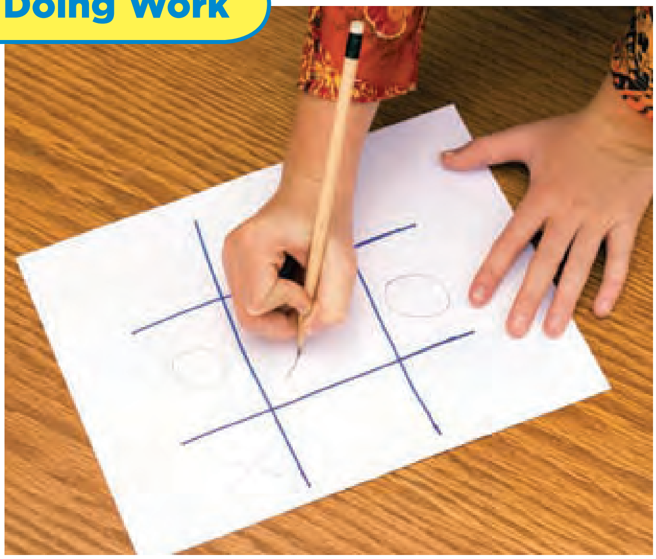
Quick Check

Summarize How can you tell if an action is work?

Critical Thinking Can play be work? Why or why not?

When you paint at an easel, you are doing work. Your hand moves the brush. ▶

Doing Work



Read a Photo

How is work being done in each picture?

Clue: Look for a force and a change in an object's motion in each picture.

What is energy?

Work cannot be done without energy (EN•uhr•jee). **Energy** is the ability to do work. Energy is what makes motion possible. An object needs energy to move. When you do work on an object, you give it that energy.

Kinds of Energy

When you throw a paper airplane, you do work. You give the airplane energy. The airplane starts to move. Energy of motion is called **kinetic energy** (ki•NET•ik EN•uhr•jee). All moving objects—roller coasters, cars, even people—have kinetic energy.

When you pull a sled to the top of a hill, you do work. You give the sled potential energy (puh•TEN•shuhl EN•uhr•jee). **Potential energy** is stored energy that is ready to be used. As the sled moves down the hill, its potential energy changes into kinetic energy.

How do you get energy to move, live, and grow? You get most of your energy from food. Food is a source of stored energy. Gasoline, wood, and food all have stored energy that is ready to be used.

Quick Check

Summarize What can energy do?

Critical Thinking When does a roller coaster have the most potential energy?

Quick Lab

Using Energy

1. You get energy to move and play from the foods you eat. Food is a source of stored energy. The table below shows how much stored energy is in some of the foods we eat.

Food	Calories of Energy
1 cup of apple juice	120
1 slice of wheat bread	75
1 slice of turkey	30
1 slice of cheese	60
1 cup of lettuce	7

2. **Use Numbers** Use the table to plan a meal. How many calories are in your meal?

3. **Use Numbers** Choose an activity from the table below. How long can you do that activity before you have used up all the stored energy from your meal?

4. **Use Numbers** Choose another activity and repeat step 3. Which activity uses the most energy?

Activity	Calories Used in 30 Minutes
biking (slow)	100
jogging	160
listening to music	17

Energy from the ball makes the pins move.

How can energy change?

Energy can move from one object to another. When you roll a bowling ball, you transfer energy from your body to the ball. When the ball hits the pins, it transfers energy to the pins. The pins move.

Energy can also change from one form into another. Rub your hands together. What do you notice? They get warmer. Your moving hands have energy. As friction slows your hands down, some of that energy is changed into heat, a kind of energy.

Quick Check

Summarize How can energy change?

Critical Thinking Why does a bowling ball slow down when it hits a pin?

FACT Energy does not get used up. It changes form.

Lesson Review

Visual Summary

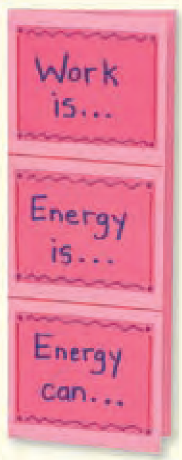
Work is done when a force moves an object or changes an object's motion.

Energy is the ability to do work.

Energy can move from one object to another. Energy can also change form.

Make a FOLDABLES™ Study Guide

Make a Three-Tab book. Use it to summarize what you learned about work and energy.

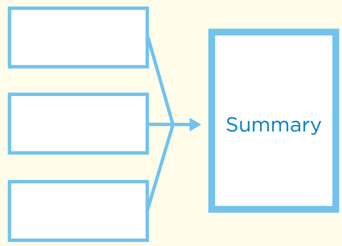


Think, Talk, and Write

1. **Main Idea** What is energy? How can it change?

2. **Vocabulary** What is work? Give two examples.

3. **Summarize** A soccer ball is at your feet. You kick the ball and it travels across the field. Use the terms work and energy to describe what happens.



4. **Critical Thinking** How is an apple like gasoline in a car?

5. **Test Prep** **Which is an example of work being done?**
   - **A** studying for a test
   - **B** picking up a feather
   - **C** holding a heavy box over your head
   - **D** pushing on a wall

Writing Link

Explanatory Writing

A rock on a hill has potential energy. What happens to this energy as the rock rolls down the hill? Write about it. Then make a drawing to illustrate your writing.

Art Link

Make a Collage

Cut pictures from magazines of objects with kinetic energy. Paste your pictures onto a poster. Write how you think each object got its energy.

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Focus on Skills

Inquiry Skill: Infer

When you do an experiment, you are trying to answer a question. Sometimes you can answer a question from the data you collect. Other times, you must **infer** the answer using facts you know.

▶ Learn It

When you **infer**, you form an idea based on observations and facts. As you make observations, it is important to record your data. The more data you collect, the better you will be able to infer.

▶ Try It

Can running water do work? To answer this question, design a water wheel. Then observe what happens to it under running water. Use your observations and what you know about work to **infer** if water can do work.

Materials **paper plate, ruler, scissors, pencil, thread, paper clip, tape, faucet**

◀ A water wheel is a machine that uses the energy of moving water to power mills and factories.

1. Cut four 3-cm slits into a plastic plate. Then bend the slits to create a pinwheel.
2. Gently push a pencil through the center of the plastic plate. ⚠ **Be Careful.** Point the pencil away from your body. Ask an adult for help.
3. Tie one end of a piece of thread to a paper clip. Tape the other end to the pencil, near the hole in the plate.
4. Turn on the faucet so that a little water flows out.
5. Rest the pencil across the palms of your hands. Then hold the edge of the plate 2 cm under the water. Record your observations.
6. Repeat with a larger stream of water. Record what you observe.

Now use observations and facts you know to answer these questions.

- What makes the water wheel move?
- Does using more water give the wheel more energy? How can you tell?
- Can running water do work? Explain your answer.

Apply It

You have learned to **infer** the answer to a question from the data you collect and the facts you know. Now you can infer answers to new questions. For example, can wind do work? How might you use your wheel to infer the answer?

CHAPTER 6 Review

Visual Summary

Lesson 1 An object is in motion when its position changes.

Lesson 2 Forces can change an object's motion.

Lesson 3 Work is done when a force moves an object. Energy is the ability to do work.

Make a FOLDABLES™ Study Guide

Glue your lesson study guides to a piece of paper as shown. Use your study guide to review what you have learned in this chapter.

Vocabulary

Fill each blank with the best term from the list.

energy, p. 262

force, p. 250

friction, p. 254

magnet, p. 252

motion, p. 242

noncontact force, p. 252

speed, p. 244

1. An object in ________ is changing its position.
PS-1
2. The ability to do work is called ________.
PS-C
3. How quickly an object moves is described by its ________.
PS-2
4. You can use a ________ to attract things made of iron.
PS-3
5. A push or pull is called a ________.
PS-3, PS-4
6. You squeeze the hand brakes on a bike. The force that slows down the bike is ________.
PS-3, PS-4
7. Gravity is an example of a ________ force.
PS-3

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Skills and Concepts

Answer each of the following in complete sentences.

8. **Problem and Solution** A car has just traveled 100 kilometers. What else do you need to know to figure out its average speed?
PS-2

9. **Explanatory Writing** When does a roller coaster have the most potential energy? When does it have the most kinetic energy?
PS-C

10. **Infer** Would you move faster down a water slide or a regular slide? Explain your answer.
PS-4

11. **Critical Thinking** Both cars and people need energy. How is the way they get energy alike?
PS-C

12. **Explanatory Writing** Write a detailed caption for a photograph showing a tug-of-war game. In your game, explain how the game relates to forces.
PS-C

The Big Idea

13. What makes something move?
PS-C

Performance Assessment

Mapping Your Motion

- Make a map of your classroom. Mark where the main objects are placed. For example, show the location of doors, windows, boards, and desks.
- For 5 minutes, slowly follow a path around the room. Stop once every minute. Mark an *X* on the map showing your location at the time that you stop.
- Who is moving faster: a student whose marks are far apart or one whose marks are close together? Compare maps with another student. Try to find out who moved faster. Explain how you know who moved at a greater speed.

Ohio Activity

Have you ever felt a strong gust of wind? Wind can be powerful. The energy from wind lifts kites through the air. It moves sailboats across the water. It also turns the blades of windmills. The turning blades collect the wind's energy and put it to work.

How has wind power been put to work in Ohio? Research an Ohio "wind farm" and write a report to share with your class.

Ohio Benchmark Practice

1 If you lifted each of the following objects the same distance, which object would need the **most** force?

A a pencil

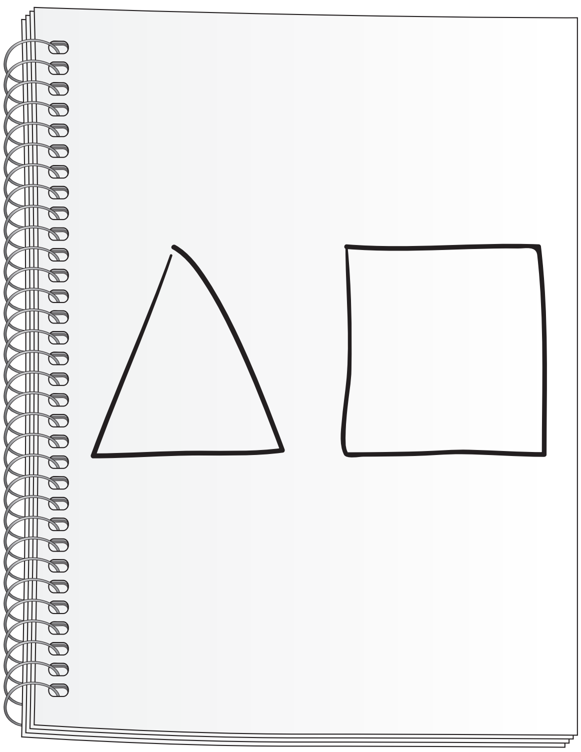
B a feather

C a magazine

D a bowling ball

PS-C

2 How would you describe the triangle in the picture below?



A The triangle is below the square.

B The triangle is to the right of the square.

C The triangle is to the left of the square.

D The triangle is above the square.

PS-C, PS-I

3 You are riding your bike along the sidewalk.

In your **Answer Document**, identify two forces acting on your bicycle tires.

Then, identify each force as a contact force or a noncontact force. (2 points)

PS-C

4 Which force pulls objects toward Earth?

A magnetism

B friction

C contact

D gravity

PS-C

5 Which of the following is true?

A Faster objects move farther in a certain amount of time.

B Speed is a change in the position of an object.

C Motion is how far something moves in a certain amount of time.

D Motion and speed are the same thing.

PS-C

6 Which of the following is the **best** description of motion?

A the location of an object

B the change in an object's position over time

C the distance that an object moves

D the direction that an object moves

PS-C, PS-2

7 A student asks, "Does the size of the wheels affect how fast a toy car rolls on the floor?"

The student hypothesizes that toy cars with large wheels roll faster. The student wants to make sure that the force that starts the car moving is always the same.

In your **Answer Document,** describe or draw how the student can set up an investigation of her hypothesis.

Then, identify two measurement tools the student will need. (4 points)

SWK-B

8 Which of the following is **not** a metric measurement of distance?

A centimeters

B liters

C kilometers

D meters

SI-B

9 Which of the following is an example of a contact force?

A a force that keeps the Moon orbiting Earth

B a force that keeps Earth orbiting the Sun

C a force that causes some metals to attract other metals

D a force that causes a bowling ball to knock down pins

PS-C

10 Read the sentence below.

Her house is 2 kilometers from school.

What does this sentence describe?

