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"Extensive knowledge and modern science must be acquired. The educational process we see today is in an ongoing and escalating challenge which requires hard work.
We succeeded in entering the third millennium, while we are more confident in ourselves."

H.H. Sheikh Khalifa Bin Zayed Al Nahyan
President of the United Arab Emirates

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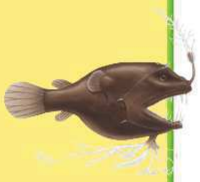
LIFE SCIENCE

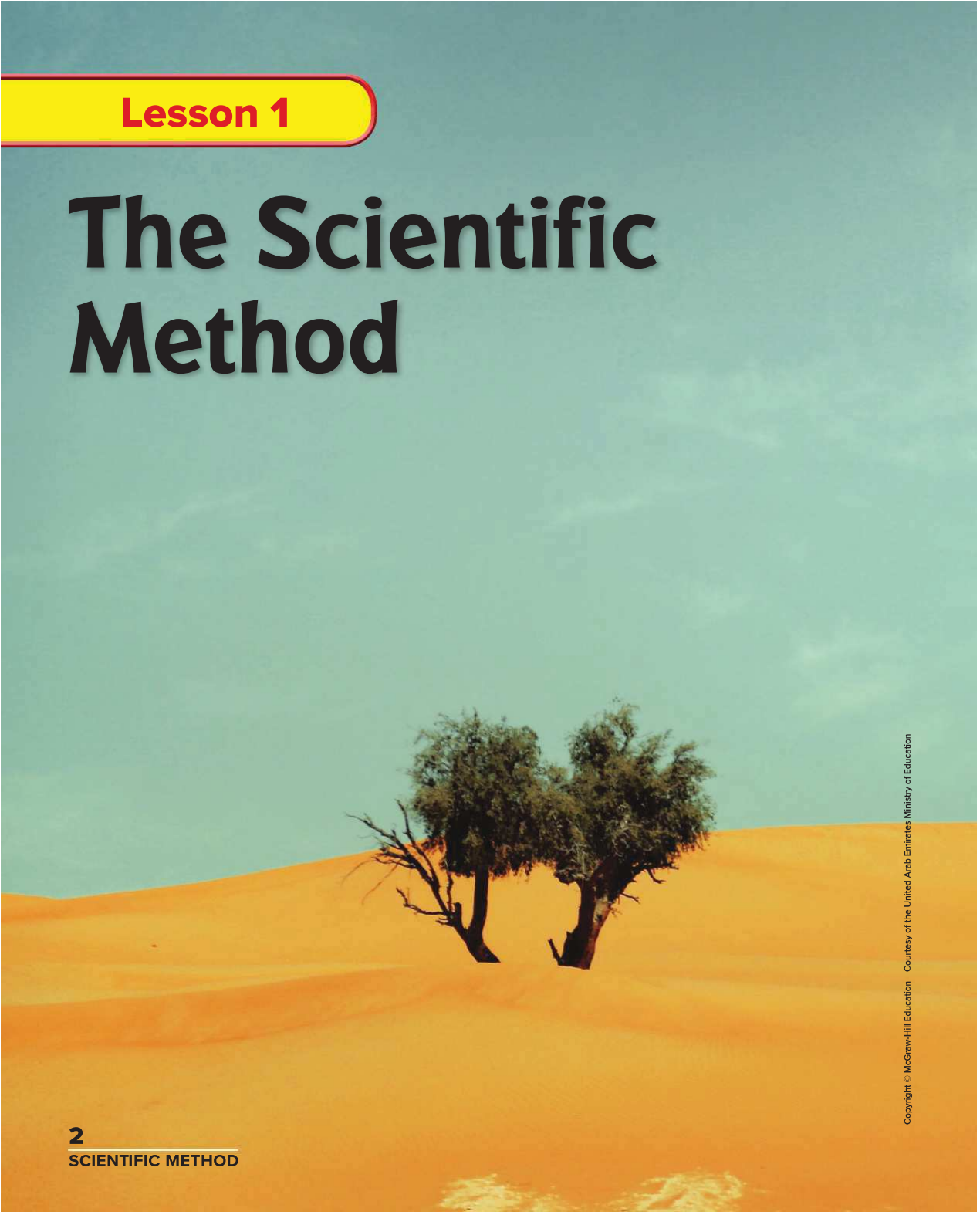


Chapter 1

Be a Scientist

Lesson 1

The Scientific Method



Look and Wonder

How can you study animals in their natural environment?

In this lesson, you will learn about Chris Raxworthy—a scientist who studies animals in their natural environment. Raxworthy works for the American Museum of Natural History in New York City and at the University of Antananarivo in Madagascar. Madagascar is a tropical island off the coast of Africa that is home to plants and animals found nowhere else on Earth.

Possible answer: I can learn where the animals live in their environment, locate the animals, and then use binoculars to observe them. I can take notes of what I observed, so I can present my findings.

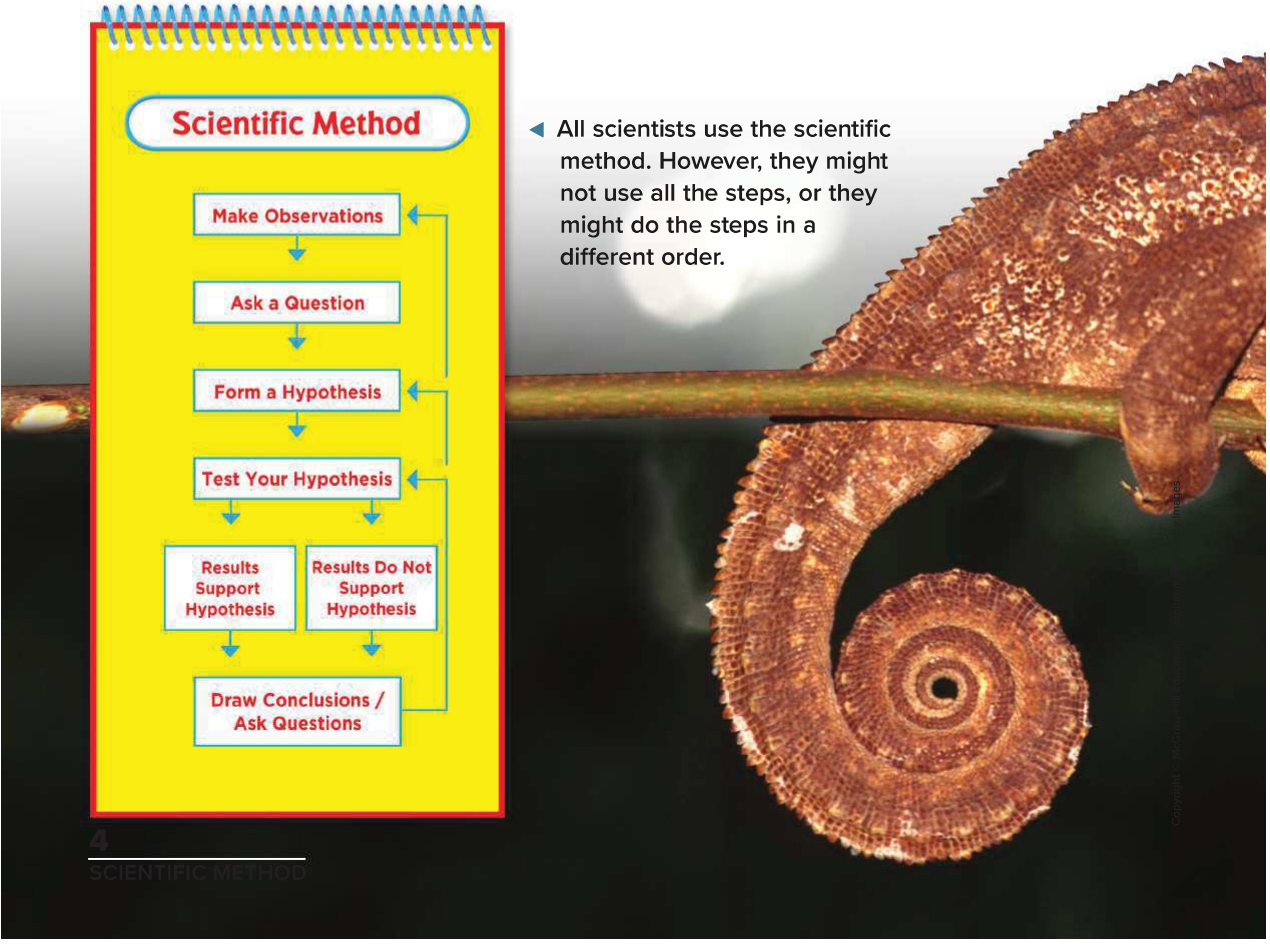
What do scientists do?

In the third paragraph, underline the question Raxworthy wants to answer.

Raxworthy wants 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, Raxworthy is studying a lizard called a giant Madagascan chameleon. He 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.

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

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

Here is Raxworthy'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.

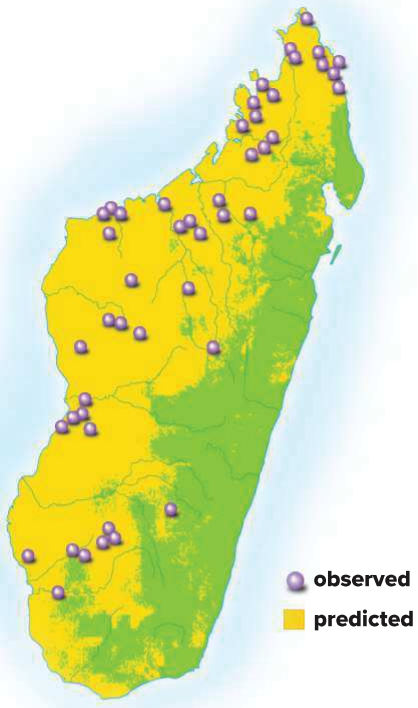
▶ **Make sure the explanations can be tested.**

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 Raxworthy look for chameleons? In order to find out, he studies his data about temperature and rainfall. Data is information. He puts this data into a computer and makes 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. Raxworthy predicts that if he goes to those areas, he 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 Raxworthy thinks the chameleons live.

Quick Check

1. How did Raxworthy know where to look for chameleons?
Possible answer: He put their data into a computer and made a map of the best search locations.

Raxworthy and others 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 Raxworthy's results.

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

Circle the two things that Raxworthy does when he finds the chameleon.

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.**

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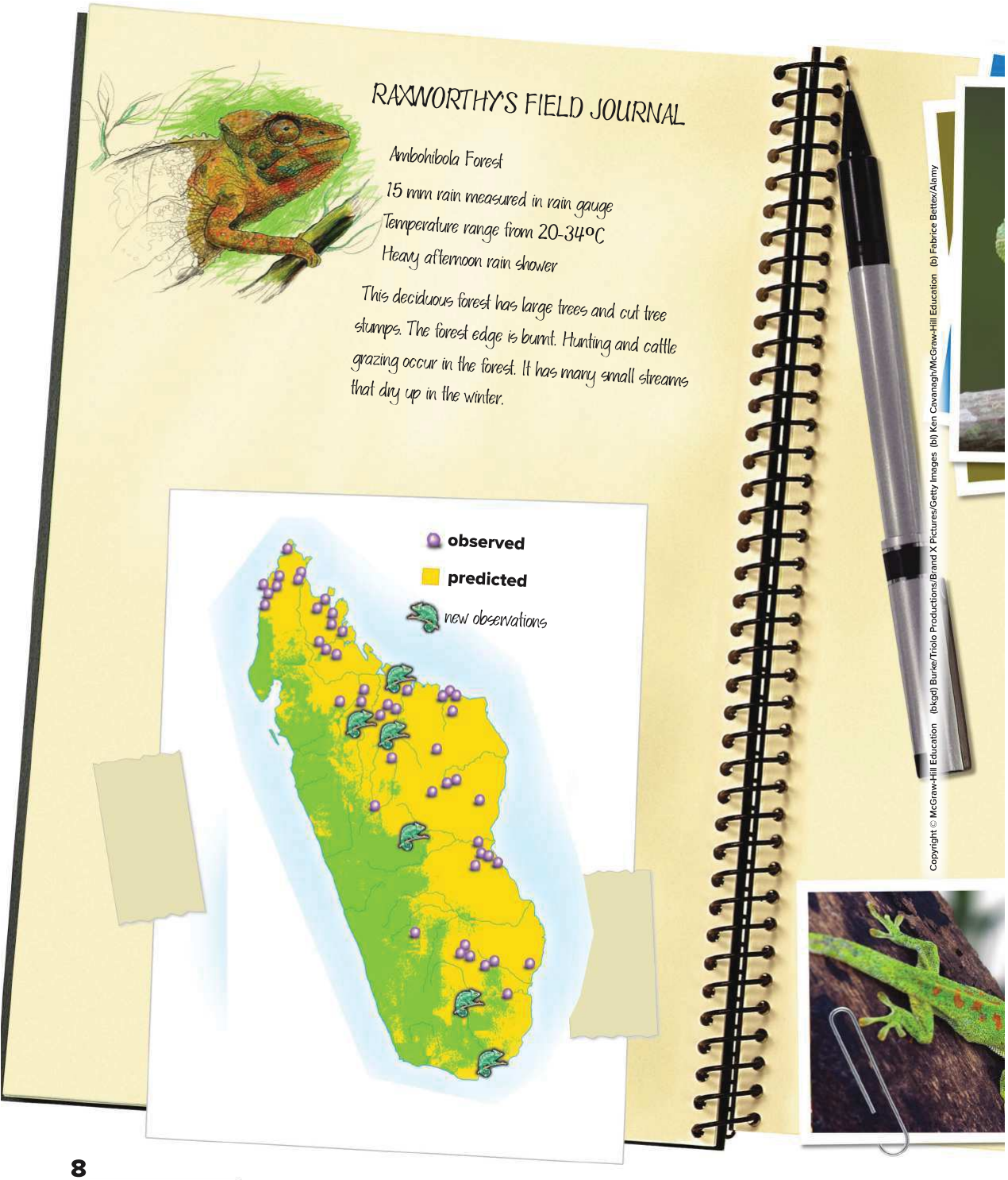
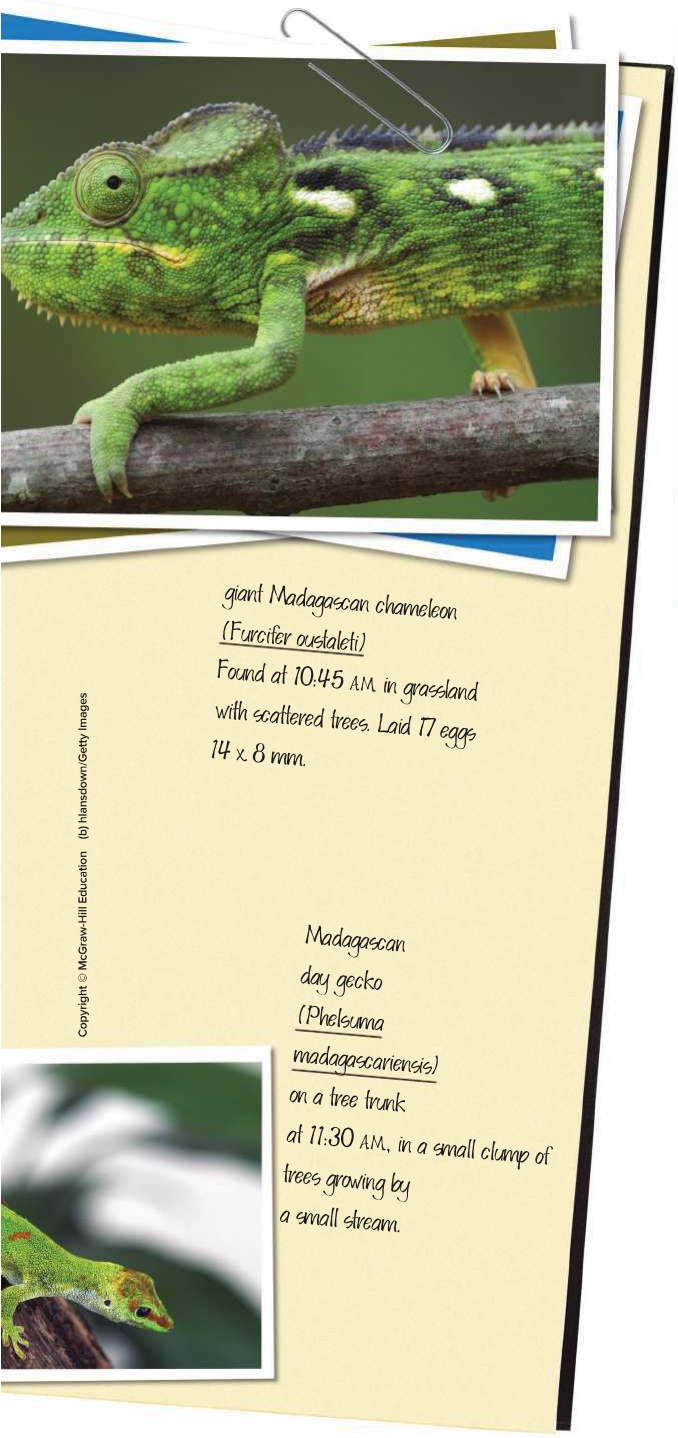




Analyze the Data

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. Raxworthy and others study the information from all of the locations they visited. They mark the six places on the map where they found a giant Madagascan chameleon. Then they look for patterns in their data.

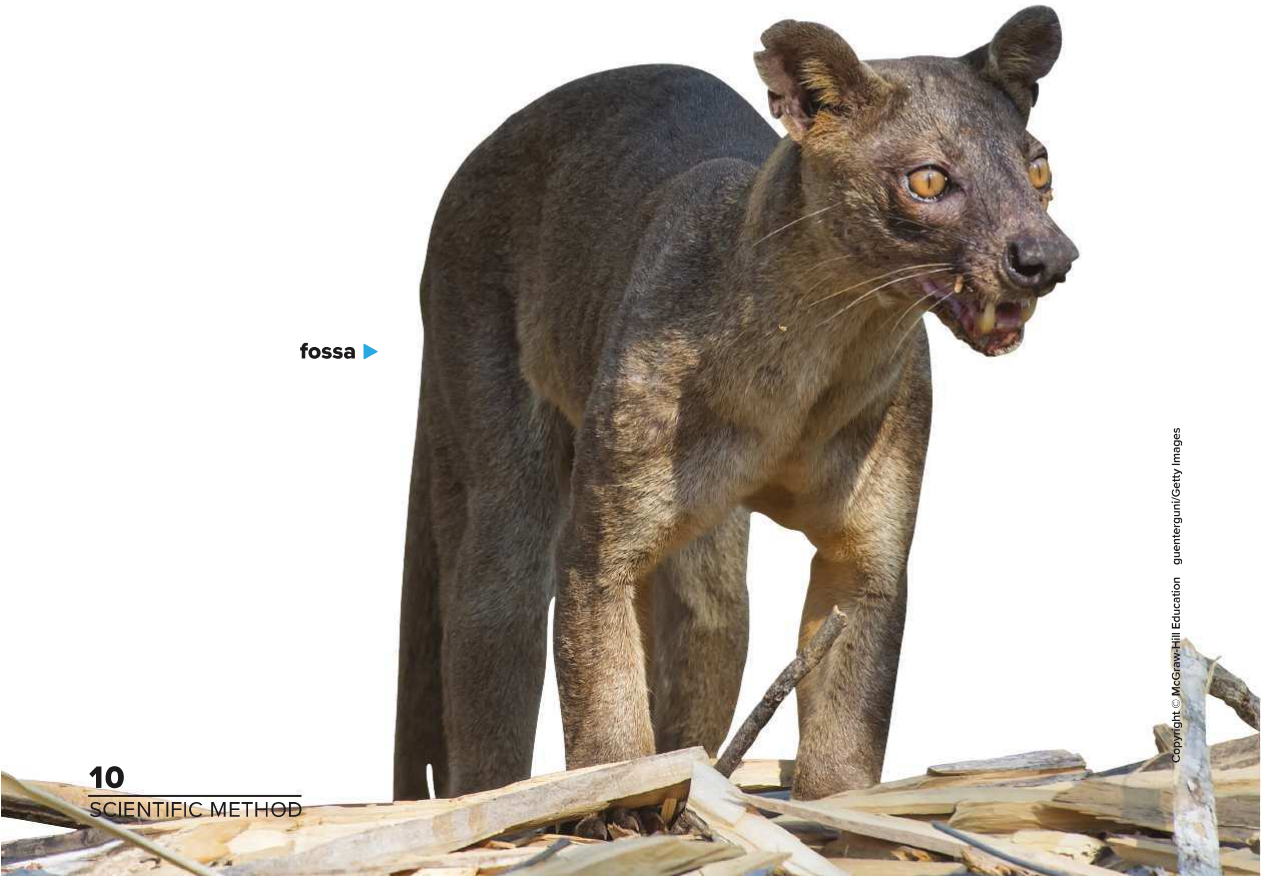
They observe that the chameleons they found were in the yellow area on the map. They talk about the temperatures and rainfall in the places where they found the chameleons.

How do scientists draw conclusions?

Did Raxworthy and others 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.

Raxworthy and others report their results so that others can learn from their work. Knowing where the chameleons live can help scientists protect the animals' homes.

In the second paragraph underline why scientists report their findings.



fossa ▶

These 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.

Quick Check

2. What did the results of the study lead to? Explain.

The results of the study led to new questions. The results of an experiment often prompt scientists to think about additional experiments.

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 ▶

▼ red millipede

Focus Skills


sea star

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.

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.

▼ **Observe Look at the animals on these pages. Record your observations in the table below.**

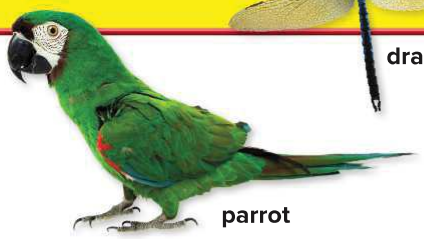
Animal	What I Observed
sea star	Possible answer: red, has five "arms"
lizard	Possible answer: striped and spotted pattern
goldfish	Possible answer: orange body with fins
beetle	Possible answer: green head, brown body
hedgehog	Possible answer: spiked fur
parrot	Possible answer: has a beak, feathers, wings
dragonfly	Possible answer: has four wings and a long body
snail	Possible answer: has a shell and two tentacles


lizard


goldfish


beetle

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.

snail

Animal Young

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

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

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.

Inquiry Skill Builder

Throughout this book, you will find Inquiry Skill Builder activites. These features will help you build the skills you need to become a great scientist.

Quick Check

3. Use the table to infer how an animal's size affects the number of young it has at a time.

The larger the animal, the fewer young it has at a time.

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.

Life Science

CHAPTER 2

A Look at Living Things

The Big Idea

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

Possible answers: Plants need water, air, and soil. Plants get water from the soil. They have leaves that allow them to make food. They have flowers that help them attract bees and other animals.

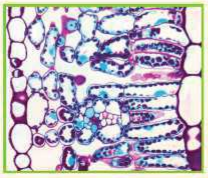
Vocabulary

organism a living thing that grows and changes and needs food, water and air to live

photosynthesis the process through which plants make food

environment all the living and nonliving things that surround an organism

vertebrate an animal with a backbone



cell the basic building block that makes up all living things

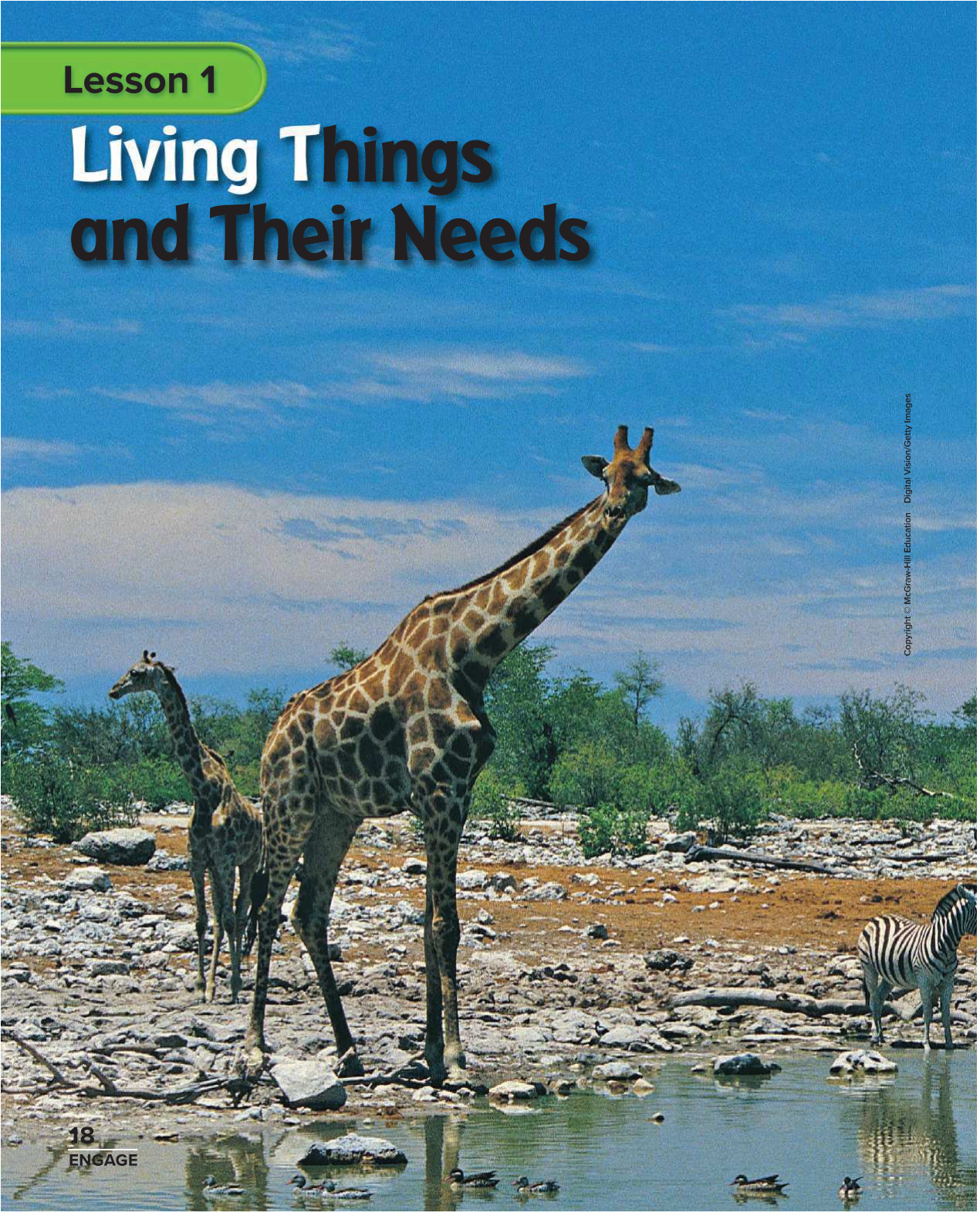
invertebrate an animal that does not have a backbone

Before reading this chapter, write down what you already know in the first column. In the second column, write down what you want to learn. After you have completed this chapter, write down what you learned in the third column.

A Look at Living Things		
What do I **K**now	What I **W**ant to Know	What did you **L**earn?
Living things need food.	What kinds of food?	
Living things move.	How do they move?	
Living things grow.	What do they need to grow?	

Lesson 1

Living Things and Their Needs



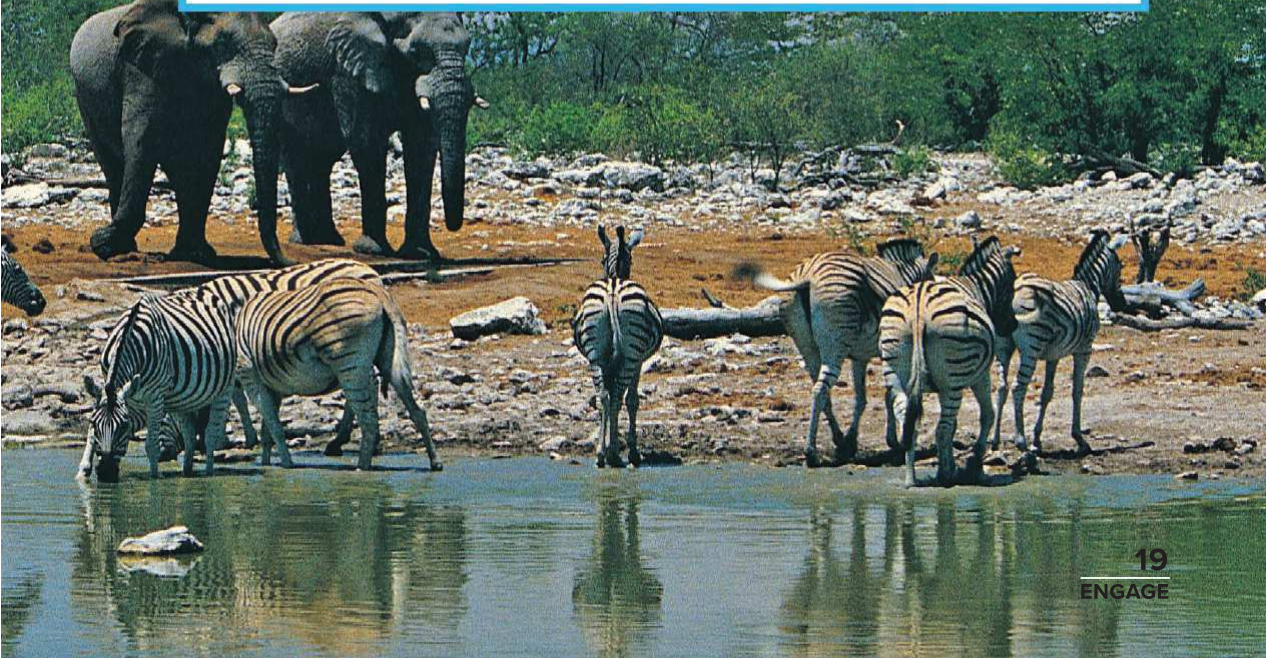
Look and Wonder

Living and nonliving things can be found all over Earth. How can you tell the difference between living and nonliving things? List some examples in the pictures.?

Possible answers: Living things move, they breathe, and they drink water.

Essential Question How are all living things alike?

Possible answer: All living things need food, water, air, and shelter to survive and grow. Living things also reproduce and respond to the world around them.



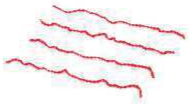
Explore

How do living and nonliving things differ?

Purpose

Find out some characteristics of living and nonliving things.

Materials



- four 1-meter pieces of string

Procedure

1. **Predict** How are living things alike? How are nonliving things alike?

Sample answers: Living things can eat, grow, and breathe. Nonliving things cannot eat, grow, or breathe.

2. Make a table. Label the columns *Living Things* and *Nonliving Things*.

Step 2

Living Things	Nonliving Things

3. Place four pieces of string outside on the ground so they form a square.

4. **Observe** Find living things in the square area. List them in your table. Tell how you know they are living. Do the same with nonliving things that you find.

Draw Conclusions

5 **Interpret Data** Which characteristics do the living things share? Which do the nonliving things share?

6 Trade tables with a partner. Do the things in your partner's table share the same characteristics as yours?

7 **Infer** How are living things different from nonliving things?

Possible answers: Living things can grow; nonliving things cannot. Living things respond to changes; nonliving things do not.

Explore More

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

Possible answers: Different plants need different amounts of sunlight; sunlight lets plants grow well. I can test by growing seeds in sunlight and in shade.

Open Inquiry

Design a plan to distinguish between living and nonliving things.

My question is: Answers will vary.

How I can test it: Answers will vary.

My results are: Answers will vary.

Read and Respond

What are living things?

Plants and animals are living things. What are some characteristics that all living things share?

Living Things Grow

Living things are called **organisms** (OR•guh•nih•zumz). All organisms use energy to grow. To ***grow*** means to increase in size. A young sunflower is small and green. Over time, it grows taller. A young bird grows into an adult. It gets bigger.

Living Things Take in Nutrients

How do living things get the things they need in order to grow? They get them from food. Food contains nutrients living things use to build the materials that make up their bodies.

Living Things Respond

Living things **respond** (rih•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 mouse 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 to be more similar to their parents.

Their colorings will begin to look more like their parents' colorings.

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

Living Things Reproduce

Living things reproduce. To reproduce means to make more of one's own kind. An apple tree reproduces by making seeds. The seeds can grow into new apple trees.

Living Things Remove Waste

Living things also need to remove waste products their bodies produce. Waste products are materials that the body does not need, such as extra water, salts, and gases. The body produces these products as it carries out life processes. If waste products are not removed, the living thing can be harmed.

Nonliving Things

Rocks, soil, and water are nonliving things that come from nature. Cars and roads are nonliving things made by people. Nonliving things do not grow, take in nutrients, respond, reproduce, or remove waste.

Quick Check

1. What are some characteristics of living things?

They grow, take in energy, respond to their surroundings, and reproduce.

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

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•VI•run•munt). An **environment** is all the living and nonliving things that surround an organism.

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.

Quick Check

2. What are some things that all organisms need to survive?

food, water, gases from air or water, space

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

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

Gases

Animals need oxygen (AHK•sih•jun) 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*** (KAR•bun di•AHK•side). Plants use energy from sunlight to change carbon dioxide and water into food and release oxygen.

Space

Organisms need space, or room. Plants need space to grow and to get 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

3. What might happen to an animal in a crowded environment?

Possible answers: The animal might die if it does not have enough space to move and find food. The animal might move to a different location to find food.

▲ **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

To learn more about cells, do the Quick Lab in the laboratory activities manual.

Quick Check

4. What are cells?

the building blocks of life, small parts that are too small to see with just your eyes

5. What do you think cells need to survive?

Possible answers: food (energy), water, gases, space

What are living things made of?

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 only your eyes. Cells are so small that it takes millions to make one little ant. You need a tool called a ***microscope*** (MI•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!

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

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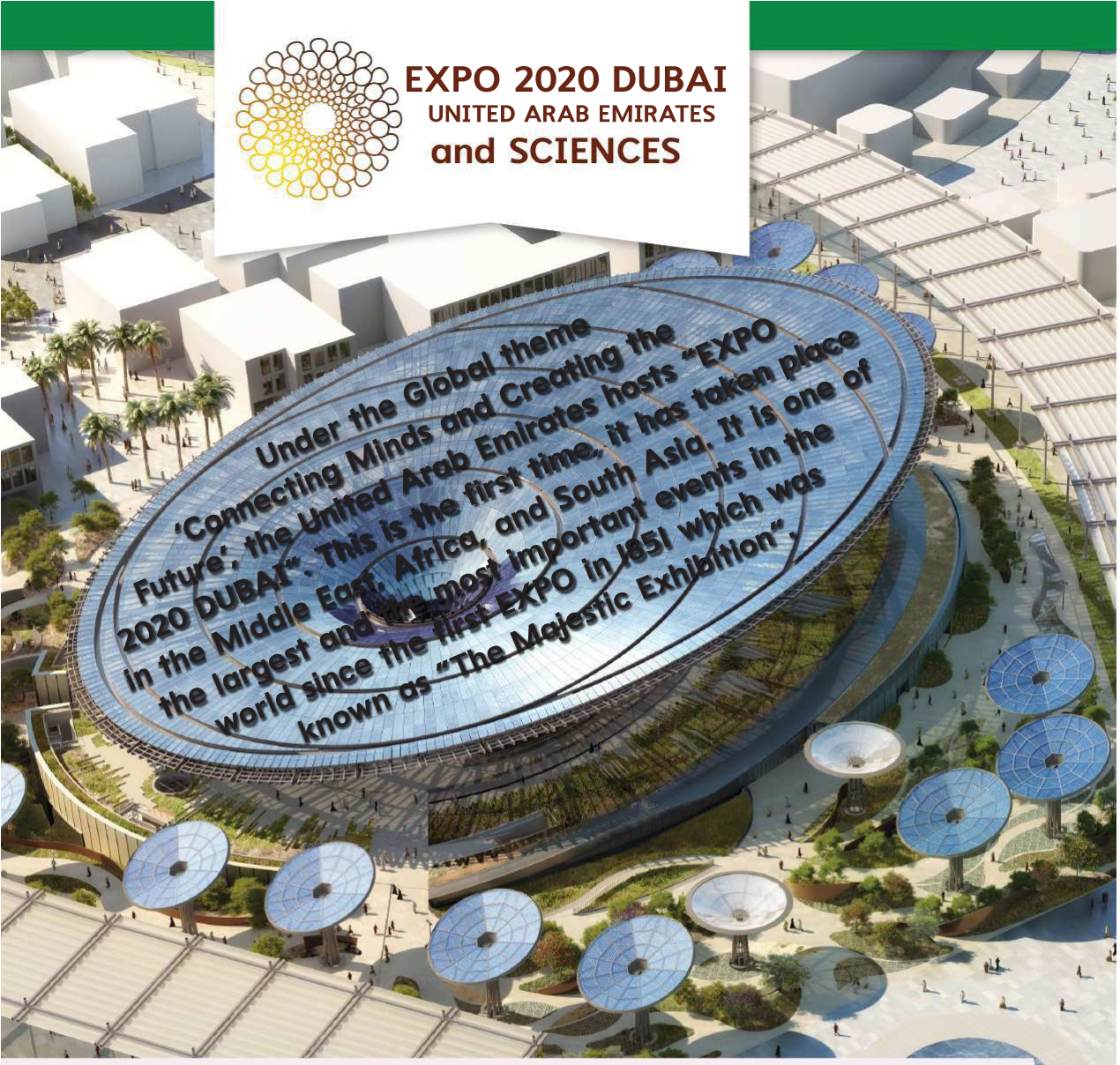
and SCIENCES



Visit the website of "Expo 2020 Dubai" to know what can be done with food waste to benefit both humanity and nature.

