CHAPTER 1

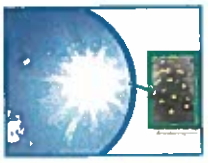
Living Things Need Energy

Vocabulary

photosynthesis the way plants use sunlight to make food

environment everything that surrounds a living thing

food chain the path of energy in the form of food going from one living thing to another



producer any living thing that makes, or produces, its own food

consumer a living thing that eats other living things

decomposer a living thing that breaks down dead plants and animals

herbivore an animal that eats mostly plants

carnivore an animal that eats other animals

The Big Idea: How do living things get energy to live and grow?

omnivore an animal that eats both plants and animals

food web a way of showing how food chains in any place are linked together

compete to try to get the same thing that others need or want

microorganism any kind of living thing that is too small to be seen with just our eyes

bacteria any of the smallest kinds of microorganism

protist a kind of microorganism larger than bacteria

fungus a plantlike living thing that breaks down dead plants and animals

What are plants?

Plants are living things. They are important for life on Earth. For example, plants make food. The food we eat all starts out from plants. Plants also make *oxygen* (OK•suh•juhn). Oxygen is a gas we breathe. Plants give off oxygen into the air.

Plants come in many shapes, sizes and colors. For example, trees, grasses, and bushes are different kinds of plants. However, most plants have three parts. They have roots, stems, and leaves.

Leaves collect light from the Sun. They use the light to make food.