A distance

B position

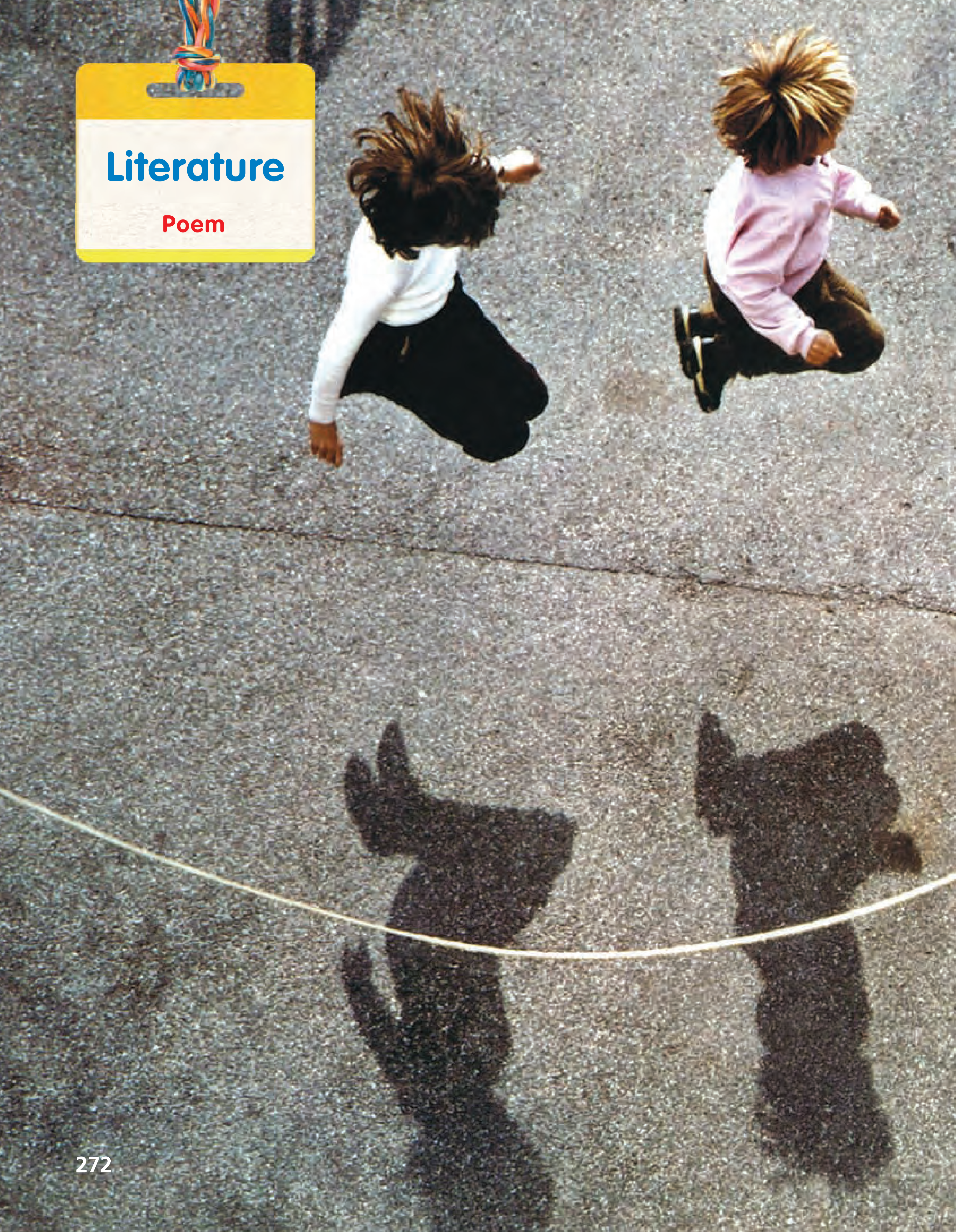
C motion

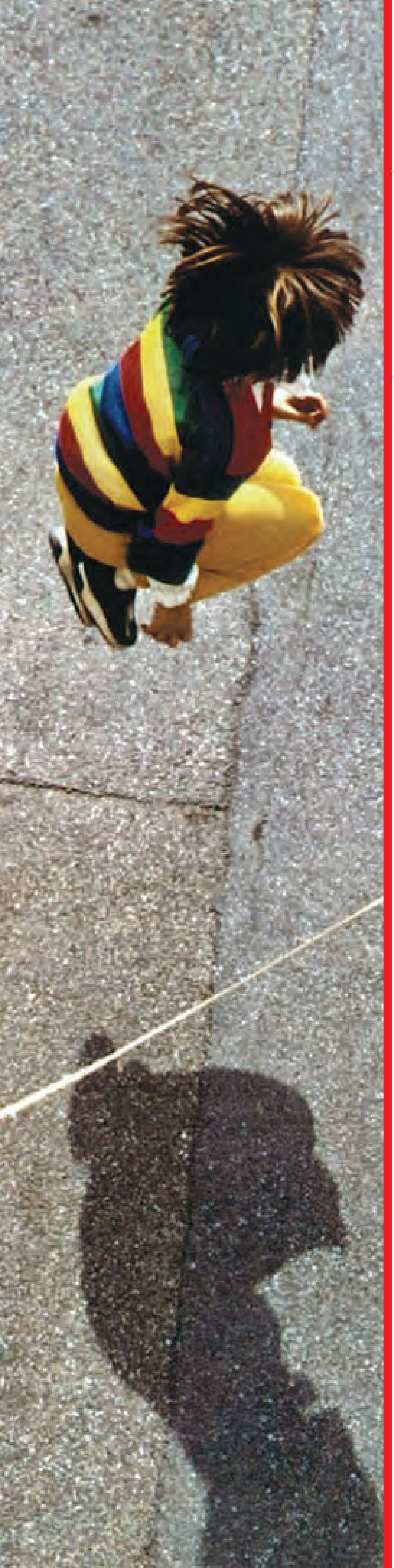
D speed

SI-B

Literature

Poem





Jump Rope

by Rebecca Kai Dotlich

Swings
up,
whirls around,
brushes ground
beneath quick feet.
Sweeps walks,
slap, slip,
double Dutch,
scissor skip.
Flip, flap,
LOOPS around,
slip, slap,
swoops down.
Slides and swirls,
twirls and twists,
song for a jump rope
sounds like this:
Tiger leap,
spider spin,
your turn next,
jump on in!

Write About It

Response to Literature This poet uses rhythm and rhyme to describe how a jump rope moves. How else do things move on the playground? Write a poem about another movement game.

LOG ON e-Journal Write about it online at www.macmillanmh.com

Careers in Science

Lighting Technician

Have you ever watched a motion picture awards show? If so, you may have heard actors thank members of the film crew. An important part of the film crew is the chief lighting technician.

The chief lighting technician designs the lighting for the scenes of a movie. The lighting must create a mood that matches the action of the scene. The chief lighting technician uses different combinations of lights for different scenes. The technician also changes the location of the light sources to create different moods.

To become a chief lighting technician, you need to know about light and electrical energy. You also should have some experience in drama or filmmaking. Many chief lighting technicians begin their career as members of a lighting crew.

▲ This technician is lighting a set for a motion picture.

▲ A lighting technician knows about light and electrical energy.

Here are some other Physical Science careers:

- electrician
- engineer
- architect
- car designer

SWK-5. Discuss how both men and women find science rewarding as a career and in their everyday lives.

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Reference

Units of Measurement

Temperature

▶ The temperature on this thermometer reads 86 degrees Fahrenheit. That is the same as 30 degrees Celsius.

Length and Area

▶ This student is 3 feet plus 9 inches tall. That is the same as 1 meter plus 14 centimeters.

Mass

▶ You can measure the mass of these rocks in grams.

Volume of Fluids

▶ This bottle of water has a volume of 2 liters. That is a little more than 2 quarts.

Weight/Force

▶ This pumpkin weighs about 7 pounds. That means the force of gravity is 31.5 newtons.

Speed

▶ This student can ride her bike 100 meters in 50 seconds. That means her speed is 2 meters per second.

Table of Measures	
SI International Units/Metric Units	**Customary Units**
Temperature Water freezes at 0 degrees Celsius (°C) and boils at 100°C.	**Temperature** Water freezes at 32 degrees Fahrenheit (°F) and boils at 212°F.
Length and Distance 10 millimeters (mm) = 1 centimeter (cm) 100 centimeters = 1 meter (m) 1,000 meters = 1 kilometer (km)	**Length and Distance** 12 inches (in.) = 1 foot (ft) 3 feet = 1 yard (yd) 5,280 feet = 1 mile (mi)
Volume 1 cubic centimeter (cm^3) = 1 milliliter (mL) 1,000 milliliters = 1 liter (L)	**Volume of Fluids** 8 fluid ounces (fl oz) = 1 cup (c) 2 cups = 1 pint (pt) 2 pints = 1 quart (qt) 4 quarts = 1 gallon (gal)
Mass 1,000 milligrams (mg) = 1 gram (g) 1,000 grams = 1 kilogram (kg)	**Area** 1 square foot (ft^2) = 1 ft x 1 ft 43,560 square feet (ft^2) = 1 acre
Area 1 square meter (m^2) = 1 m x 1 m 10,000 square meters (m^2) = 1 hectare	**Speed** miles per hour (mph)
Speed meters per second (m/s) kilometers per hour (km/h)	**Weight/Force** 16 ounces (oz) = 1 pound (lb) 2,000 pounds = 1 ton (T)
Weight/Force 1 newton (N) = 1 kg x 1 m/s^2	

Measurements

Measure Time

You measure time to find out how long something takes to happen. Stopwatches and clocks are tools you can use to measure time. Seconds, minutes, hours, days, and years are some units of time.

Try it **Use a Stopwatch to Measure Time**

1. Get a cup of water and an antacid tablet from your teacher.
2. Tell your partner to place the tablet in the cup of water. Start the stopwatch when the tablet touches the water.
3. Stop the stopwatch when the tablet completely dissolves. Record the time shown on the stopwatch.

▲ **Push the button on the top right of the stopwatch to start timing. Push the button again to stop timing.**

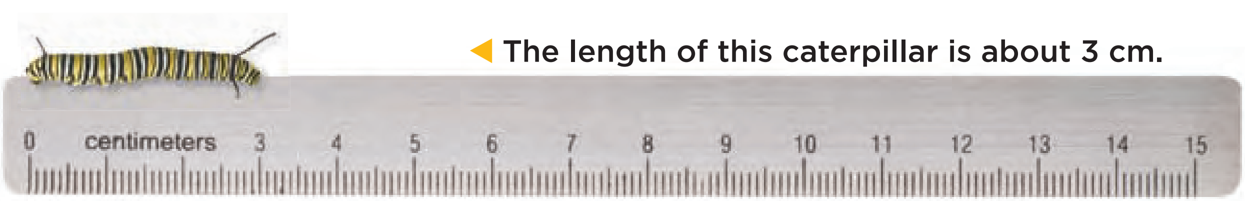
Measure Length

You measure length to find out how long or how far away something is. Rulers, tape measures, and metersticks are some tools you can use to measure length. You can measure length using units called meters. Smaller units are made from parts of meters. Larger units are made of many meters.

Look at the ruler below. Each number represents 1 centimeter (cm). There are 100 centimeters in 1 meter. In between each number are 10 lines. Each line is equal to 1 millimeter (mm). There are 10 millimeters in 1 centimeter.

Try it **Find Length with a Ruler**

Place a ruler on your desk. Line up a pencil with the "0" mark on the ruler. Record the length of the pencil in centimeters.

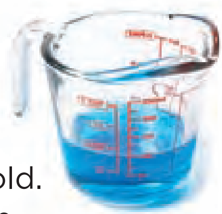


◀ **The length of this caterpillar is about 3 cm.**

Measure Liquid Volume

Volume is the amount of space something takes up. Beakers, measuring cups, and graduated cylinders are tools you can use to measure liquid volume. These containers are marked in units called milliliters (mL).

Try it Measure Liquid Volume



1. Gather a few empty plastic containers of different shapes and sizes.
2. Use a graduated cylinder to find the volume of water each container can hold. To start, fill the graduated cylinder with water, then pour the water into the container. Continue pouring this until the container is full. Keep track of the number of milliliters you add.

▲ This graduated cylinder can measure volumes up to 100 mL. Each number on the cylinder represents 10 mL.

Measure Mass

Mass is the amount of matter an object has. You use a balance to measure mass. To find the mass of an object, you compare it with objects whose masses you know. Grams are units people use to measure mass.

Try it Measure the Mass of a Box of Crayons

1. Place a box of crayons on one side of a pan balance.
2. Add gram masses to the other side until the two sides of the balance are level.
3. Add together the numbers on the gram masses. This total equals the mass of the box of crayons.

Measurements

Measure Force/Weight

You measure force to find the strength of a push or pull. Force can be measured in units called newtons (N). A spring scale is a tool used to measure force.

Weight is a measure of the force of gravity pulling down on an object. A spring scale measures the pull of gravity. One pound is equal to about 4.5 newtons.

Try it Measure the Weight of an Object

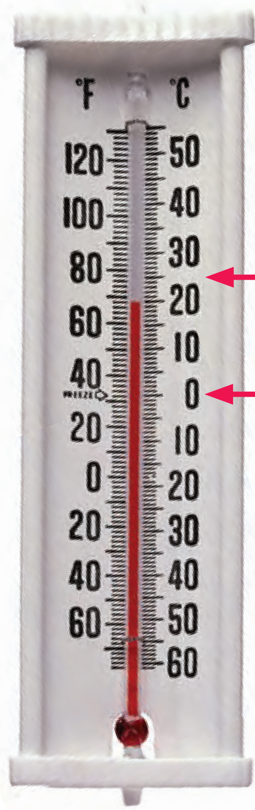
1. Hold a spring scale by the top loop. Put a small object on the bottom hook.
2. Slowly, let go of the object. Wait for the spring to stop moving.
3. Read the number of newtons next to the tab. This is the object's weight.

Measure Temperature

Temperature (TEM•puhr•uh•chuhr) is how hot or cold something is. You use a tool called a thermometer (thuhr•MOM•i•tuhr) to measure temperature. In the United States, temperature is often measured in degrees Fahrenheit (°F). However, you can also measure temperature in degrees Celsius (°C).

Try it Read a Thermometer

1. Fill a beaker with ice water. Then put a thermometer in the water.
2. Wait several minutes. Read the number next to the top of the red liquid inside the thermometer. This is the temperature.
3. Repeat with warm water.

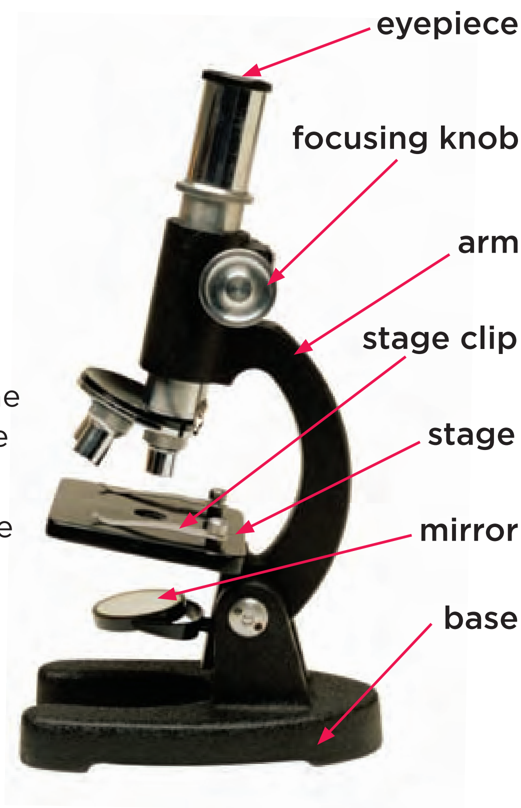


This thermometer shows temperature in both degrees Fahrenheit and degrees Celsius.