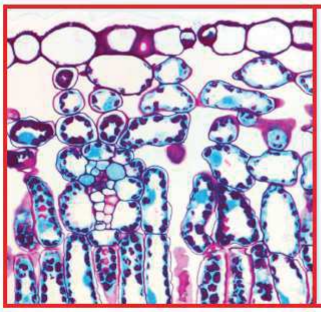
It's time to explore sustainability efforts!

Visual Summary

Complete the lesson summary in your own words.

Living things grow, respond, and reproduce.

Living Things Need food, water, gases from air or water, and space to live.



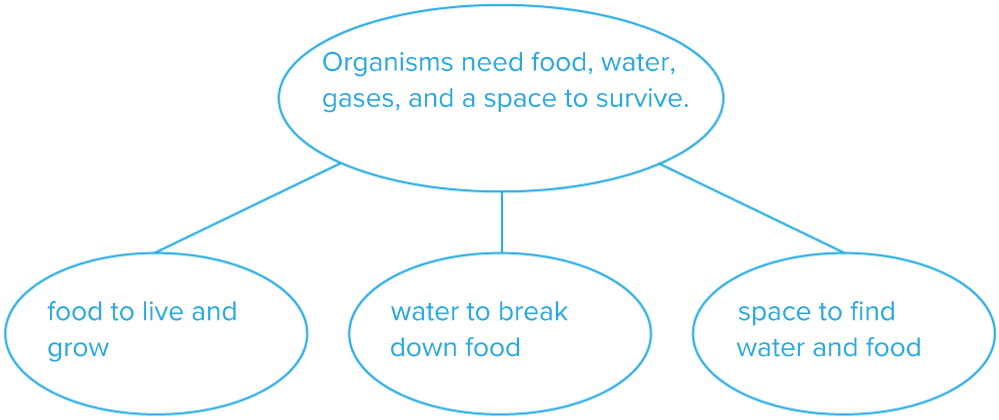
Living Things Are Made of made of cells.

Think, Talk, and Write

1 **Vocabulary** What is an environment?

all the living and nonliving things that surround an organism

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



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

Make sure the plants received enough water, sunlight, and space to grow.

4 **Test Prep** People need all of the following to survive except

A air. **C** cars.

B water. **D** space.

Essential Question How are all living things alike?

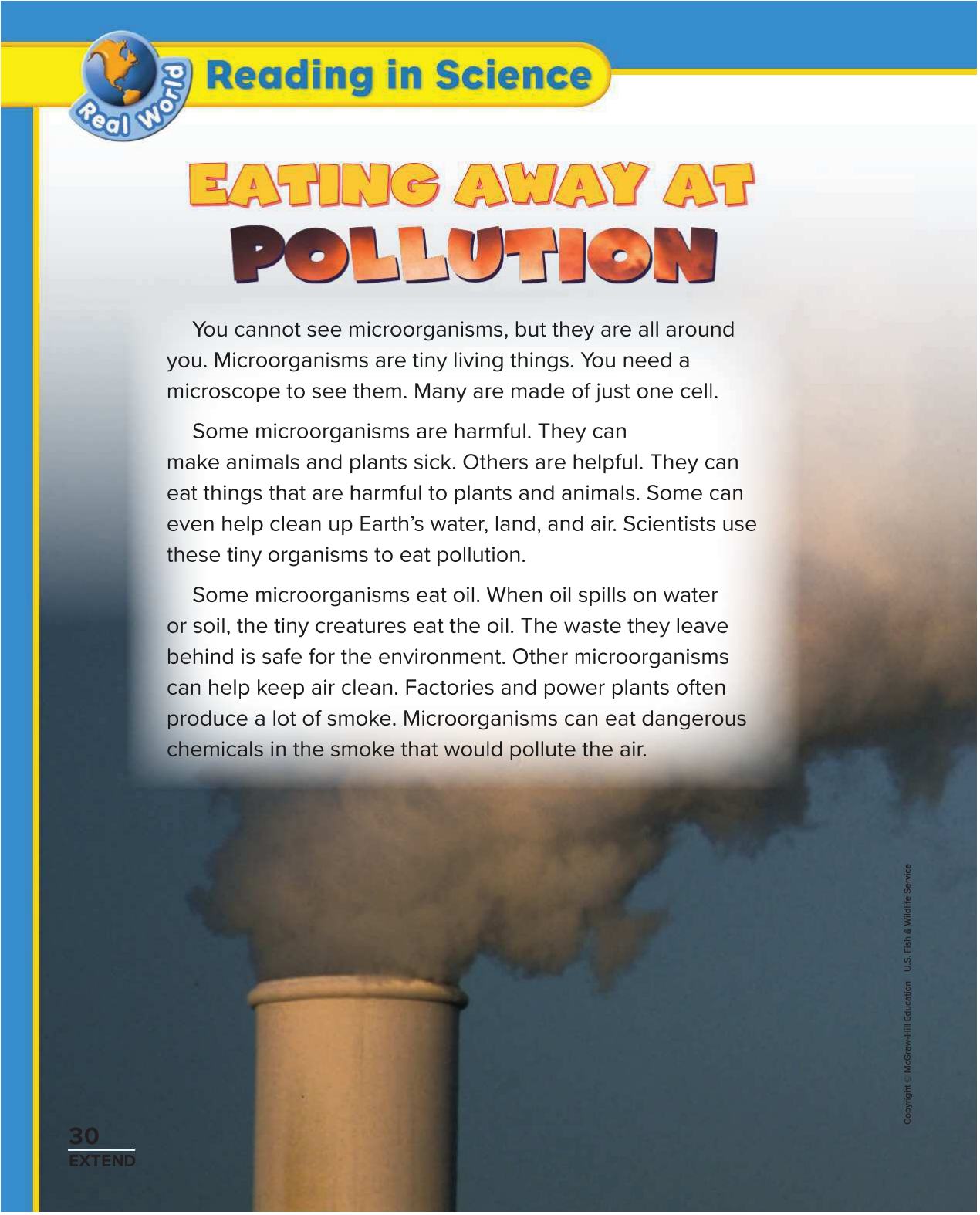
Living things grow, respond to their environment, and reproduce.

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.

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.



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

Classify

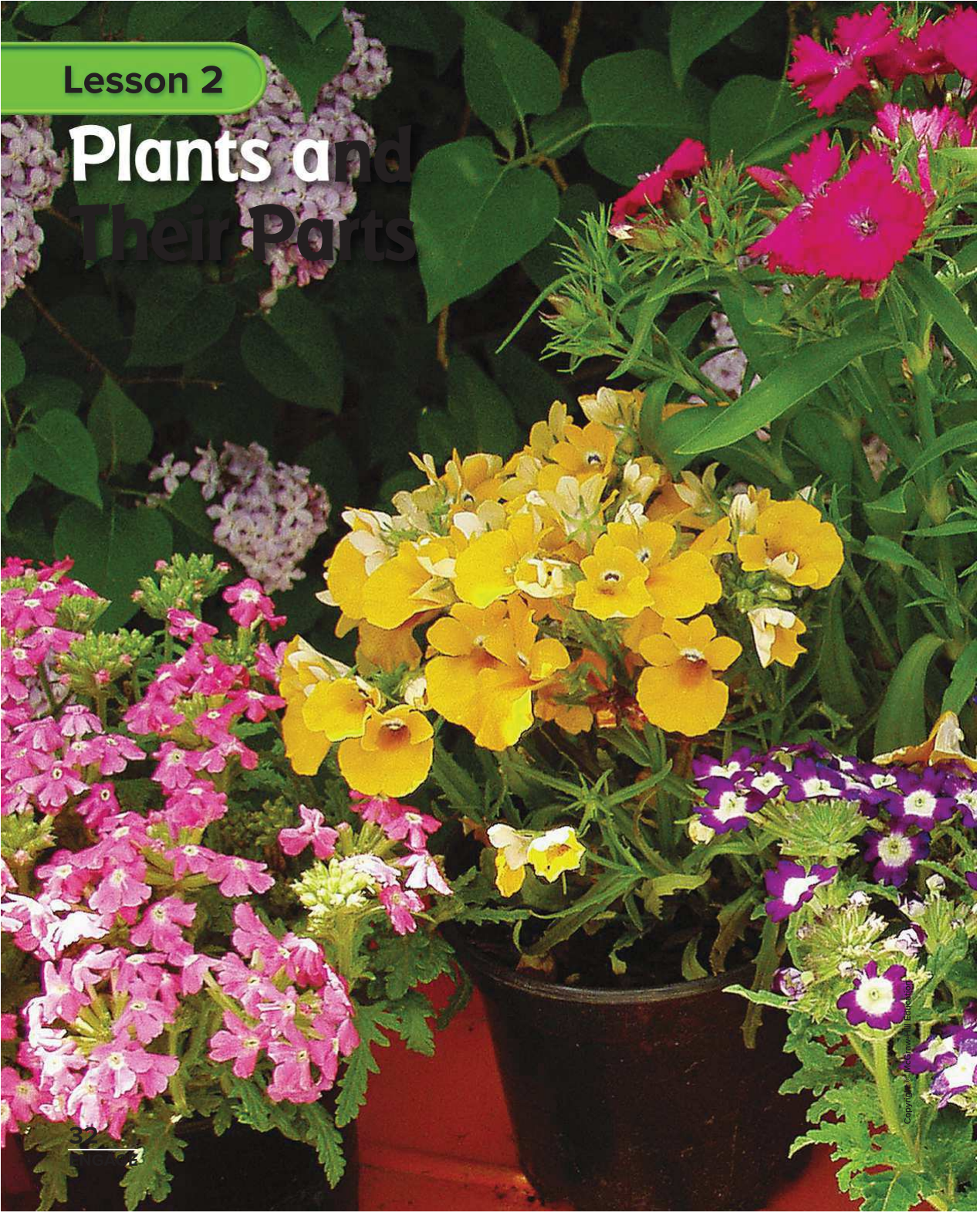
When you classify,

- **you compare things to learn how they are alike and different;**
- **you put things into groups based on their characteristics.**

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.

Sample classification: Microorganisms can be classified by the foods they eat. Some microorganisms eat oil; others eat the chemicals found in smoke.



Lesson 2

Plants and Their Parts

Look and Wonder

Some plants catch flies. Some smell like rotting meat. Some can grow three feet in one day. Plants come in many shapes and sizes. How are plants alike?

Possible answers: They are green. They have leaves. They have roots. They have stems.

Essential Question How do plant structures compare?

Possible answers: Some have leaves, flowers, large trunks, and stems.

Explore

How are plants alike?

Purpose

Find out about some characteristics of plants.

Materials

- hand lens
- 3 plants

Procedure

1. **Observe** Study each plant carefully. Which plants have leaves? How do their leaves compare? Describe them using words and pictures.

2. **Infer** Which part of each plant grows underground? How is this part the same on each plant? How is it different? Record your observations with words and pictures.

Answers will vary, but students should recognize that most plants have roots that grow underground; however, the roots may vary in thickness, number, and texture.

3. **Observe** Look carefully at each plant again. What other parts does each plant have? How are these parts the same? How are they different? Record your observations.

Students should recognize that plants have round, stalk-like stems where leaves attach, but they vary in thickness, number, and texture. Some will also have flowers, fruit, or cones.

Draw Conclusions

4 **Infer** Which parts do most plants have?

Most plants have roots, stems, and leaves.

5 How are plants alike?

Students should recognize that plants have parts that are green, and that plants have common structures, such as roots, stems, and leaves.

Explore More

Experiment Can different-looking plants survive under the same conditions? How could you find out? Make a plan and try it.

Answers will vary.

Open Inquiry

Design a test to discover what happens to plants when they grow in a shady area compared to a sunny area.

My question is: Answers will vary.

How I can test it: Answers will vary.

My results are: Answers will vary.

Read and Respond

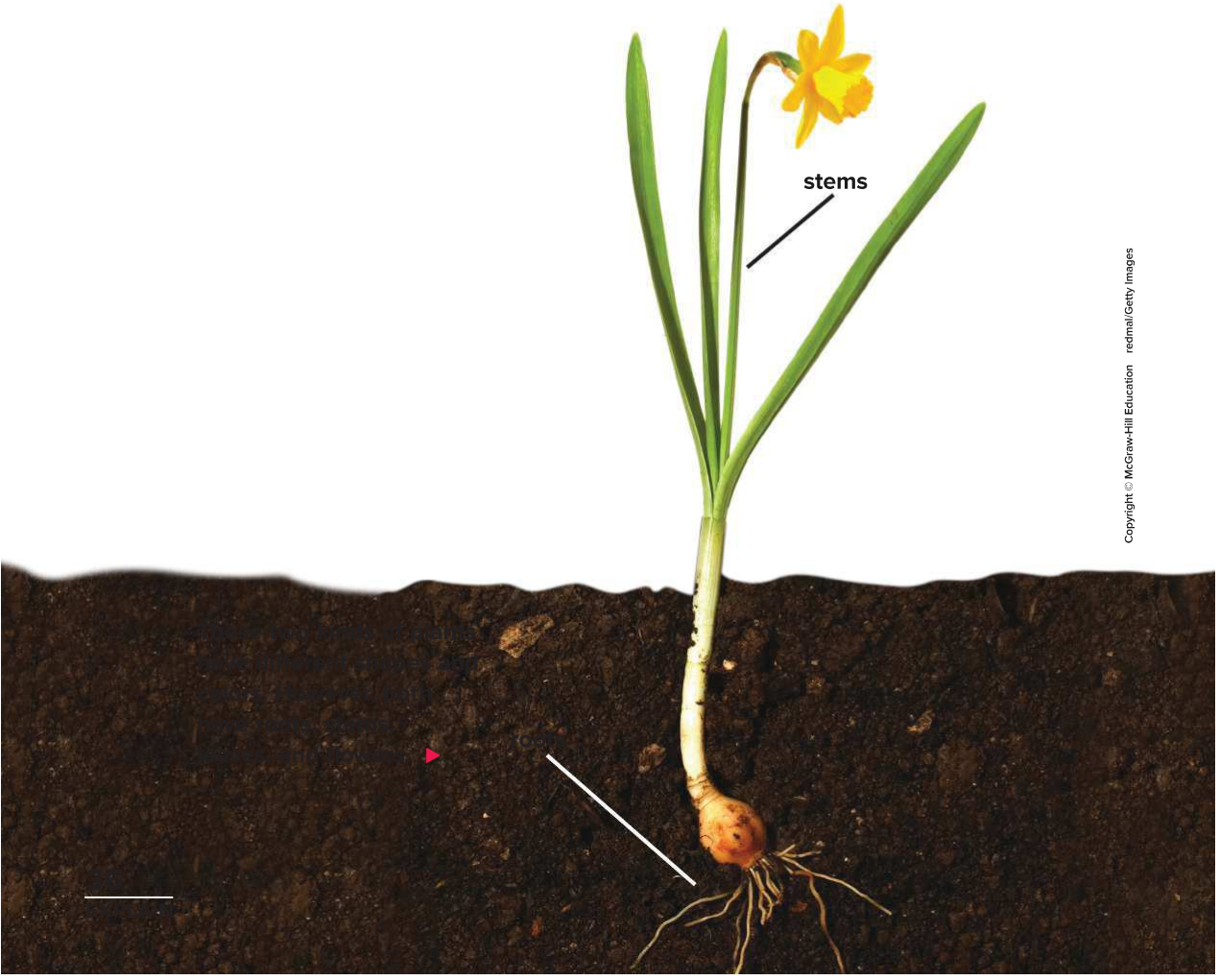
What are plants?

From tall trees to tiny wildflowers, plants come in different shapes and sizes. What do plants have in common? One characteristic that all plants share is that they can make their own food. They use energy from the Sun to make food, grow and reproduce.

Quick Check

1. Most plants do not have structures for eating. What might be a reason for this?

Possible answer: Plants do not eat food. They make their own food from energy from the Sun.



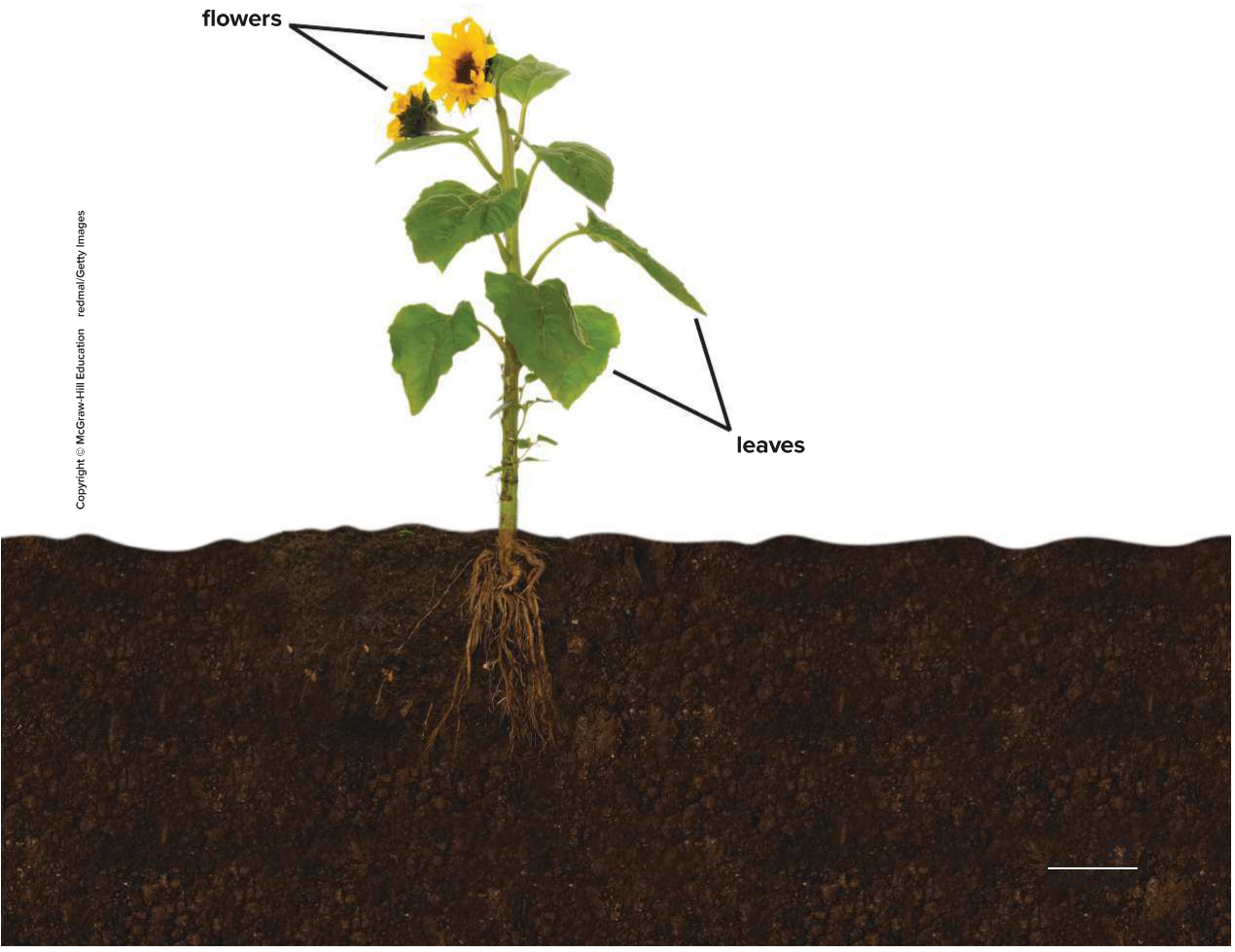
Most plants share other characteristics too. Most plants have parts that are green. Most grow in the ground. Plants cannot move around like animals can.

Many plants have the same basic **structures** (STRUK•churz), or parts. Most plants have roots, stems, and leaves. These structures help plants get what they need to survive. Some plants have flowers and fruits. Some have cones. These structures help plants reproduce.

Quick Check

2. What three structures do most plants have?

roots, stems, leaves



How do roots and stems help plants?

Most plants have roots and stems. These structures help plants get what they need to survive.

Roots

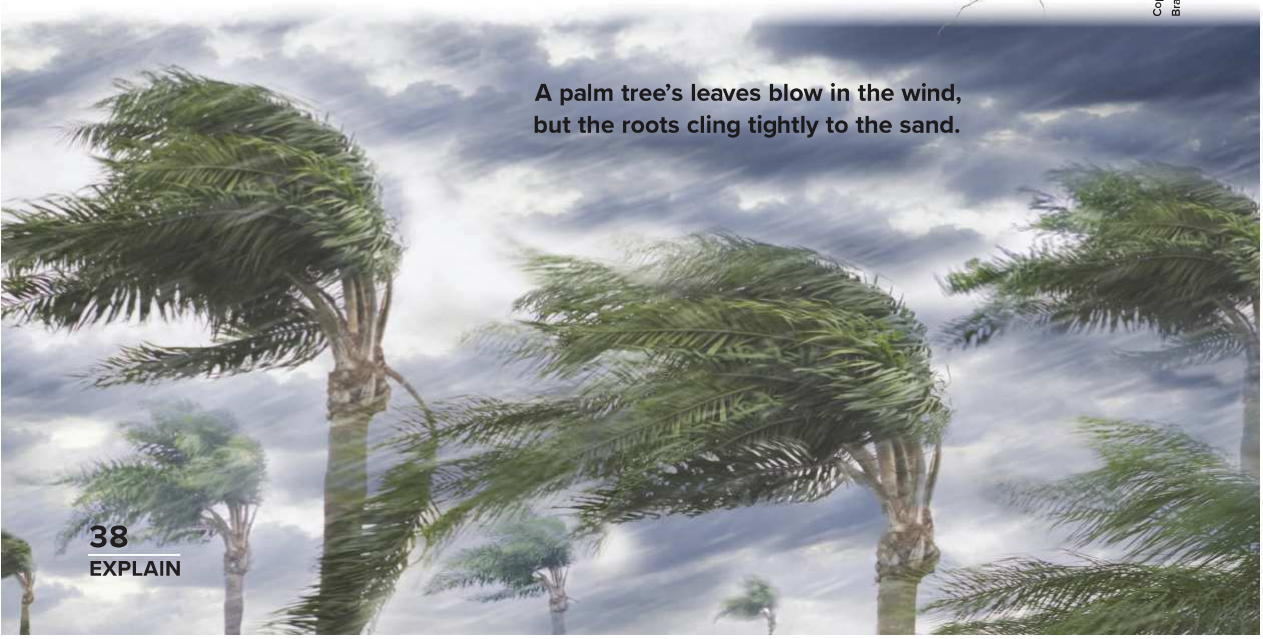
Plants need water. They take in water with their roots. **Roots** are structures that take in water and hold a plant in place. Some plants, such as carrots and radishes, have one thick root called a taproot. Others have a web of thinner roots. Roots may grow deep in the soil to find water far underground. They may spread wide to take in water from a large area.

Roots also take in nutrients (NEW•tree•unts). **Nutrients** are substances that help living things grow and stay healthy. They are part of soil. When roots take in water, they also take in nutrients.

Some roots have the job of storing food for a plant. These roots can be good for people too. Carrots, radishes, and sweet potatoes are roots that you eat.

A beet has one main root.

This plant has many thin roots.



A palm tree's leaves blow in the wind, but the roots cling tightly to the sand.

Stems

A stem is a structure that holds up a plant. Leaves attach to it. The stem holds leaves upright so they can get sunlight. The stem also carries water, nutrients, and food throughout a plant. Water and nutrients flow up from the roots through tubes in the stem. Food flows from the leaves through other tubes.

Not all stems are alike. Stems can be soft and green like tulip stems. They can be hard and woody like tree trunks. A trunk is a tree's stem.

Quick Lab

To learn more about stems, do the Quick Lab in the laboratory activities manual.

Quick Check

3. How do stems help a plant meet its needs?

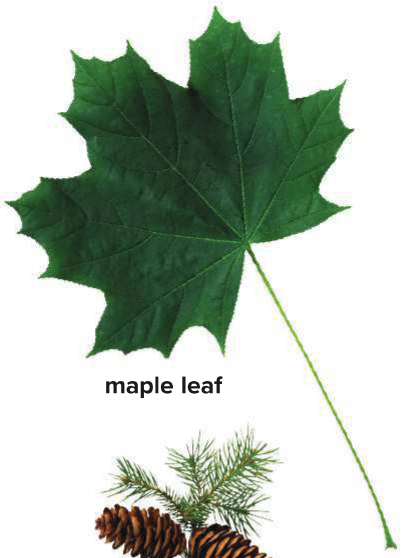
Possible answers: Stems hold a plant upright so its leaves can take in sunlight. They transport water, nutrients, and food through the plant.

This tree trunk is a stem that is wide, tall, and woody. These bluebells have soft, green stems.

Why are leaves important?

Leaves come in many shapes and sizes. Leaves on a pine tree are like short needles. Leaves on a maple tree are wide and flat. Whatever their shape and size, leaves do an important job for a plant. A **leaf** is the structure where a plant makes food.

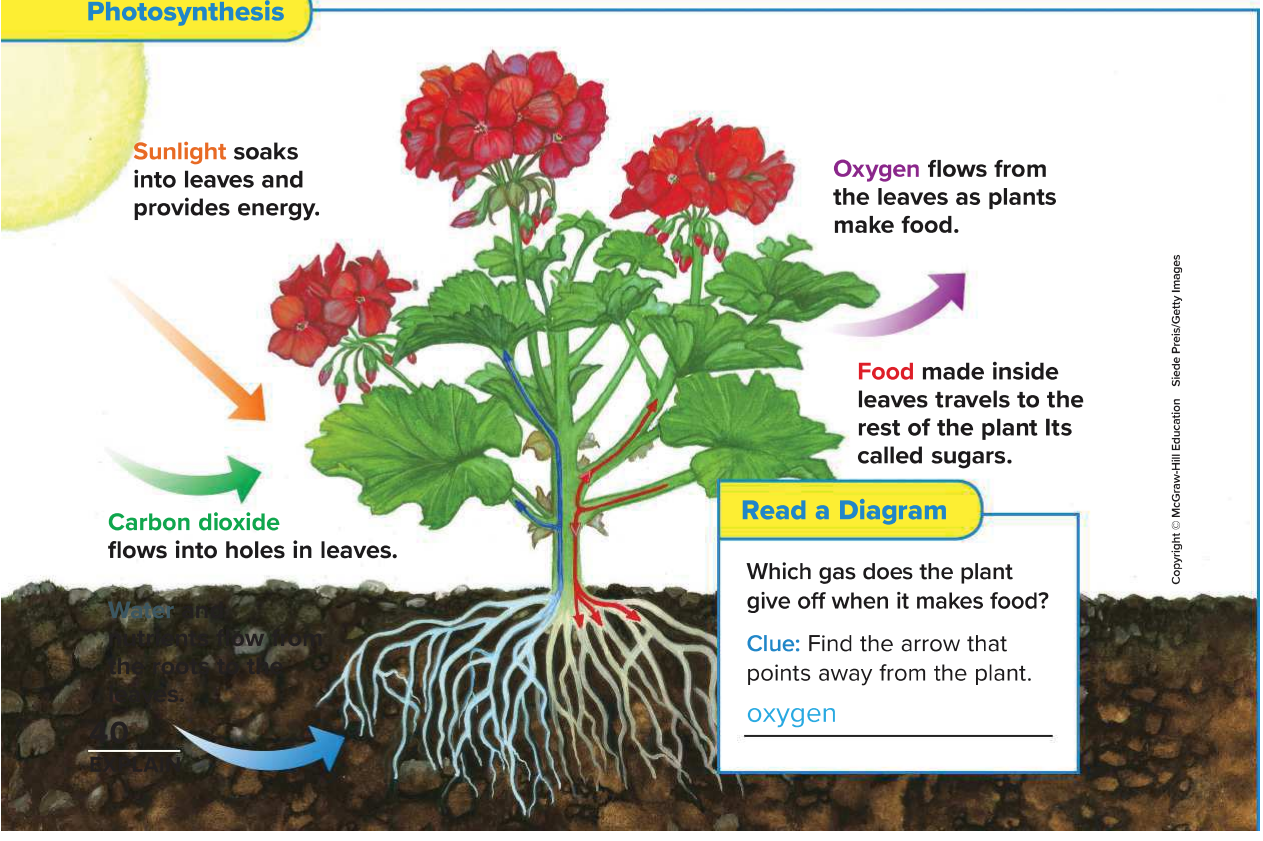
Plants make food in a process called **photosynthesis** (foh•toh•SIN•thuh•sus). During photosynthesis plants use energy from the Sun to change carbon dioxide and water into sugars. Sugars are food for a plant. Sugars give plants the energy they need to grow.



maple leaf

pine needles

Photosynthesis

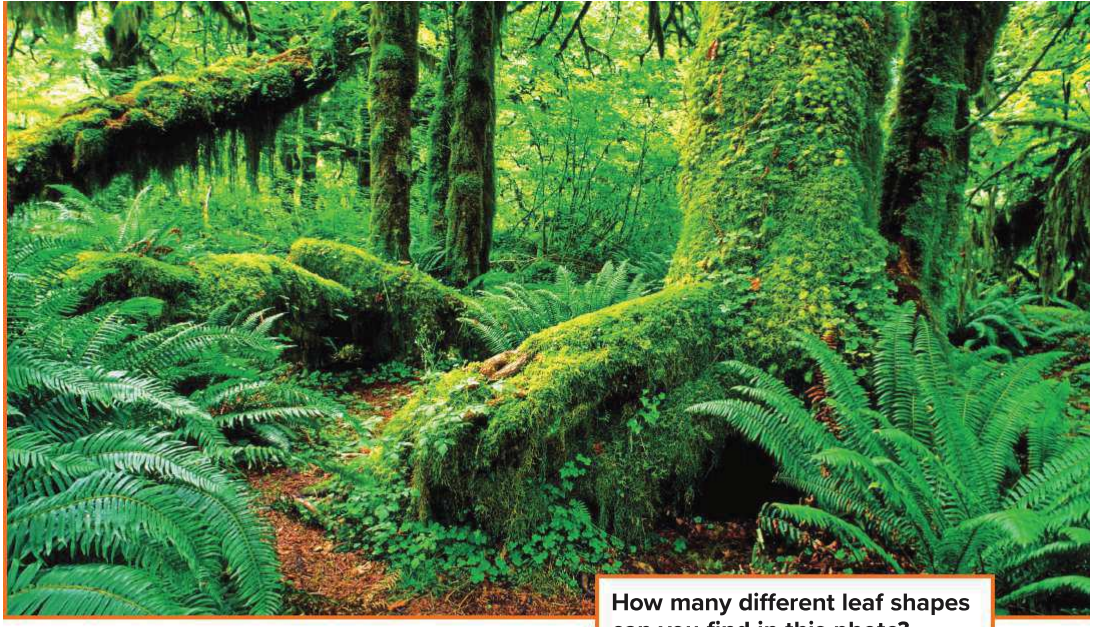


Read a Diagram

Which gas does the plant give off when it makes food?

Clue: Find the arrow that points away from the plant.

oxygen



How many different leaf shapes can you find in this photo?

Leaves take in the carbon dioxide and sunlight that plants need for photosynthesis. Carbon dioxide enters through tiny holes on the underside of a leaf. Leaves trap energy from sunlight with chlorophyll (KLOR•uh•fil). ***Chlorophyll*** is a substance inside a plant's cells. Chlorophyll gives leaves their green color.

During photosynthesis plants also give off oxygen. People and animals need oxygen to live.

Quick Check

4. How do leaves help plants survive?

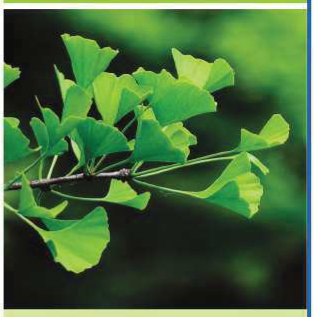
Leaves take in carbon dioxide and sunlight, and they are the site where food for the plant is made.

5. How would air change if there were fewer plants?

Possible answer: Carbon dioxide could build up and less oxygen would be available for animals.

FACT Plants need oxygen.

Classifying Plants

Flowering	Nonflowering
 cherry tree	 ginkgo tree
 prickly pear cactus	 yew tree
 squash plant	 juniper tree

How can you classify plants?

There are thousands of different kinds of plants on Earth. Scientists put all these plants into groups to study and learn about them. That way, they can study a whole group of plants at once.

Scientists often group plants by their structures. They can group plants by the types of roots, stems, or leaves the plants have. They can group plants by whether the plants make flowers. There are several examples of flowering and nonflowering plants in the chart on this page. How would you group plants?

Quick Check

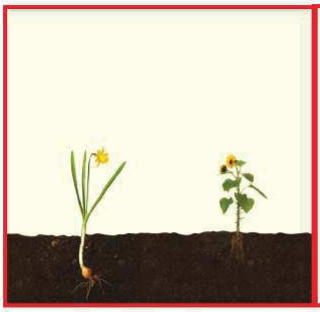
6. Why do you think it is useful for scientists to group plants?

Student answers will vary.

My Notes

Visual Summary

Complete the lesson summary in your own words.



Plant Structures help them survive. Most plants have roots, stems, and leaves.

Roots and Stems Roots take in water and hold a plant in place. Stems hold up a plant so it can get sunlight.

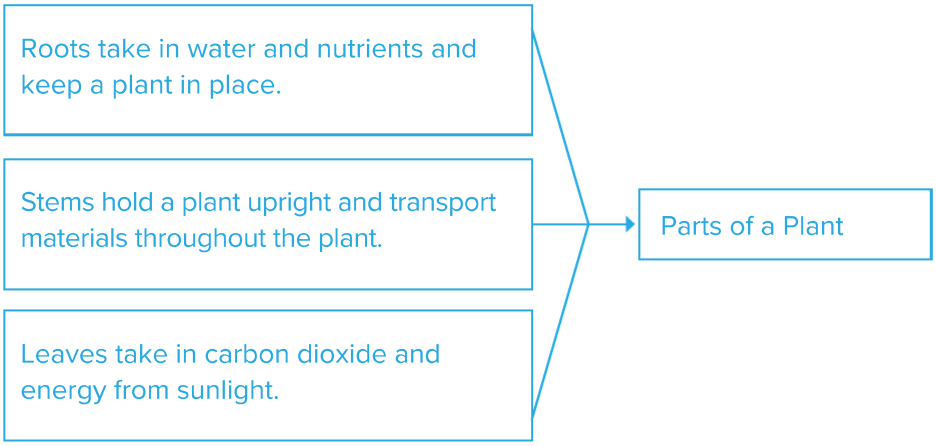
Leaves are where food is made in a plant. Plants use sunlight, carbon dioxide, and water to make food.