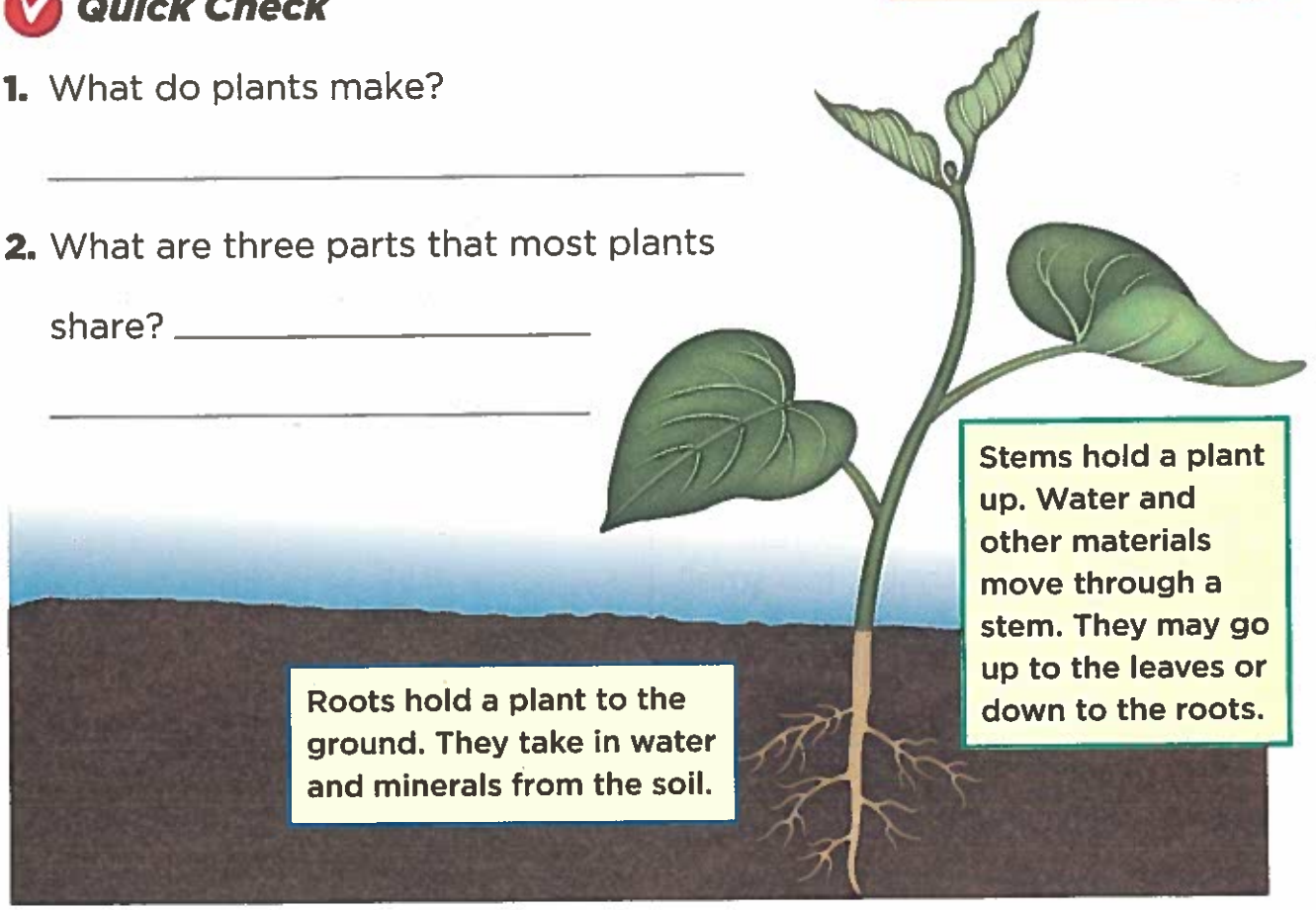
Quick Check

1. What do plants make?

_____

2. What are three parts that most plants share? _____

_____

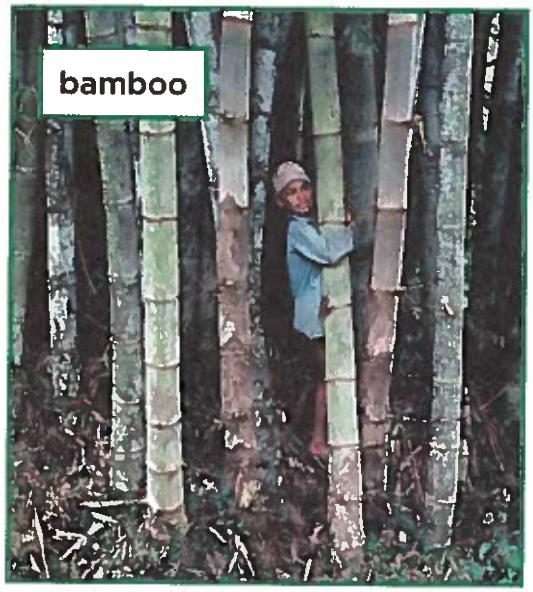


Stems hold a plant up. Water and other materials move through a stem. They may go up to the leaves or down to the roots.

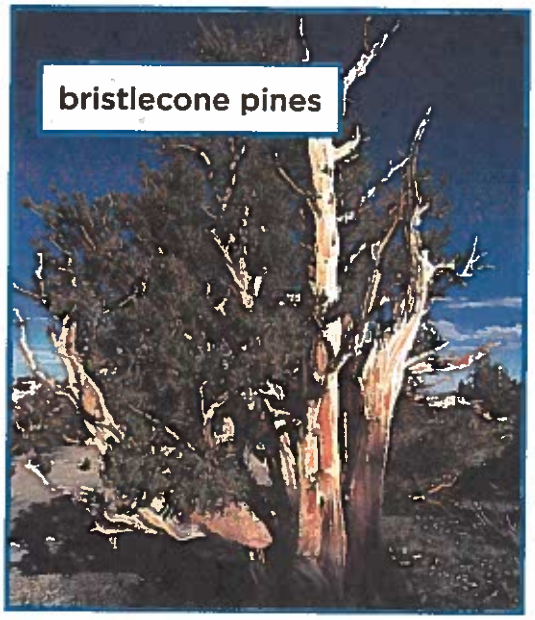
Roots hold a plant to the ground. They take in water and minerals from the soil.

Here are some plants that hold world records. Some of them are natives of Calfornia.

Redwoods are the world's tallest plants. They grow in California. Some are over 100 meters (327 feet) tall. Some are over 2,000 years old.



Bamboo plants are the fastest growing plants. Some bamboo plants grow more than 2 centimeters (about 1 inch) an hour.



The oldest trees are the bristlecone pines. They live in California's White Mountains. One bristlecone pine is almost 5,000 years old.

Quick Check

3. Which of these amazing plants live in California? Why are they amazing? _____

_____

How do plants get energy?