Tools of Science

Use a Microscope

A microscope (MYE•kruh•skohp) is a tool that magnifies objects, or makes them look larger. A microscope can make an object look hundreds or thousands of times larger. Look at the photo to learn the different parts of a microscope.

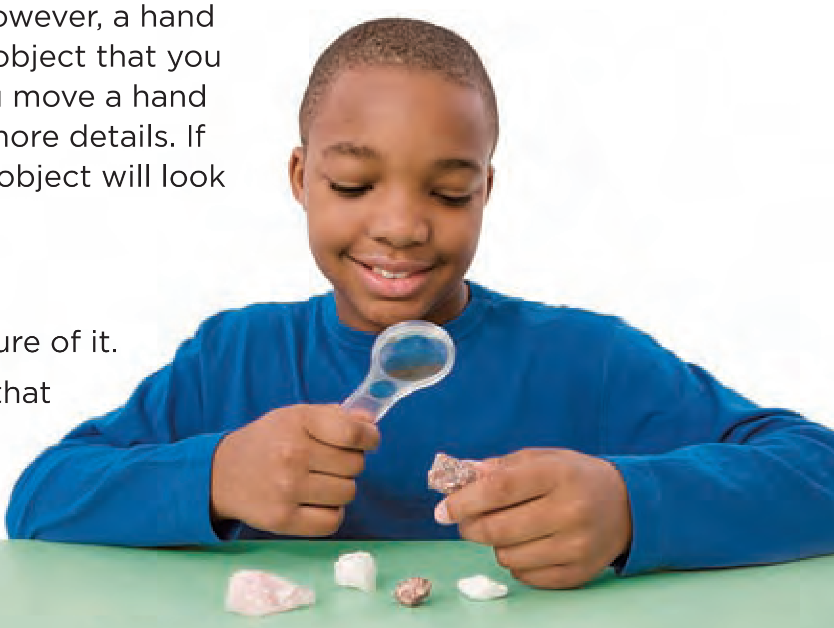


Try it Examine Salt Grains

1. Move the mirror so that it reflects light up toward the stage. ⚠ **Be Careful**. Never point the mirror at bright lights or the Sun. This can cause permanent eye damage.
2. Place a few grains of salt on a slide. Put the slide under the stage clips on the stage. Be sure that the salt grains are over the hole in the stage.
3. Look through the eyepiece. Turn the focusing knob slowly until the salt grains come into focus. Draw a picture of what you see.

Use a Hand Lens

A hand lens is another tool that magnifies objects. It is not as powerful as a microscope. However, a hand lens still allows you to see details of an object that you cannot see with your eyes alone. As you move a hand lens away from an object, you can see more details. If you move a hand lens too far away, the object will look blurry.



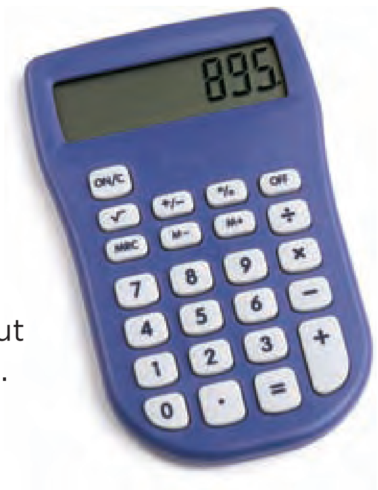
Try it Magnify a Rock

1. Look at a rock carefully. Draw a picture of it.
2. Hold a hand lens above the rock so that you can see the rock clearly.
3. Fill in any details on your original drawing that you did not see before.

Tools of Science

Use a Calculator

Sometimes during an experiment, you have to add, subtract, multiply, or divide numbers. A calculator can help you carry out these operations.



Try it Convert from °F to °C

Water boils at 212°F. Use a calculator to convert 212°F into degrees Celsius.

1. Press the ON key. Then, enter the number 212 by pressing 2 1 2.
2. Subtract 32 by pressing - 3 2.
3. Multiply by 5 by pressing x 5.
4. Finally, divide by 9 by pressing ÷ 9. Press =. This is the temperature in degrees Celsius.

Now, convert 100°F into degrees Celsius.

Use a Camera

During an experiment or nature study, it helps to observe and record changes that happen over time. Sometimes it can be difficult to see these changes if they happen very quickly or very slowly. A camera can help you keep track of visible changes. Studying photos can help you understand what happened over the course of time.

Try it Gather Data From a Photo

The photos below show a panda eight days after birth and then several months later. What differences do you notice? How has the panda changed over those months? Now think of something else that changes over time. With the help of an adult, use a camera to take photos at different times. Compare your photos.

Computers

Use a Computer

A computer has many uses. You can use a computer to get information from compact discs (CDs) and digital videodiscs (DVDs). You can also use a computer to write reports and to show information.

The Internet connects your computer with computers around the world, so you can collect all kinds of information. When using the Internet, visit only Web sites that are safe and reliable. Your teacher can help you find safe and reliable sites to use. Whenever you are online, never give any information about yourself to others.

Try it Use a Computer for a Project

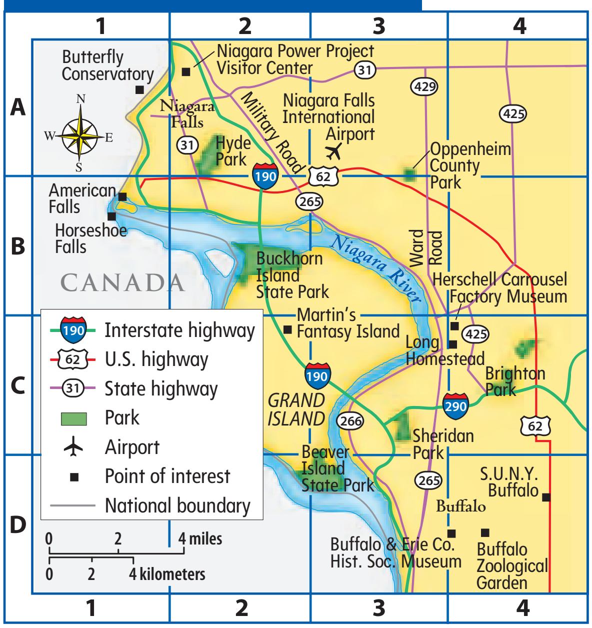
1. Choose an environment to research. Then use the Internet to find out about this environment. Where is the environment located in the world? What is the climate like in the environment? What kinds of plants and animals live there?
2. Use DVDs or other sources from the library to find out more about your chosen environment.
3. Use the computer to write a report about the information you gathered. Then share your report with others.

Make Maps

Locate Places

A map is a drawing that shows an area from above. Many maps have numbers and letters along the top and side. The letters and numbers help you find locations. The Buffalo Zoological Garden, for example, is located at D4 below. To find it, place a finger on the letter D along the side of the map and another finger on the number 4 at the top. Then move your fingers straight across and down the map until they meet. Now find B1. What is there?

Niagara Falls, New York



Try it Make a Map

Make a map of an area in your community. It might be a park or the area between your home and school. Include numbers and letters along the top and side. Use a compass to find north, and mark north on your map.

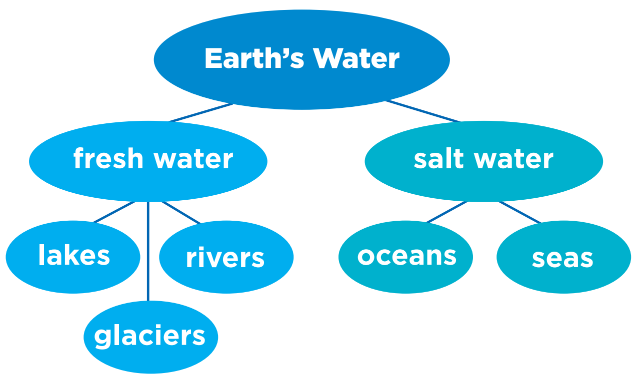
Idea Maps

The Niagara Falls map shows how places are connected to each other. Idea maps, on the other hand, show how ideas are connected to each other. Idea maps help you organize information about a topic.

Look at the idea map below. It connects ideas about water. This map shows that Earth's water can be fresh water or salt water. The map also shows three sources of fresh water. You can see that there is no connection between "rivers" and "salt water" on the map. This can remind you that salt water does not flow in rivers.

Try it Make an Idea Map

Make an idea map about a topic you are learning in science. Your map can include words, phrases, or even sentences. Arrange your map in a way that makes sense to you and helps you understand the connection between ideas.



Make Charts

Charts are useful for recording information during an experiment and for communicating information. In a chart, only the column or the row has meaning but not both. In this chart, one column lists living things. A second column lists nonliving things.

Living	Nonliving
tree	rock
chipmunk	puddle
bird	cloud

Try it **Organize Data in a Chart**

Take a survey of your class. Find out each student's favorite kind of pet. Make a chart to show this information. Remember to show your information in columns or in rows.

Make Tables

Tables also help to organize data, or information. Tables have columns that run up and down and rows that run across. Column and row headings tell you what kind of data they hold.

The table below shows the properties of some minerals. Which mineral in the table has a white streak? Which mineral is yellow in color?

Try it **Organize Data in a Table**

Collect a few minerals from your teacher. Observe the properties of each. Make a table like the one shown. Use the same column headings. Record the properties of each mineral.

Mineral Identification Table

	Hardness	Luster	Streak	Color	Other
pyrite	6–6.5	metallic	greenish-black	brassy yellow	called "fool's gold"
quartz	7	nonmetallic	none	colorless, white, rose, smoky, purple, brown	
mica	2–2.5	nonmetallic	none	dark brown, black, or silver-white	flakes when peeled
feldspar	6	nonmetallic	none	colorless, beige, pink	
calcite	3	nonmetallic	white	colorless, white	bubbles when acid is placed on it

Organizing Data

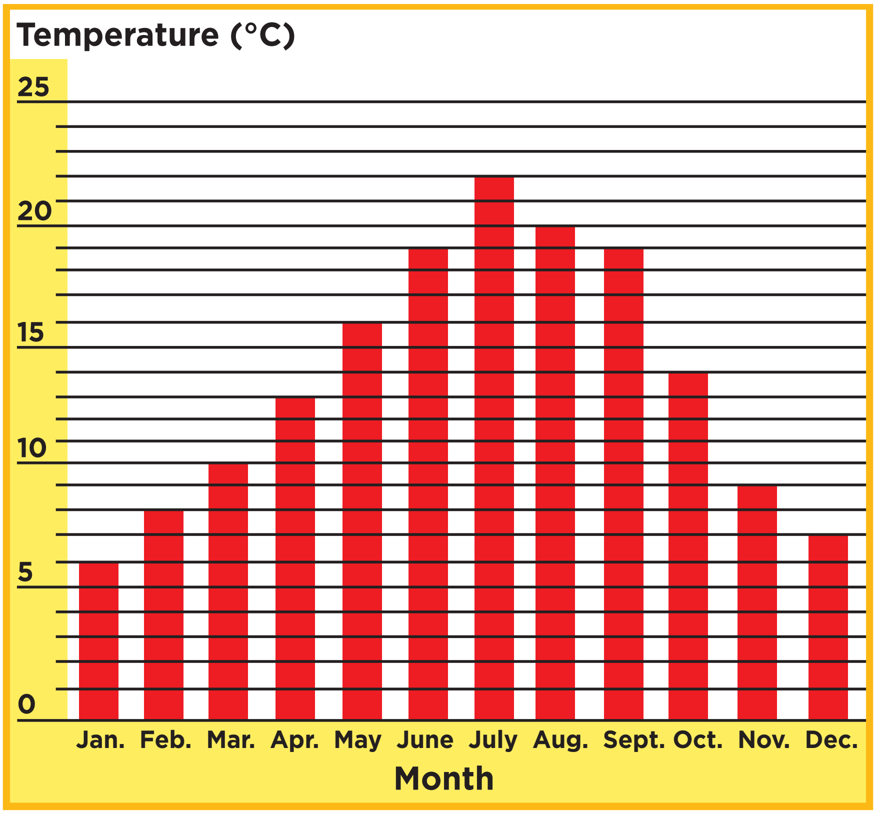
Make Graphs

Graphs also help organize data. Graphs make it easy to notice trends and patterns. There are many kinds of graphs.

Bar Graphs

A bar graph uses bars to show data. What if you want to find the warmest and coldest months for your city? Every month you find the average temperature in the newspaper. You can organize the temperatures in a bar graph so you can easily compare them.

Month	Temperature (°C)
January	6
February	8
March	10
April	13
May	16
June	19
July	22
August	20
September	19
October	14
November	9
December	7



1. Look at the bar for the month of April. Put your finger at the top of the bar. Move your finger straight over to the left to find the average temperature for that month.
2. Find the highest bar on the bar graph. This bar represents the month with the highest average temperature. Which month is it? What is the average temperature for this month?
3. Look at the bars of the graph. What pattern do you notice in the temperatures from January to December?

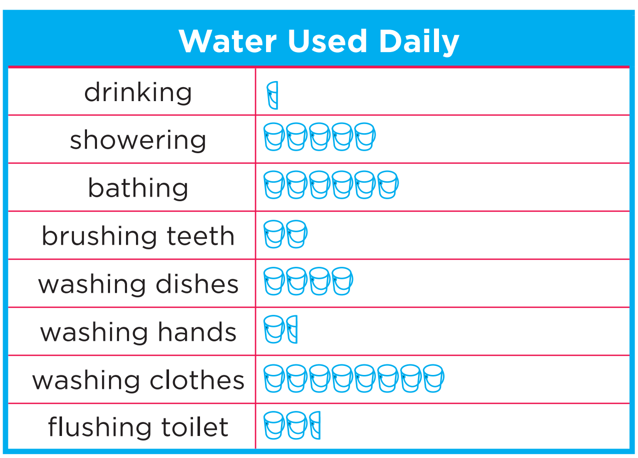
Pictographs

A pictograph uses symbols, or pictures, to show information. What if you collect information about how much water your family uses each day?