Think, Talk, and Write

1 **Vocabulary** What is photosynthesis?

the process by which a plant makes its own food

2 **Summarize** How do a plant's parts help it survive?



3 **Critical Thinking** How are plants different from animals?

Student answers will vary. Students should recognize that plants can make their own food while animals cannot, that animals can move in ways that plants cannot, and that plants and animals have different structures.

4 **Test Prep** What is the main job of roots?

A They make the plant green.
B They take in water and nutrients.
C They produce seeds.
D They take in sunlight.

Essential Question How do plant structures compare?

Student answers will vary. However, they should discuss the roots, stems, and leaves.

Be a Scientist

Structured Inquiry

What do plants need to survive?

Form a Hypothesis

Do plants need light to grow? Do they need water? Write a hypothesis. Start with "If plants do not get light and water, then..."

Possible hypothesis: If plants do not get light and water, then they will not grow.

Materials

- 4 identical plants

- measuring cup and water

- ruler

Test Your Hypothesis

1. Label four identical plants as shown.

2. **Observe** How do the plants look? How tall are they? Measure them and record your observations in a chart. Use words and pictures.

Answers will vary. Accept all reasonable responses.

3. Put the plants labeled *No Light* in a dark place, such as in a closet. Put the plants labeled *Light* in a sunny place, such as on a windowsill.

4 **Predict** What do you think will happen to each plant? Record your predictions.

Answers will vary.

5 **Observe** Look at the plants on a regular basis. Water each plant labeled *Water* with 200 milliliters of water. Measure how tall the plants grow. Record your observations in your chart using words and pictures.

Draw Conclusions

6 **Interpret Data** Which plant grew the most after two weeks? Which plant looks the healthiest? Use your chart to help you.

Possible answer: The plants that received both light and water are the healthiest and grew the most.

7 What do plants need to survive?

Possible answer: Plants need both water and light to survive.

Be a Scientist

Guided Inquiry

What else do plants need to survive?

Form a Hypothesis

Do plants need air? Do they need soil? Write a hypothesis about one of these.

Possible hypothesis: If a plant is given nutrients, then it will grow.

Test Your Hypothesis

Design an experiment to test your hypothesis. Decide which of the materials below you will use. Write the steps you will follow.

- two identical plants
- petroleum jelly
- measuring cup
- water
- soil

Results and observations will vary.

Draw Conclusions

Did your results support your hypothesis? Why or why not? Share your results with your classmates. What questions do they have about your investigation?

Answers will vary but students should recognize that plants need both air and nutrients to grow.

Open Inquiry

What other questions do you have about plants and their needs or structures? Talk with your classmates about questions you have. Choose one question to investigate. How might you answer this question? Make sure your experiment tests only one variable at a time.

My hypothesis is:

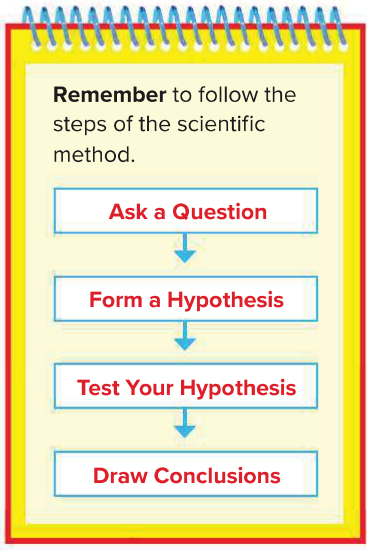
Answers will vary.

My experiment includes the following steps:

Answers will vary.

My conclusions are:

Answers will vary.



Lesson 3

Animals and Their Parts

Look and Wonder

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

Possible answer: No. Some animals do not have arms, some lack teeth.

Essential Question What helps animals survive in their environments?

Possible answers: food, water, and shelter.

Explore

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

Purpose

Observe a snail to learn about its structures.

Materials


- snail


- clear plastic container


- cotton swab


- paper towel


- water


- lettuce leaf

Procedure

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

   Be Careful. Handle animals with care.

   Possible answers: The snail does not have legs or arms. The snail has a shell and eyes.

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?

   Possible answers: The snail's foot, the muscular structure on its underside, helps it move. Its eyes help it find food. The shell keeps it safe.

4. **Experiment** Gently touch the snail with a cotton swab. Observe the snail's actions for a few minutes. Record what you see.

   Possible answer: The snail goes inside its shell.

5. **Experiment** Place a wet paper towel in the container. Record the snail's actions. Now repeat this step using a lettuce leaf.

   Possible answers: The snail moved toward the paper towel. The snail ate the lettuce. The snail did not respond.

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.

Answers will vary depending on student observations.

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?

Answers will depend on which animal students compare the snail to.

Explore More

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

Answers will vary.

Open Inquiry

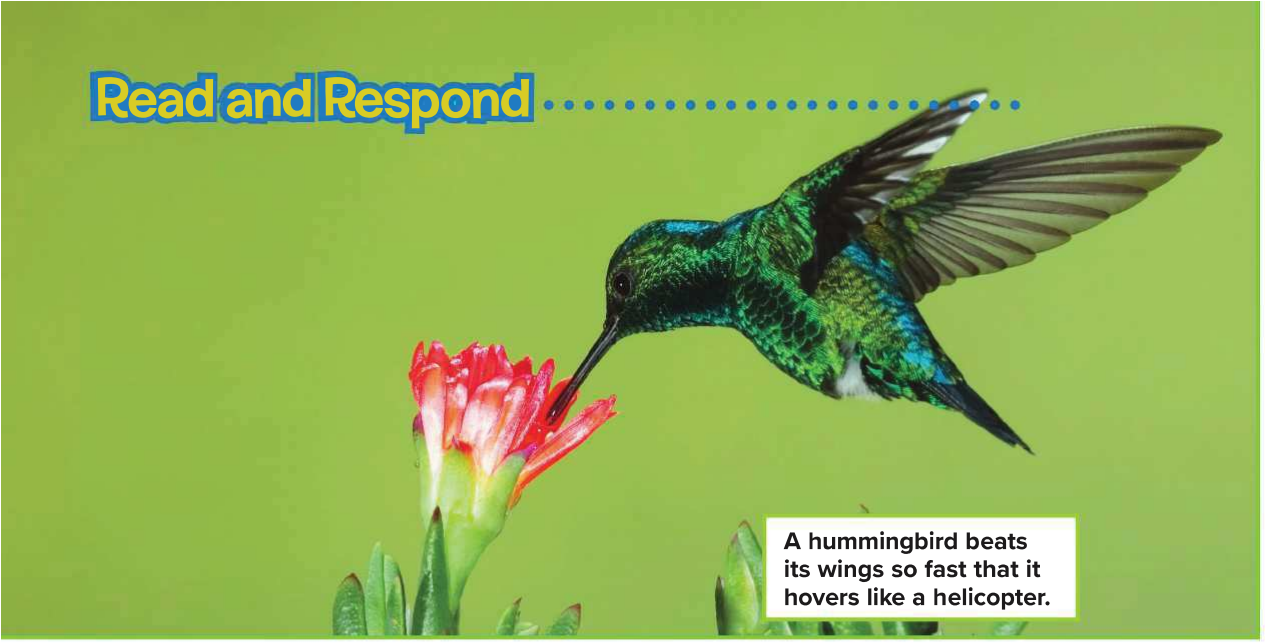
How might a snail respond to something different?

My question is: Answers will vary.

How I can test it: Answers will vary.

My results are: Answers will vary.

Read and Respond



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

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

What are animals?

What do guppies, gerbils, and even tiny mealworms have in common? They are all part of a group of living things called *animals*. What are animals? How are they different from plants?

Animals have certain traits in common. Most animals can move. Birds can fly. Foxes can run and jump. Sharks swim. Unlike plants, animals cannot make their own food. They must eat other organisms to get energy and nutrients.

Animals respond to their environments in more noticeable ways than plants. 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 sunlight 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. Legs, fins, wings, and tails are some animal structures.

Quick Check

1. What are some different ways that animals move with?

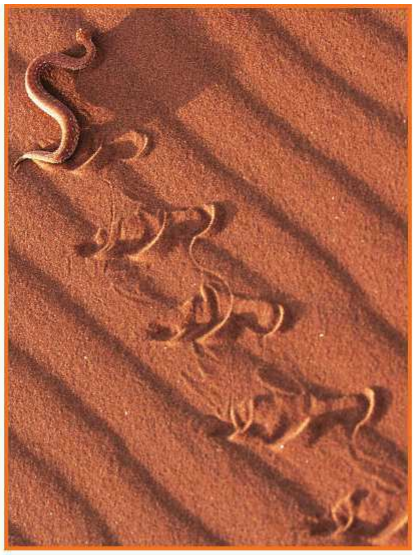
Animals may use feet, legs, tails, wings, fins, and other structures to move.

How Animals Move

Animals move to find food and water. They move to escape danger. Animals may use feet, legs, tails, wings, fins, 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 without 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

2. How can you tell that a cat is an animal?

It moves and responds to its environment in a visible way. It cannot make its own food.

To run and jump, this wolf pushes off the ground with its strong back legs.

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

How do animals get what they need?

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

Getting 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 and pour it into their mouths.

The same structures help animals get 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.

◀ **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 Lab

To observe animal structures, do the Quick Lab in the laboratory activities manual.

Quick Check

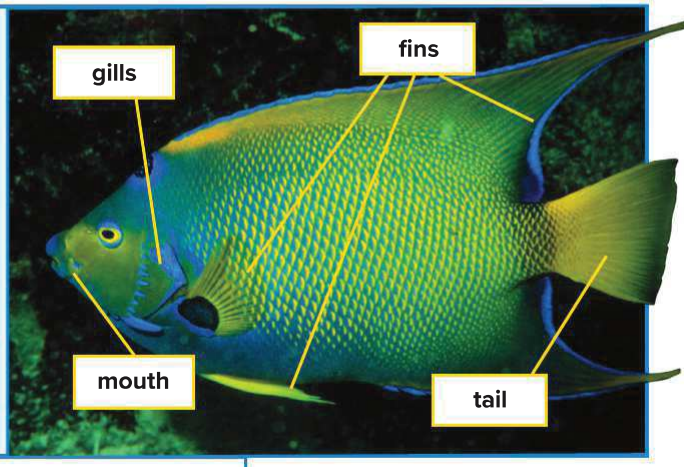
3. How are lungs like gills? How are they different?

Possible answers: Alike: Both lungs and gills take in oxygen. Different: Lungs take in oxygen from the air. Gills take in oxygen from water.

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.

Mouth and gills

▲ **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 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

4. Describe two different ways that animals use to stay safe.

Possible answers: Animals may find safety in shelters, or they may build structures that keep them safe.

My Notes

Visual Summary

Complete the lesson summary in your own words.

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.

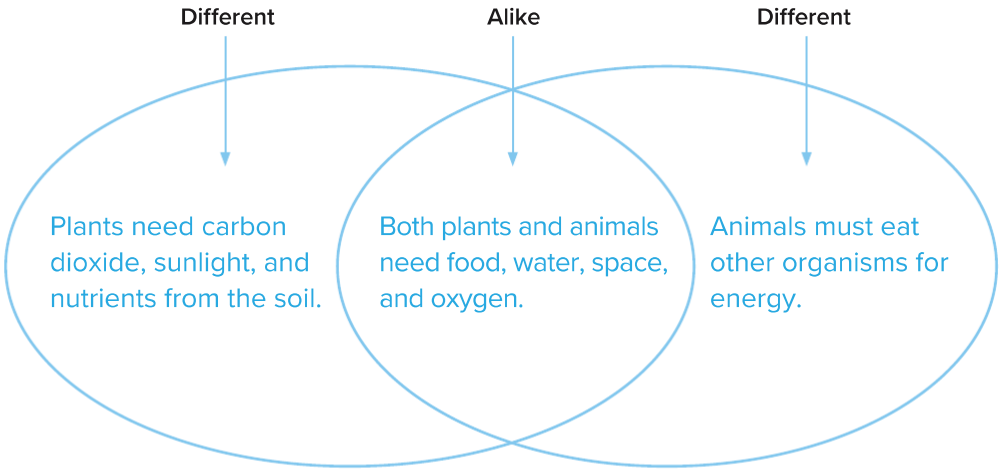
To stay safe animals can find shelter. Some build structures to keep them safe.

Think, Talk, and Write

1 **Vocabulary** What is a shelter?

A place where an animal can stay safe.

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



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

Possible answer: Long legs might help a bird stand in water to look for food.

4 **Test Prep** Animals use all the structures below to get oxygen except

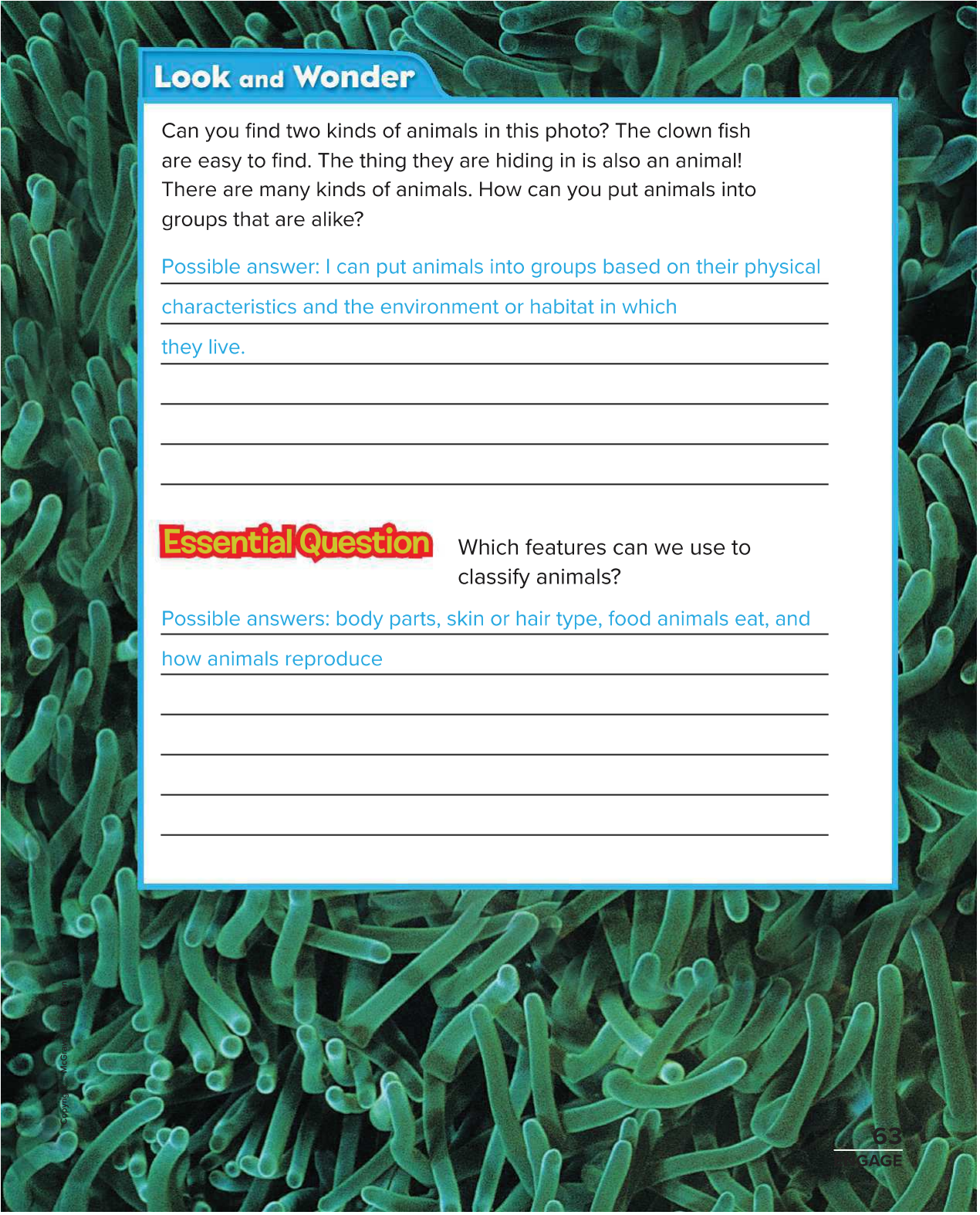
A lungs. **C** eyes.
B gills. **D** skin.

Essential Question What helps animals survive in their environments?

Animals survive in their environments by using their structures to get food, water, and oxygen.

Lesson 4

Classifying Animals



Look and Wonder

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

Possible answer: I can put animals into groups based on their physical characteristics and the environment or habitat in which they live.

Essential Question Which features can we use to classify animals?

Possible answers: body parts, skin or hair type, food animals eat, and how animals reproduce

Explore

How can you classify animals?

Purpose

Classify animals to form groups that have similar characteristics.

Materials

- 4 plastic containers

- hand lens

- worm

- beetle

- snail

- ant

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?

Possible answers: The beetle and ant have legs. The worm and snail do not. The beetle and ant have six legs, a head, and a body. The snail has a head.

2. **Communicate** Make a chart like the one shown. Use words and pictures to describe characteristics of each animal.

بنتية الحيوان	الخنفساء	الحلزون	الدودة	النملة
ارجل	6			
قرون استشعار	2			
الرأس				
الفم				
العين				
لصدقة				

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?

Student answers will vary but students should be able to provide reasons for their groupings. For example, the beetle and ant are in the same group because they have six legs.

Draw Conclusions

4 **Interpret Data** Which two animals are most similar to each other?

Most students will recognize that the beetle and ant are the most similar.

5 **Communicate** What rule did you use to classify the animals? Why did you classify the animals the way you did?

Accept all reasonable answers that illustrate that students know how to group animals based on common characteristics.

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.

Answers will vary.

Open Inquiry

Look at more photos of animals and think about new ways to group them.

My question is: Answers will vary.

How I can test it: Answers will vary.

My results are: Answers will vary.

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. Now think of 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

Apply It

Classify these animals using your own rule.

fish
have scales

eagle
can fly

frog
can hop

cat
have spots

chameleon
change color

butterfly
starts as a catepillar

bear
have fur

wild sheep
climb mountains

snake
have fangs

squirrel
hide food

tiger
run fast

dragonfly
fly fast

Read and Respond

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•brayts). Tigers, dogs, eagles, and goldfish are all examples of vertebrates.

Vertebrates and Invertebrates

Read a Diagram

Where does a raccoon's backbone begin and end?

It begins at the skull and ends at the end of the tail.

Animals without backbones are called **invertebrates** (in•VUR•tuh•brayts). 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 Lab

To create a model of an animal's backbone, do the laboratory activities manual.

Quick Check

1. How do bones help vertebrates?

Possible answers: hold up bodies; give them shape; help them to move.

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.

Quick Check

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

Possible answers: water—lobsters, squid, scallops, clams; land—most insects, spiders, snails

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•so•SKEH•luh•tun).

Quick Check

3. Is an octopus an invertebrate? How can you tell?

Yes, it is an invertebrate. It does not have a backbone, or any other bones.

arthropods

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

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?

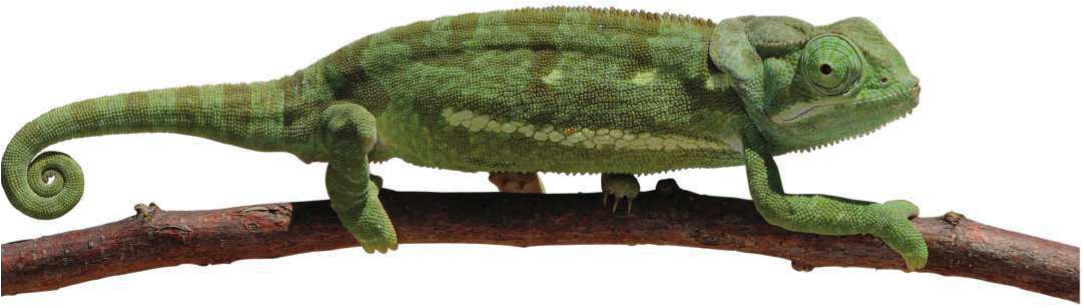
Are all vertebrates alike? Compare these four types and see what you think.

Birds

A **bird** is a kind of animal with a beak, feathers, two wings, and two legs. Birds breathe air with lungs. They reproduce by laying eggs. Most birds feed their young until the young can find food on their own. Wings and feathers help some birds fly. Feathers also help keep birds warm.

Reptiles

Crocodiles, turtles, and snakes are reptiles. **Reptiles** (REP•tilez) 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•FIH•bee•unz). 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.

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. These help protect the fish.

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

Quick Check

4. Do you think turtles breathe with lungs or gills? Why?

Possible answer: They breathe with lungs, because they breathe air.

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, cats, tigers, and elephants. **Mammals** (MA•mulz) are vertebrates with hair or fur. Most 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 their own.

Mammals are covered with hair or fur. Mammals such as cats and bears have thick fur. Thick fur helps keep them warm in cold environments. Others, such as elephants and camels,, 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

5. Which characteristics help you know that a bear is a mammal?

Possible answers: backbone, hair, lungs, gives birth to young.

▼ **Dolphins poke their heads out of water to breathe.**

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

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

My Notes

Visual Summary

Complete the lesson summary in your own words.

Animals are classified according to their structures and characteristics.

Invertibrates is an animal without a backbone. Insects, spiders and lobsters are invertebrates.

Vertibrates is an animal with a backbone. Fish, birds, reptiles, and mammals are vertebrates.

Think, Talk, and Write

1 **Vocabulary** What is an exoskeleton?

a thin, hard body covering

2 **Classify** What kind of animal is a Zebra? How do you know?

Mammal	Mammal
A Zebra has hair and gives birth to live young.	A Zebra does not have scales or feathers like other groups of vertebrates.

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

Possible answer: Bones support body shape and allow movement in certain directions.

4 **Test Prep** All reptiles are animals that have

A backbones and gills.
B lungs and legs.
C backbones and lungs.
D backbones and fins.

Essential Question Which features can we use to classify animals?

A backbone is one feature that can be used to classify animals. Other features like fur or laying eggs can also be used to classify animals.

Writing in Science

Desert Birds

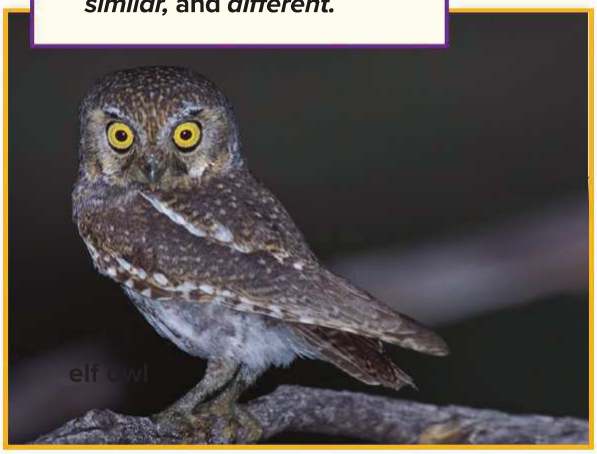
Roadrunners are birds that live in deserts. Roadrunners run fast on their strong feet. They are black and white with long white-tipped tails. They hunt lizards, snakes, and insects during the day.

Elf owls live in 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

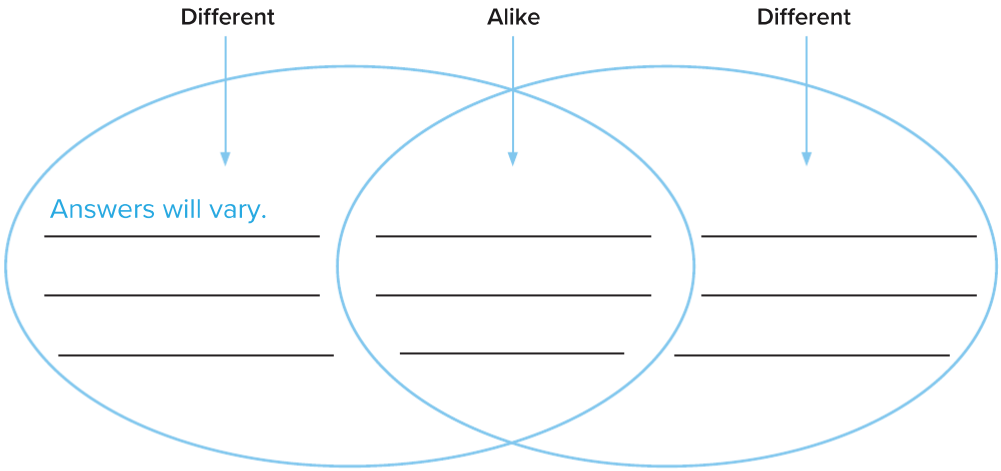
A good description

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



Write About It

Descriptive Writing Choose two animals. Learn more about them. Then complete the Venn diagram to show how the two animals are alike and different.



Write a paragraph that describes how the animals are alike and different.

Students' responses will vary but they should include details that describe how the animals are alike and different.

CHAPTER 2 Review

Visual Summary

Summarize each lesson in your own words.

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

Lesson 2 Most plants have roots, stems, and leaves. Each plant part does a special job to keep a plant alive.

Lesson 3 Different kinds of animals have different structures that help them get what they need from their environment.

Lesson 4 Animals can be classified based on their structures and characteristics.

Vocabulary

Fill each blank with the best term from the list.

cells	mammal	photosynthesis	shelter
environment	nutrient	reproduce	vertebrate
invertebrate	organism		

1. Animals often seek a safe place, or shelter to protect themselves.
2. Each living thing is an organism.
3. An animal with a backbone is called a vertebrate.
4. Living things reproduce to make more of their own kind.
5. A vertebrate that is born live is called a mammal.
6. A substance that helps living things grow and stay healthy is a nutrient.
7. Plants make their own food using the process of photosynthesis.
8. Living things are made of one or more tiny cells.
9. An animal without a backbone is called an invertebrate.
10. All the living and nonliving things that surround an organism are part of an environment.

CHAPTER 2 Review

Skills and Concepts

Answer each of the following in complete sentences.

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

Living things use energy to grow, respond, and reproduce, while nonliving things do not.

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

Fish breathe using gills, while other animals have lungs. Some animals can take in oxygen through their skin.

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

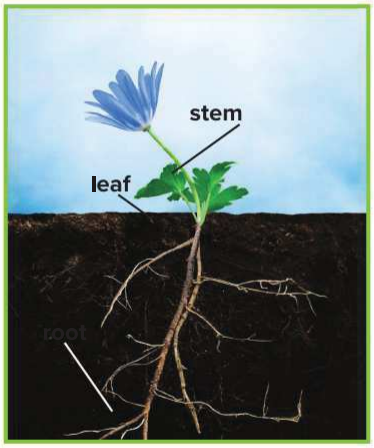
Vertebrates	Invertebrates
cow, goldfish, owl	butterfly, snail, spider

14. **Critical Thinking** What might happen to a plant if someone picked most of its leaves?

A plant that lost most of its leaves would not be able to make much food through photosynthesis. Either it would grow new leaves quickly, or it would die.

15. Explain how each labeled part helps a plant survive.

stem: holds up a plant and carries nutrients through the plant; leaf: turns sunlight into food for the plant; root: brings water and nutrients from the soil to the plant, helps support the plant



The Big Idea

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

Answers will vary. Students can use information from the chapter to answer.

Test Prep

Circle the best answer for each question.

1. What is one question you could ask to find out whether something is living?

A Does it take in nutrients?
B Was it made by humans?
C Does it come from nature?
D Is it made of more than one cell?

2. Some plants in tropical rain forests have very large leaves. The large leaves help the plants

A save their energy.
B lose extra rainwater.
C absorb more sunlight.
D support their tall trunks.

3. The large ears of a desert jackrabbit help it

A run fast.
B blend in.
C find food.
D stay cool.

4. How do animals use camouflage to survive?

A by standing out from their environment
B by absorbing more sunlight
C by blending in with their environment
D by giving warning calls

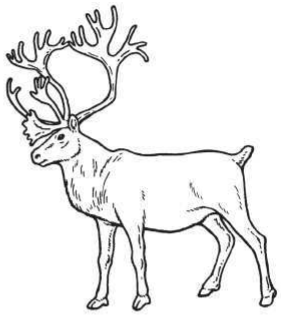
5. Where would you most likely find animals with thick fur and a lot of blubber?

A the desert
B cold, arctic waters
C a rain forest
D warm ocean waters

6. All of the following are needed for a plant to live except

A nutrients only.
B water, air, soil and light.
C light and water only.
D soil and air only.

7. Caribou live in the arctic tundra. They spend most of the summer eating small plants.



What do they do in winter when plants are hard to find?

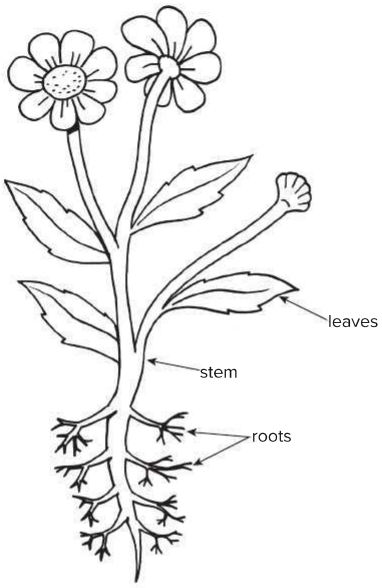
A eat meat instead of plants
B hibernate
C change color
D migrate

8. How do a plant's roots help it get what it needs?

A They take in sunlight.
B They take in carbon dioxide.
C They take in water.
D They take in food.

Answer the following question.

9. Describe how the labeled parts of the plant help it survive.



Leaves help a plant take in sunlight to make food; the stem holds up the plant and transports water to the other plant parts; roots hold a plant in the ground and take in water and nutrients from the soil.

CHAPTER 3

Living Things Grow and Change

The Big Idea

How do living things change?

Possible answers: Plants start as seeds. Animals may start as eggs or babies.

Vocabulary

seed a structure that can grow into a new plant

pollination when pollen moves from the male part of a plant to an egg, after which a seed can form

life cycle how an organism grows and reproduces

ecosystem the living and nonliving things that share an environment and interact

metamorphosis a series of changes through which an organism's body changes form

egg an animal structure that protects and feeds some very young animals such as birds

inherited trait a characteristic that is passed from parents to offspring

producer an organism that makes its own food

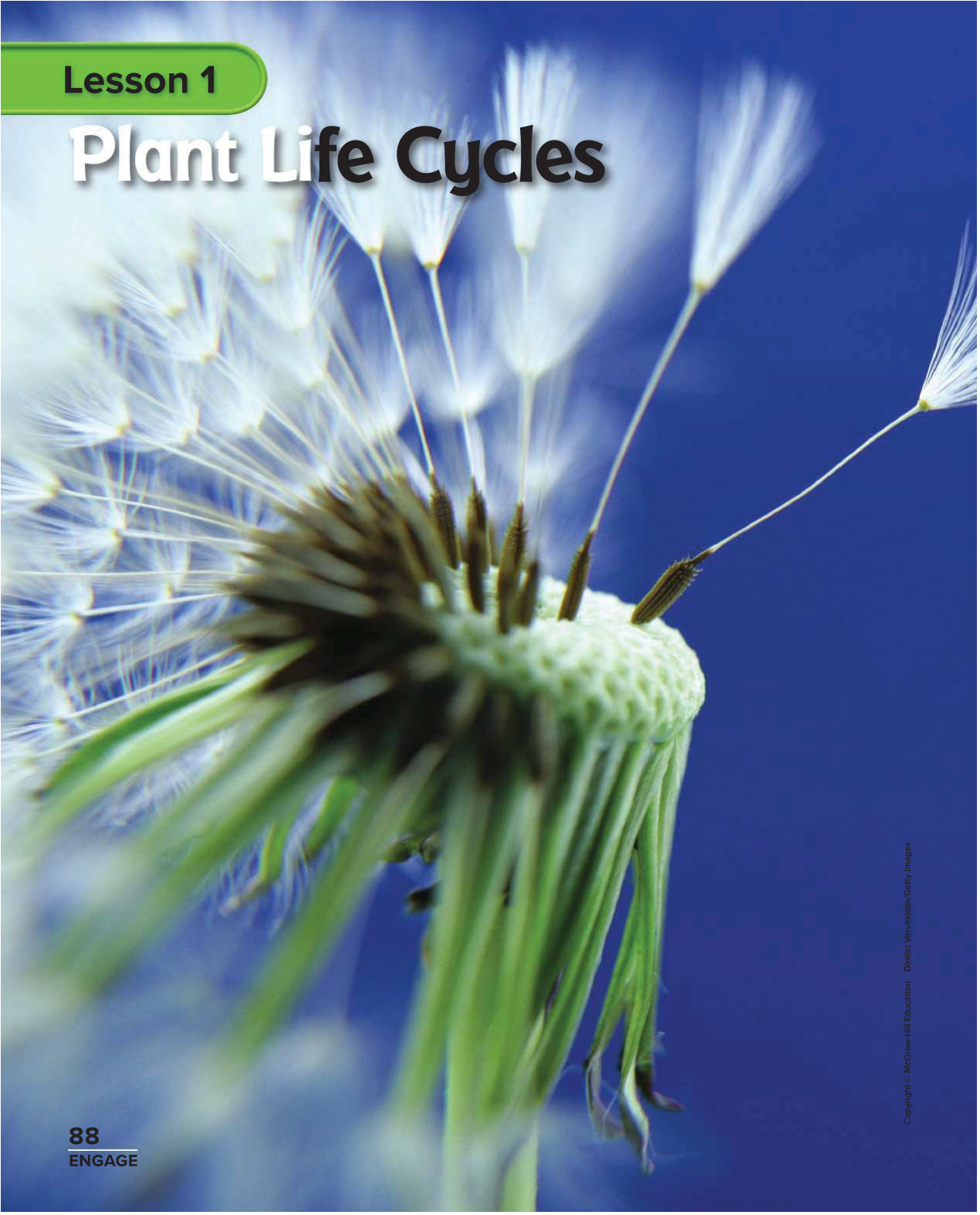
consumer an organism that eats other organisms

Before reading this chapter, write down what you already know in the first column. In the second column, write down what you want to learn. After you have completed this chapter, write down what you learned in the third column.

Living Things Grow and Change		
What do I **K**now	What I **W**ant to Know	What did you **L**earn?
Most plants start out as seeds.	What is a seed?	
Animals begin their lives in many different forms.	How can we predict how an animal will grow?	
Parents and their young have similar features.	What are some features that parents and young share?	

Lesson 1

Plant Life Cycles



Look and Wonder

Did you know that when you blow on a dandelion, you are helping seeds spread? New plants grow from those seeds. Where do seeds come from? How do seeds grow into plants?

Possible answers: Seeds grow into plants when they are in the soil and have enough water. Seeds grow into plants when the temperature gets warmer in the spring.

Essential Question How do plants grow and reproduce?

Answers will vary. Possible answer: Seeds grow into flowers and bees carry the plant's pollen to other areas to start new plants.

Explore

What does a seed need to grow?

Form a Hypothesis

Do seeds need water to grow? Form a hypothesis. Write your answer in the form "If seeds do not get water, then..."

Possible hypothesis: If seeds do not get water, then they will not grow.

Materials

- 6 seeds

- hand lens

- 2 paper towels

- water

- tablespoon

- 2 plastic bags

Test Your Hypothesis

1. **Observe** Look at the seeds with a hand lens. Draw what you see.

2. **Use Variables** Fold each paper towel into quarters. Then put two tablespoons of water onto one towel. Put the wet towel into a plastic bag. Label the bag *Water.* Put the dry towel into a bag. Label this bag *No Water.*

3. Place three seeds into each bag. Seal the bags and place them in a warm spot.

4. **Observe** Look at the seeds every day for one week. Record what you see with pictures and words. If the paper towel in the *Water* bag feels dry, add two tablespoons of water.

Draw Conclusions

5 **Interpret Data** Which seeds changed? How did they change?

Answers will vary but should reflect results from the experiment.

6 **Infer** Why do you think the seeds changed?

Possible answer: The seeds changed because they got what they needed to grow.

7 Did your results support your hypothesis?

Yes. My results supported my hypothesis. Seeds need water to grow.

Explore More

Experiment What would happen if you wet the paper towel with something other than water? Experiment to find out.

Answers will vary.

Open Inquiry

Form a hypothesis and design an experiment about other possible needs for a seed to sprout

My question is: Answers will vary.

How I can test it: Answers will vary.

My results are: Answers will vary.

Read and Respond

How do plants grow?

Did you know that when you eat corn, peas, or nuts, you are eating seeds? Seeds come in all shapes and sizes. Some are big like lima beans. Some are tiny like poppy seeds. Big or small, all seeds have the same function.

A **seed** is a structure that can grow into a new plant. It holds a young plant that is ready to grow. This young plant is called an **embryo** (EM•bree•oh). A seed has parts that help an embryo survive. It holds stored food that the embryo uses to grow. It has a tough covering that protects the embryo.

When a seed is planted in the soil, it can *germinate*, or begin to grow. A seed needs water, nutrients, and the right temperature to germinate. It can wait to grow for months or even years until conditions are right.

Quick Check

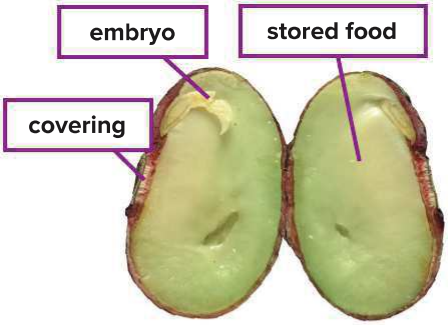
1. What happens to a seed after it germinates?

It grows into a seedling and then into an adult plant.

From Seed to Plant

1. **A seed is planted in soil.**
2. **The seed germinates. Roots start growing down into the soil.**

When a seed begins to germinate, it soaks up water. That makes it swell up and break through its covering. The embryo grows out of the seed. It grows into a small plant called a *seedling*. A seedling can grow into an adult plant.

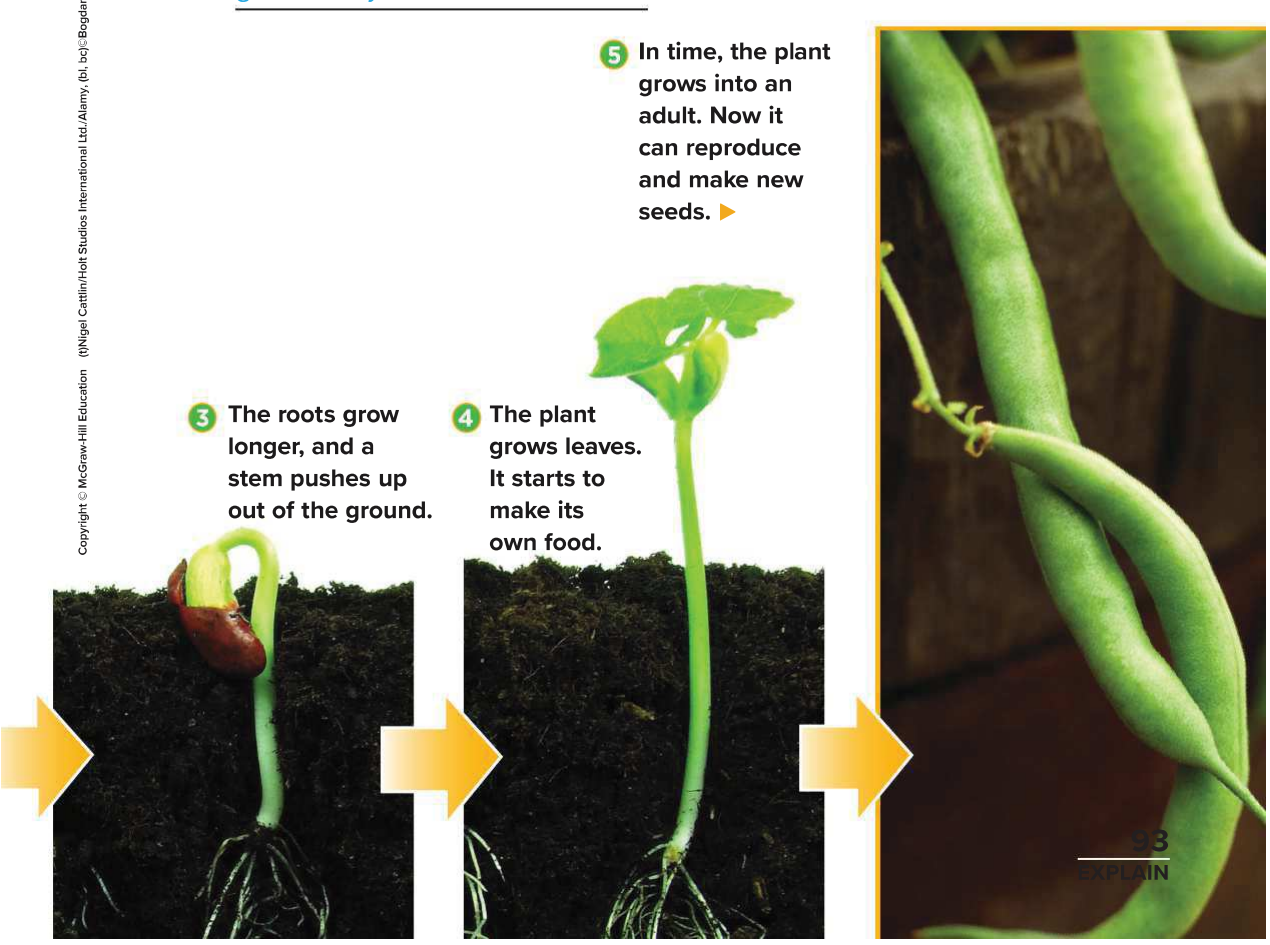


parts of a seed

Quick Check

2. What might happen to a seed if it does not get enough water?

The seed might not germinate. It might germinate but dry out or grow slowly.

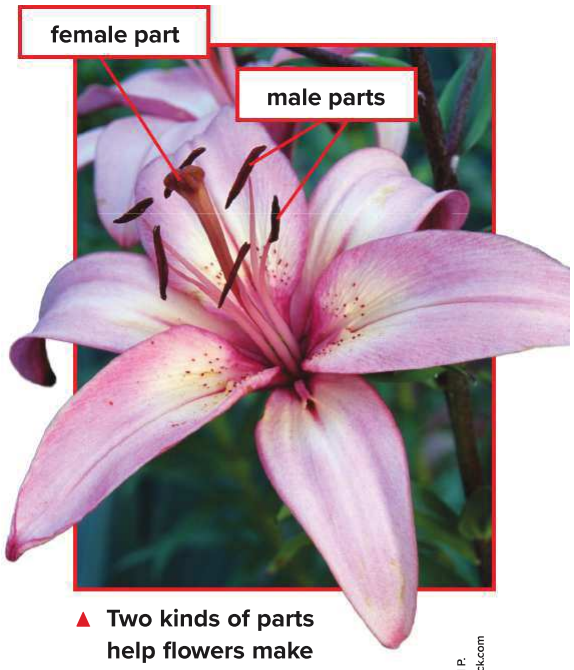


How do plants make seeds?

Flowers can look pretty and smell sweet. They also do an important job. Many plants need flowers to reproduce. A **flower** is a plant structure that makes seeds. Plants that use flowers to make seeds are called *flowering plants*.

A flower has two parts that help it make seeds—a male part and a female part. The male part makes a powder called *pollen*. The female part makes tiny eggs. When pollen and an egg come together, a seed can form.

How does pollen get to an egg? Wind can blow pollen from one flower to another. Animals such as hummingbirds, bees, and bats can carry pollen too. Some animals are attracted to a flower's smell or bright colors. They drink a sweet liquid, called *nectar*, from the flower. Sticky pollen clings to their bodies. Then, they carry the pollen to another flower.



▲ **Two kinds of parts help flowers make seeds—male parts and female parts.**

When a bee drinks nectar from a flower, yellow pollen sticks to its body. ▶

The movement of pollen from the male part of a flower to the female part is called **pollination** (pah•luh•NAY•shun). After pollination, seeds can develop. In flowering plants, fruit forms around the seeds. **Fruit** is a structure that holds seeds.

How Seeds Travel

Before a seed can germinate, it must find its way to the soil. How does it get there? Some seeds, such as a fuzzy dandelion's, are made to blow in the breeze. Other seeds fall to the ground inside of ripe fruit. The fruit rots and spills its seeds.

Animals can help too. Seeds, such as acorns, can be buried by squirrels. Prickly seeds can stick to an animal's fur and be carried to a new place. When an animal eats fruit, the seeds can pass through the animal's body. They are left on the ground in the animal's waste.

Quick Lab

To learn more about fruits and seeds, do the Quick Lab in the laboratory activities manual.

Quick Check

3. How do bright, sweet-smelling flowers help plants?

They attract animals, which help in pollination.

Berry seeds will pass through this Redwing's body and into the soil, where they can grow.

FACT Tomatoes have seeds, so they are fruit.

What is a plant's life cycle?

How a plant germinates, grows, and reproduces is the plant's **life cycle**. Plants grow and reproduce in different ways. For example, some plants have flowers, and others have cones.

In time, adult plants die. They *decompose*, or break down, and become part of the soil. This adds nutrients to the soil that help other plants grow.

Flowering Plants

Most plants are flowering plants. Flowering plants grow from seeds into adult plants. As adults, they reproduce and make new seeds using flowers.

Quick Check

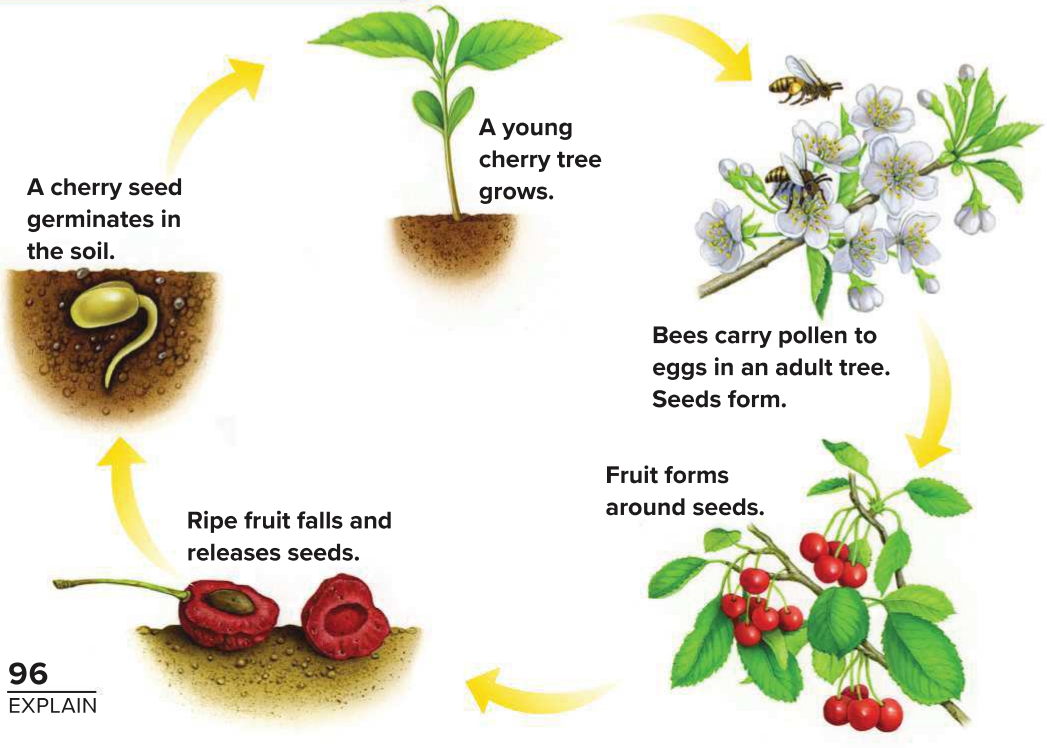
4. How do conifers form seeds?

Male cones produce pollen. Wind carries pollen to the female cones, which have eggs. Seeds form in cones.

5. How are flowers and cones alike? How are they different?

Flowers and cones form seeds and help plants reproduce. Flowers usually have male and female parts. Cones can be either female or male.

Life Cycle of a Cherry Tree

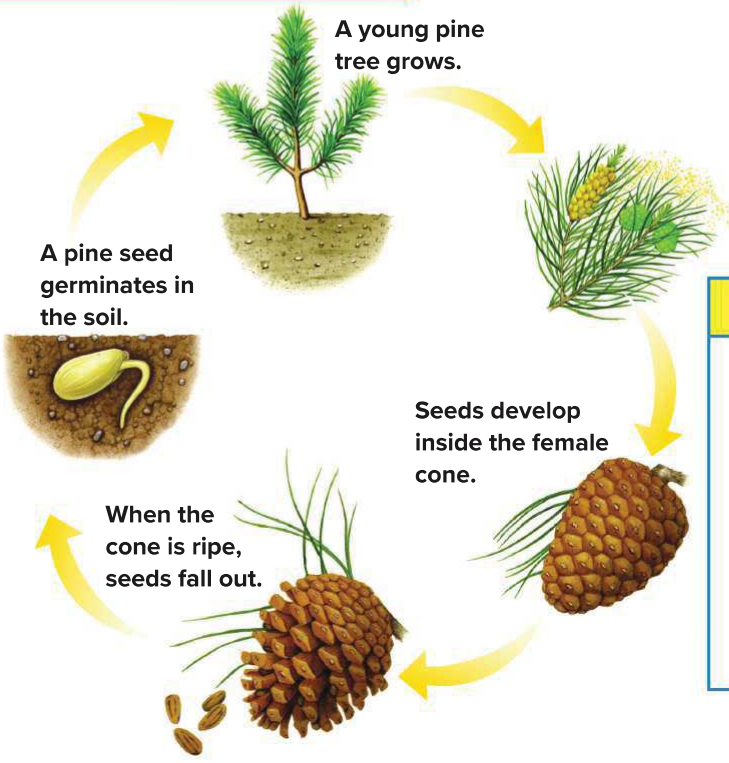


Conifers

Have you ever picked up a pine cone? **Cones** are plant structures that make seeds. Plants that reproduce with cones are called *conifers*. They include pine, spruce, and hemlock trees. Conifers have similar life cycles to flowering plants. Both grow from seeds. Both reproduce and make new seeds through pollination. However, conifers make seeds inside of cones instead of flowers.


pine tree

Life Cycle of a Pine Tree



Read a Diagram

What are the stages of a conifer's life cycle?
Clue: Arrows help show a sequence.

seed, young plant, adult plant with cones, and seed formation

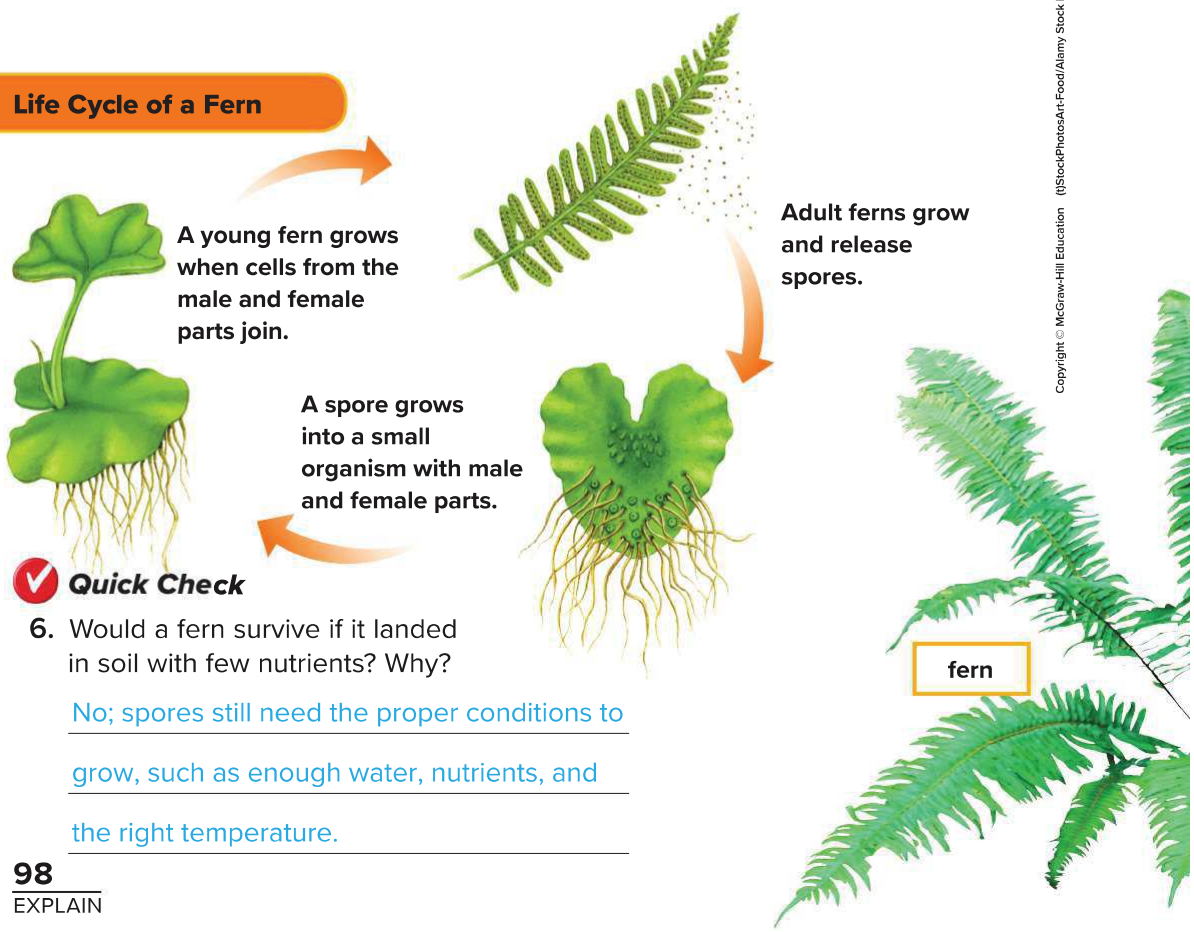
How do plants grow without seeds?

Some plants reproduce without making seeds. A type of plant called a **fern** never makes seeds. Instead it makes ***spores***. Like a seed, a spore can fall to the ground. It can grow into a new fern plant. Unlike a seed, a spore does not have stored food.

New plants can also grow from parts of plants. Potato plants can grow from the white spots, or **"eyes,"** on a potato. Other plants grow from an underground stem called a ***bulb***. An onion is one type of bulb. Sometimes, a new plant can also grow from a stem or a leaf that is placed in water.

▲ **New stems and leaves can grow from the "eyes" of a potato.**

Life Cycle of a Fern



Quick Check

6. Would a fern survive if it landed in soil with few nutrients? Why?

No; spores still need the proper conditions to grow, such as enough water, nutrients, and the right temperature.

My Notes

Visual Summary

Complete the lesson summary in your own words.

Growth Changes Plants go through a series of changes as they grow into adults.

Flowering Plants and Conifers grow from seeds and have similar life cycles.

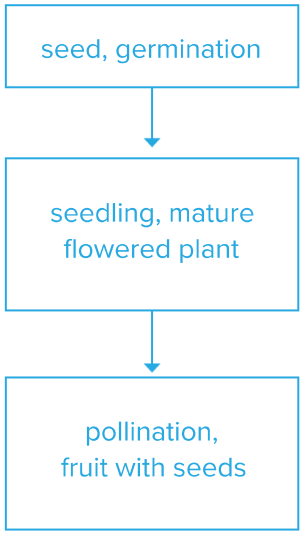
Ferns Ferns make spores. Other plants grow in different ways.

Think, Talk, and Write

1 **Vocabulary** What is fruit?

a plant structure that grows around the seeds of flowering plants

2 **Sequence** What is the life cycle of a flowering plant?



3 **Critical Thinking** How do animals help flowering plants?

by carrying pollen between plants and by spreading seeds

4 **Test Prep** How does a conifer reproduce?

A with bulbs
B with flowers
C with cones
D with spores

Essential Question How do plants grow and reproduce?

Plants reproduce by sending spores through the air or by being carried by other insects like bees.

Focus on Skills

Inquiry Skill: Form a Hypothesis

You just learned how seeds grow into plants. Can seeds grow when the weather is cold? To answer questions like this, scientists start with what they know about plants. Then they use this information to turn their question into a testable statement. That is, they **form a hypothesis**.

▶ Learn It

When you **form a hypothesis**, you make a statement that you can test by collecting data. Suppose you want to find out if plants need sunlight. Based on what you know, you could **form a hypothesis** like this: If plants do not get sunlight, then they will not grow.

A good hypothesis needs to be testable. You could test the hypothesis above by placing one plant in the dark and one in sunlight. Then you could observe and record what happens. A hypothesis also needs to identify the variables. In the example above, sunlight and plant growth are variables.

▶ Try It

Form a hypothesis about what seeds need to grow. Then test that hypothesis with an experiment.

Materials **water, 2 paper towels, 6 pea seeds, 2 sealable plastic bags, 2 foam cups, ice**

1. Think about what you know about seeds. Now form a hypothesis about this question: *Will pea seeds germinate more quickly in a cold spot or in a warm spot?* Begin with "If I plant a pea seed in the cold, then..."

Answers will vary.

2. Fold two wet paper towels in half and place three seeds onto each. Place each paper towel into a plastic bag and seal the bags.
3. Fill one foam cup with ice. Place one bag into this foam cup. Place the other bag into the empty foam cup.
4. Record your observations in your science journal. Transfer your notes to the table below. Use it to record your observations each day. Do your results support your hypothesis?

Step 4

	Cold	Warm
Day 1		
Day 2		
Day 3		
Day 4		

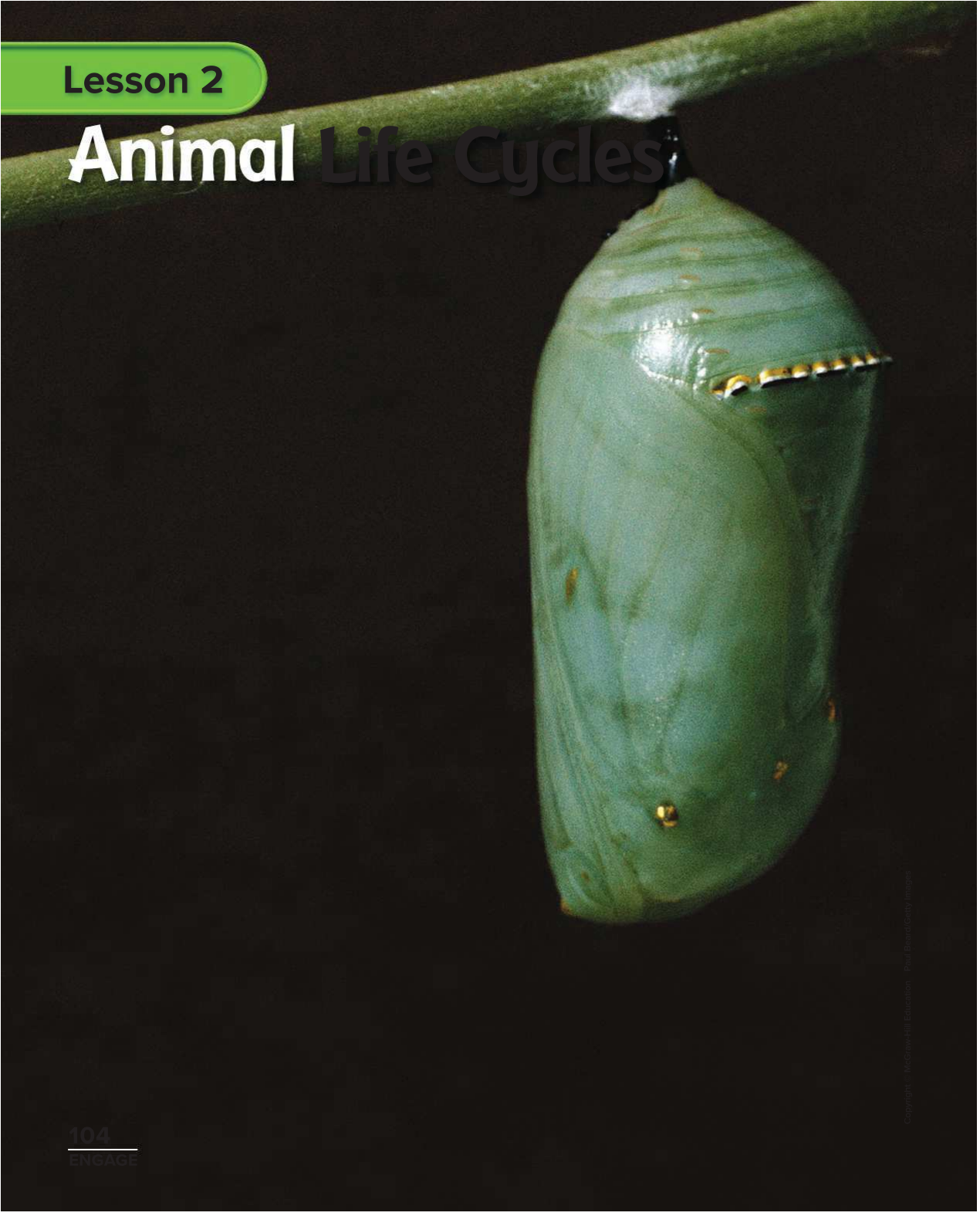
Apply It

Now that you have learned to think like a scientist, you can answer other questions. Do seeds germinate more quickly in the light or dark? **Form a hypothesis** about this question. Then plan an experiment to test your hypothesis.

Answers will vary.

Lesson 2

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?

Possible answer: No; some animals change a lot, like a tadpole growing into a frog. Other animals look like small adults when they are born, such as a giraffe.

Essential Question How do animals grow and reproduce?

Possible answer: Animals start out small and get larger. They grow and age and then reproduce.

Explore

How does a caterpillar grow and change?

Make a Prediction

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

Possible prediction: A caterpillar will grow larger and change into a butterfly.

Test Your Prediction

Materials

- caterpillar

- hand lens

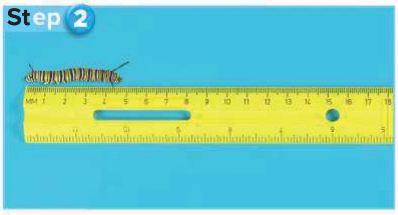
- ruler

- caterpillar kit

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?

Possible answer: first slow growth and then changing into a pupa and later a butterfly.

6 **Infer** What are the stages in a butterfly's life cycle?

Larva, pupa (chrysalis) and butterfly (adult)

Explore More

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

Answers will vary.

Open Inquiry

Think about another animal and explore its growth.

My question is: Answers will vary.

How I can test it: Answers will vary.

My results are: Answers will vary.

Read and Respond

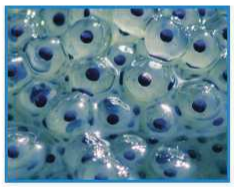
What are some animal life cycles?

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 might 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

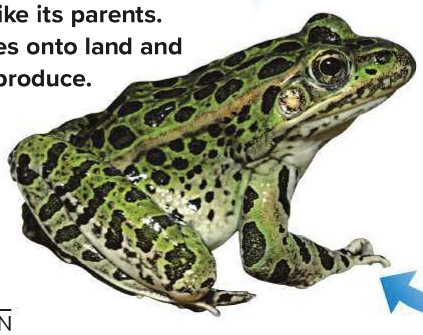


Egg Frogs lay eggs in water.

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** (me•tuh•MOR•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.

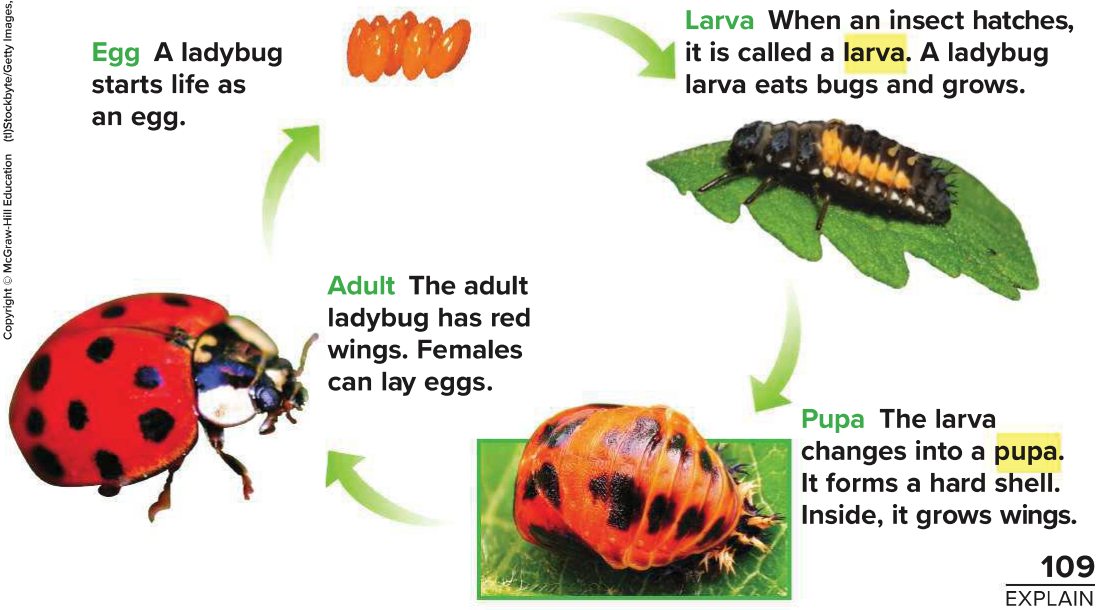
Quick Check

1. Compare a frog's life cycle to a ladybug's life cycle.

Both frogs and ladybugs go through metamorphosis.

Both start life as eggs.

Life Cycle of a Ladybug



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 kilograms (300 pounds). Females stay in the sea until they are ready to lay eggs.**

EXPLAIN

In time, young reptiles, fish, and birds grow into adults. 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 Lab

To learn about a bird's life cycle, do the Quick Lab in the laboratory activities manual.

Quick Check

2. How is a reptile's life cycle similar to a frog's? How does it differ?

Both reptiles and frogs start life as eggs. Newly hatched frogs and adult frogs look different. Frogs go through metamorphosis as part of their life cycle and reptiles do not. Reptiles hatch looking similar to small adults.

Life Cycle of a Salmon

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?

Most 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.

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.

The cheetah becomes stronger, loses fat and gains muscle, and looks more like an adult.

My Notes

Visual Summary

Complete the lesson summary in your own words.

Animal metamorphosis. has its own life cycle. Amphibians and most insects go through metamorphosis.

Reptiles, Birds, and Fish hatch from eggs. Reptiles and fish do not usually care for their young.

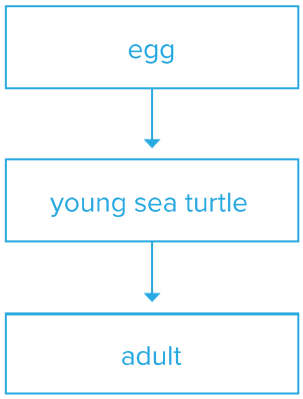
Most mammals are born live. They depend on their parents until they can get their own food.

Think, Talk, and Write

1 **Vocabulary** What is metamorphosis?

a series of changes some animals go through during their life cycle

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



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

No; when humans are born they have many adult features.

4 **Test Prep** An iguana's life cycle would be most like a
(A) turtle's. C fly's.
B cheetah's. D bear's.

Essential Question How do animals grow and reproduce?

Answers will vary. However, students should understand that animals grow and reproduce in different ways.

Graphing Life Spans

How long do animals live? A fruit fly is likely to live for only about one 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 on the right. Use the data to make a bar graph comparing the animals' life spans.

Animal	Average Life Span*
black-tailed deer	10 years
robin	13 years
rat snake	23 years
fence lizard	4 years
toad	15 years

*** under ideal conditions**

robin

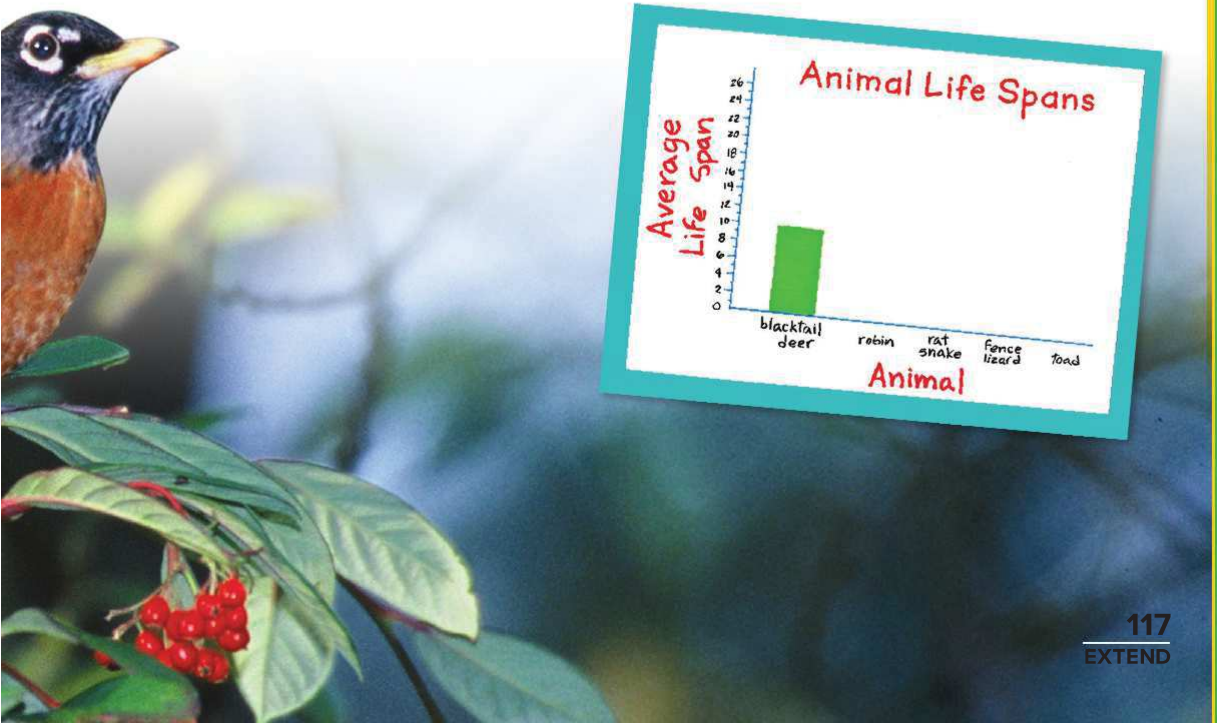
Solve It

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

The life spans of the American robin and the toad are most similar. The life spans of the fence lizard and the rat snake are the most different.