Water Used Daily (liters)	
drinking	10
showering	100
bathing	120
brushing teeth	40
washing dishes	80
washing hands	30
washing clothes	160
flushing toilet	50

You can organize this information into a pictograph. In the pictograph below, each bucket means 20 liters of water. A half bucket means half of 20, or 10, liters of water.

1. Which activity uses the most water?
2. Which activity uses the least water?



= 20 liters of water

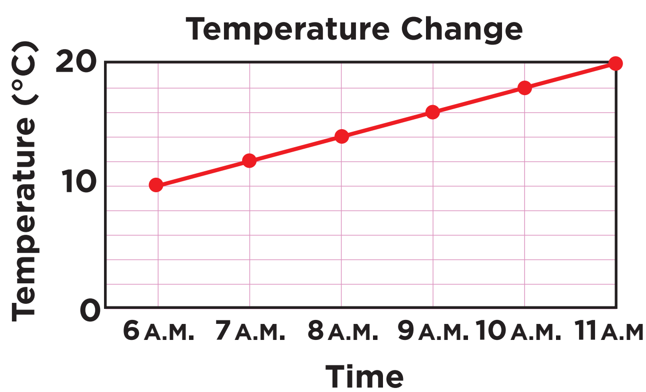
Line Graphs

A line graph can show how information changes over time. What if you measure the temperature outdoors every hour starting at 6 A.M.?

Time	Temperature (°C)
6 A.M.	10
7 A.M.	12
8 A.M.	14
9 A.M.	16
10 A.M.	18
11 A.M.	20

Now organize your data by making a line graph. Follow these steps.

1. Make a scale along the bottom and side of the graph. Label the scales.
2. Draw a point on the graph for each temperature measured each hour.
3. Connect the points.
4. How do the temperatures and times relate to each other?



Human Body Systems

The Skeletal System

Feel your elbows, wrists, and fingers. What are those hard parts? Bones! Bones make up the skeletal system. The skeletal system is one of many body systems. A body system is a group of organs that work together to perform a specific job.

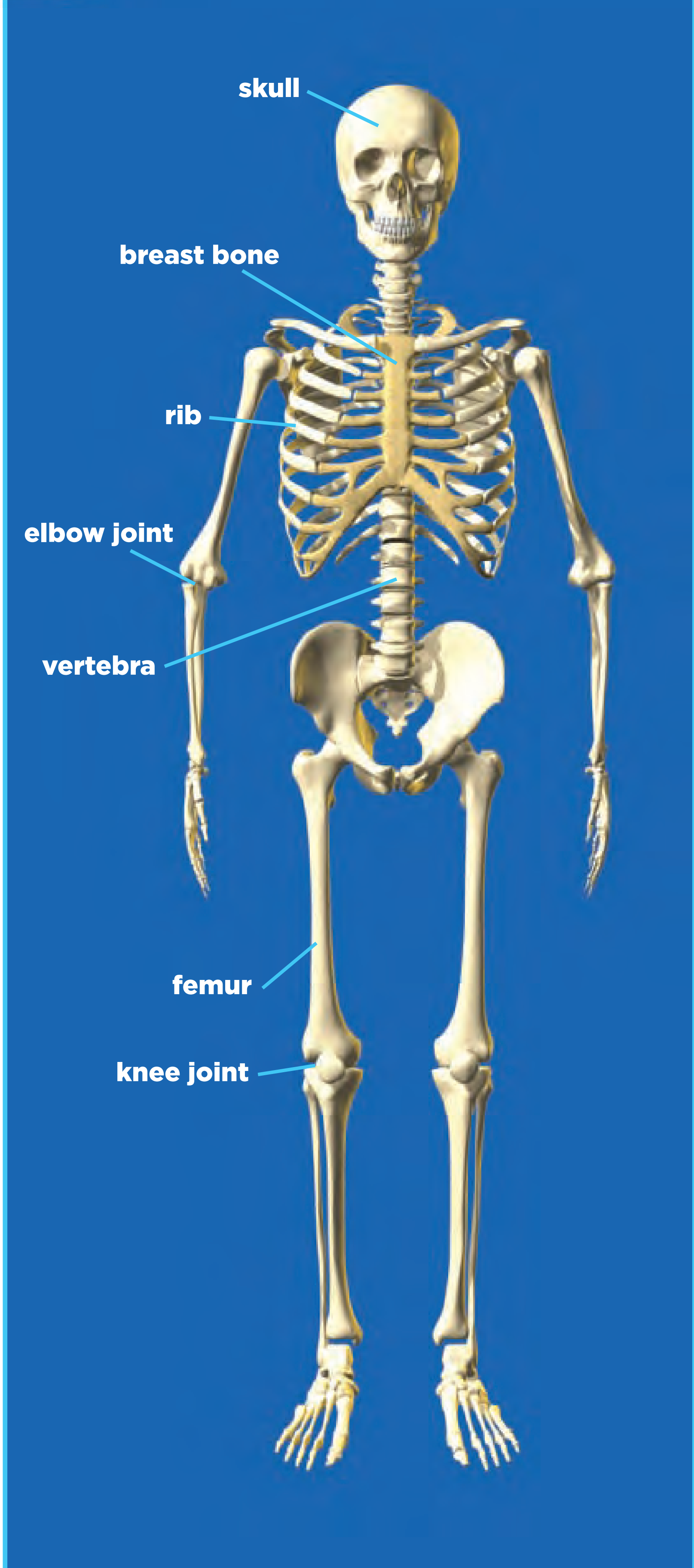
The skeletal system is made up of 206 bones. Each bone has a particular job. The long, strong leg bones support the body's weight. The skull protects the brain. The hip bones help you move. Together, bones do important jobs to keep the body active and healthy.

- Bones support the body and give the body its shape.
- Bones protect organs in the body.
- Bones work with muscles to move the body.
- Bones store minerals and produce blood for the body.

Joints

A joint is a place where two or more bones meet. There are three main types of joints.

Immovable joints form where bones fit together too tightly to move. The 29 bones of your skull meet at immovable joints. Partly movable joints are places where bones can move a little. Ribs are connected to the breastbone with these joints. Movable joints, like the knee, are places where bones can move easily. The knee lets the bones of your leg move.



The Muscular System

Together, all the muscles in the body form the muscular system. Muscles allow the body to move. Without muscles, you would not be able to run, smile, breathe, or even blink.

Most muscles are attached to bones and skin. These are called skeletal muscles. To move bones back and forth, skeletal muscles usually work in pairs. Each pulls on a bone in a different direction. When you want to move, your brain sends a message to a pair of skeletal muscles. One muscle contracts, or gets shorter. It pulls on the bone and skin. The other muscle relaxes to let the bone move.

▲ There are 53 muscles in your face. You use 12 of them whenever you smile.

◀ To bend his arm, this boy's biceps contract while his triceps relax.

Some muscles work without you even thinking about it. The heart is made of muscle. It pumps blood throughout the body even while you sleep. Smooth muscle in the lungs helps you breathe. Smooth muscle in the stomach helps you digest food.

Human Body Systems

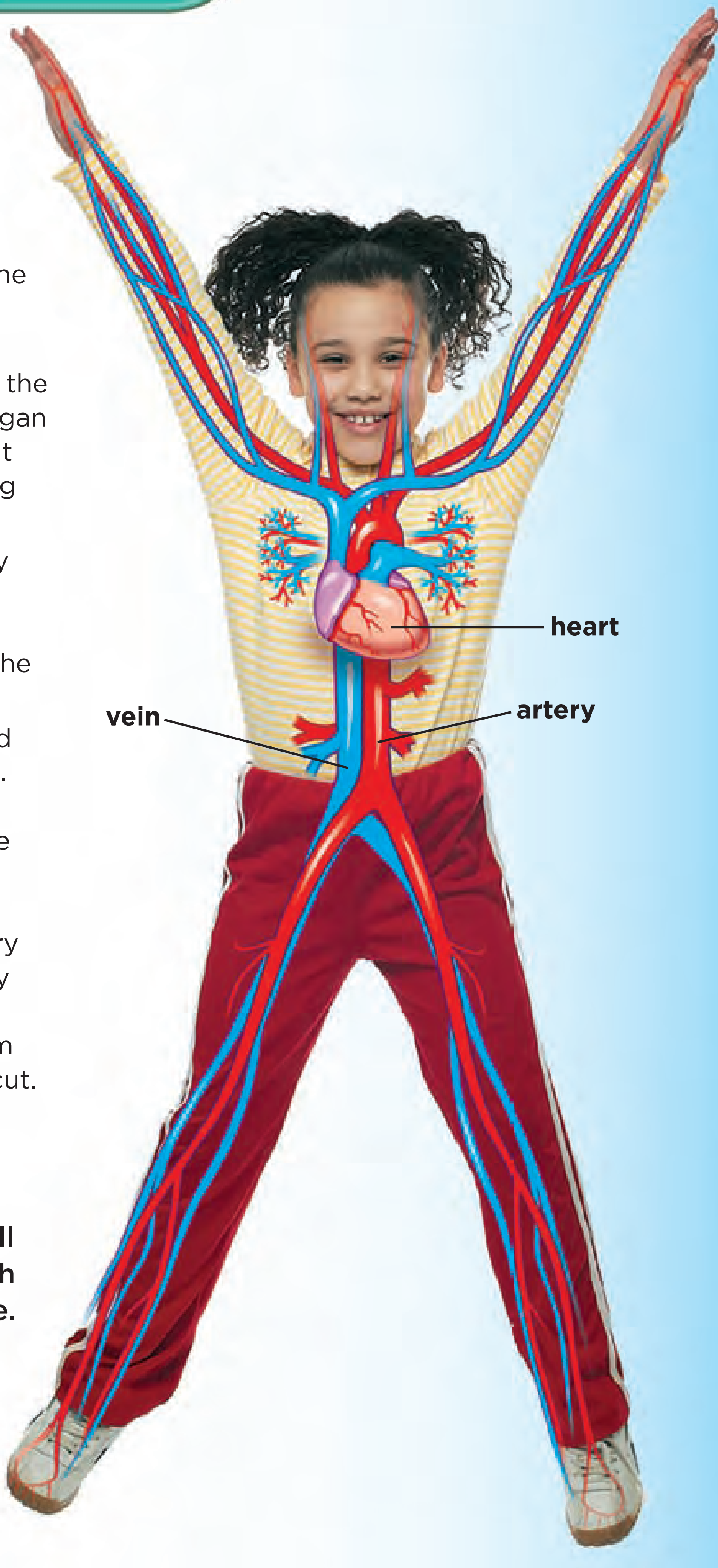
The Circulatory System

The body's cells need a constant supply of oxygen and nutrients. The circulatory (SUR•kyuh•luh•tawr•ee) system is responsible for sending these things throughout the body. The circulatory system is made up of the heart, blood vessels, and blood.

Blood rich in oxygen travels from the lungs to the heart. The heart is an organ about the size of a fist. It beats about 70 to 90 times each minute, pumping blood through the blood vessels.

Blood vessels are tubes that carry blood. There are two main types of blood vessels. Arteries are blood vessels that carry blood away from the heart. Veins carry blood back to it.

Blood contains plasma, red blood cells, white blood cells, and platelets. Plasma is the liquid part of blood. It carries nutrients and other things the body needs. Red blood cells carry oxygen to all the cells of your body. Red blood cells and plasma also carry wastes, such as carbon dioxide, away from cells. White blood cells work to fight disease. Platelets keep you from bleeding too much when you get a cut.



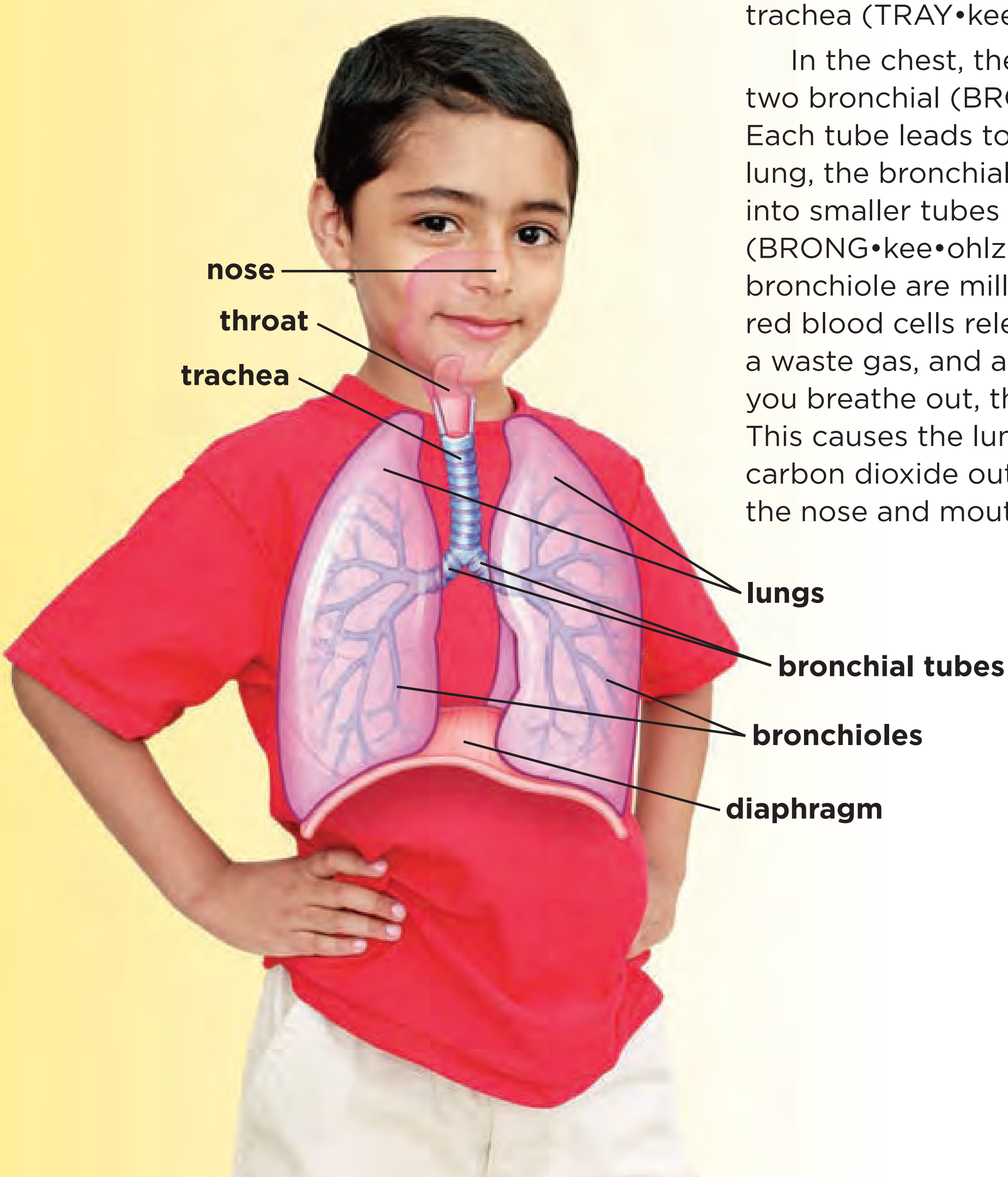
This is how a red blood cell looks through a microscope.