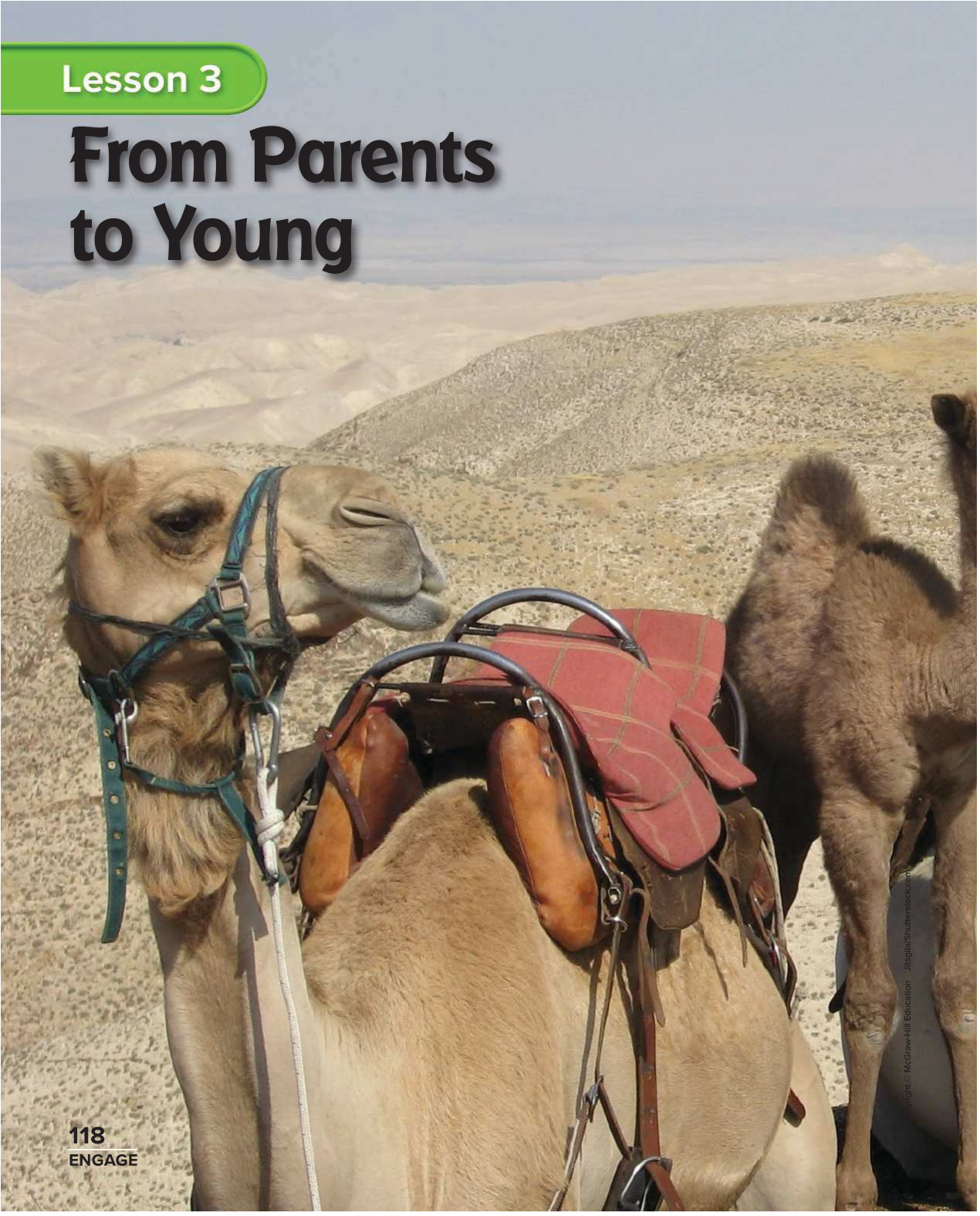
Make a Bar Graph

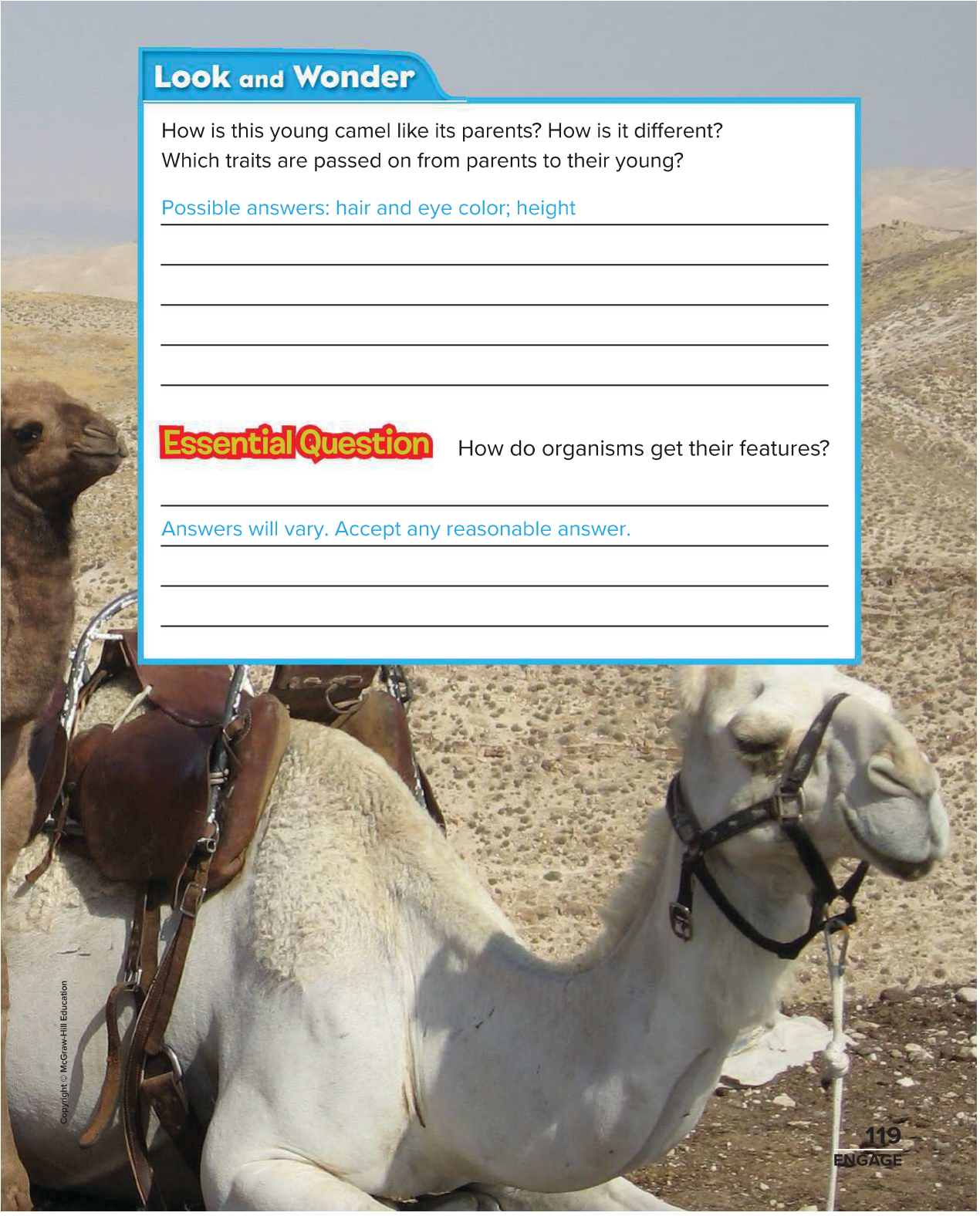
- **Title your graph. Label the left side and the bottom.**
- **Next, list the animals along the bottom of the graph.**
- **Write numbers up the left side. Start with 0 and count to the longest life span.**
- **Draw a bar for each animal up to the number that shows its life span.**



Lesson 3

From Parents to Young





Look and Wonder

How is this young camel like its parents? How is it different? Which traits are passed on from parents to their young?

Possible answers: hair and eye color; height

Essential Question How do organisms get their features?

Answers will vary. Accept any reasonable answer.

Explore

Which traits are passed from parents to their young?

Make a Prediction

Which of your traits are inherited, or passed on, from your parents? Is your hair color or hair length inherited? Make a prediction.

Students' predictions will vary depending on the trait they are observing.

Test Your Prediction

1. **Communicate** Make a data table like the one shown. Use your table to describe your traits.

2. **Classify** Some traits have changed since you were little. Others have not changed. Circle the traits that have not changed.

3. **Communicate** Compare tables with a classmate. Which of your classmate's traits have stayed the same over time?

Step 1

Trait Name	Trait Description
Hair Color	
Hair Length	long/short (circle one)
Dimples	yes/no (circle one)
Earlobes	attached/unattached (circle one)
Favorite Food	

Step 3

Draw Conclusions

4 Which traits did most students classify as traits that stay the same?

Answers will vary.

5 **Infer** How do you think you got the traits that do not change?

Answers will vary. Students should recognize that the traits they were born with are more likely to be inherited traits.

6 **Infer** Some of your traits are inherited from your parents. Underline the traits that you think you inherited. Explain why you chose these traits.

Inherited traits: hair color, eye color, attached/unattached ear lobes, and dimples

Explore More

Make a trait table that has a column for each member of your family. Which traits do you share with your family members?

Answers will vary.

Open Inquiry

Think about other ways to explore inherited and learned traits.

My question is: Answers will vary.

How I can test it: Answers will vary.

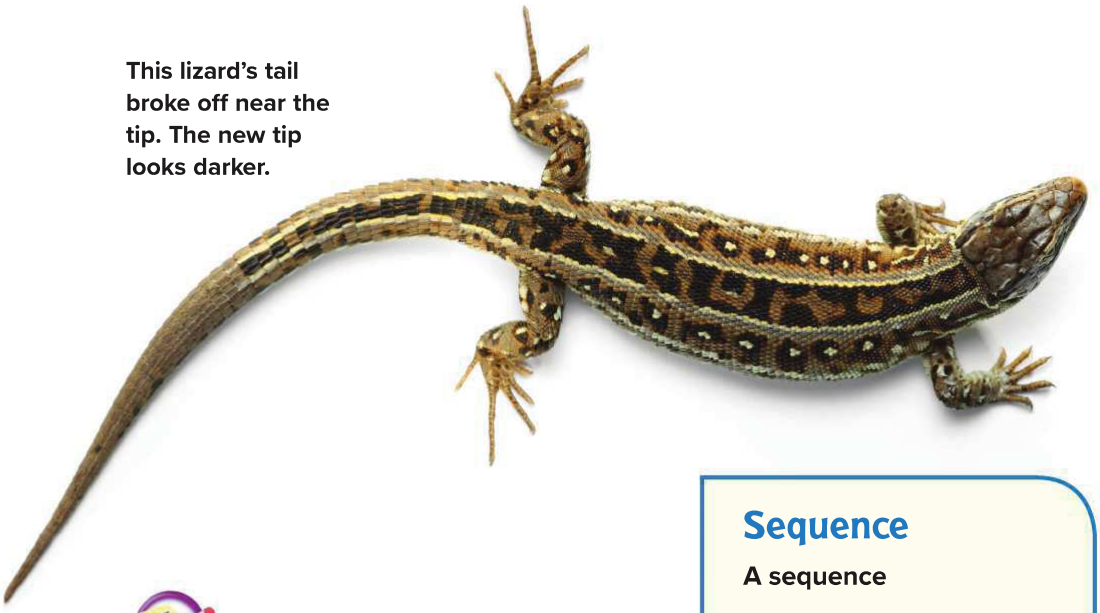
My results are: Answers will vary.

Meet Darrel Frost

A lizard is soaking up warmth from the Sun when a hawk soars overhead. The hawk spots the lizard, then swoops down to grab a meal. The lizard has no time to scurry away. How can it escape the hawk's claws?

If the hawk catches the lizard's long tail, the tail will break off. The bird will be left holding a wriggling tail while the lizard runs away. In time, the lizard will grow a new tail. Growing new body parts is a trait called regeneration.

Regeneration is one of the many amazing traits that Darrel Frost studies. Darrel is a scientist that studies reptiles and amphibians. He travels all over the world to collect different kinds of lizards. Then he observes their traits. Finally, he uses his observations to find out how different kinds of lizards are related.



This lizard's tail broke off near the tip. The new tip looks darker.

Sequence

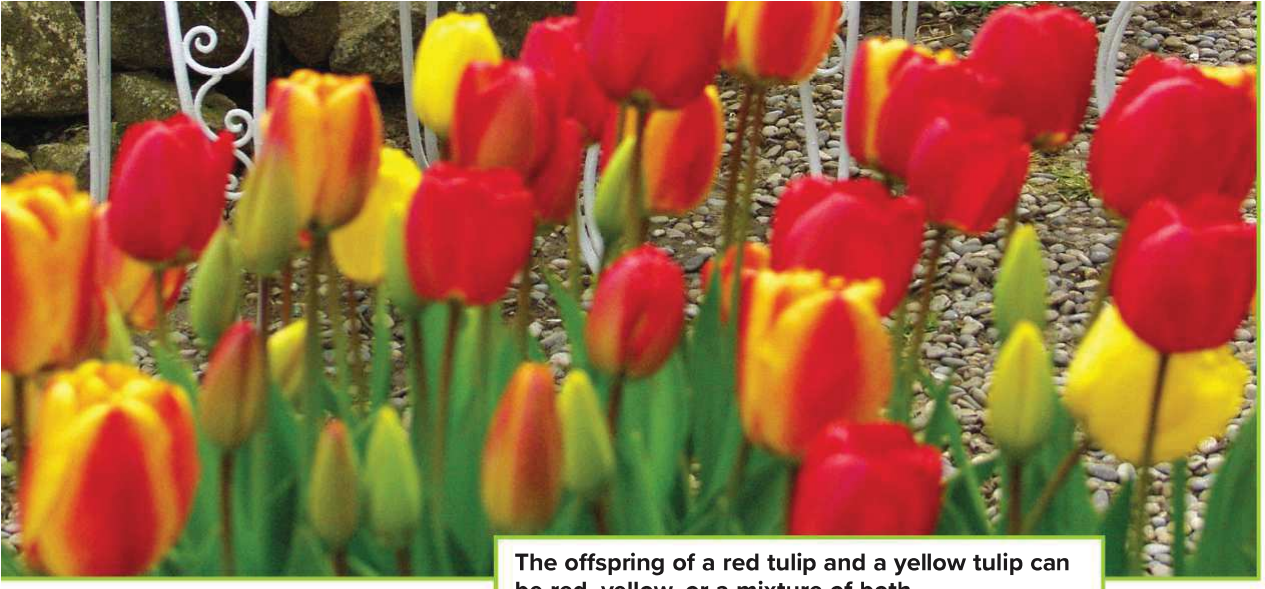
A sequence

- **gives events in order;**
- **tells what happens first, next, and last;**
- **uses time-order words, such as *first, next, then,* and *finally.***

Write About It

Sequence Read the article with a partner. Fill in a sequence-of-events chart to show how Darrel learns about lizards. Then use your chart to write a summary about Darrel and his work.

First, Darrel travels all over the world to observe lizards. Then, he studies their traits. Last, he uses his observations to try to find how the lizards are related.



The offspring of a red tulip and a yellow tulip can be red, yellow, or a mixture of both.

Read and Respond

What are inherited traits?

Have you ever wondered why people look the way they do? Why do some people have brown eyes and other people have green eyes, for example? Every organism has traits that make it unique. A **trait** is a feature of a living thing. Eye and hair color are traits. The shape of a plant's flowers, stems, and leaves are traits. Traits help you recognize and describe an organism.

Where do an organism's traits come from? Part of the answer is heredity. **Heredity** is the passing on of traits from parents to young. Traits that come from parents are called **inherited traits**. A flower's shape and color are inherited traits. Your eye color and hair color are inherited traits. The number of arms and legs an animal has is also inherited. Inherited traits make organisms look like their parents.

Most organisms inherit traits from both parents. For this reason, organisms almost never look exactly like either parent. A baby girl might have her mother's hair color but her father's eye color, for example.

Organisms may look more like one parent than the other. This happens when one parent gives its offspring traits that are more visible. *Offspring* are an organism's young. The offspring of a gray dog and a yellow dog may be yellow. The offspring of a red flower and a yellow flower could be red.

Quick Lab

To learn more about inherited traits, do the Quick Lab in the laboratory activities manual.

Quick Check

1. What are inherited traits?

traits that come from parents

Do these people look like they are related? What traits do they share? ▼

Which traits are not inherited?

Some of your traits come from your parents. Others are learned. People and animals can gain new skills over time. These new skills are called **learned traits**. Riding a bicycle and speaking a language are learned traits.

Some of your traits are affected by your environment. For example, your hair may get lighter from being in sunlight. A plant's green leaves may become yellow if it gets too much water. A rabbit may grow fat when it finds a lot of food. It may grow skinny when food is hard to find.

Learned traits are not passed on from parents to offspring. Your parents may know how to ride a bicycle, but you still had to learn to ride one yourself. Traits affected by the environment are also not passed on. If an animal gets a scar, its offspring will not be born with scars. If a tree loses branches in a storm, its offspring will not grow with missing branches.

Quick Check

2. Answer true or false.

   Speaking a language is an inherited trait.

   false

▲ **A sea otter smashes a clam shell against a rock. This learned trait helps the otter get food.**

Changing Traits

Read a Photo

How has this tree been affected by things in its environment?
Clue: compare the tree with other trees around you.
Possible answer: The tree appears to have holes in it made by the bird pictured, or by other birds.

My Notes

Visual Summary

Complete the lesson summary in your own words.

Inherited Traits are passed on from parents to offsprings.

Learned Traits are new skills an organism gains during its life.

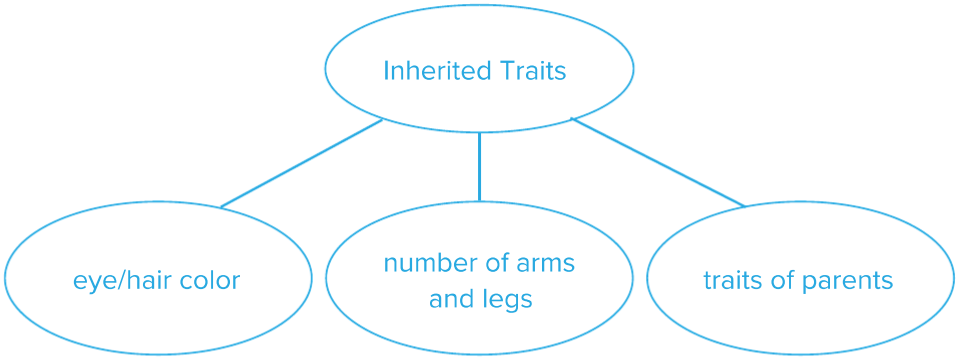
Some Traits are affected by an organism's environment.

Think, Talk, and Write

1 Vocabulary What is heredity?

the passing on of traits from parents to young

2 Main Idea and Details What is an inherited trait? Give examples.



3 Critical Thinking Why do you look the way you do?

Possible answer: I look the way I do partly because of traits I inherited from my parents. Other traits are the result of my environment.

4 Test Prep A plant loses branches during a storm. This is an example of

A an inherited trait.
B a trait affected by the environment.
C a learned trait.
D heredity.

Essential Question How do organisms get their features?

Organisms get features from their parents and their environment.

Lesson 4

Food Chains and Food Webs

Look and Wonder

A bald eagle can fly at 160 kilometers 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?

Possible answers: Animals depend on plants for food; animals depend on other animals for food.

Essential Question How do living things interact?

Answers will vary. Accept any reasonable answer.

Explore

What kinds of food do owls pigeons need?

Purpose

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

Materials

- plastic gloves

- paper plate

- owl pellet

- tweezers

- hand lens

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 or pigeon pellet? Write your prediction.

Answers will vary. Accept all reasonable responses.

3. Using the tweezers, separate the objects in the pellet.

4. **Observe** What is in the owl or pigeon pellet? Use the hand lens. Record your observations. **Be Careful.** Wash your hands when you are done.

Answers will vary but students may find undigested things, such as hair and bones.

Draw Conclusions

5 **Interpret Data** What do the materials inside the owl or pigeon pellet tell you about what an owl or pigeon eats?

Answers will vary. Accept all reasonable responses.

6 **Infer** What organisms might an owl or pigeon eat? What might those organisms eat?

Guide students to infer that owls eat small animals, such as mice.

Explore More

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

Student answers will vary. Students should find that their foods come from a variety of sources.

Open Inquiry

Think about a animal that lives in a different type of environment and what its diet might be.

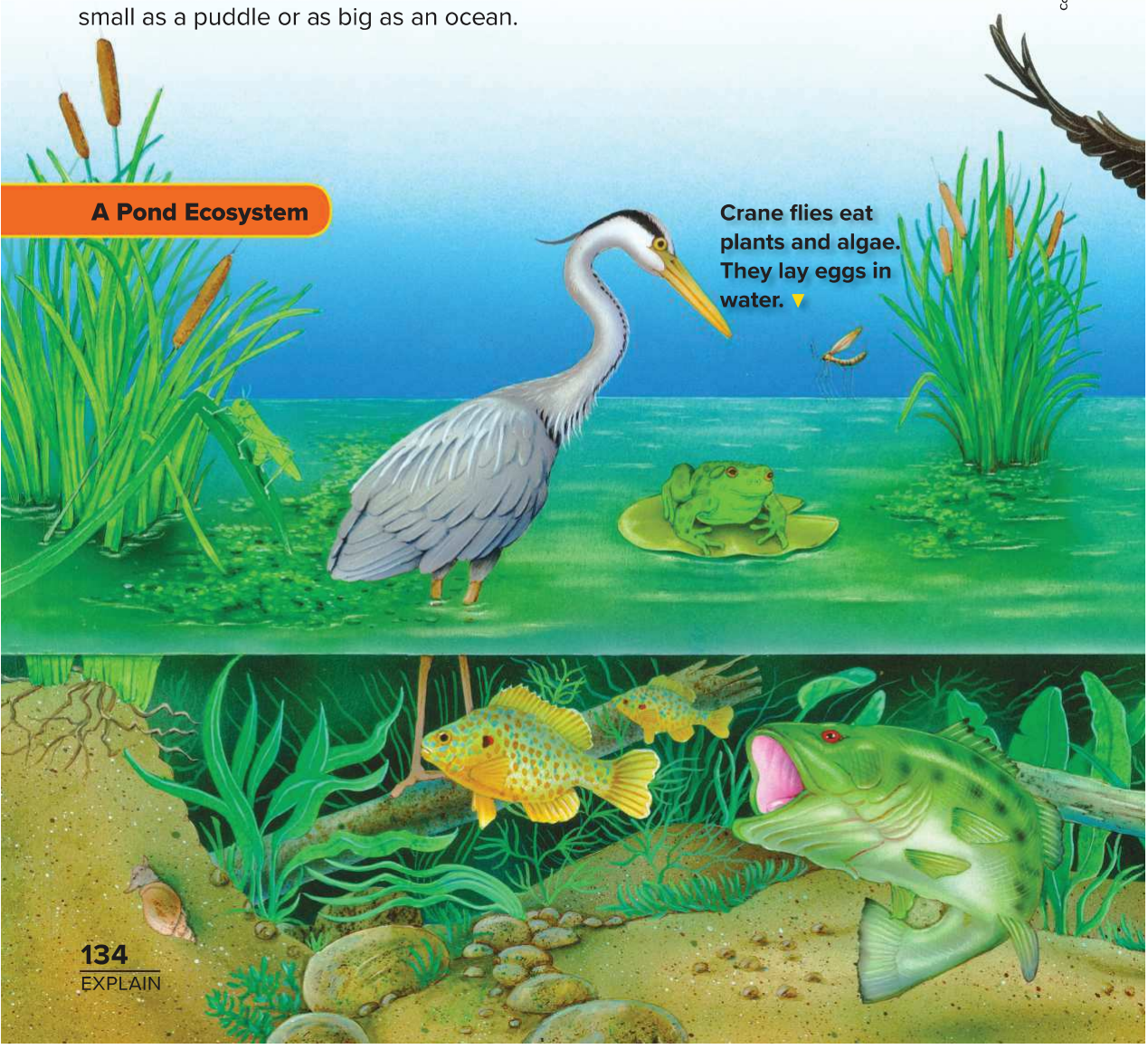
My question is: Student answers will vary.

How I can test it: Student answers will vary.

My results are: Student answers will vary.

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** (EE•koh•sis•tum). 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.



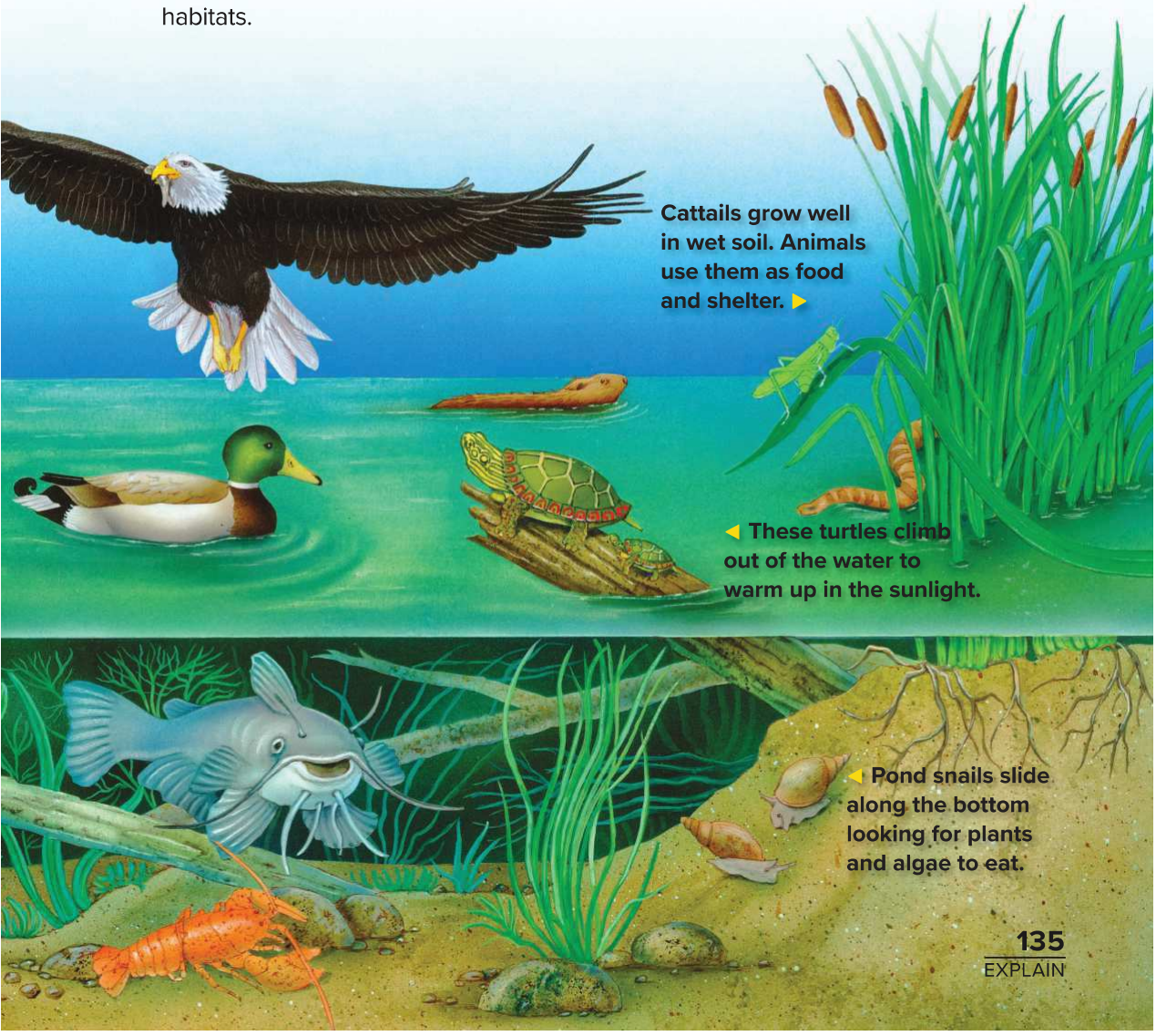
Big or small, ecosystems are made up of living and nonliving things. Frogs, birds, and plants are some living things in a pond. Sunlight, water, and soil are some nonliving things.

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

1. Which pond animals could also survive in a land ecosystem?

Possible answer: The bird and the insects could survive in a field.



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 sunlight.

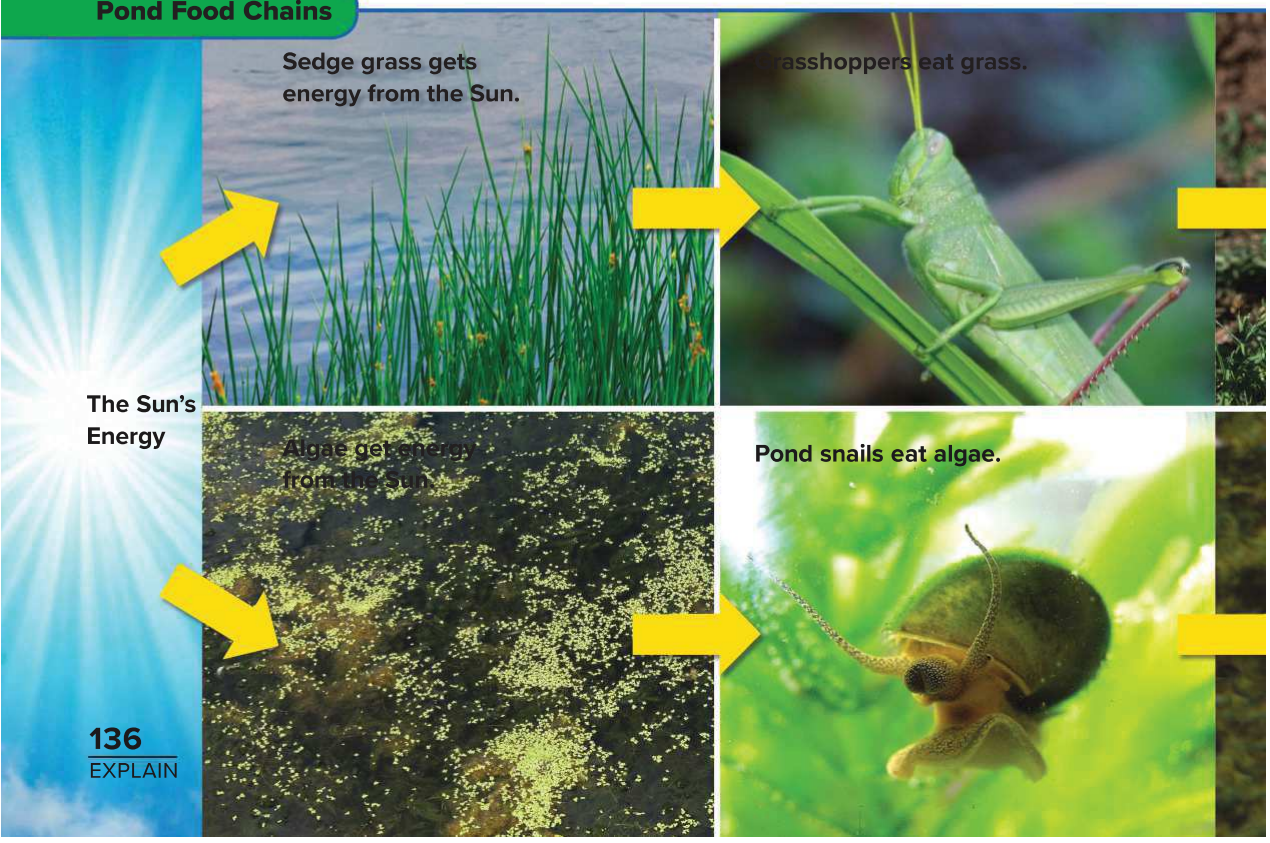
◀ Pond snails slide along the bottom looking for plants and algae to eat.

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. Look at the diagram below. The arrows show the flow of energy.

The first organism in a food chain is a producer (proh•DEW•sur). 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



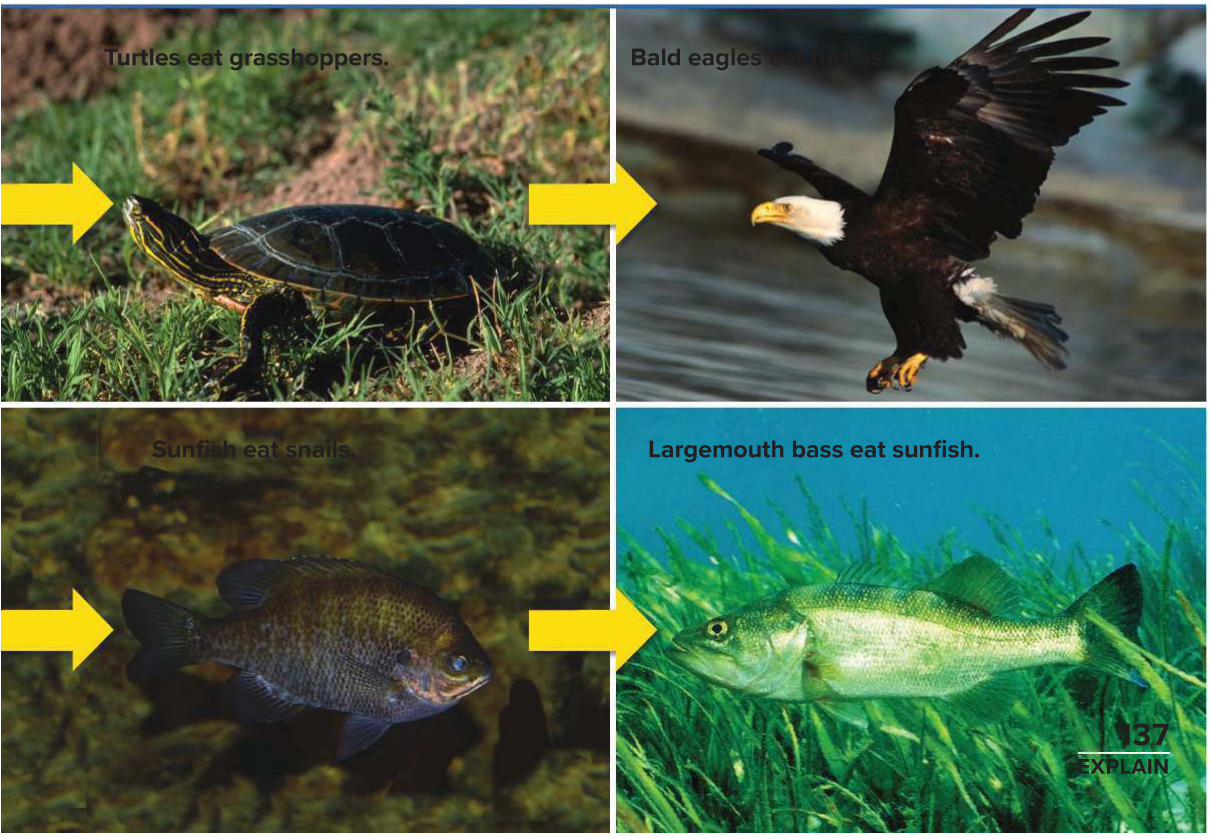
The next organisms in a food chain are consumers (kun•SEW•murz). A **consumer** is an organism that eats other organisms. All animals are consumers. A food chain may have many consumers.