The Respiratory System

The respiratory (RES•puhr•uh•tawr•ee) system helps the body take in oxygen and give off carbon dioxide and other waste gases. All of the cells in your body require oxygen to work properly. You take in oxygen from the air when you breathe.

Every time you inhale, a muscle called the diaphragm (DYE•uh•fram) contracts. This makes room in your lungs for air. Air is taken in through the nose or mouth. This air travels down the throat into the trachea (TRAY•kee•uh).

In the chest, the trachea splits into two bronchial (BRONG•kee•uhl) tubes. Each tube leads to a lung. Inside each lung, the bronchial tube branches off into smaller tubes called bronchioles (BRONG•kee•ohlz). At the end of each bronchiole are millions of tiny air sacs. Here, red blood cells release carbon dioxide, a waste gas, and absorb oxygen. When you breathe out, the diaphragm relaxes. This causes the lungs to deflate and push carbon dioxide out of your body through the nose and mouth.



Human Body Systems

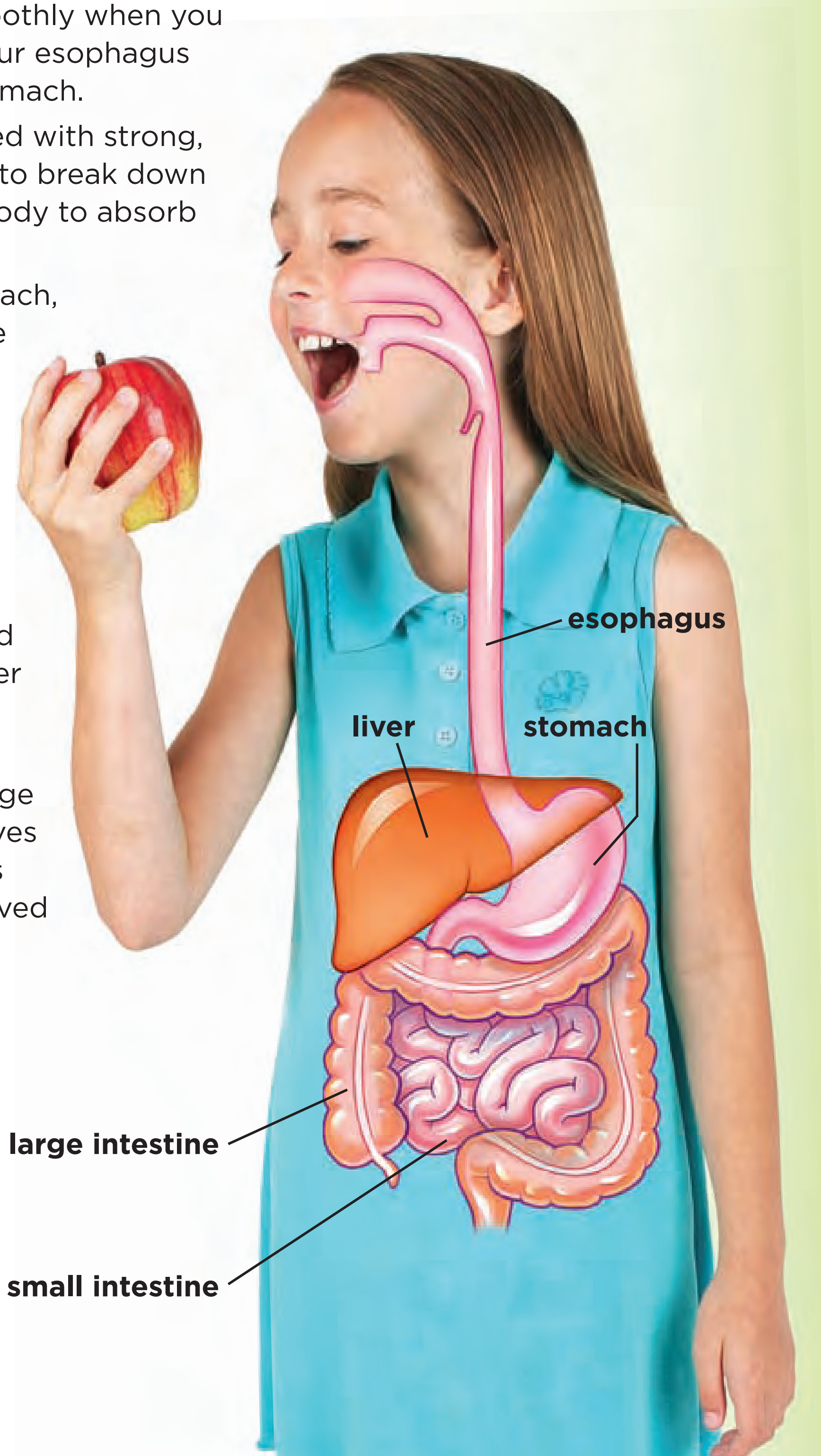
The Digestive System

The digestive (dye•JES•tiv) system is responsible for breaking down food into nutrients the body can use. Digestion begins when you chew food. Chewing breaks food into smaller pieces and moistens it with saliva. Saliva helps food travel smoothly when you swallow. The food travels down your esophagus (i•SOF•uh•guhs) and into your stomach.

Inside the stomach food is mixed with strong, acidic juices. This causes the food to break down further, making it easier for your body to absorb nutrients from the food.

After passing through the stomach, food moves into the small intestine (in•TES•tin). This is where most nutrients are absorbed. The small intestine is a narrow tube about 6 meters (20 feet) long. It is coiled tightly so it fits inside the body. As food passes through the small intestine, digested nutrients are absorbed into the blood. The blood then carries these nutrients to other parts of the body.

After food has passed through the small intestine, it enters the large intestine. The large intestine removes water from the unused food that is left. Then the unused food is removed from the body as waste.



The Excretory System

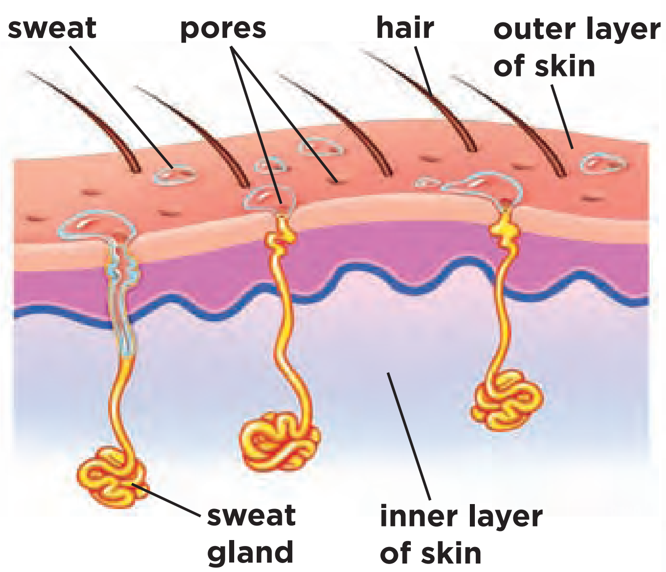
The excretory (EK•skri•tawr•ee) system gets rid of waste products from your cells. Waste products are materials the body does not need, such as extra water and salts. The liver, kidneys, bladder, and skin are some organs of the excretory system.

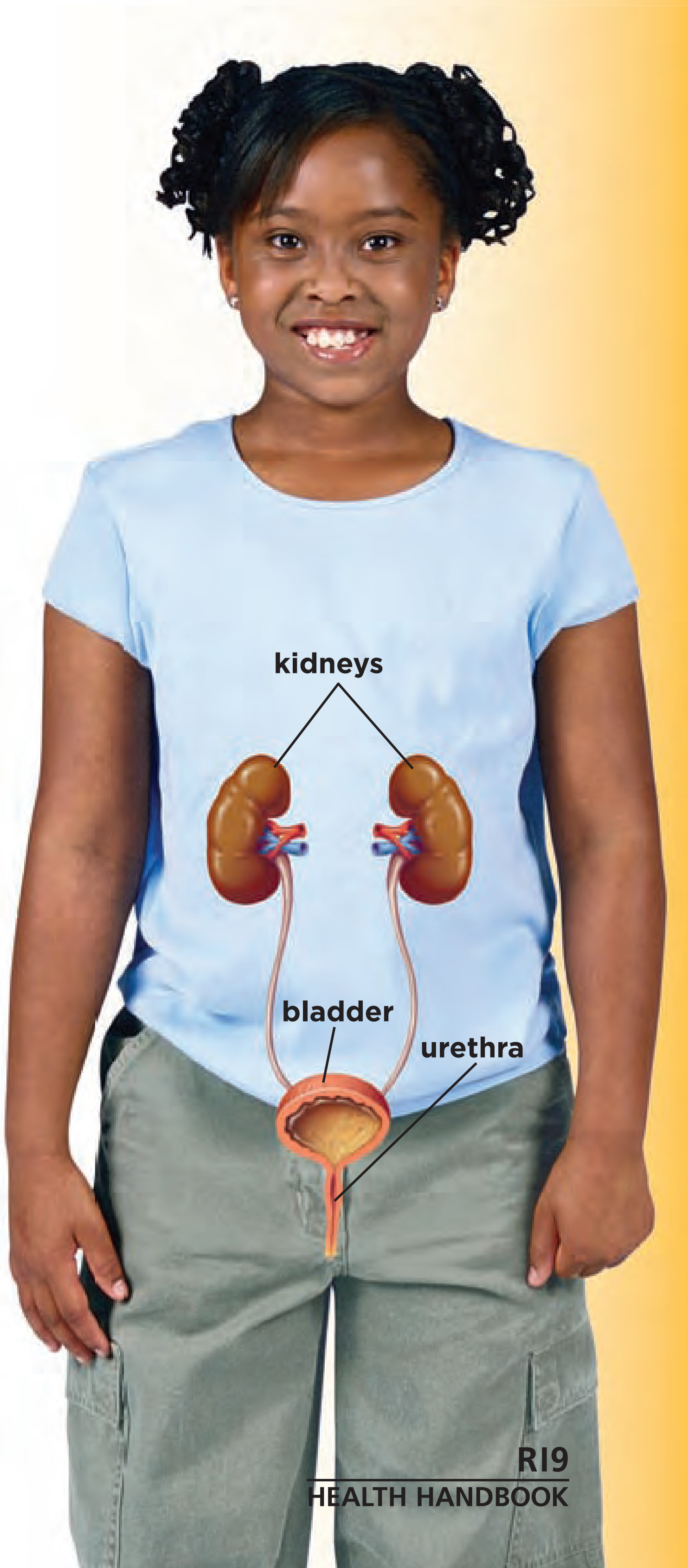
Liver, Kidneys, and Bladder

The liver filters wastes from the blood. It changes wastes into a chemical call urea and sends the urea to the kidneys. Kidneys turn urea into urine. Urine flows from the kidney to the bladder. It is stored in the bladder until it is pushed out of the body through the urethra.

Skin

The skin takes part in excretion when a person sweats. Sweat glands in the inner layer of skin produce sweat. Sweat is made up of water and minerals that the body does not need. Sweat is excreted onto the outer layer of the skin. Sweating cools the body and helps it maintain an internal temperature of about 98°F (37°C).



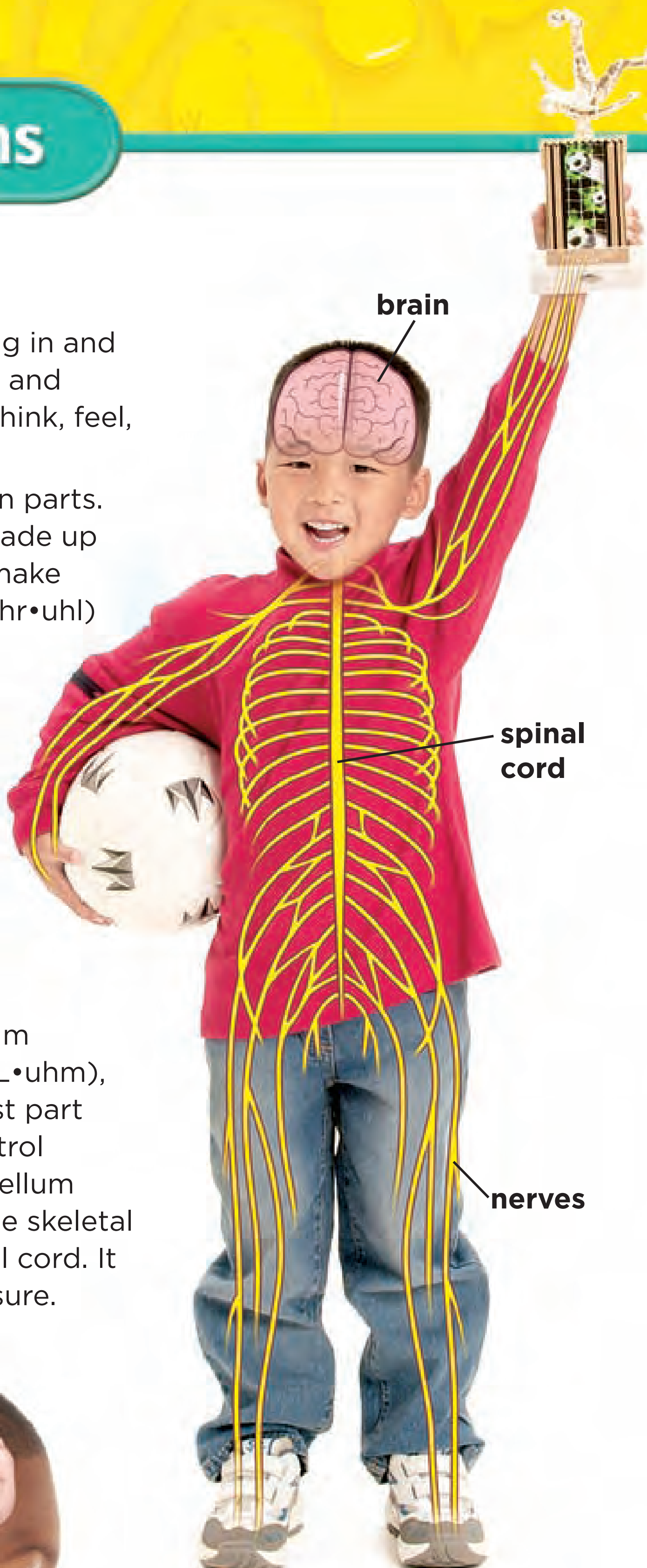


Human Body Systems

The Nervous System

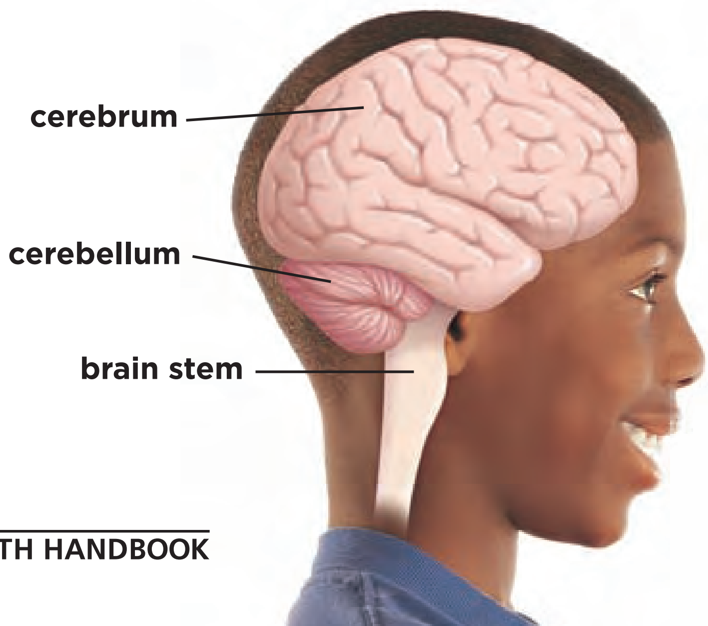
The nervous system is responsible for taking in and responding to information. It controls muscles and helps the body balance. It allows a person to think, feel, and even dream.

The nervous system is made up of two main parts. The first part, the central nervous system, is made up of the brain and spinal cord. All other nerves make up the second part, the peripheral (puh•RIF•uhr•uhl) nervous system. Nerves from the peripheral nervous system receive sensory information from cells in the body. They pass this information on to the brain through the spinal cord. When the brain receives this information, it makes decisions about how the body should respond. Then it passes this new information back through the spinal cord to the nerves, and the body responds.



The Brain

The brain has three main parts, the cerebrum (suh•REE•bruhm), the cerebellum (ser•uh•BEL•uhm), and the brain stem. The cerebrum is the largest part of the brain. It stores memories and helps control information received by the senses. The cerebellum helps the body keep its balance and directs the skeletal muscles. The brain stem connects to the spinal cord. It controls heartbeat, breathing, and blood pressure.



The Senses

Different nerves in the body take in information from the environment. These nerves are responsible for the body's sense of sight, hearing, smell, taste, and touch.

Sight

Light reflects off an object, such as a leaf, and into the eye. The reflected light passes through the pupil in the iris. Cells in the eye change light into electrical signals. The signals travel through the optic nerve to the brain.

Hearing

Sound waves enter the outer ear. They reach the eardrum and cause it to vibrate. Cells in the ear change the sound waves into electrical signals. The signals travel along the auditory nerve to the brain.

Smell

As a person breathes, chemicals in the air mix with mucus in the upper part of the nose. When they reach certain cells in the nose, those cells send information along the olfactory nerve to the brain.

Taste

On the tongue are more than 10,000 tiny bumps, called taste buds. Each taste bud can sense four main tastes—sweet, sour, salty, and bitter. The taste buds send information along a nerve to the brain.

Touch

Different nerve cells in the skin give the body its sense of touch. They help a person tell hot from cold, wet from dry, and hard from soft. Each cell sends information to the spinal cord. The spinal cord then sends the information to the brain.

Human Body Systems

Immune System

The immune system protects the body from germs. Germs cause disease and infection. Most of the time, the immune system is able to prevent germs from entering the body. Skin, tears, and saliva are parts of the immune system. They work to kill germs and keep them out of the body.

When germs do find a way into your body, white blood cells help find and kill them quickly before you become ill. White blood cells are part of the blood. They travel through blood vessels and lymph (LIMF) vessels. Lymph vessels are similar to blood vessels. However, instead of carrying blood, they carry a fluid called lymph. Many white blood cells are made and live in lymph nodes. Here, they filter out harmful materials from the body.

White blood cells are not always able to kill germs before the germs start to reproduce in your body. When germs reproduce, they cause illness. Even while you feel ill, the immune system works to kill and remove germs until you are well again.

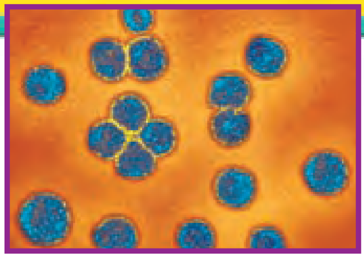
This is how a white blood cell looks through a microscope.

Viruses and Bacteria

One of the main types of germs that makes the body ill are viruses. Illness from a virus like a cold or flu can be a big deal. Yet, viruses themselves are very small. In fact, you need a special microscope, an electron microscope, to look at a virus.

Viruses need to be inside living cells, called hosts, in order to reproduce. As they reproduce, viruses take nutrients and energy from the cell. They can even produce harmful materials that make the body itch or have dangerously high temperatures.

The other main type of germ that can make the body ill is bacteria. Bacteria are tiny, one-celled organisms. They can live on most surfaces and are able to reproduce outside of cells. Some bacteria can have a harmful effect on the body. Other bacteria, however, are good for the body. Some bacteria in your body, for example, help you digest food.



▲ **A cold virus as seen through a microscope.**

▲ ***E. coli* bacteria as seen through a microscope.**

You can help your body defend itself against germs. Here's what you can do.

▶ Eat healthful foods. This helps your body get all of the nutrients it needs to stay healthy. A healthy body is better able to fight germs.

▶ Be active. Being active makes your body fit. A fit body is better able to fight germs.

▶ Get a yearly check-up. Make sure you get all of your immunizations. Follow directions when taking medicines given to you by a doctor.

▶ Get plenty of rest. You need about 10 hours of sleep every night. Sleeping helps repair your body. Get extra rest when you are ill.

▶ Do not share cups or utensils with other people. Germs can be on objects you touch. Wash your hands, especially before eating and drinking. By washing your hands, you kill germs and make it harder for harmful things to get into your body.

Nutrients

Nutrients are materials in foods that help the body grow, get energy, and stay healthy. By eating a balance of healthful foods, your body gets the nutrients it needs to do all of these things.

There are six kinds of nutrients—carbohydrates, vitamins, minerals, proteins, water, and fats. Each nutrient helps the body in different ways.

carbohydrates

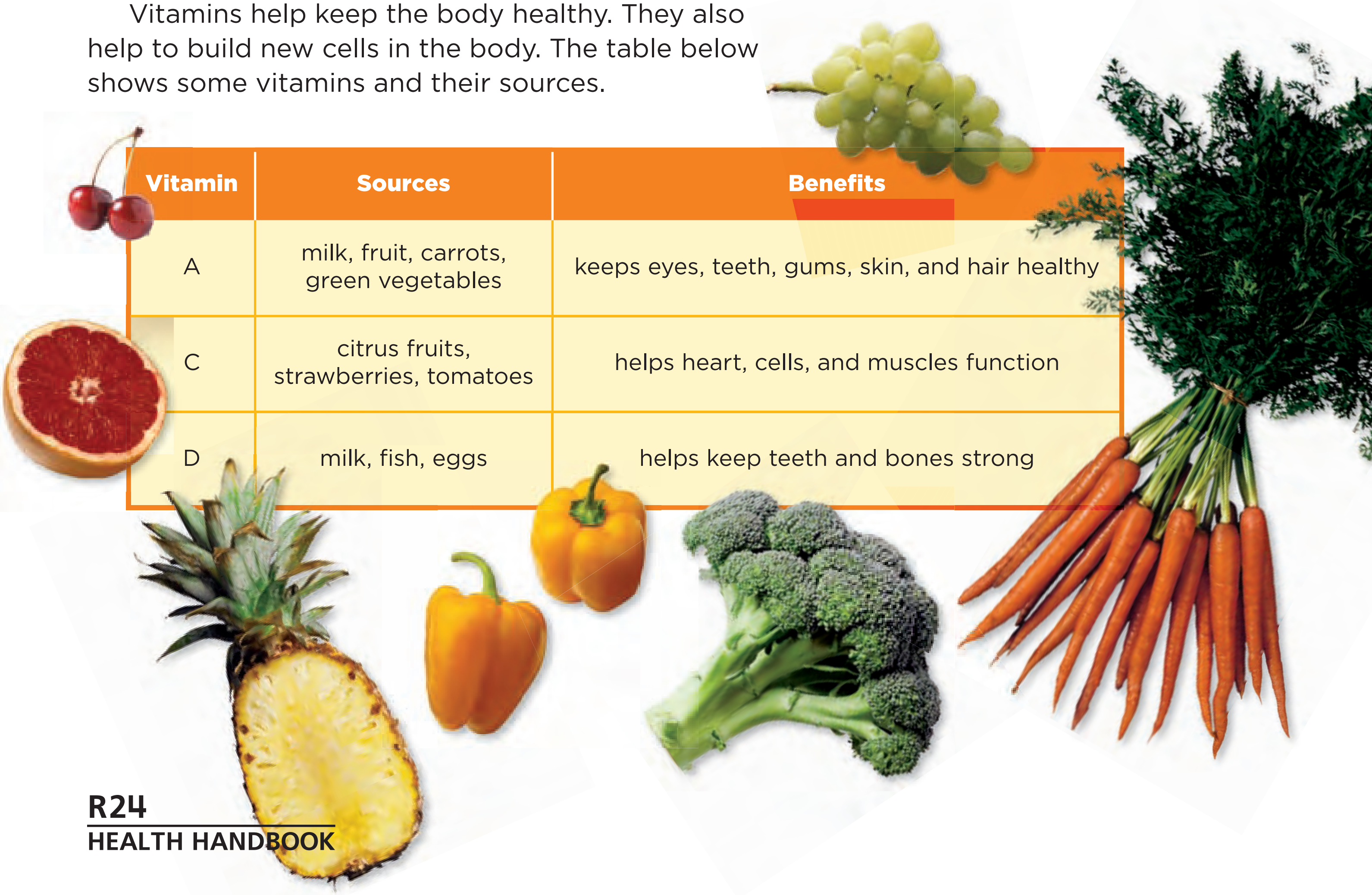
Carbohydrates

Carbohydrates are the main source of energy for the body. Starches and sugars are two types of carbohydrates. Starches come from foods like bread, pasta, and cereal. They provide long-lasting energy. Sugars come from fruits and can be used immediately by the body for energy.

Vitamins

Vitamins help keep the body healthy. They also help to build new cells in the body. The table below shows some vitamins and their sources.

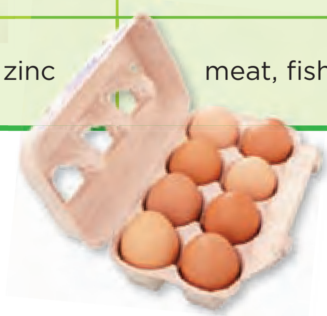
Vitamin	Sources	Benefits
A	milk, fruit, carrots, green vegetables	keeps eyes, teeth, gums, skin, and hair healthy
C	citrus fruits, strawberries, tomatoes	helps heart, cells, and muscles function
D	milk, fish, eggs	helps keep teeth and bones strong



Minerals

Minerals help form new bone and blood cells. They also help your muscles and nervous system work properly. Here are some minerals and their sources.

Mineral	Sources	Benefits
calcium	yogurt, milk, cheese, and green vegetables	builds strong teeth and bones
iron	meat, beans, fish, whole grains	helps red blood cells function properly
zinc	meat, fish, eggs	helps your body grow and helps to heal wounds



Fats

Fats help the body use other nutrients and store vitamins. Fats also help the cells of the body to work properly. They even help keep the body warm. Fats can be found in foods such as meats, eggs, milk, butter, and nuts. Oils also contain fats. Though some fats help the body, some fats can cause health problems.

fats

Water

Water is one of the most important nutrients. About $\frac{2}{3}$ of the body is made up of water! Water makes up most of the body's cells. It helps the body remove waste and protects joints. It also prevents the body from getting too hot.

Proteins

Proteins are a part of every living cell. Proteins help bones and muscles grow. They even help the immune system fight diseases. Foods high in protein are milk, eggs, meats, fish, nuts, and cheese.