Next in the food chain are decomposers (dee•kum•POH•zurz). 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

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

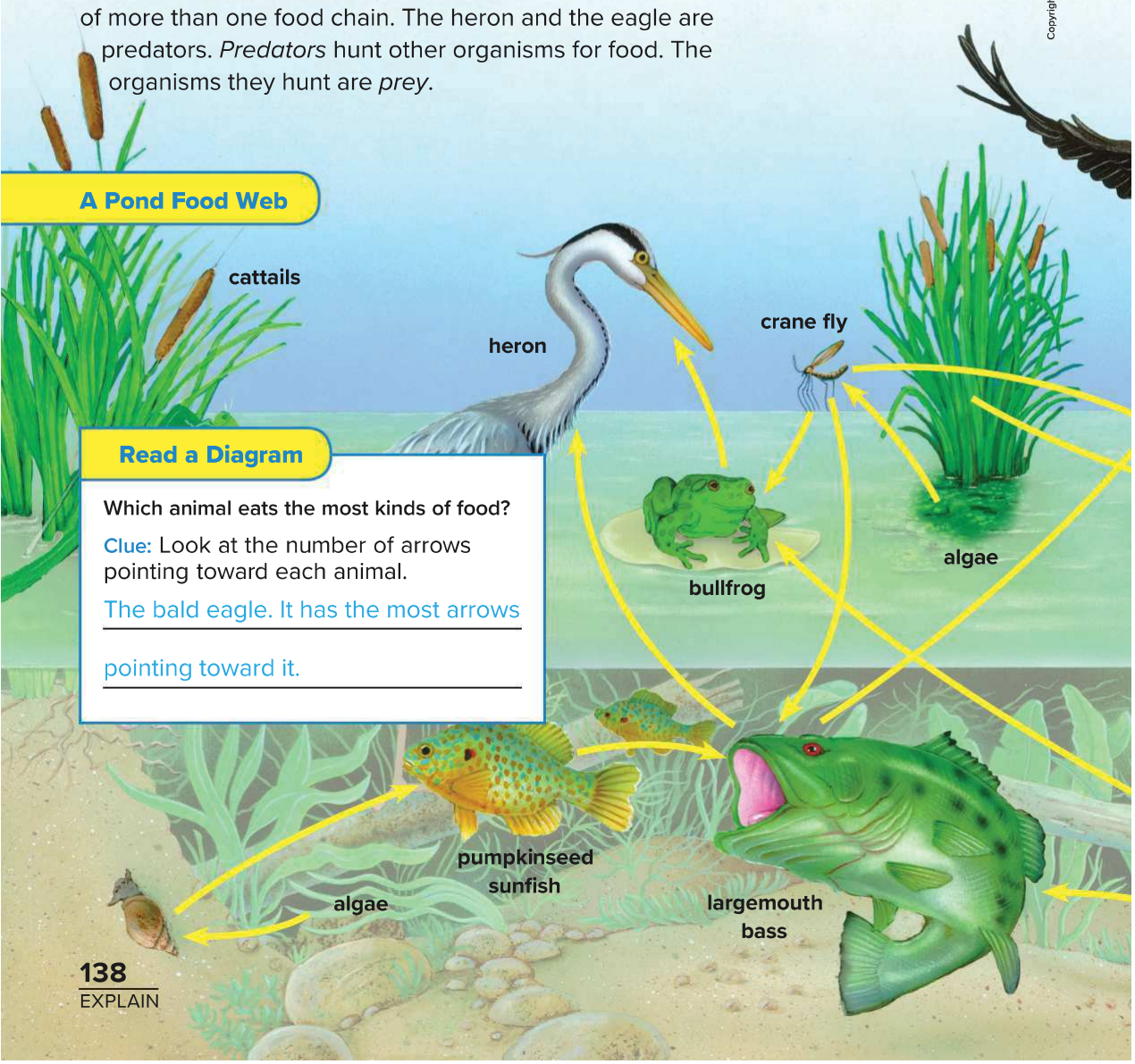
The eagles would not have as much to eat and their population might shrink. The grasshoppers would not get eaten by turtles, and their population might grow.



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*.



Read a Diagram

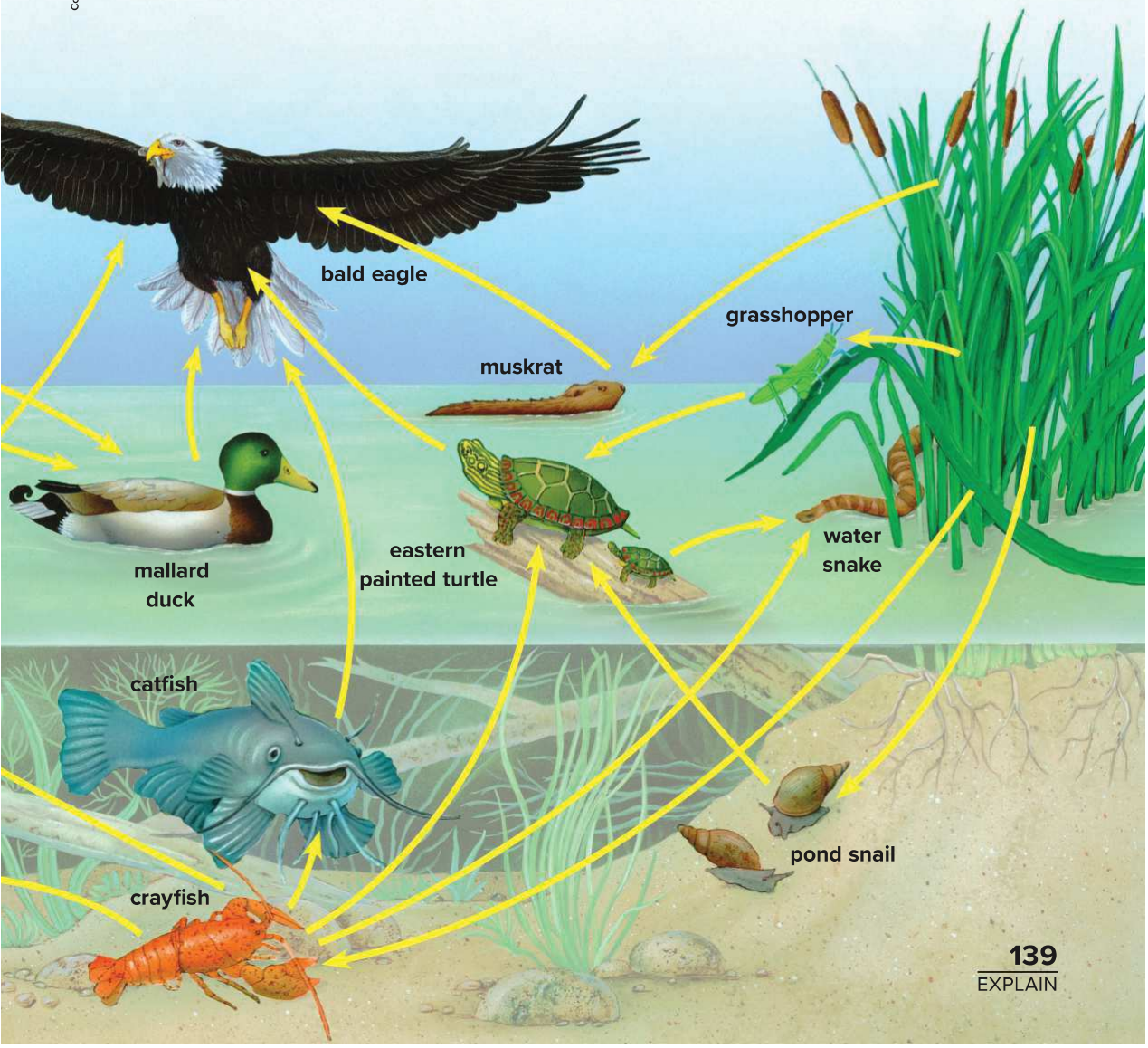
Which animal eats the most kinds of food?

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

The bald eagle. It has the most arrows pointing toward it.

You can learn about living things by studying food webs. Below, you can see that the snail eats plants. Organisms that eat plants are *herbivores*. Some animals, such as herons, eat 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 turtles, fish, or bullfrogs might go hungry.



Quick Lab

To learn more about decomposers, do the Quick Lab activity in the laboratory activities manual.

Quick Check

3. How do decomposers help a pond ecosystem?

They add nutrients to soil and water that help pond plants grow. They break down material so it doesn't fill up the pond.

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. ▼

My Notes

Visual Summary

Complete the lesson summary in your own words.

Ecosystems have living and nonliving things that depend on each other to survive.

Food Chains and Food Webs show how energy flows through an ecosystem.

Decomposers play an important role in an ecosystem. They eat dead material and release nutrients.

Think, Talk, and Write

1 **Vocabulary** What is a consumer?

an organism that eats other organisms

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

Clues	What I Know	What I Infer
Animals compete for food.	There might not be enough of one kind of food.	More food is available in other food chains.

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

Decomposers recycle nutrients that help plants grow; animals may depend on these plants or upon other animals that eat the plants.

4 **Test Prep** Most producers get their energy from

(A) sunlight. **C** predators.
B consumers. **D** rocks.

Essential Question How do living things interact?

Student answers will vary but should reflect an understanding of the lesson material.

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

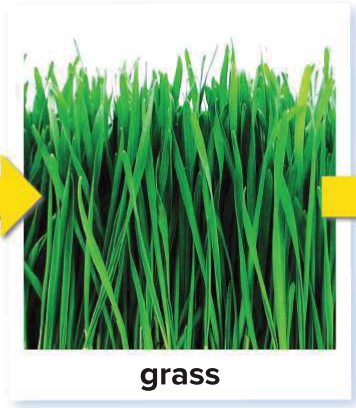
In this activity you will organize and **communicate** data about a grassland ecosystem. Look at the data table below. It shows how some organisms in a grassland get energy. It also tells how the organisms interact. A table is one way to **communicate** data. You will try some other ways.

Grassland Organisms

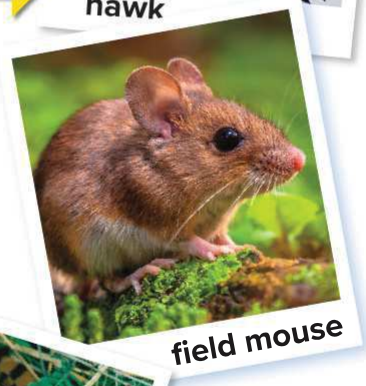
Organism	Where Organism Gets Energy
grass	Sun
snake	field mouse
hawk	snake
field mouse	grass

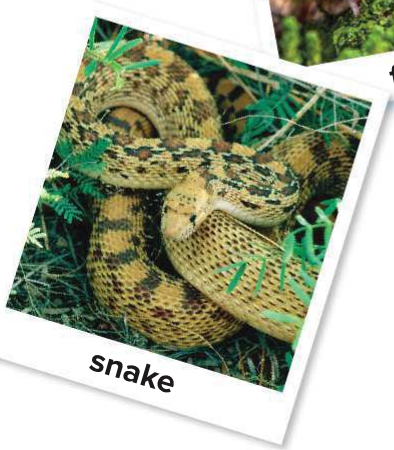
1. One way you can **communicate** the data is by making a food-chain diagram. The photographs show the start of a food chain. Copy this food chain. Complete it by adding the last three organisms in the correct order.


Sun

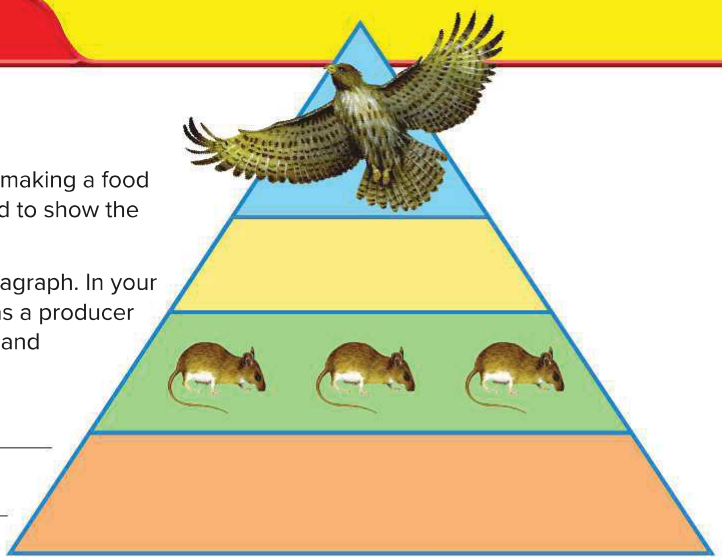

grass


hawk


field mouse


snake

Focus on Skills



2. Another way to **communicate** is by making a food pyramid. Complete the food pyramid to show the sequence in the food chain.

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.

Answers will vary. Students should communicate the same information about the energy transfer in a written narrative.

4. Did all three ways of communicating help you understand the data? Which way did you think worked best? Why?

Answers will vary. Students might indicate that the food pyramid and food chain diagram helped them understand the data better by using visuals.

Apply It

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

CHAPTER 3 Review

Visual Summary

Summarize each lesson in your own words.

Lesson 1 A life cycle describes how an organism grows and reproduces. Most plants grow from seeds.

Lesson 2 Animals have different life cycles. Some animals are born looking like their parents. Others change significantly as they grow.

Lesson 3 Organisms have traits that they inherit from their parents. Some traits are learned or affected by the environment.

Lesson 4 Food chains and food webs show how organisms in an ecosystem depend on one another.

CHAPTER 3 Review

Vocabulary

Fill each blank with the best term from the list.

cone	life cycle	decomposer	producer
egg	metamorphosis	camouflage	ecosystem
heredity	pollination	food chain	
inherited traits	seed	forest	
larva	trait		

1. An amphibian begins its life as an egg.
2. A conifer's seeds are made inside a cone.
3. An organism goes through stages that make up its life cycle.
4. Some organisms, such as caterpillars, go through a metamorphosis in which their body changes shape.
5. The passing of traits from parents to young is known as heredity.
6. A structure that can grow into a new plant is called a seed.
7. A feature of a living thing is called a trait.
8. Animals and wind help plants reproduce through pollination.
9. Traits that an organism gets from its parents are called inherited traits.
10. When an insect hatches from an egg, it is called a larva.

11. An ecosystem that has many trees is called a forest.

12. In an ecosystem a food chain shows how energy passes from one organism to another.

13. An organism that makes its own food is called a producer.

14. An adaptation called camouflage helps an animal blend in with its environment.

15. Living and nonliving things interacting in their environment make up an ecosystem.

16. An organism that breaks down dead plants and animals is called a decomposer.

CHAPTER 3 Review

Skills and Concepts

Answer each of the following in complete sentences.

17. **Sequence** List the stages of a flowering plant's life cycle in the correct order.

seed, germination, young plant, mature plant with flowers, pollination, fruit with seeds

18. **Personal Narrative** Describe how you use learned traits during the course of a typical school day.

Answers will vary, but students should mention skills such as speaking a language, reading, writing, doing math, and using certain skills to play games on the playground.

19. **Predict** A ripe apple falls to the ground. How can this help an apple tree reproduce?

After an apple falls to the ground, it will rot and release seeds, or the apple could be eaten by an animal and the seeds carried to a new place. The seeds will grow into new plants.

20. **Infer** Is it possible to have more than one producer in a food chain?

Could there be more than one consumer ?

A food chain shows only one type of producer. There could be several consumers, though: a snake might prey on a mouse, and a hawk might prey on that snake, for example.

Answer each of the following.

21. **Compare and write** How are pond ecosystems and wetland ecosystems alike? How are they different? Write as much as you can about the comparison.

Both ecosystems are wet. Both ecosystems have a variety of different types of organisms, many of which depend on water. Wetlands dry out for part of the year so many wetland organisms can tolerate dry spells. Many pond organisms depend on water throughout the year.

22. **Critical Thinking:** How can an environment affect the life cycle of a bird?

Possible response: The environment provides a place to live and materials to build a nest. It may be difficult for a young bird to live in cold weather, other animals can try to feed on eggs.

23. **Critical Thinking** Imagine that you are taking care of plants and animals in a desert ecosystem. What kind of environment you would cerate for them to live in?

Possible answers: a dry, sandy environment with temperatures that vary from day to night, large area to allow space between plants, shady areas for animals to cool themselves

24. What is happening in this picture? Which part of a life cycle does this picture show?

Possible answer: It is the stage in the life cycle where the seeds have developed and are traveling to the soil so new plants can grow.

The Big Idea

25. How do living things change?

Students should use information from the chapter to answer.

Test Prep

Circle the best answer for each question.

1. What contains the seeds in flowering plants?

A cone
B bulb
C fruit
D tuber

2. Which animal goes through a stage of its life cycle in which it can breathe with gills?

A ladybug
B cheetah
C turtle
D frog

3. Which best describes a green plant's role in an ecosystem?

A making oxygen and food
B breaking down dead animals
C eating other organisms
D recycling soil

4. Wind, insects, and animals help plants reproduce by bringing together eggs and

A pollen.
B oxygen.
C organisms.
D water.

5. Which of the following nonliving parts of an environment do all living things need to survive?

A rocks and water
B water and air
C water and fire
D fire and food

6. What provides a seed with energy for germination?

A stored food
B soil
C air
D fruit

7. What is the correct order for a growing plant?

A spore, seed, seedling
B seed, spore, seedling
C seed, seedling, adult plant
D seedling, adult plant, seed

8. The table below shows the number of birds in a wetland ecosystem.

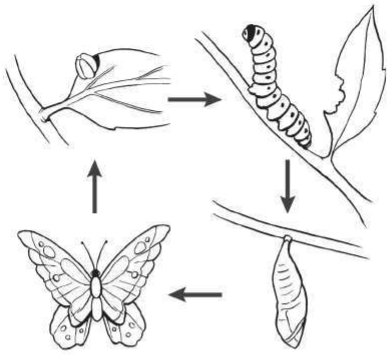
What most likely explains the difference between seasons?

Season	Number of Birds
summer	700
winter	60

A Many birds drown when the ice melts in the fall.
B Many birds are killed by predators in the spring.
C Many birds die when the winter becomes cold.
D Many birds migrate south for the winter.

Answer the following questions.

Refer to the diagram to answer questions 9-11.



9. What is shown in the diagram above?

life cycle

10. The pupa stage is between what two stages?

larva and adult

11. In which stage does a female butterfly produce eggs?

adult

12. Fill in the chart below. Write yes if the trait is inherited. Write no if the trait is not inherited.

Trait	Inherited
A. scars	no
B. eye color	yes
C. riding a bicycle	no
D. hair color	yes
E. language	no

13. List two traits that are inherited. Include one animal trait and one plant trait.

Answers will vary. Possible answers: fur color, flower's color, height

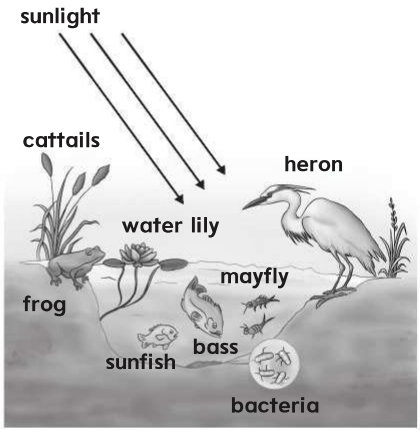
14. Organisms almost never look exactly like either parent. What explains this?

Organisms do not look exactly like one parent because they inherit traits from both parents.

15. Name a producer in an ocean ecosystem.

Algae is a producer in an ocean ecosystem. Accept all reasonable responses.

Use the illustration below to answer question 16.



16. Frogs and bass eat mayflies in this pond ecosystem. In spring, temperatures were cold. Few mayflies survived.

How will the pond food web be affected in summer?

Possible answer: In summer, frogs would have fewer mayflies to eat. Some frogs may die. This would affect animals like herons, which depend on frogs for food.

My Notes

Science, Technology, and Engineering

CHAPTER 4

Technology and Design

The Big Idea

How do we design technologies to solve problems?

Answers will vary. Accept reasonable responses.

Vocabulary

technology all the ways people change nature to meet their needs

prototype a working model that can be tested

system a group of parts that work together to solve a problem

impact an effect

design process a series of steps for developing products and processes that solve problems

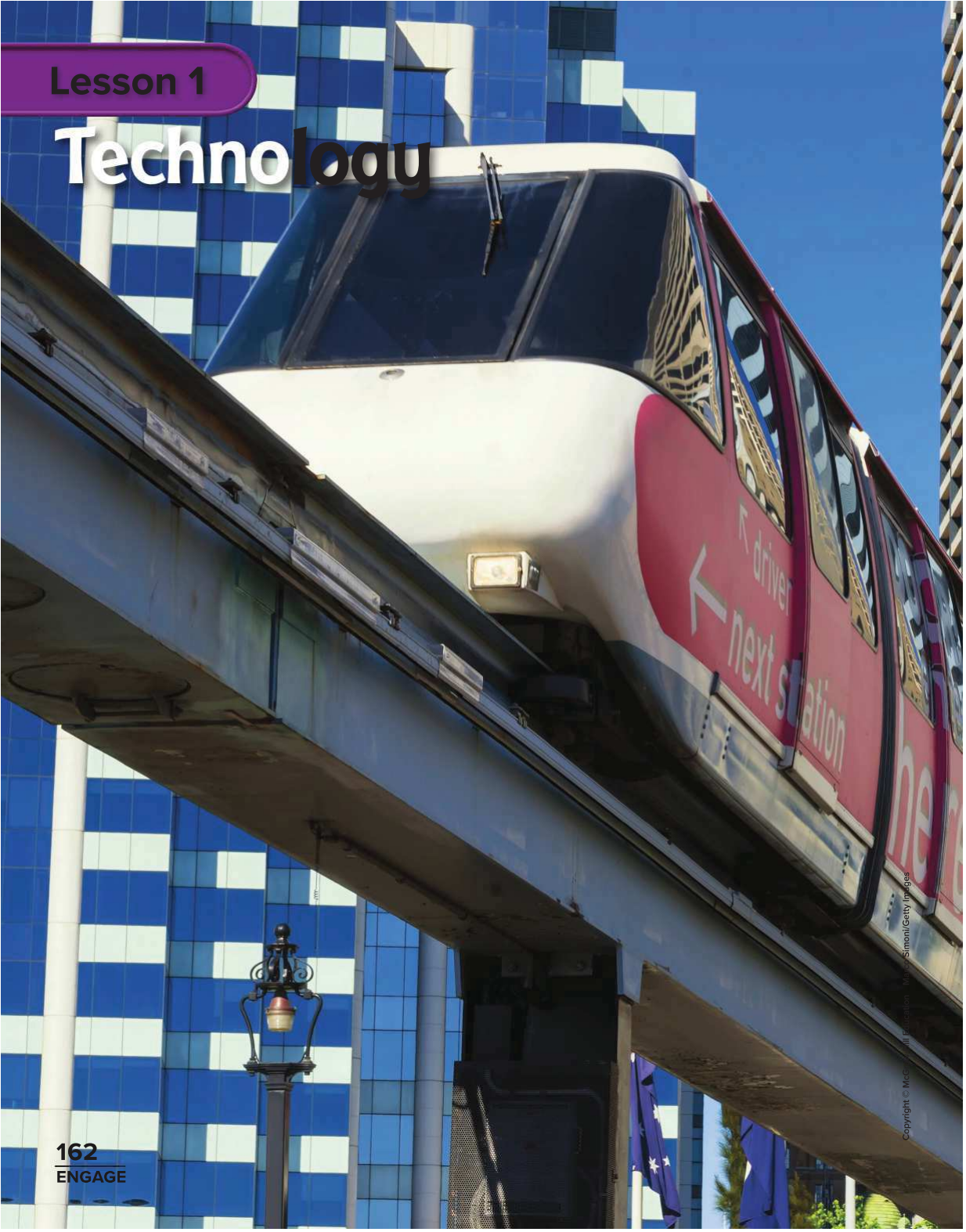
conserve to uses resources wisely

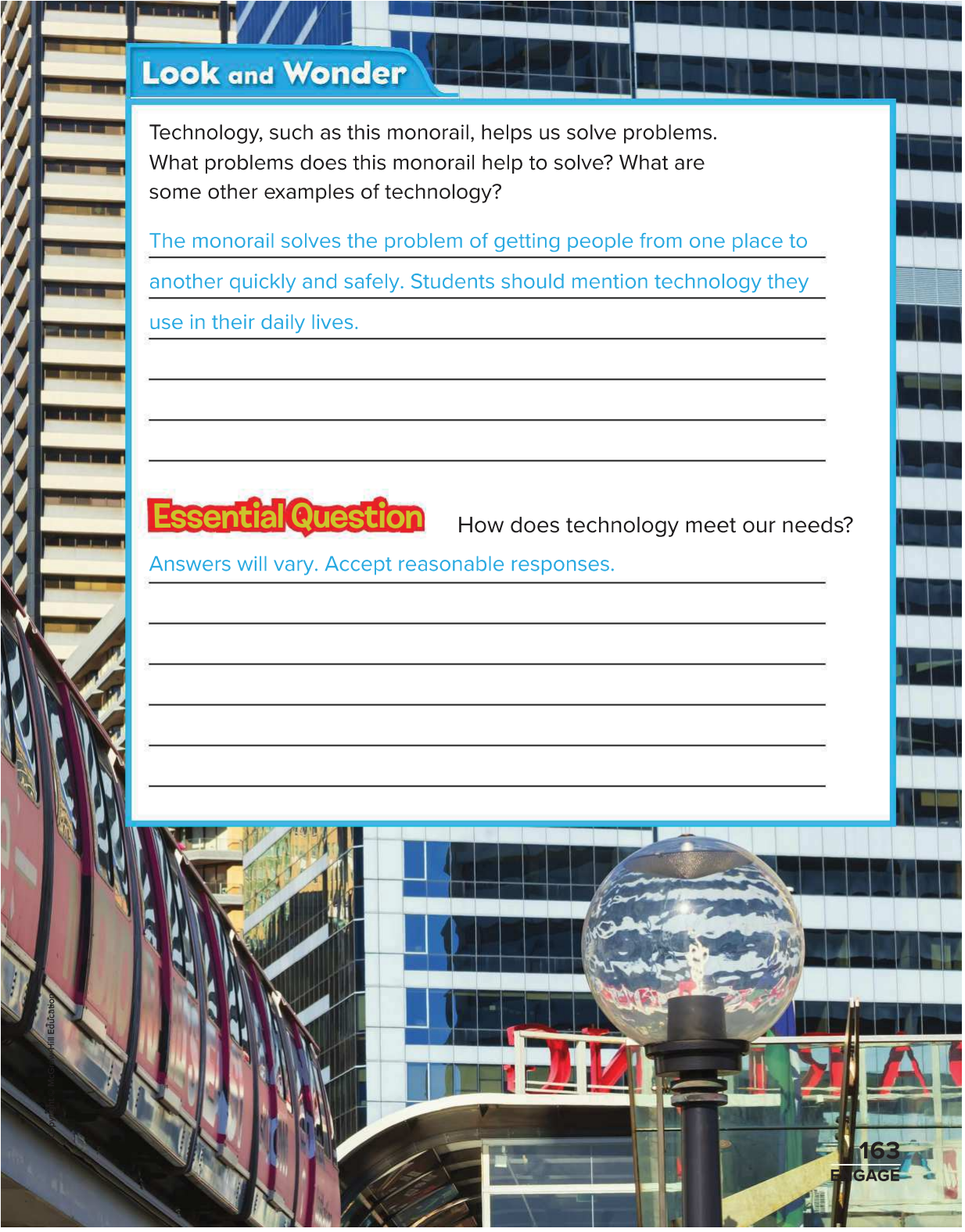
Before reading this chapter, write down what you already know in the first column. In the second column, write down what you want to learn. After you have completed this chapter, write down what you learned in the third column.

Technology and Design		
What do I **K**now	What I **W**ant to **K**now	What did we **L**earn?
We use computers every day.	How do engineers design new technology?	
Technology helps us learn and communicate.	Are there ways that technology hurts Earth?	
Technology can help us find new ways to make fuels.		

Lesson 1

Technology





Look and Wonder

Technology, such as this monorail, helps us solve problems. What problems does this monorail help to solve? What are some other examples of technology?

The monorail solves the problem of getting people from one place to another quickly and safely. Students should mention technology they use in their daily lives.

Essential Question How does technology meet our needs?

Answers will vary. Accept reasonable responses.

Explore

How can you design a parachute?

Purpose

Your team's goal is to construct a parachute that makes a washer fall to the ground as slowly as possible.

Materials

- washer

- anything you can think to use
- stopwatch

Procedure

1. **Communicate** With your group, think about possible ways to design a parachute. Sketch out different designs and compare them. Select one

Answers may vary. Accept reasonable responses.

2. A prototype is a model that allows you to test a design. Gather materials and build a prototype of the design you selected. Remember to attach the washer to the parachute.

3. Test how well your design worked by dropping the washer approximately 3 meters from the ground. Use a stopwatch to measure how long it takes the washer to reach the ground.

Answers will vary. Sample answer: Test 1:5 seconds.

4. Repeat step 3 several times to confirm your results.

Sample answer: Test 2: 6 seconds; Test 3: 3 seconds; Test 4: 4 seconds; Test 5: 4 seconds

Draw Conclusions

5 **Interpret Data** Present your prototype to the class. Which parachutes make the washer fall the slowest? What do the parachutes have in common?

Sample answer The parachutes that made the waster fall the slowest were the ones that were the biggest. All of the parachutes were of light-weight material and made shapes like umbrellas.

6 **Communicate** Discuss with your group how you might change your design. Test your new design and communicate your findings.

Sample answer: We could use a different material or attach the material to the washer in more places.

Explore More

What would happen if you added more washers? Do you need to change your design? Make a plan and test it.

If we used a bigger piece of material, we could make more washers fall slowly.

Open Inquiry

How are parachutes used for doing things such as slowing down race cars or slowing a spacecraft returning to Earth? What do scientists think about in their designs? How do the parachutes work? What kind of parachute would you like to research? Where will you look for information?

Sample answer: We will look at parachutes for spacecraft. I will look on the NASA Web site.

What is technology?

Computers, phones, and cars are technology. **Technology** includes all the ways people change nature to meet their needs. It includes all the tools we design, make, and use. Even pencils and paper are technology. Technology helps people solve problems. Think about the things you use every day. What problems do these things help solve?

Technology dates back to when the first person picked up a rock and used it as a tool. It is always changing. Think about how people get from place to place. How has transportation changed since the days when people used simple, wooden wheels?

Quick Check

1. Why are paper and pencils considered technology?

_____

_____

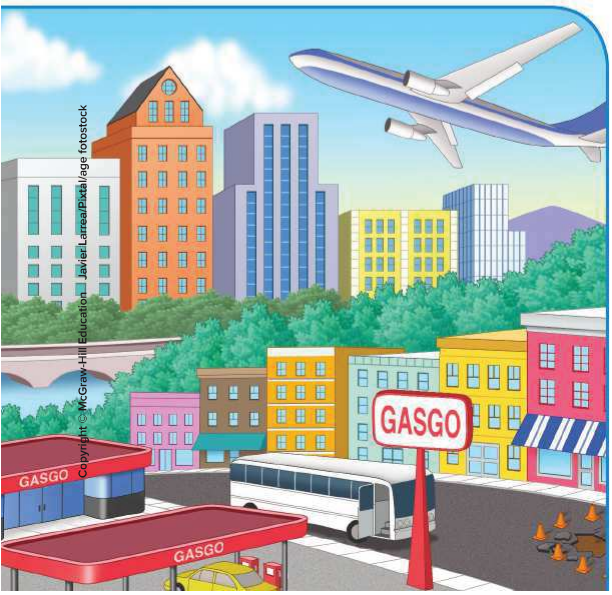
_____

Technology and Systems

Technology can be more than just a single tool or invention. Technology can be a system. A **system** is a group of parts that work together to solve a problem. Systems help people move, communicate, and build things.

Years ago, people had to walk or ride horses to get from place to place. Later, the automobile was developed. Over many years, improvements were made to automobiles. Today, transportation systems included automobiles, bridges, roads, and highways.

▲ **This system includes, cars, roads, traffic signs, and bridges all working together.**



Read a Diagram

What transportation systems can you find in this city? Do you have the same systems where you live?

How do communication systems connect people?

You use a form of communication when you use a cell phone or send an email. Long ago, people communicated using smoke signals or drumbeats. Messengers carried mail by foot or on horseback.

With the discovery of electricity, new forms of communication were possible. The invention of the telegraph in the 19th century changed communication. Telegraph machines sent patterns of long and short clicks over electrical wires. The series of clicks spelled out words. This was called Morse code.

The telephone soon replaced the telegraph. Early phones needed operators to connect callers. Instead of sending signals over wires, today's phones use radio waves.

Read a Diagram

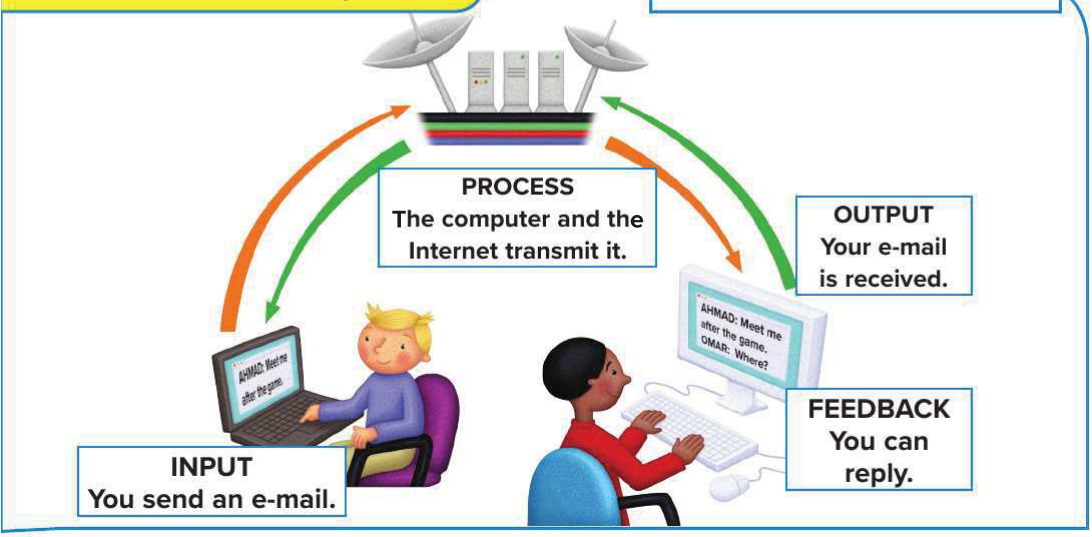
What would happen if this system had no output?

_____

_____

_____

Parts of a System



▲ **There are many parts to a communication system.**

A communication system has four basic parts—input, process, output, and feedback. Think about sending an email to a friend. The input is the message you put in the email. The process is how it's sent over the Internet. The delivery of the email to your friend is the output. A return email from your friend is the feedback.

Computers were developed to do math. The first computer was bigger than an elephant. Today's computers are smaller and faster. They are important components in ways people communicate.

Quick Lab

To learn more about the Morse Code, do the Quick Lab in the back of the book.

Quick Check

2. What is a communication system? Give an example.

3. What technologies are involved in communication?

How is technology used in medicine?

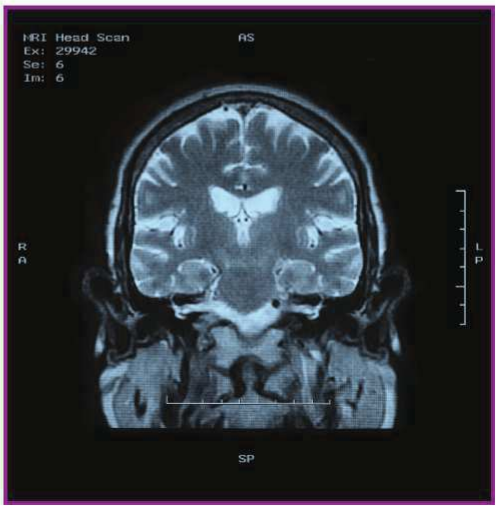
Technology is improving medicine every day. New technology, including medical technology, often comes from a scientific advance. A **scientific advance** is an important scientific discovery.

Medical technology includes the tools, medicines, and methods that help people stay healthy and safe. To develop these technologies, science and technology go hand-in-hand. This means they are connected. A stethoscope (STE•thuh•skohp) helps doctors hear inside your chest. This tool could not have been invented unless someone knew how sound traveled.

Around 1875, a scientist discovered a type of energy that passed through some solid objects, but not others. This discovery led scientists to develop the first X-ray machine.

X-rays allow doctors to see broken bones. ▼

MRIs let doctors look inside the body. ▼



Doctors still use X-rays, but they have other tools to help them see inside your body. CAT scanners, MRIs, and ultrasound help them find problems. Other tools help doctors go inside the body. An endoscope is a tiny camera with a light that helps doctors see inside an organ or body cavity

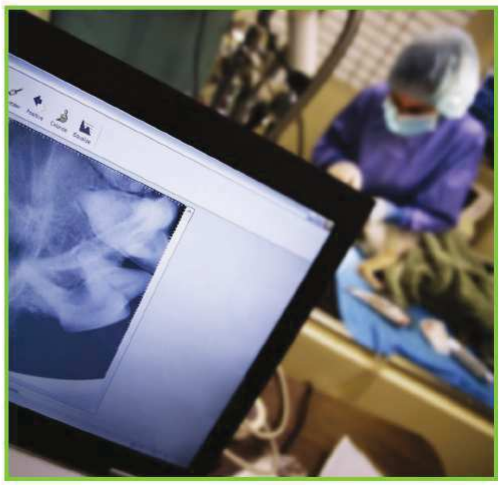
Medical technology does not only help people. A veterinarian has important technology for keeping cats, and other pets healthy. What if an animal needs an operation? The vet may operate using the same kinds of tools and methods used on humans.

Quick Check

4. What technologies do medical professionals use?

Advances in prosthetics allow people to live normal lives. ▼

Veterinarians use medical technologies to find out what is wrong with animals. ▼



▲ **In the future, people might rely more on solar power instead of fossil fuels.**

How will technology shape the future?

It's impossible to know for sure what the future will be like, but we can make predictions. How do we do this? We study the past. Then we look at what we know today.

In the future, the Internet will continue to improve the ways we work and communicate. Today, you can send many types of information around the world in seconds. This will only get faster.

Faster communication, working across long distances—these are paths to globalization (glow•buhl•ih•ZAY•shuhn). **Globalization** is the way technology makes the world seem like a smaller place. It helps people around the world do business with one another. One day you may live in Dubai.

Quick Check

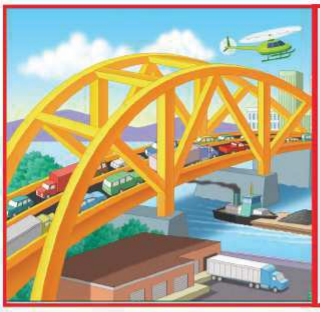
5. How is technology helping with globalization?

My Notes

My Notes

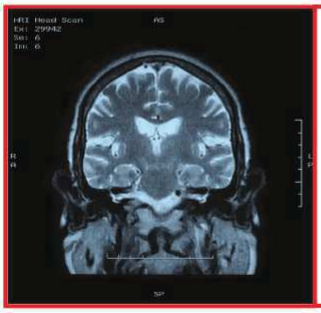
Visual Summary

Complete the lesson summary in your own words.



Technology People solve problems and meet their needs through technology.

Communication Technology has improved communication systems.



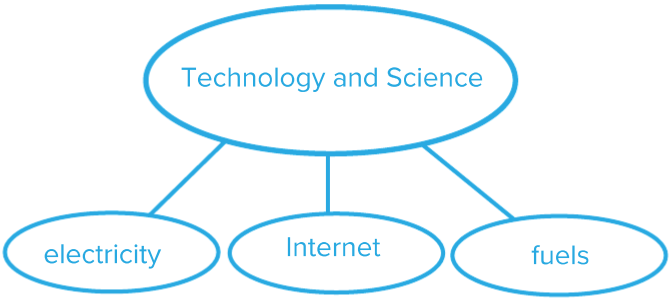
Medical Technologies Medical technologies help people to live longer, heathier lives.

Think, Talk, and Write

1 **Vocabulary** A group of parts that work together to do a job is a(n)

system

2 **Main Idea and Details** How are technology and science connected?



3 **Critical Thinking** Describe a technology you use every day. How could you use it to conduct a scientific investigation?

Possible answer: I use the Internet ever day. I could use it to do find the latest research on a science topic.

4 **Test Prep** A communication system starts with a(n)

(A) input.
B output.
C process.
D end user.

Essential Question How does technology meet our needs?

Possible answer: Technology helps us solve problems.

Focus on Skills

Practice: Make a Model

A model explains how something looks or works. For example, a globe is a model of planet Earth. You can observe the globe to find Earth's oceans and continents. You can spin the globe to understand how Earth moves. A model can also help you learn about living things. You can use a model to understand how an animal uses its structures.

Beaks are common bird structures. The shape of a bird's beak can tell you which foods it might eat. The hummingbird has a beak shaped like a straw. How do you think it uses its beak?

hummingbird

Learn It

The student below is using a model to investigate how a hummingbird uses its beak.

The student has three different straws and a beaker of sugar water. She dips each straw into the water. Then she puts her finger over the top of each straw. She removes the straw, holding her finger over the top of the straw. She places the bottom of the straw over the opening of a graduated cylinder. Finally, she removes her finger and lets the sugar water flow into the graduated cylinder.

The model shows how hummingbird beaks get nectar from a flower. It also shows which size beak can get the most nectar.

Focus On Skills

▶ Design It

Your goal is to design an animal structure to do a job, such as move or obtain food, water, or shelter. With your classmates, brainstorm the materials and products you could use to design this structure.

On a piece of poster board, your team needs to:

- State the problem

Sample problem: Design an animal structure that will help it move over slick rocks to find food.

- Propose a solution

Sample solution: Our animal feet will have tiny suction cups.

- Identify materials needed

Sample materials: small, flat plastic cards, old bath mat with suction cups, glue, ribbon, scissors

- Provide a drawing with labels demonstrating the solution

Students might draw small suction cups glued in an X pattern on a plastic card with a ribbon around it to illustrate an "octopus shoe" that could be tied on.

Use any available materials to construct your animal structure. Document the process of building your model. Take photographs showing each step.

This tool models how a mole uses its paws.

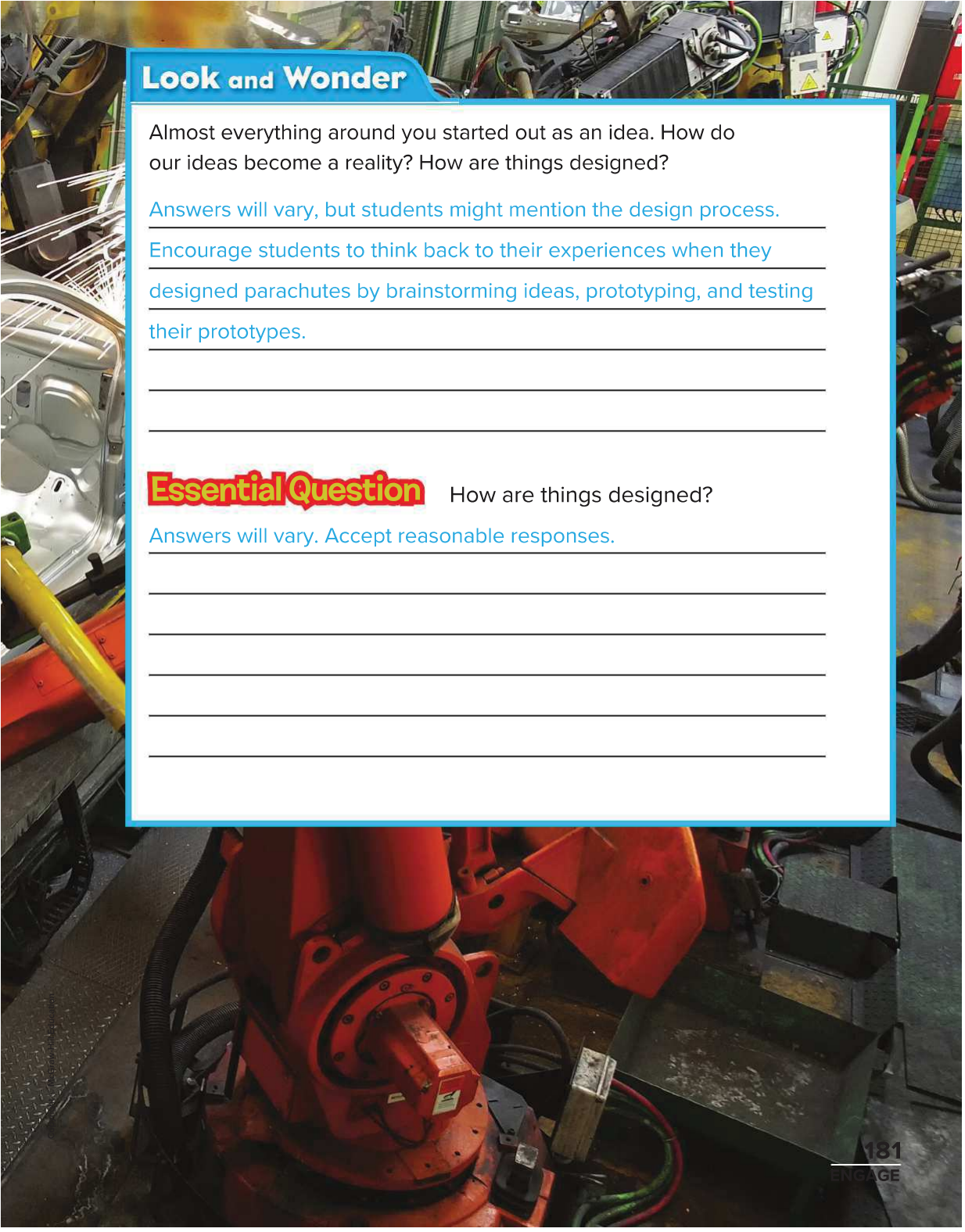
▶ Apply It

Now present your animal structure model to the class. After all the presentations are given, get together with your team and discuss what you have learned. How might you change your design?

Answers will vary.

Lesson 2

The Design Process



Look and Wonder

Almost everything around you started out as an idea. How do our ideas become a reality? How are things designed?

Answers will vary, but students might mention the design process. Encourage students to think back to their experiences when they designed parachutes by brainstorming ideas, prototyping, and testing their prototypes.

Essential Question How are things designed?

Answers will vary. Accept reasonable responses.

Draw Conclusions

4 **Interpret Data** You might need to go back and make improvements to your design. Make revisions until you are satisfied with the results.

5 **Communicate** Present your design to the class. Compare your results with those of your classmates.

Students might take turns presenting the design, location decision, test procedure, and test results. Allow other groups to ask questions. When the presentations finish, each group should discuss one way to improve their design. Sample answer: If we made the bin bigger, people would not think it was too full at the end of the day.

Explore More

What are some other ways you can encourage people to recycle? Make a plan and carry it out.

Sample answer: We will ask our classmates what would make them recycle paper instead of putting it in the trash can. We will redesign our bin after we hear their answers.

Open Inquiry

How are people encouraging others to recycle using very creative ideas that others haven't thought of? Where will you look for information?

Sample answer: We will look at magazines and on the Internet for ideas.

Read and Respond

What are the steps in the design process?

Underline the first step in the design process.

Some people make existing objects work better. Others find new ways to use objects. Still others come up with ideas for new things. The **design process** is a series of steps for developing products and processes that solve problems.

The first step in the design process is to identify a problem. How do you identify a problem? You observe people and patterns. You ask questions.

Suppose your pet's toy rolls behind a piece of furniture. The furniture is too heavy to move, and you can't reach far enough underneath it to grab the toy. You have just identified a problem. You need a safe way to get the toy back.

Read a Photo

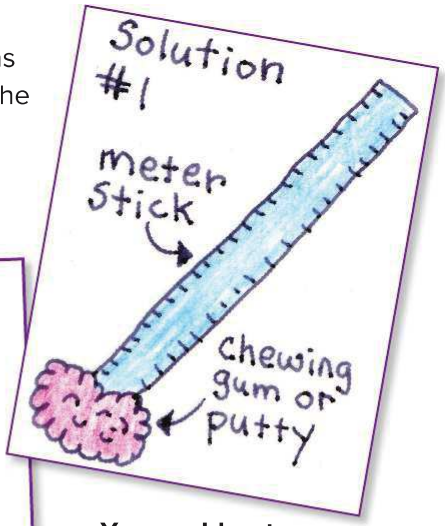
What need can you identify from this picture?

The need is for a tool to remove the ball from under the couch.

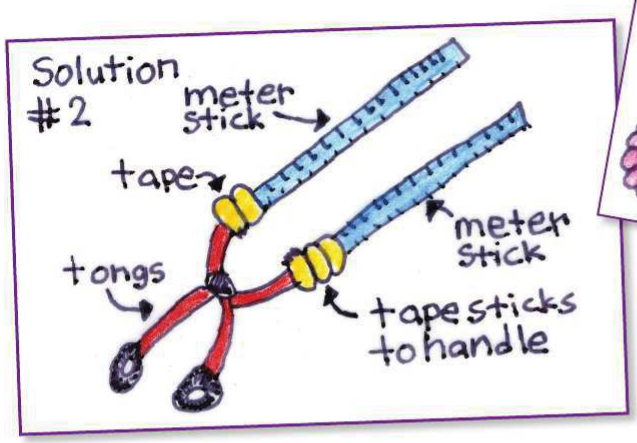
Clue: Explain the problem in your own words.

What's the Problem?

The next step is to think of possible solutions and sketch them. *Solutions* are ideas to solve the problem. What are some ideas that could help solve your problem?



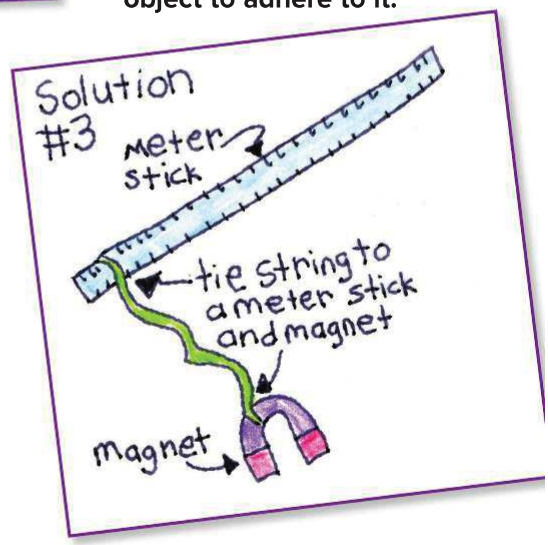
▲ **You could put something sticky at the end of a meter stick and try to get the object to adhere to it.**



▲ **You could use a long set of tongs to pick up the object.**

After sketching your ideas, pick the best one to try. Ask questions to figure out the challenges in each idea. What materials are needed? Are they available? Are there any risks involved? How much would it cost to make?

To answer these questions, you talk to people, make observations, and do research.



▲ **You could use a meter stick with a magnet on a string to attract the object.**

Quick Check

1. Which do you do first, sketch an idea, or identify the problem? Why?

You cannot begin to sketch a solution until you have identified the problem.

What are the steps in the design process?

Build a model to test your ideas. A **model** helps you understand how your solution works. Sometimes you need to build a prototype of your invention. A **prototype** is a life-size working model that can be tested.

Test the Design

Inventors test their designs by asking questions. Does the invention do what it was designed to do? Is the product safe to use? Often, the best way to test the prototype is to actually use it. You want to know if it solves the problem or meets a need. You might want other people to test the design.

Make sure to take careful notes as you test your design. This will allow you to evaluate how well your design solved to problem. You should repeat your tests. This will allow you to verify, or check, your results.

◂ Testing the tongs!

▲ **Using the design process is a part of an Engineer's job.**

Suppose the invention doesn't work. In this case, you would have to rethink the design. Rethinking the design could lead to a completely different solution. When a design works, inventors often improve or refine it multiple times. Then they might try to sell their design to a manufacturing company. An important part of this step is knowing how much it will cost to make the product.

Quick Lab

To learn how to design a boat, do the Quick Lab in the back of the book.

Quick Check

2. What are some questions you might ask when you test a prototype?

Possible answer: You might ask what materials are needed, whether those materials are available, what risks might be involved, and how much the device would cost to make.

3. What might happen if someone didn't test his or her solution?

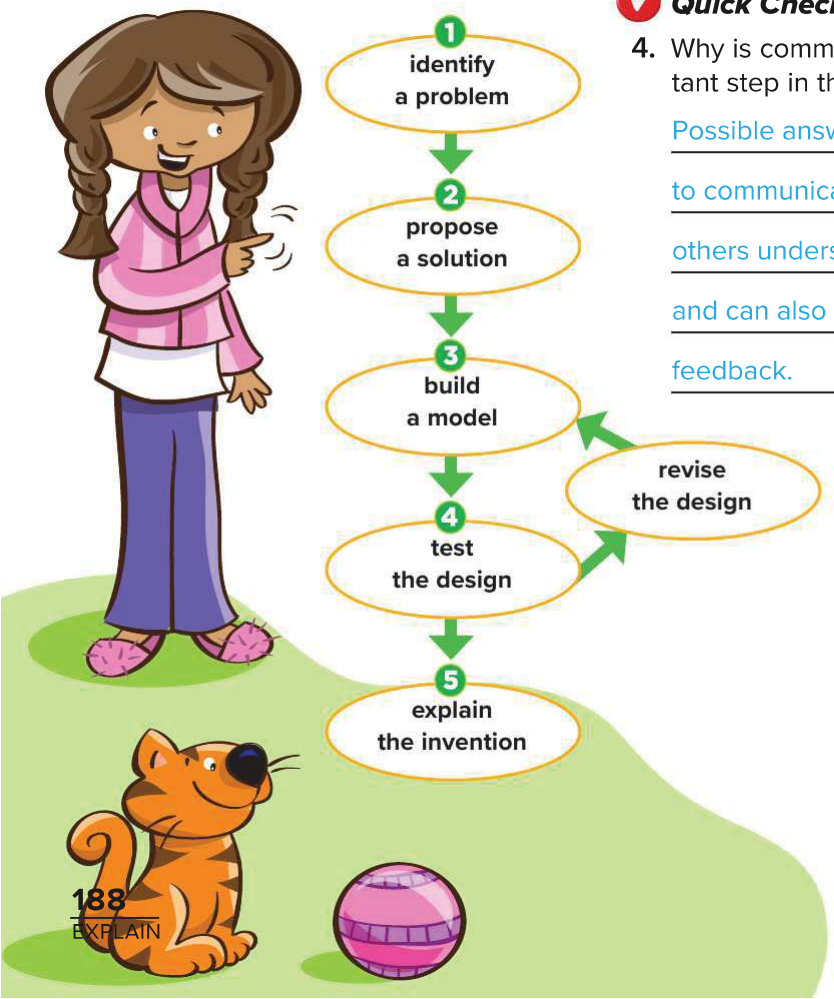
Possible answer: Without a test, the solution might ultimately fail. The solution may not meet people's needs. The product might not be safe for people to use.

What is the last step in the design process?

Communication

Communication is the last step in the design process. You need to tell people how you solved the problem. Communication can be like a show and tell. You can use group discussions, written reports, and pictures. If you made a product you want to sell, you name it and advertise it.

You might also want to get a patent for your solution. A **patent** gives a person the right to claim a solution as their own.



Quick Check

4. Why is communication an important step in the design process?

Possible answer: It's important to communicate results so that others understand the solution and can also give their own feedback.

My Notes

Visual Summary

Complete the lesson summary in your own words.

Design Process The design process is a series of steps you follow to develop products and processes that solve problems.

Prototypes Prototypes are solutions to a problem that you can tested.

Communication Group discussions, written reports, and pictures are ways to communicate your solution to a problem.

Think, Talk, and Write

1 **Vocabulary** A(n) patent gives a person the right to claim a solution as their own.

2 **Summarize** What are the steps in the design process?

- Identify a problem
- sketch a solution
- choose an idea to try

3 **Critical Thinking** Why is it important for someone to follow the steps of the design process when creating a solution to a product?

Heat moves from the hot forehead to the cooler cloth. The cloth gets warm and the forehead gets cooler.

4 **Test Prep** A person is satisfied with the solution to a problem. What step will she most likely do next?

A identify the problem
B communicate her solution
C think about possible solutions
D start the design process

Essential Question How are things designed?

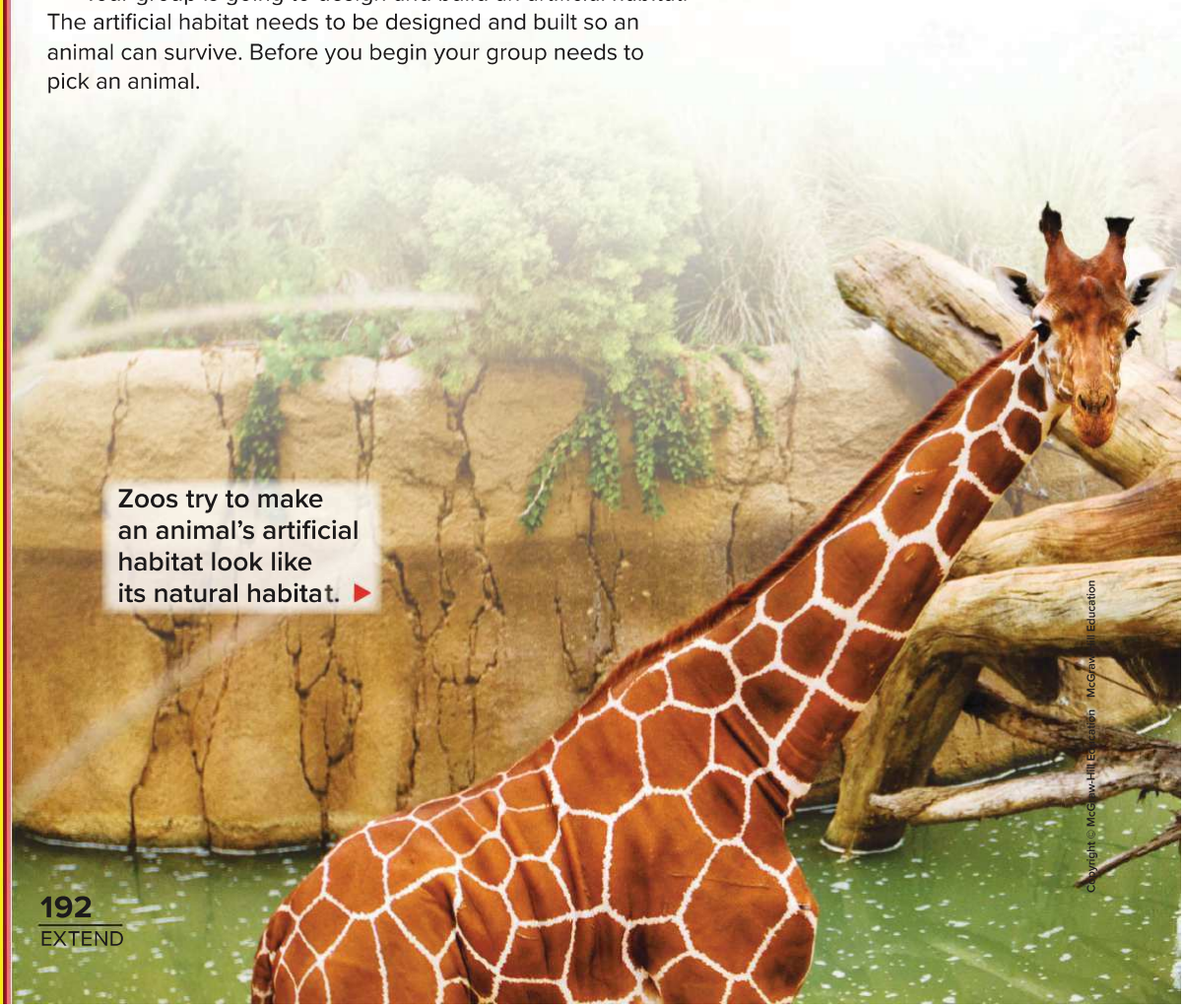
Things are designed with a process that starts with brainstorming solutions to a problem and ends with the creation and testing of a model to create a prototype.

Practice: Designing Solutions

Have you ever been to a zoo or an aquarium? If you have, you probably saw animals that live in different habitats. The animals' artificial habitats, or human-made habitats, were probably designed to look like their natural habitats. This helps to keep the animals healthy. Zoos and aquariums also provide the animals with the right food and the right amount of water.

▶ Learn It

Your group is going to design and build an artificial habitat. The artificial habitat needs to be designed and built so an animal can survive. Before you begin your group needs to pick an animal.



Zoos try to make an animal's artificial habitat look like its natural habitat. ▶

Think about animals you can keep in your classroom. You might not want to pick a large animal. For example, you wouldn't pick an elephant. Its habitat is too big. You might also want to think about animals you can buy.

Do research to find out about the animals' natural habitats. What type of habitats do the animals live in? Find out what the animals need to survive. What types of food do they eat? How much water do they need? Do you need to have any plants in your artificial habitat? Will you be able to create an artificial habitat that has everything the animal needs?

▶ Design It

Select an animal. Gather the materials you need and build the habitat.

Remember, living things get everything they need from their habitat. The artificial habitat you build must provide everything the animal needs. Add your animal to the habitat once you think it's ready.

▲ This artificial habitat has everything these hermit crabs need to survive.

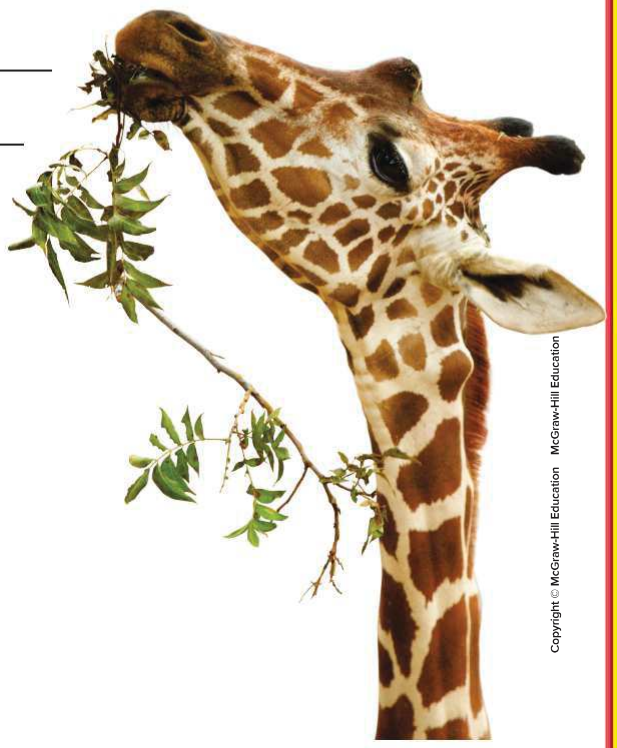
Apply It

Examine your habitat every day. Do you think the animal still has everything it needs? You might need to go back and make changes. Continue to observe your habitat every day. Keep making changes until you are satisfied that the animal has everything it needs.

Answers will vary.

Now present the habitat to the class. Tell how your habitat provides everything your animal needs to survive.

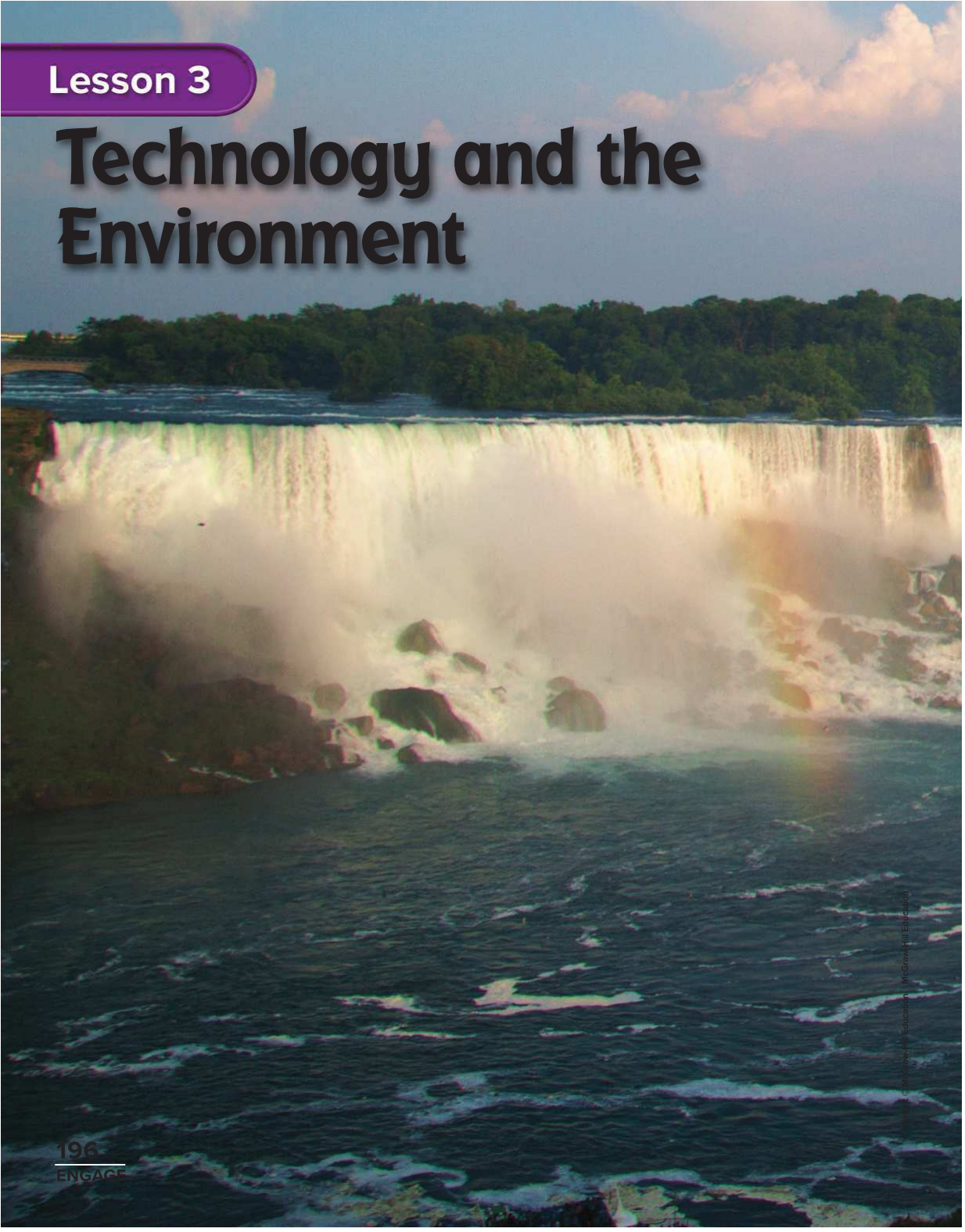
Students might take turns presenting different aspects of the animal's needs and the habitat. Allow other groups to ask questions. If possible, give groups time to review the questions and redesign as needed.

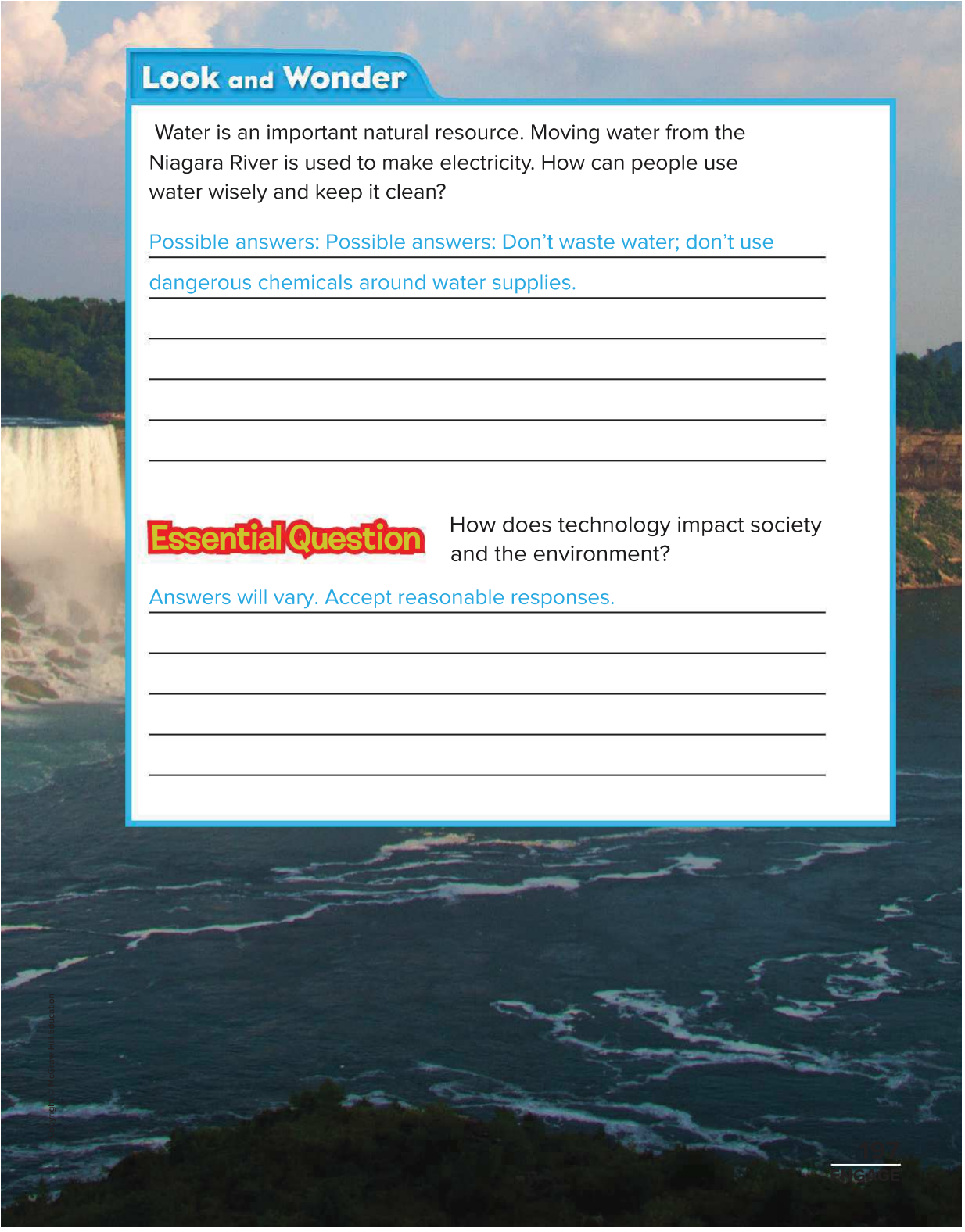


My Notes

Lesson 3

Technology and the Environment





Look and Wonder

Water is an important natural resource. Moving water from the Niagara River is used to make electricity. How can people use water wisely and keep it clean?

Possible answers: Possible answers: Don't waste water; don't use dangerous chemicals around water supplies.

Essential Question How does technology impact society and the environment?

Answers will vary. Accept reasonable responses.

Explore

How is Earth's water made clean?

Purpose

Find out how Earth's water can be made clean.

Procedure

Materials


funnel


large, clear plastic cup


spoon and gravel


coarse sand


small, clear plastic cup of water


soil and crushed leaves

1. **Make a Model** Place a funnel inside a large, clear plastic cup. Use a spoon to fill the funnel with gravel half way. Then fill the rest of the funnel with coarse sand. What do you think these layers model?

Possible answer: These model Earth's layers of rock and soil.

2. **Observe** Mix a little soil and some crushed leaves into a small, clear cup of water. Draw what you see.

3. **Observe** Slowly pour the water, soil, and leaves into the funnel. Draw what you see in the cup under the funnel.

Student drawings show water that is mostly clear with no leaves and few soil particles.

Draw Conclusions

4 How did the water in step 3 compare with the water in step 2?

The water in step 3 had no leaves and was less muddy than the water in step 2.

5 How can Earth's water be made clean?

Possible answer: Earth's water is made clean as it passes through layers of soil, sand, and rocks.

Explore More

Experiment Can food coloring be removed from water this way? Repeat to find out.

Possible answer: I predict that food coloring cannot be removed from water.

Open Inquiry

What is the best way to get water clean? Think of your own questions about what could be used to get water cleaner. Make a plan and carry out an experiment to answer your question.

Possible answer: Plucking a tighter rubber band will produce a higher sound than plucking a looser one.

My question is:

Sample question: Would muddy water get cleaner if it were filtered through fine sand?

How I can test it:

Sample answer: I can fill a funnel with fine sand, hold it over a beaker, and pour muddy water through the funnel into the beaker.

My results are:

Sample answer: The water in the beaker is less muddy after being poured through the sand.