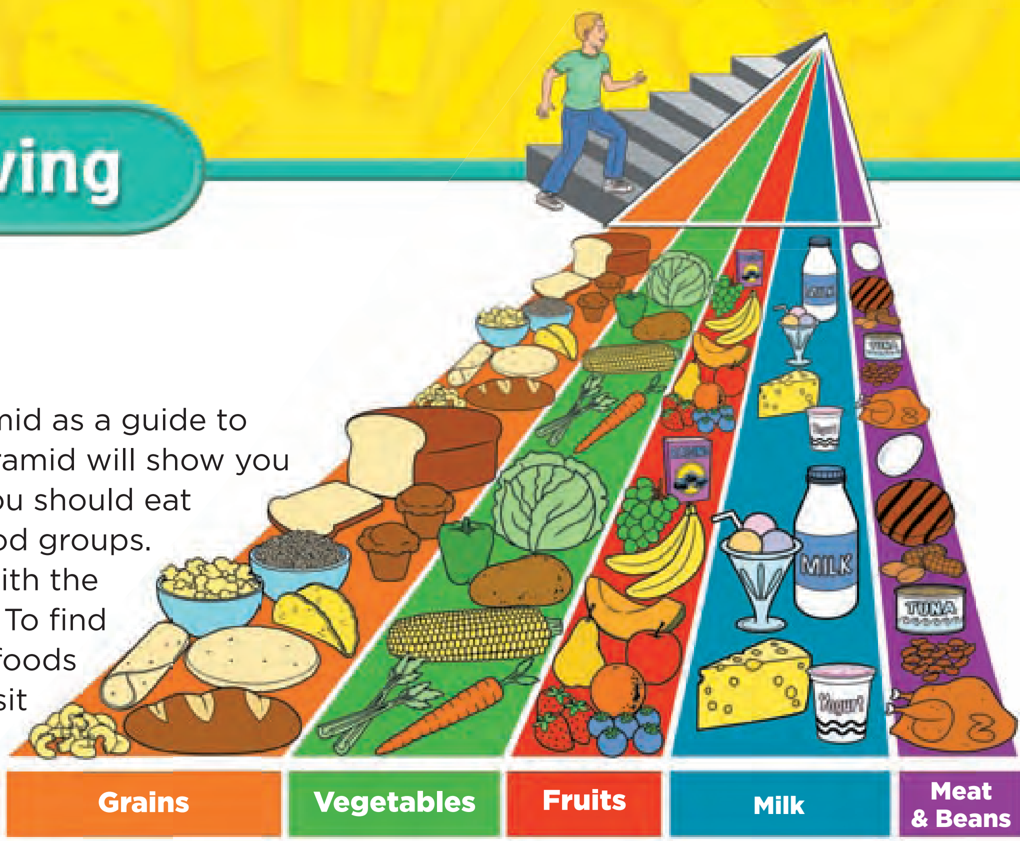
proteins

Healthy Living

Stay Fit

MyPyramid

You can use MyPyramid as a guide to healthful eating. The pyramid will show you the amounts of foods you should eat from each of the five food groups. A food group is foods with the same kinds of nutrients. To find the correct amounts of foods that are right for you, visit www.MyPyramid.gov



Be Drug-Free

Do not use cigarettes, illegal drugs, or alcohol. These things can harm your body. They can keep you from growing properly and becoming fit.

Be Physically Active

You need to be physically active for at least 60 minutes every day. When you are physically active, you become physically fit. When you are physically fit, your heart, lungs, bones, joints, and muscles stay strong. You keep a healthful weight and lower the risk of disease. You do not have to be on a sports team to be physically active. You just need to move your body. Running, biking, and swimming are just some ways to be physically active.

FOLDABLES™

by Dinah Zike

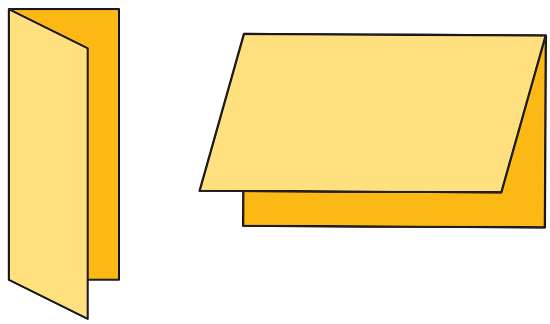
Folding Instructions

The following pages offer step-by-step instructions about how to make Foldables study guides.

Half-Book

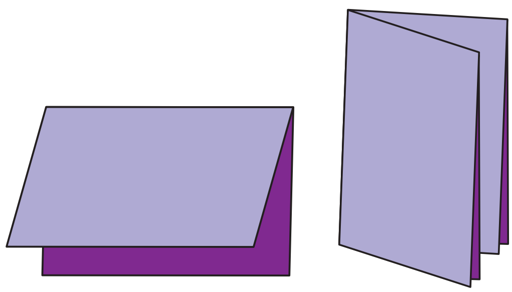
Fold a sheet of paper ($8\frac{1}{2}$″ x 11″) in half.

1. This book can be folded vertically like a hot dog or . . .
2. . . . it can be folded horizontally like a hamburger.



Folded Book

1. Make a Half-Book.
2. Fold in half again like a hamburger. This makes a ready-made cover and two small pages inside for recording information.

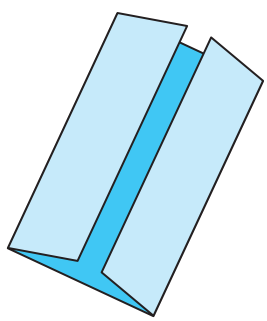


Pocket Book

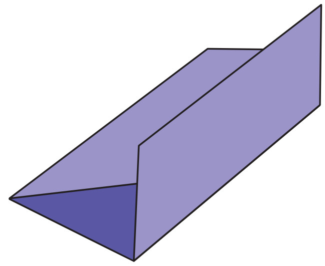
1. Fold a sheet of paper ($8\frac{1}{2}$″ x 11″) in half like a hamburger.
2. Open the folded paper and fold one of the long sides up two inches to form a pocket. Refold along the hamburger fold so that the newly formed pockets are on the inside.
3. Glue the outer edges of the two-inch fold with a small amount of glue.

Shutter Fold

1. Begin as if you were going to make a hamburger, but instead of creasing the paper, pinch it to show the midpoint.
2. Fold the outer edges of the paper to meet at the pinch, or midpoint, forming a Shutter Fold.

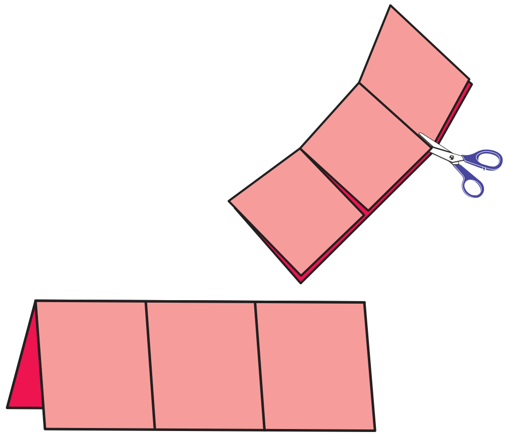


Trifold Book



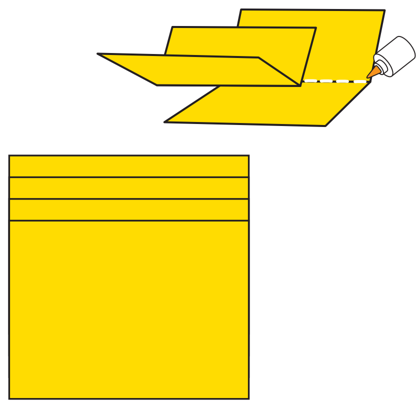
1. Fold a sheet of paper ($8\frac{1}{2}$″ x 11″) into thirds.
2. Use this book as is or cut into shapes.

Three-Tab Book



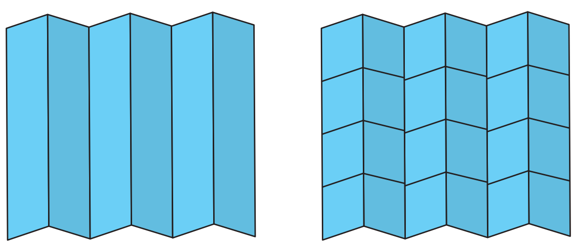
1. Fold a sheet of paper like a hot dog.
2. With the paper horizontal and the fold of the hot dog up, fold the right side toward the center, trying to cover one half of the paper.
3. Fold the left side over the right side to make a book with three folds.
4. Open the folded book. Place one hand between the two thicknesses of paper and cut up the two valleys on one side only. This will create three tabs.

Layered-Look Book



1. Stack two sheets of paper ($8\frac{1}{2}$″ x 11″) so that the back sheet is one inch higher than the front sheet.
2. Bring the bottoms of both sheets upward and align the edges so that all of the layers or tabs are the same distance apart.
3. When all the tabs are an equal distance apart, fold the papers and crease well.
4. Open the papers and glue them together along the valley, or inner center fold, or staple them along the mountain.

Folded Table or Chart

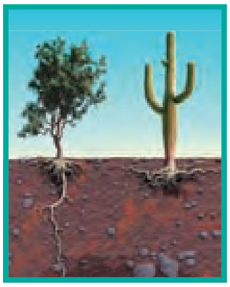


1. Fold the number of vertical columns needed to make the table or chart.
2. Fold the horizontal rows needed to make the table or chart.
3. Label the rows and columns.

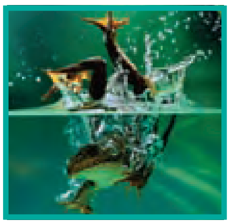
Glossary

Use this glossary to learn how to pronounce and understand the meanings of Science Words used in this book. The page number at the end of each definition tells you where to find that word in the book.

A

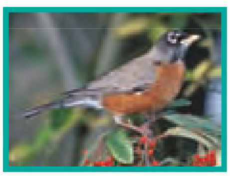


adaptation (a′dəp·tā′shən) A structure or behavior that helps a living thing survive in its environment. (p. 100) *Sharp spines are one adaptation that helps a cactus survive.*



amphibian (am·fib′ē·ən) A vertebrate that spends part of its life in water and part of its life on land. (p. 51)

B



bird (bûrd) A vertebrate that has a beak, feathers, wings, and two legs and lays eggs. (p. 50)

C

camouflage (kam′ə·fläzh′) An adaptation that allows an organism to blend into its surroundings. (p. 100)

cell (sel) The basic building block that makes up all living things. (p. 30) *You can use a microscope to see that a leaf is made up of many tiny cells.*

climate (klī′mət) The pattern of weather at a certain place over a long time. (p. 86) *This desert has a hot, dry climate.*

Pronunciation Key

The following symbols are used throughout the Macmillan/McGraw-Hill Science Glossaries.

a	**a**t	e	**e**nd	o	h**o**t	u	**u**p	hw	**wh**ite	ə	**a**bout
ā	**a**pe	ē	m**e**	ō	**o**ld	ū	**u**se	ng	so**ng**		tak**e**n
ä	f**a**r	i	**i**t	ôr	f**or**k	ü	r**u**le	th	**th**in		penc**i**l
âr	c**a**re	ī	**i**ce	oi	**oi**l	ů	p**u**ll	<u>th</u>	**th**is		lem**o**n
ô	l**a**w	îr	p**ier**ce	ou	**ou**t	ûr	t**ur**n	zh	mea**s**ure		circ**u**s

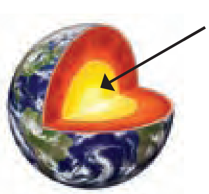
′ = primary accent; shows which syllable takes the main stress, such as **kil** in **kilogram** (kil′ e gram′).
′ = secondary accent; shows which syllables take lighter stresses, such as **gram** in **kilogram**.

community (kə·mū′ni·tē) All the living things in one place that interact. (p. 134) *All the organisms in this pond make up a community.*

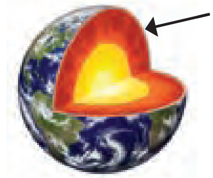
competition (kom′pə·tish′ən) The struggle among organisms for water, food, or other needs. (p. 121) *There is competition for water between these springbok.*

consumer (kən·sü′mər) An animal that eats plants or other animals. (p. 77) *Eagles eat fish, snakes, and other small organisms so they are consumers.*

continent (kon′tə·nənt) A great area of land on Earth. (p. 167) *You live on the continent of North America.*



core (kôr) Earth's deepest and hottest layer. (p. 172)



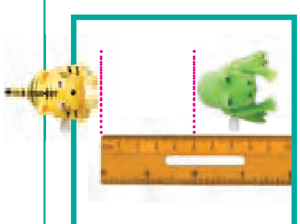
crust (krust) Earth's outermost layer. (p. 172)

D

decomposer (dē′kəm·pō′zər) An organism that breaks down dead plant and animal material. (p. 77) *Worms are decomposers that eat dead leaves that fall to the ground.*

deposition (dep′ə•zi′shən) The dropping off of weathered rock. (p. 180)

desert (dez′ərt) A sandy or rocky ecosystem with little rainfall and little plant life. (p. 88)



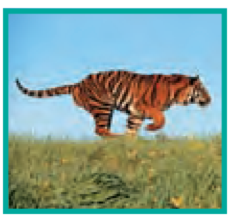
distance (dis′təns) The amount of space between two objects or places. (p. 241) *The distance between these two toys is five centimeters.*

drought (drout) When there is an unusual lack of rain in an area for a long period of time. (p. 130)

E

ecosystem (ē′kō·sis′təm) The living and nonliving things that share an environment and interact. (p. 74)

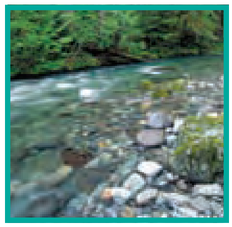
egg (eg) An animal structure that protects and feeds some very young animals such as birds. (p. 59)



endangered (en·dān′jərd) Having very few of a kind of organism left; close to becoming extinct. (p. 136) *Bengal tigers are endangered animals because there are very few of them left in the world.*

energy (en′ər·jē) The ability to do work. (p. 262) *Energy from this bowling ball causes the pins to fall over.*

environment (en·vī′rən·mənt) All the living and nonliving things that surround an organism. (p. 28) *Water, soil, rocks, trees, and zebras are parts of the giraffes' environment.*



erosion (i·rō′zhən) The movement of weathered rock. (p. 180) *Erosion happens when water in this stream carries rocks away.*