Read and Respond

How does technology impact society?

Technology has always had an impact, or effect, on society. It has changed society so much over the years. Sometimes we don't get the positive results we expect with technology. Sometimes technology has a negative impact.

Underline the part of the text that shows a trade-off computers have created.

We need to be careful about how we use technology. That is because there are trade-offs to any technological solution. A trade-off is something you have to give up in order to get what you want. Common examples of trade-offs are cost and safety. Computers, for example, have improved the way we work and communicate. However, computers can also be used to steal your personal information.

Fire is used to clear land, but the loss of habitat for animals is a negative impact.

Trucks transport products over great distance but consume a lot of fuel and release large amounts of carbon dioxide. ▼

How can we make sure that people use technology responsibly? One way is to set up **ethics**, or rules. For example, there is an ethic that applies to people who are test subjects in experiments. They need to be told about any risks and benefits before they decide to participate.

Some governments also help people use technology responsibly. They make some ethics into laws. The government has agencies to help enforce these laws.

People do not always agree on ethics. When there are two sides to an issue, positive and negative impacts might affect one or the other differently. For example, we can use wind turbines to generate electricity from the wind. However, some people feel that the wind turbines are ugly and noisy.

Quick Check

1. Think about a technology you use. What are some trade-offs that come with using this technology?

Possible answer: I ride to school in a car. A car gets me to school more quickly than walking, and it's safer to ride in a car than to walk across the very busy highway. But cars release fumes into the air and use gas, a fossil fuel.

Wind turbines are a great alternative to fossils fuels. However, people might not want them near their homes.

How does technology affect nature?

Technology can also impact the environment. The way we use technology can have good or bad effects on the environment.

DDT is an example of a technology that had a bad effect on the environment. DDT is a chemical that kills weeds and other pests. At one time many farmers sprayed their crops with DDT. This poisoned water sources. Birds that had eaten poisoned fish laid eggs that did not hatch. The bald eagle almost disappeared as a result. DDT caused problems for other wildlife as well.

In 1972 the U.S. government outlawed the use of DDT. Fish and wildlife began to recover. Today the bald eagle has recovered in many places.

Underline three examples of the negative effects DDT had on the environment.

Bald eagle populations have made a comeback thanks to the ban on DDT. ▼

▲ **There are many laws that prevent companies from releasing chemicals into the environment.**

Following the Rules

Today there are many laws in the United Arab Emirates and around the world to protect nature. There are strict laws that prevent companies from dumping chemicals into lakes and streams. There are rules companies must follow when they release chemicals into the air. There are laws to protect endangered species.

We also work to conserve our natural resources. To **conserve** means to uses resources wisely. There are many things you can do to use fewer resources. For example, you can turn off water as you brush your teeth.

Quick Lab

To record your daily use of water, do the Quick Lab in the back of the book.

Quick Check

2. Give your opinion about ways you could conserve natural resources.

Answers will vary, but students might suggest such ideas as turning off lights when not needed and conserving water by taking showers instead of baths.

3. Why is it important to consider the impact of technology on the environment?

Answers will vary, but students will most likely suggest that the environment needs to be preserved and cared for in order for it to last.

What We Throw Away

Read a Graph

Do people discard more paper and cardboard or more plastics?

People discard more paper and cardboard because it is the largest wedge of the pie chart.

Clue: Compare the sizes of the wedges.

How is technology helping to protect the environment?

People produce large quantities of garbage every day. For years, we disposed of trash by burying it in dumps or landfills. **Landfills** are specially designed places where garbage is deposited. Some of this garbage is **biodegradable**, or able to break down naturally over a short period of time. Apple cores, banana peels, and paper are biodegradable.

New technology is helping to turn trash into fuel. Landfills give off methane gas. If you seal the landfill, the gas builds up. Then scientists collect the gas and send it through pipelines to places that can use it as a source of energy.

Quick Check

4. What are some other ways technology is helping to protect the environment?

Answers will vary. Possible answer: We recycle products, which cuts down on waste. We are making cars that have reduced the amount of harmful gasses entering the environment.

My Notes

Visual Summary

Complete the lesson summary in your own words.

Impact of Technology Possible answer: The impact of technology can be good, bad, or both.

Technology and the Environment Possible answer: The way we use technology affects the environment.

People and the Environment Possible answer: People can try to reduce technology's effect on the environment. They can recycle products to make less waste.

Think, Talk, and Write

1 **Vocabulary** Something you have to give up in order to get what you want is called a(n)

trade-off

2 **Fact and Opinion** State one fact and one opinion about landfills.

Fact	Opinion
Landfills are a source of methane gas.	Landfills are the worst thing in a city.

3 **Critical Thinking** How can using disposable products damage the environment?

Possible answer: Disposable products create waste and fill landfills.

4 **Test Prep** Rules for appropriate use of technology are called

A ethics
B landfills.
C trade-offs.
D impacts.

Essential Question How does technology impact society and the environment?

The impact of technology can be good, bad, or both.

Real World **Reading in Science**

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.

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.

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.

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.

Answers will vary. Accept reasonable responses.

CHAPTER 4 Review

Visual Summary

Summarize each lesson in your own words.

Lesson 1 Technology includes all of the ways people change nature to meet their needs.

Lesson 2 The design process is a series of steps you follow to develop products and processes that solve problems.

Lesson 3 Technology can have good and bad impacts on society and the environment.

Vocabulary

Fill each blank with the best term from the list.

conserve	prototype
design process	scientific advance
globalization	system
landfill	technology
model	trade-off

1. A group of parts that work together to solve a problem is called a system
2. A model that can be tested is a prototype.
3. The way technology makes the world seem like a smaller place is called globalization.
4. You can build a model to understand how a solution works.
5. The tools we design, make, and use are examples of technology, or ways people change nature to meet their needs.
6. A specially designed place where garbage is deposited is called a landfill.
7. The series of steps you follow to develop products and processes that solve problems is the design process.
8. A thing you have to give up in order to get what you want is called a trade-off.
9. An important scientific discovery is called a scientific advance.
10. To use resources wisely is to conserve.

CHAPTER 4 Review

Skills and Concepts

Answer each of the following in complete sentences.

11. How are models and prototypes similar?

A A model is a plan to make a prototype.

B A prototype is a plan to make a model.

C A model is a prototype that can be tested.

D A prototype is a model that can be tested.

12. Which is an example of a communication system?

A an email

B a language

C an email, the Internet, the receipt of the email, and a returned email

D a computer, an email, a sender, and a language

13. True and False *All types of technology include many different parts.* Is this statement true or false? Explain.

Technology is simply the use of something in nature to meet a need. A stick could be technology if that stick were used to pry the lid off something or to stir a can of paint.

14. **Problem and Solution** What problem can a patent solve?

Possible answer: A patent protects an inventor. When a patent is filed, then no one else can profit from the exact same invention.

15. **Cause and Effect** Give an example of a way that technology can positively impact the environment.

Answers will vary widely. Students should choose technology that creates a positive impact, such as wind turbine technology, which creates energy without creating pollution.

16. **Critical Thinking** What trade-offs are involved in developing new smartphone technology? Give examples.

Possible answer: Cellphone technology makes it easier to communicate. Cellphones, however, can be expensive, making it more difficult for some people to access that communication. Cellphones can also break or be stolen, and information can be stolen from the Internet.

17. **Communicate** Write a paragraph explaining the importance of a recent scientific advance in the field of medicine.

Students should name a medical advance, such as MRI technology, and explain its importance, such as increasing the ability for early detection and successful treatment.

الفكرة الرئيسة

18. How do we design technologies to solve problems?

Answers will vary. Students should use information from the chapter to answer the question.

Test Prep

Circle the best answer for each question.

1. Look at the table below describing a cellular communication system.

		Cellular Communication System
1	input	caller speaks
2	process	cellular towers transmit message
3	output	delivery of spoken message
4	feedback	receiver speaks

Calls are being lost before the message is delivered to the receiver. What part of the system needs to be improved?

A input
B process
C output
D feedback

2. Which improvement might help the problem described in question 1?

A add more cellular towers
B improve the caller's phone
C improve the receiver's phone
D get a hearing aid for the caller

3. Which would decrease the impact that cars have on the environment?

A increase comfort of the interior
B increase speed
C decrease pollution caused by burning fuel
D improve appearance

4. What trade-offs might be considered when designing faster transportation technologies?

A speed and performance
B speed and appearance
C materials and performance
D safety and environmental impact

5. How are prototypes used in the design process?

A They are built to see how much the solution costs.
B They do research on previous solutions to the problem.
C They are tested to see how the solution works.
D They identify problems.

6. Which technology would work best to move large numbers of people quickly and safely across water?

A high-speed ferry
B airplane
C bus
D train

7. Which would work best to test a medication that treats allergies?

A Observe and compare patients' symptoms with and without the medication.

B Observe patients' symptoms with the medication.

C Observe patients' symptoms without the medication.

D Observe side-effects of the drug.

8. The table below shows the results of tests performed on different prototypes designed to deliver packages.

Technology	Number of Packages Delivered per Day
Existing Package Delivery Service	56
Improved Package Delivery Service	72
New Drone Delivery Service	109

What can you conclude from the results?

A The existing package delivery service can deliver the most packages per day.

B The improved package delivery service can deliver the most packages per day.

C The new drone delivery service can deliver the most packages per day.

D All services perform equally well.

9. Use the table from question 8. What else needs to be done before deciding which technology works best for delivering packages?

A consider trade-offs

B build a prototype

C identify the problem

D list possible solutions

10. Which should be done before a prototype is built?

A research other solutions

B test the prototype

C record test results

D analyze test results

11. What is the first step in the design process?

A identify a solution

B identify a problem

C research a problem

D identify materials

12. Give an example of a technology that has had a negative impact on society or the environment. Has this technology been improved? If so, how? What questions do you need to ask before deciding on a solution?

Answers will vary. Students might identify a technology such as automobiles, which pollute the environment with their emissions. They have been improved with newer clean burning engines.

Physics Teacher

When you see a roller coaster, do you think about the forces that keep the cars moving on the track? Do you think about the energy that allows the roller coaster to move? If you like physical science, you might enjoy sharing your interest with students. A career as a physics teacher might be for you.

Physics is the branch of science that studies forces, motion, and energy. Physics teachers use their understanding of physics to lead classroom discussions, perform demonstrations, and help students with their research and investigations. To be a physics teacher, you need strong math skills. You also need to be a good at solving problems.

In order to become a physics teacher, you would need a bachelor's degree in physics and science education. You will also have to get your teaching certification. To teach at a college or university, you would need advanced degrees.

▲ **A physics teacher might explain how forces act on moving objects.**

▲ **Helping students with their investigations is one of the jobs of a physics teacher.**

Write About It

Write a question you might have about the job of a physics teacher.

Sample question: What type of research do physics teachers conduct?

My Notes

My Notes

A

absorb to take in *A green leaf absorbs all colors of light except for green.*

امتصاص استيعاب واحتواء.
تمتص الورقة الخضراء جميع ألوان الضوء ما عدا اللون الأخضر.

adaptation a structure or behavior that helps an organism survive in its environment *Sharp spines are one adaptation that helps a cactus survive.*

تكيّف سلوك يساعد الكائن الحي على البقاء حيًا في بيئته.
يستخدم الصبار الأشواك الحادة كوسيلة للتكيّف لتساعده على البقاء.

amphibian a vertebrate that spends part of its life in water and part of its life on land

برمائي حيوان فقاري يبدأ حياته في الماء و يقضي بقية حياته متنقلا بين الماء و اليابسة. *الضفدع من البرمائيات.*

B

bird a vertebrate that has a beak, feathers, two wings, and two legs and lays eggs

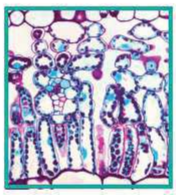
طائر كائن فقاري له منقار وريش وجناحان وقدمان ويبيض. العصفور من الطيور.

C

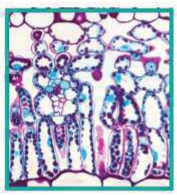
camouflage an adaptation that allows an organism to blend into its surroundings

تمويه طريقة تسمح للكائن الحي بالاندماج مع البيئة المحيطة به بغرض التخفي.

cell the basic building block of life *You can use a microscope to see that a leaf is made up of many tiny cells.*



خلية الوحدة البنائية الأساسية للحياة.
يمكنك استخدام المجهر لرؤية أن ورقة النبات تتكون من العديد من الخلايا الدقيقة.



circuit the path that is made of parts that work together to allow current to flow *This circuit is made of a battery, wires, a light bulb, and a switch.*

دّارة مسار مغلق من أجزاء تعمل معا لتسمح بتدفق التيار الكهربائي خلالها.
تتكون هذه الدّارة من بطارية وأسلاك ومصباح إضاءة ومفتاح.

community all the living things in one place that interact *All the organisms in this pond make up a community.*

مجتمع أحيائي جميع الكائنات الحية الموجودة في مكان واحد والتي تتعايش معًا.
تكون جميع الكائنات الحية في هذه البركة مجتمعًا أحيائيًا.

تنافس الصراع بين الكائنات الحية على الماء أو الغذاء أو الاحتياجات الأخرى.
تتنافس هذه الظباء الإفريقية على الماء.

competition the struggle among organisms for water, food, or other needs *There is competition for water between these springbok.*

آلة مركبة آلتان بسيطتان أو أكثر موضوعتان معًا.
المقص آلة مركبة لأنه يتكون من رافعة وإسفين. (وتد يستعمل في أغراض كثيرة منها ربط جسم بآخر أو الإبقاء على الانفراج.)

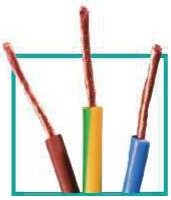
compound machine two or more simple machines put together *Scissors are a compound machine because they are made of levers and wedges.*

توصيل انتقال الحرارة بين جسمين متلامسان.
ستدفأ يداك عندما تمسك بكوب من الكاكاو الساخن. فهذا الكوب يوصل الحرارة.

conduction heat transfer between two objects that are touching The mug of hot cocoa warms your hands by conduction.

موصل مادة تنتقل الحرارة أو التيار الكهربائي من خلالها بسهولة.
النحاس موصل جيد للحرارة والتيار الكهربائي.

conductor a material which heat or electric current moves through easily *Copper is a good conductor of heat and electric current.*



cone a plant structure where seeds are made in some nonflowering plants

مخروط جزء من النبات حيث تتكون البذور في بعض النباتات غير المزهرة. الصنوبر من المخروطيات.

consumer an organism that eats plants or other animals *Eagles eat fish, snakes, and other small organisms so they are consumers.*

مستهلك كائن حي يأكل النباتات أو الحيوانات الأخرى.
تتغذى النسور على الأسماك والثعابين وكائنات حية أخرى. فهي من الكائنات المستهلكة.

convection heat transfer through liquids or gases A convection oven blows hot air around food to bake it.

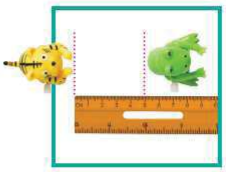
حمل حراري انتقال الحرارة عبر السوائل أو الغازات.
تدفع أفران الحمل الحراري الهواء الساخن حول الطعام لينضج.

D

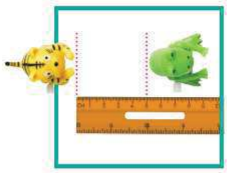
decomposer an organism that breaks down dead plant and animal material *Worms are decomposers that eat dead leaves that fall to the ground.*

مُحلّل كائن حي يُحلل مكونات النباتات والحيوانات الميتة.
الديدان كائنات مُحلّلة. فهي تتغذى على الأوراق الميتة التي تسقط على الأرض.

distance the amount of space between two objects or places *The distance between these two toys is five centimeters.*



مسافة البعد بين جسمين أو مكانين.
تبلغ المسافة بين هاتين اللعبتين 5 سنتيمترات.



drought when there is no rain in an area for a long period of time

جفاف انقطاع هطول الأمطار لفترة طويلة على منطقة ما.

E

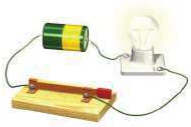
ecosystem the living and nonliving things that interact in an environment

نظام بيئي الكائنات الحية والأشياء الغير حية التي تتفاعل مع بعضها في بيئة معينة.

egg an animal structure that protects and feeds some very young animals such as birds

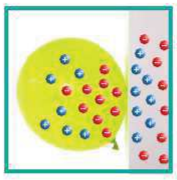
بيضة تركيب يحوي حيوانا صغيرا و يوفر له الحماية و الغذاء كبيوض الطيور.

electric current a flow of charged particles *When electric current flows from a battery to a light bulb, the bulb glows.*

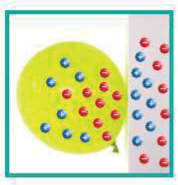


تيار كهربائي تدفق جسيمات ذات شحنات كهربائية.
عندما تتدفق الشحنات عبر الأسلاك بسبب دفع البطارية لها، يضيء المصباح.

electrical charge the property of matter that causes electricity *Rubbing a balloon on a sweater gives the balloon a negative electrical charge.*



شِحْنة كهربائية خاصية في المادة تُولد الكهرباء.
عند حك البالون في معطف، يُحمّل البالون بشحنات كهربائية سالبة.



electromagnetic rays visible light, X-rays, and radio waves *Light is the only electromagnetic ray you can see.*

أشعة كهرومغناطيسية ضوء مرئي وأشعة سينية وموجات راديو.
الضوء هو الأشعة الكهرومغناطيسية الوحيدة التي يمكنك رؤيتها.

element a building block of matter *Gold is an element.*

عنصر وحدة بناء المادة الذهب من العناصر.

embryo a young plant that is just beginning to grow

جنين (البادرة) نبات صغير بدأ توه طور النمو .

endangered when one kind of organism has very few of its kind left *Bengal tigers are endangered animals because there are very few of them left in the world.*

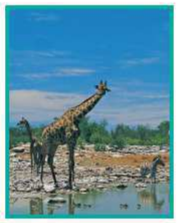
مهدد بالانقراض كائنات حية يبقى عدد قليل جدًا من أفراد نوعها.
النمر البنغالي من الحيوانات المهددة بالانقراض، حيث بقي عدد قليل جدًا منه في جميع أنحاء العالم.

energy the ability to do work *Energy from this bowling ball causes the pins to fall over.*

طاقة المقدرة على القيام بشغل.
تؤدي الطاقة الناتجة عن كرة البولينج إلى سقوط الزجاجات.

environment all the living and nonliving things that surround an organism *Water, soil, rocks, trees, and zebras are parts of the giraffes' environment.*

بيئة المكان وما يحويه من كائنات حية و غير حية.
الماء والتربة والصخور والأشجار والحمير الوحشية هي أجزاء من بيئة الزراف.



exoskeleton a hard covering, or shell, that holds up and protects an invertebrate's body *A snail's shell is an exoskeleton.*

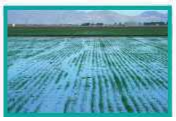
هيكل خارجي غلاف صلب أو قوقعة تُحيط بجسم الحيوان اللافقاري وتحميه.
قوقعة الحلزون هي هيكله الخارجي.

F

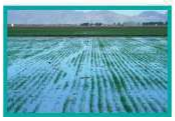
fish a vertebrate that lives in water and breathes oxygen using gills

سمكة حيوان فقاري يعيش في الماء ويتنفس الأكسجين باستخدام الخياشيم.

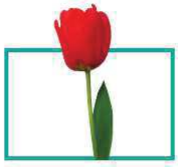
flood when dry land becomes covered with water



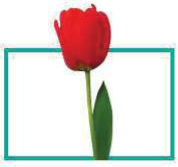
فيضان هو تراكم أو تزايد المياه التي تغمر الأرض، بسبب ارتفاع منسوب مياه الأنهار أو البحار أوعند سقوط أمطار غزيرة.



flower a plant structure where seeds are made



زهرة جزء من النبات تنمو فيه البذور.



food chain a series of organisms that depend on one another for food

سلسلة غذائية سلسلة من الكائنات الحية التي تعتمد على بعضها البعض للحصول على الغذاء.

food web several food chains that are connected

شبكة غذائية عدة سلاسل غذائية مرتبطة ببعضها.

force a push or a pull

قوة حركة الدفع أو السحب (الشد).

friction a force that occurs when one object rubs against another *Friction between a brake pad and a rim stops a bike.*

احتكاك القوة المتولدة عن تحريك جسم على جسم آخر.
الاحتكاك بين الفرامل والإطار يُوقف الدراجة.

fruit a plant structure that holds seeds

ثمرة جزء من النبات يحتوي على البذور.

G

gas matter that has no certain shape or volume *These balloons are filled with a gas called helium.*

غاز مادة ليس لها شكل معين أو حجم.
تملأ البالونات بغاز يسمى الهيليوم.

gills a structure some animals use to take in oxygen from water

خياشيم جزء من جسم بعض الحيوانات يستخلص الأكسجين من الماء.

gravity a pulling force between two objects, such as you and Earth *Gravity pulls these skydivers toward Earth.*

جاذبية قوة الشد المتبادلة بين جسمين، مثل قوة جذب الأرض لجسمك.
تجذب الجاذبية لاعبي القفز الحر نحو الأرض.

H

habitat the home of a living thing *A coral reef is a habitat for many fish.*

موطن بيئي هو المكان الذي يعيش فيه الكائن الحي في الطبيعة.
الشعاب المرجانية هي الموطن البيئي للعديد من الأسماك.

heat the flow of energy from a warmer object to a cooler object *The Sun is Earth's main source of heat.*

الحرارة هي الطاقة الحرارية المنتقلة من مكان إلى آخر.
الشمس هي مصدر الحرارة الأساسي على الأرض.

heredity the passing on of traits from parents to offspring

وراثة انتقال السمات من الآباء إلى الأبناء.

hibernate to rest or go into a deep sleep through the cold winter

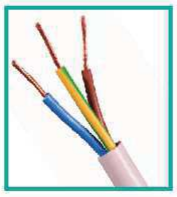
بيات شتوي الاسترخاء أو النوم العميق خلال فصل الشتاء البارد.

1

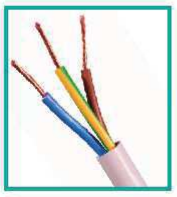
inherited trait a characteristic that is passed from parents to offspring *A flower's color is an inherited trait.*

صفة موروثة صفة تنتقل من الآباء إلى الأبناء.
لون الزهرة صفة موروثة.

insulator a material that heat or electric current does not move through easily *Plastic is a good insulator of electric current.*



عازل مادة لا تنتقل الحرارة أو التيار الكهربائي خلالها بسهولة.
اللدائن عازل جيد للتيار الكهربائي.



invertebrate an animal that does not have a backbone

لافقاري حيوان ليس لديه عمود فقري. قنديل البحر من اللافقاريات.

K

kinetic energy energy in the form of motion

طاقة حركية طاقة ناتجة عن الحركة.

L

larva the stage in some insects' life cycles which comes after hatching

يرقة مرحلة في دورة حياة بعض الحشرات وتلي مرحلة الفقس.

leaf the plant structure where a plant makes food

ورقة جزء من النبات حيث يصنع النبات الغذاء.

learned trait new skills you are taught or learn with experience Riding a bicycle is a learned trait.

سمة مكتسبة مهارات جديدة يكتسبها الإنسان أو يتعلمها نتيجة الخبرات التي يمر بها في حياته.
ركوب الدراجة سمة مكتسبة.

lever a simple machine that consists of a straight bar that moves on a fixed point, or fulcrum

رافعة آلة بسيطة تتكون من قضيب مستقيم يتحرك حول نقطة ثابتة أو نقطة ارتكاز.

life cycle how a certain kind of organism grows and reproduces

دورة حياة مراحل نمو نوع معين من الكائنات الحية وتكاثره.

light a form of energy that allows you to see objects Light travels in a straight path from a lighthouse.

ضوء أحد أشكال الطاقة يسمح لك برؤية الأشياء.
ينتقل الضوء في خط مستقيم من مصدر الضوء.

liquid matter that has a certain volume but not a certain shape

سائل مادة لها حجم معين وتأخذ شكل الإناء الذي يحويه.

lung a structure some animals use to take in oxygen from air Humans breathe oxygen using lungs.

رئة عضو في جسم بعض الكائنات الحية يساعد على استنشاق الأكسجين من الهواء.
يتنفس الإنسان الأكسجين بالرئتين.

magnet an object with a magnetic force; magnets can attract or repel certain metals

مغناطيس جسم له قوة مغناطيسية؛ يجذب المغناطيس معادن معينة.

mammal a vertebrate that has hair or fur, is born live, and feeds its young with milk

ثديي حيوان فقاري له شعر أو فرو، يلد و يرضع صغاره الحليب.

mass a measure of the amount of matter in an object

كتلة كمية المادة الموجودة في الجسم.

matter anything that takes up space and has mass

مادة أي شيء يشغل حيزًا من الفراغ وله كتلة.

metamorphosis a series of changes in which an organism's body changes form *A tadpole becomes a frog through metamorphosis.*

تحوّل سلسلة من التغييرات يتحول خلالها شكل جسم الكائن الحي.
يصبح أبو ذنيبة في مراحل نموه ضفدعا بالتحول.

metric system a common system of standard units of measurement *A centimeter is a unit in the metric system.*

نظام متري نظام عام لوحدات القياس المعيارية.
السنتيمتر وحدة قياس في النظام المتري.

migrate to move from one place to another *These geese migrate south when the weather gets cold.*

هجرة الانتقال من مكان إلى آخر.
يهاجر الإوز جنوبًا عندما يصبح الطقس باردًا.

mimicry an adaptation in which one kind of organism looks like another kind in color or shape

محاكاة طريقة للتكيف يبدو فيها أحد أنواع الكائنات الحية مثل كائن آخر، من حيث اللون أو الشكل.

model A representation of something that cannot be directly observed.

نموذج تجسيد لشيء لا يمكن ملاحظته مباشرةً.

motion a change in the position of an object

حركة تغير في موضع الجسم.

N

nocturnal an adaptation in which an animal is active during the night and asleep during the day

نشاط ليلي طريقة لتكيف بعض الحيوانات حيث تنشط أثناء الليل و تنام أثناء النهار.

nutrient a substance that helps living things grow and stay healthy *Spinach has many nutrients that people need.*

عنصر غذائي مادة تساعد الكائن الحي على النمو والبقاء بصحة جيدة.
السبانخ غنية بالعديد من العناصر الغذائية التي يحتاج إليها جسم الإنسان.

O

opaque not allowing light to pass through *An ice cream cone is opaque. You cannot see through it.*

معتم لا يسمح بمرور الضوء خلاله.
مخروط الأيس كريم معتم. ولا يمكنك أن ترى من خلاله.

organism a living thing *Koala bears and eucalyptus trees are organisms.*

حي كائن يحتاج للهواء و الماء و الغذاء لينمو و يتكاثر.
دببة الكوالا وأشجار الأكاليبتوس كائنات حية.

P

pan balance a tool used to measure mass

ميزان ذو كفتين أداة تُستخدم لقياس الكتلة.

photosynthesis the process through which plants make food

بناء ضوئي عملية صنع النبات للغذاء.

pitch how high or low a sound is *A whistle has a high pitch.*

شدة الصوت مقدار ارتفاع أو انخفاض الصوت.
طَبَقة صوت الصفير مرتفعة.

pollination when pollen moves from the male part of a flower to the female part, after which a seed can form

تلقيح انتقال اللقاح من العضو الذكري في الزهرة إلى العضو الأنثوي، وبعدها تتكون البذرة.

pollution what happens when harmful materials get into water, air, or land

تلوث تراكم المواد الضارة في الماء أو الهواء أو اليابسة.

population all the members of one kind type of organism in an ecosystem

الفصيلة جميع الأفراد التي تنتمي إلى نوع واحد من الكائنات الحية في النظام البيئي.

position the location of an object

مَوْقع مكان وجود الشيء.

potential energy energy that is stored and ready to be used *A sled at the top of a hill has potential energy.*

طاقة الوضع الطاقة المُخزنة في الجسم وجاهزة للاستخدام.
للزلاجة الموجودة أعلى التل طاقة وضع.

producer an organism, such as a plant, that makes its own food

منتِج كائن حي يصنع غذاءه، مثل النبات.

property any characteristic of matter that you can observe *A sweet taste is a property of this pineapple.*

خاصية سمة للمادة يمكنك ملاحظتها.
يتميز الأناناس بخاصية المذاق الطيب.

prototype A life-size, working model of a product that can be tested.

نموذج أولي نموذج بالحجم الحقيقي لمنتج ما بحيث يمكن اختباره.

pulley a simple machine that uses a rope and wheel to move an object

بكرة آلة بسيطة تستخدم حبلاً وعجلة لتحريك جسم.

pupa the stage of some insects' life cycles before becoming an adult

الشرنقة مرحلة في دورة حياة بعض الحشرات تسبق مرحلة الحشرة الكاملة.

R

radiation transfer of energy by electromagnetic rays such as light, radio waves, and X-rays *The Sun warms your face with light radiation.*

إشعاع انتقال الطاقة عبر الأشعة الكهرومغناطيسية مثل الضوء وموجات الراديو والأشعة السينية.
تُدفئ الشمس الأرض بالإشعاع.

recycle to turn old things into new things *Plastic can be recycled to make new bottles and other products.*

إعادة تدوير صنع منتجات جديدة من أشياء قديمة.
يمكن إعادة تدوير اللدائن لتصنيع زجاجات جديدة ومنتجات أخرى.

reduce to use less of something *When you fix a leaky faucet, you reduce your use of water.*

ترشيد استخدام كمية أقل من شيء ما.
يتم ترشيد استهلاك الماء عند إصلاح الصنبور الذي يُسرب الماء.

reflect to bounce off a surface *Light reflects off a mirror.*

انعِكاس ارتداد الضوء عن السطح. ينعكس الضوء عن سطح المرآة.

refract to bend *Light refracts as it moves from the air to the water.*

انكسار انحراف الضوء عن مساره عند انتقاله بين وسطين شفافين.
ينكسر الضوء عندما ينتقل من الهواء إلى الماء.

reproduce to make more of one's own kind

تكاثر انتاج المزيد من نوع واحد.

reptile a vertebrate that has scaly, waterproof skin, breathes air with lungs, and lays eggs

زواحف حيوان فقاري تغطي جسمه الحراشف وجلده مقاوم للماء ويتنفس من رئتيه ويضع البيض.

resource something in the environment that helps an organism survive *Flowers are a resource for butterflies.*

مصدر شيء في البيئة يُساعد الكائن الحي على البقاء.
الزهور مصادر للفراشات.

respond to react to something *When the weather gets cool in the fall, this tree responds by losing its leaves.*

استجابة القيام برد فعل تجاه شيء ما.
عندما يبرد الطقس في الخريف، تستجيب الأشجار لهذا بتساقط أوراقها.

reuse to use something again *Old bottles were reused to make this building.*

إعادة استعمال استخدام الشيء مجددًا.
أُعيد استخدام الزجاجات القديمة في بناء هذا المبنى.

root a plant structure that takes in water and nutrients and holds a plant in place

جذر جزء من النبات يمتص الماء والعناصر الغذائية ويُثَبِت النبات في مكانه.

S

screw a simple machine made up of an inclined plane wrapped into a spiral

برغيّ آلة بسيطة تتكون من سطح مائل وملفوف بشكل حلزوني.

seed a structure that can grow into a new plant

بذرة جزء من النبات ينمو ليصبح نباتًا جديدًا.

shadow a dark space that forms when light is blocked

ظل مكان لا يصله الضوء يتكون عندما يصطدم الضوء بحاجز.

shelter a place in which an animal can stay safe *A nest is a shelter for young birds.*

مأوى مكان يعيش فيه الحيوان وينعم بالأمان.
العش مأوى أفراخ الطيور.

simple machine a machine with few or no moving parts *A lever is a simple machine.*

آلة بسيطة آلة تتكون من أجزاء قليلة أو بلا أجزاء متحركة.
الرافعة آلة بسيطة.

solid matter that has a certain shape and volume

صلب مادة لها شكل وحجم معين.

sound a form of energy that comes from objects that vibrate

صوت أحد أشكال الطاقة التي تصدر من الأجسام التي تهتز.

speed how fast an object moves over a certain distance

سرعة مقدار ما يقطع الجسم من مسافة في وحدة الزمن.

state of matter a form of matter, such as solid, liquid, and gas

حالة المادة أحد أشكال المادة. مثل الحالة الصلبة والسائلة والغازية.

static electricity the build up of an electrical charge on a material *Static electricity can cause you to get a shock from touching a doorknob.*

كهرباء ساكنة تراكم الشحنات الكهربائية على المادة.
يمكن أن تتسبب الكهرباء الساكنة في إصابتك بصدمة عندما تلمس مقبض الباب.

stem a plant structure that holds a plant up and helps leaves reach sunlight

ساق جزء من النبات يرفع النبات لأعلى ويساعد أوراق النبات على التعرض لأشعة الشمس.

structure a part of an organism *Horns are structures that help wild sheep keep safe.*

عضو جزء من الكائن الحي، يساعده على تلبية احتياجاته.
القرون هي بُنى تساعد الخراف على حماية أنفسها.

switch a device that allows you to control the flow of electric current through a circuit

مفتاح جهاز يتيح لك التحكم في تدفق التيار الكهربائي عبر الدّارة.

T

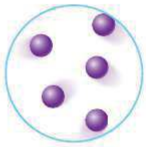
Technology all the ways people change nature to meet their needs

تكنولوجيا جميع الأساليب التي يتبعها الإنسان لتغيير الطبيعة لتلبي احتياجاته.

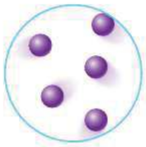
temperature a measure of how hot or cold something is *When you visit the doctor, she measures your body's temperature.*

درجة الحرارة قياس لمدى سخونة أو برودة الأشياء.
عندما تزور الطبيبة، ستقيس درجة حرارة جسمك.

thermal energy the energy of moving particles of matter



طاقة حرارية طاقة الجسيمات المتحركة من المادة.



thermometer a tool that is used to measure temperature

مقياس الحرارة (الترمومتر) أداة تُستخدم لقياس درجة الحرارة.

trait a feature of a living thing *Spots are a trait of Dalmatians.*

سمة صفة يتسم بها الكائن الحي.
من سمات كلاب الدلماسي الرقط السوداء.

translucent scattering light that passes through, so that objects on the other side appear blurry *Frosted glass is translucent.*

شبه شفاف وسط ينفذ جزءا من الضوء ويعكس الجزء الاخر ولا يمكنك رؤية الأجسام بوضوح من خلاله.
يصبح الزجاج المجمد شبه شفاف.

transparent letting all light through, so that objects on the other side can be seen clearly *Clear glass is transparent.*

شفاف السماح لجميع أشعة الضوء بالمرور عبر المادة. بحيث يمكن رؤية الأشياء على الجانب الآخر بوضوح.
الزجاج النقي شفاف.

V

vertebrate an animal with a backbone

فقاري حيوان له عمود فقري.

vibrate to move back and forth quickly *A guitar string vibrates after you pluck it.*

اهتزاز الحركة للأمام والخلف سريعا.
تهتز خيوط الجيتار عند العزف عليها.

volume a measure of how much space an object takes up
The garduated container is used to measure liquids volume

حجم هو الحيز الذي تشغله المادة.
يستخدم الوعاء المدرج لقياس حجم السوائل.

W

wedge a simple machine that uses force to split objects apart

إسفين آلة بسيطة تستخدم القوة لتجزيء الأجسام إلى شرائح.

weight a measure of the pull of gravity on an object

وزن مقدار قوة الجاذبية المؤثرة في الجسم.

wheel and axle a simple machine that consists of a wheel that moves around a post; the post is called an axle

العجلة الدوارة آلة بسيطة تتكون من عجلة تتحرك حول عمود يُسمى المحور.

work what is done when a force changes an object's motion *You do work when you move a bow to play the violin.*

الشغل استخدام قوة لتحريك جسم أو تغيير شكله.
إنك تبذل الشغل عندما تُحرك القوس لعزف الكمان.

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