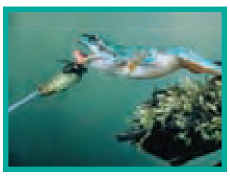
exoskeleton (ek′sō·skel′i·tən) A hard covering, or shell, that holds up and protects an invertebrate's body. (p. 49) *A snail's shell is an exoskeleton.*

extinct (ek·stingkt′) Died out, leaving no more of that type of organism alive. (p. 142) *Many dinosaurs became extinct millions of years ago.*

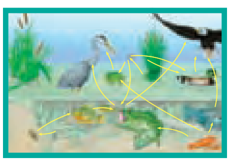
F

fish (fish) A vertebrate that lives in water and breathes oxygen with gills. (p. 51)

flood (flud) Water flowing over land that is usually dry. (p. 130)

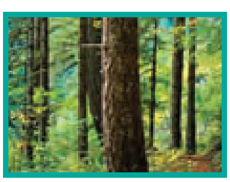


food chain (füd chān) A series of organisms that depend on one another for food. (p. 76)



food web (füd web) Several food chains that are connected. (p. 78)

force (fôrs) A push or a pull. (p. 250)



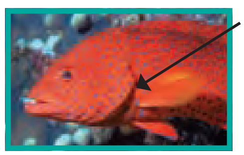
forest (fôr′ist) An ecosystem with many trees. (p. 90)

fossil (fos′əl) The trace or remains of something that lived long ago. (pp. 142, 216)

friction (frik′shən) A force that occurs when one object rubs against another. (p. 254) *Friction between a break pad and a rim stops a bike.*

fuel (fū′əl) A material that is burned for energy. (p. 218) *Wood and gasoline are examples of fuels.*

G



gills (gilz) A structure some animals use to take in oxygen from water. (p. 39)

glacier (glā′shər) A large sheet of ice that moves slowly over land. (p. 180)

gravity (grav′i·tē) A pulling force between two objects, such as you and Earth. (p. 253) *Gravity pulls these skydivers toward Earth.*

H

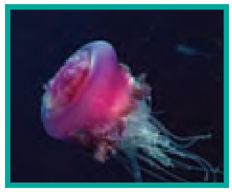
habitat (hab′i·tat′) The home of a living thing. (p. 75) *A coral reef is a habitat for many fish.*

hibernate (hī′bər·nāt) To rest or sleep through the cold winter. (p. 105)

humus (hū′məs) Decayed plant and animal material in soil. (p. 206) *Humus makes soil look dark.*

I

igneous rock (ig′nē·es rok) A rock that forms when melted rock cools and hardens. (p. 197)

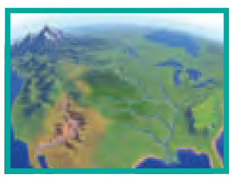


invertebrate (in·vûr′tə·brāt) An animal that does not have a backbone. (p. 47)

K

kinetic energy (ki·net′ik en′ûr·jē) Energy in the form of motion. (p. 262)

L



landform (land′fôrm′) A feature of land on Earth's surface. (p. 168)

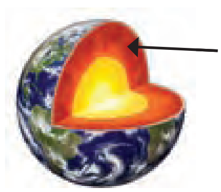
larva (lär′və) The stage in some insects' life cycles which comes after hatching. (p. 59)

lung (lung) A structure some animals use to take in oxygen from air. (p. 39) *Humans breathe oxygen using lungs.*

M

magnet (mag′nit) An object with a magnetic force; magnets can attract or repel certain metals. (p. 252)

mammal (mam′əl) A vertebrate that has hair or fur, is born live, and feeds its young with milk. (p. 52)



mantle (man′təl) The layer of Earth below the crust. (p. 172)

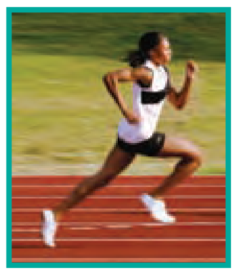
metamorphic rock (met′ə·môr′fik rok) A kind of rock that has been changed by heating and squeezing. (p. 199)

metamorphosis (met′ə·môr′fə·sis) A series of changes in which an organism's body changes form. (p. 59) *A tadpole becomes a frog through metamorphosis.*

migrate (mī′grāt) To move to another place. (p. 107) *These geese migrate south when the weather gets cold.*

mimicry (mim′i·krē) An adaptation in which one kind of organism looks like another kind in color or shape. (p. 105)

mineral (min′ə rəl) A solid, nonliving substance found in nature. (p. 194)



motion (mō′shən) A change in the position of an object. (p. 242)

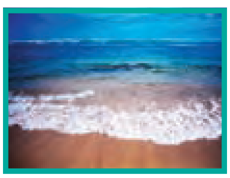
N

natural resource (nach′ər əl rē′sôrs′) A material on Earth that is necessary or useful to people. (p. 210) *Plants and soil are natural resources.*

nocturnal (nok·tûr′nəl) An adaptation in which an animal is active during the night and asleep during the day. (p. 103)

nonrenewable resource (non′ri·nü′ə·bəl rē′sôrs′) A resource that cannot be replaced or reused easily. (p. 219) *Oil is a nonrenewable resource. Once it is used up, it is gone forever.*

O



ocean (ō′shən) A large body of salt water. (pp. 92, 166)

organism (ōr′gə·niz·əm) A living thing. (p. 26) *Koala bears and eucalyptus trees are organisms.*

P

pollution (pə·lü′shən) What happens when harmful materials get into water, air, or land. (p. 122)

population (pop′yə·lā′shən) All the members of a single type of organism in an ecosystem. (p. 134)

position (pə·zish′ən) The location of an object. (p. 240)

potential energy (pə·ten′shəl en′ûr·jē) Energy that is stored or waiting to be used. (p. 262) *A sled at the top of a hill has potential energy.*

producer (prə·dü′sər) An organism, such as a plant, that makes its own food. (p. 76)

pupa (pū′pə) The stage of some insects' life cycles before becoming an adult. (p. 59)

R

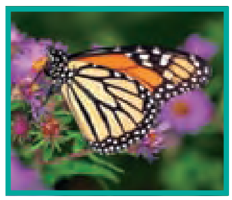
recycle (rē·sī′kəl) To turn old things into new things. (p. 124) *Plastic can be recycled to make new bottles and other products.*

reduce (ri·düs′) To use less of something. (p. 124) *When you fix a leaky faucet, you reduce your use of water.*

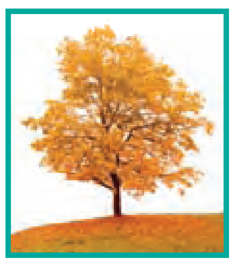
renewable resource (ri·nü′ə·bəl rē′sôrs′) A resource that can be replaced or used again and again. (p. 219) *Wind is a renewable resource.*

reproduce (rē′prə·düs′) To make more of one's own kind. (p. 27)

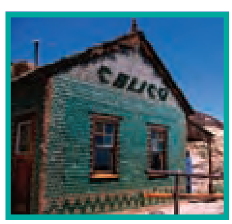
reptile (rep′tīl) A vertebrate that has scaly, waterproof skin, breathes air with lungs, and lays eggs. (p. 50)



resource (rē′sôrs) Substances in the environment that help an organism survive. (p. 120) *Flowers are a resource for butterflies.*



respond (ri·spond′) To react to something. (p. 26) *When the weather gets cool in the fall, this tree responds by losing its leaves.*



reuse (rē·ūz′) To use something again. (p. 124) *Old bottles were reused to make this building.*

rock (rok) A nonliving material made of one or more minerals. (p. 196)

S

sediment (sed′ə mənt) Tiny bits of weathered rock or once-living animals and plants. (p. 198)

sedimentary rock (sed′ə·mən′tə·rē rok) A kind of rock that forms from layers of sediment. (p. 198)

shelter (shel′tər) A place in which an animal can stay safe. (p. 40) *A nest is a shelter for young birds.*

soil (soil) A mixture of minerals, weathered rocks, and decayed plant and animal matter. (pp. 86, 206)

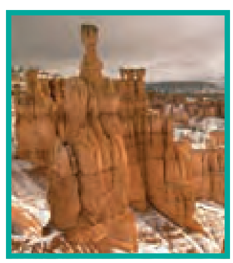
solar energy (sol′ər en′ûr·jē) Energy from the Sun. (p. 220)

speed (spēd) How fast an object moves over a certain distance. (p. 244)

V

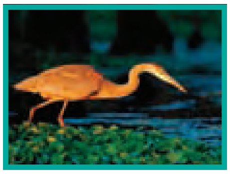
vertebrate (vûr′tə·brāt′) An animal with a backbone. (p. 46)

W



weathering (weth′ər·ing) The breaking down of rocks into smaller pieces. (p. 178) *Weathering caused these interesting rock shapes to form.*

weight (wāt) A measure of the pull of gravity on an object. (p. 253)



wetland (wetʹland) An ecosystem where water covers the soil for most of the year. (p. 94)

work (wûrk) What is done when a force changes an object's motion. (p. 260) *You do work when you move a bow to play the violin.*

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Index

Note: Pages followed by an asterisk (*) indicate activities.

A

B

F

J

K

L

M

Q

R

S

Science Content Standards

Ohio Science Benchmarks – Grades 3-5

Earth and Space Sciences (ESS)

A. Explain the characteristics, cycles and patterns involving Earth and its place in the solar system.

B. Summarize the processes that shape Earth's surface and describe evidence of those processes.

C. Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.

D. Analyze weather and changes that occur over a period of time.

Life Sciences (LS)

A. Differentiate between the life cycles of different plants and animals.

B. Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.

C. Compare changes in an organism's ecosystem/habitat that affect its survival.

Physical Sciences (PS)

A. Compare the characteristics of simple physical and chemical changes.

B. Identify and describe the physical properties of matter in its various states.

C. Describe the forces that directly affect objects and their motion.

D. Summarize the way changes in temperature can be produced and thermal energy transferred.

E. Trace how electrical energy flows through a simple electrical circuit and describe how the electrical energy can produce thermal energy, light, sound and magnetic forces.

F. Describe the properties of light and sound energy.

Science and Technology (ST)

A. Describe how technology affects human life.

B. Describe and illustrate the design process.

Scientific Inquiry (SI)

A. Use appropriate instruments safely to observe, measure and collect data when conducting a scientific investigation.

B. Organize and evaluate observations, measurements and other data to formulate inferences and conclusions.

C. Develop, design and safely conduct scientific investigations and communicate the results.

Scientific Ways of Knowing (SWK)

A. Distinguish between fact and opinion and explain how ideas and conclusions change as new knowledge is gained.

B. Describe different types of investigations and use results and data from investigations to provide the evidence to support explanations and conclusions.

C. Explain the importance of keeping records of observations and investigations that are accurate and understandable.

D. Explain that men and women of diverse countries and cultures participate in careers in all fields of science.

Grade Level Indicators – Grade 3

Earth and Space Sciences (ESS)

Earth Systems

1. Compare distinct properties of rocks (e.g., color, layering and texture).

2. Observe and investigate that rocks are often found in layers.

3. Describe that smaller rocks come from the breakdown of larger rocks through the actions of plants and weather.

4. Observe and describe the composition of soil (e.g., small pieces of rock and decomposed pieces of plants and animals, and products of plants and animals).

5. Investigate the properties of soil (e.g., color, texture, capacity to retain water, ability to support plant growth).

6. Investigate that soils are often found in layers and can be different from place to place.

Life Sciences (LS)

Heredity

1. Compare the life cycles of different animals including birth to adulthood, reproduction and death (e.g., egg–tadpole–frog, egg–caterpillar–chrysalis–butterfly).

Diversity and Interdependence of Life

2. Relate animal structures to their specific survival functions (e.g., obtaining food, escaping or hiding from enemies).

3. Classify animals according to their characteristics (e.g., body coverings and body structure).

4. Use examples to explain that extinct organisms may resemble organisms that are alive today.

5. Observe and explore how fossils provide evidence about animals that lived long ago and the nature of the environment at that time.

6. Describe how changes in an organism's habitat are sometimes beneficial and sometimes harmful.

Physical Sciences (PS)

Forces and Motion

1. Describe an object's position by locating it relative to another object or the background.

2. Describe an object's motion by tracing and measuring its position over time.

3. Identify contact/noncontact forces that affect motion of an object (e.g., gravity, magnetism and collision).

4. Predict the changes when an object experiences a force (e.g., a push or pull, weight and friction).

Science and Technology (ST)

Understanding Technology

1. Describe how technology can extend human abilities (e.g., to move things and to extend senses).

2. Describe ways that using technology can have helpful and/or harmful results.

3. Investigate ways that the results of technology may affect the individual, family and community.

Abilities To Do Technological Design

4. Use a simple design process to solve a problem (e.g., identify a problem, identify possible solutions and design a solution).

5. Describe possible solutions to a design problem (e.g., how to hold down paper in the wind).

Scientific Inquiry (SI)

Doing Scientific Inquiry

1. Select the appropriate tools and use relevant safety procedures to measure and record length and weight in metric and English units.

2. Discuss observations and measurements made by other people.

3. Read and interpret simple tables and graphs produced by self/others.

4. Identify and apply science safety procedures.

5. Record and organize observations (e.g., journals, charts and tables).

6. Communicate scientific findings to others through a variety of methods (e.g., pictures, written, oral and recorded observations).

Scientific Ways of Knowing (SWK)

Nature of Science

1. Describe different kinds of investigations that scientists use depending on the questions they are trying to answer.

Ethical Practices

2. Keep records of investigations and observations and do not change the records that are different from someone else's work.

Science and Society

3. Explore through stories how men and women have contributed to the development of science.

4. Identify various careers in science.

5. Discuss how both men and women find science rewarding as a career and in their everyday lives.

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