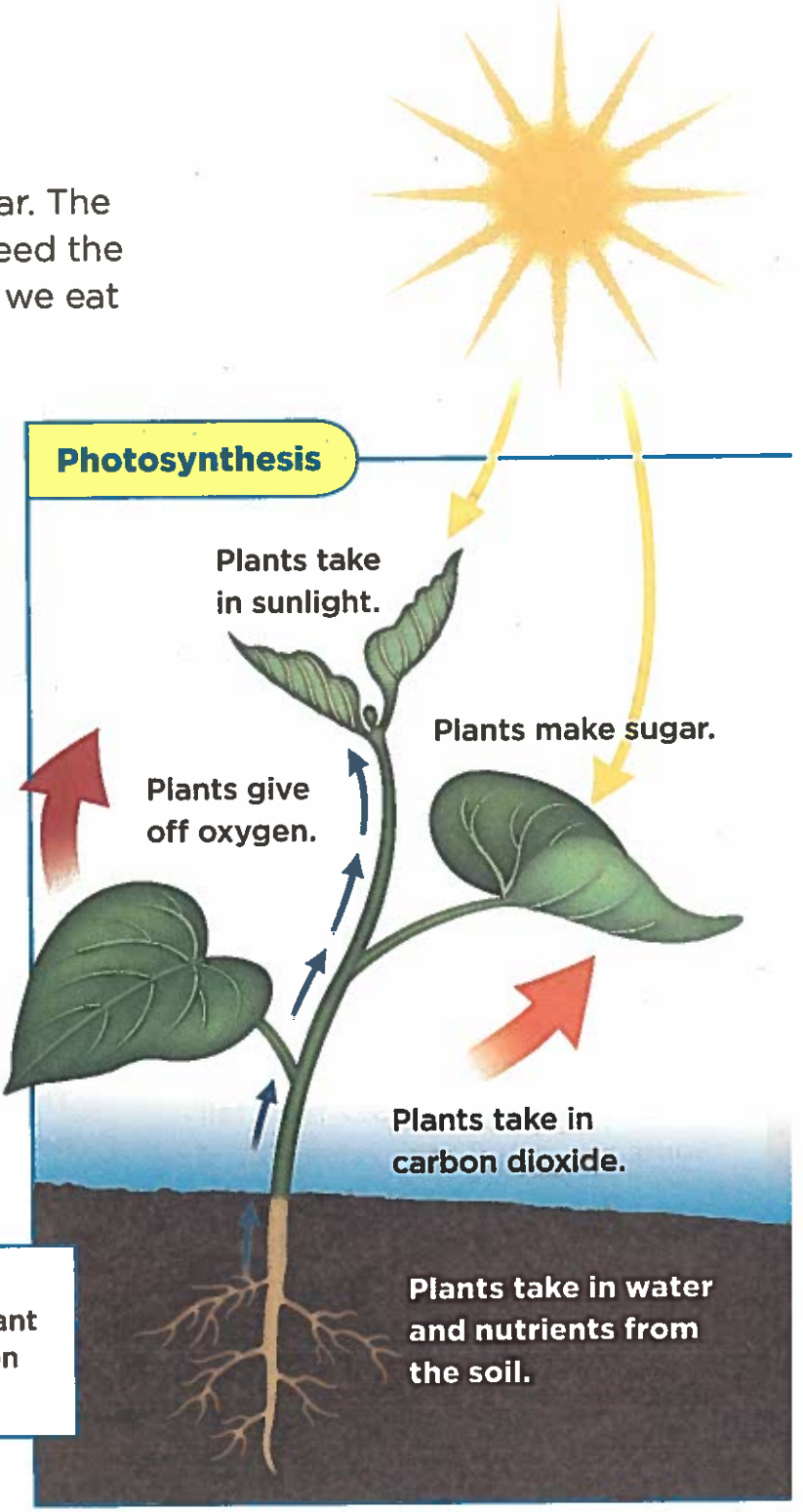
Most plants carry out photosynthesis (foh•toh•SIN•thuh•suhs). **Photosynthesis** is the way plants make their own food. To make food, plants need:

- sunlight
- water
- a gas (carbon dioxide)

The food plants make is sugar. The sugar has energy in it. Plants need the energy to live and grow. When we eat plants, we get that energy.

Getting Sunlight

Plants look green because they contain a green material, chlorophyll (KLAWR•uh•fil). Chlorophyll traps sunlight, energy from the Sun. A plant uses the energy to make sugar. The sugar is made in their leaves.



Reading Diagrams

Follow the arrows to see how a plant takes in sunlight, water, and carbon dioxide and give off oxygen.

Getting Water and Carbon Dioxide

Plants get water from the ground. Most plants you know have roots to take in water. Once inside the roots, water travels up through thin tubes:

- from the roots, water goes up the stem
- from the stem, water goes into leaves

Carbon dioxide is a gas in the air. Plants have tiny holes to take in this gas. These holes are the stomata (STOH•muh•tuh). They are on the bottom of each leaf. Carbon dioxide enters a leaf through the stomata.

This photo shows the bottom of a leaf up close. The leaf here is shown over 100 times larger than it really is.

Quick Check

Write the letter of the word that fits each statement.

4. _____ Plants get this from the Sun.

5. _____ Plants make this food.

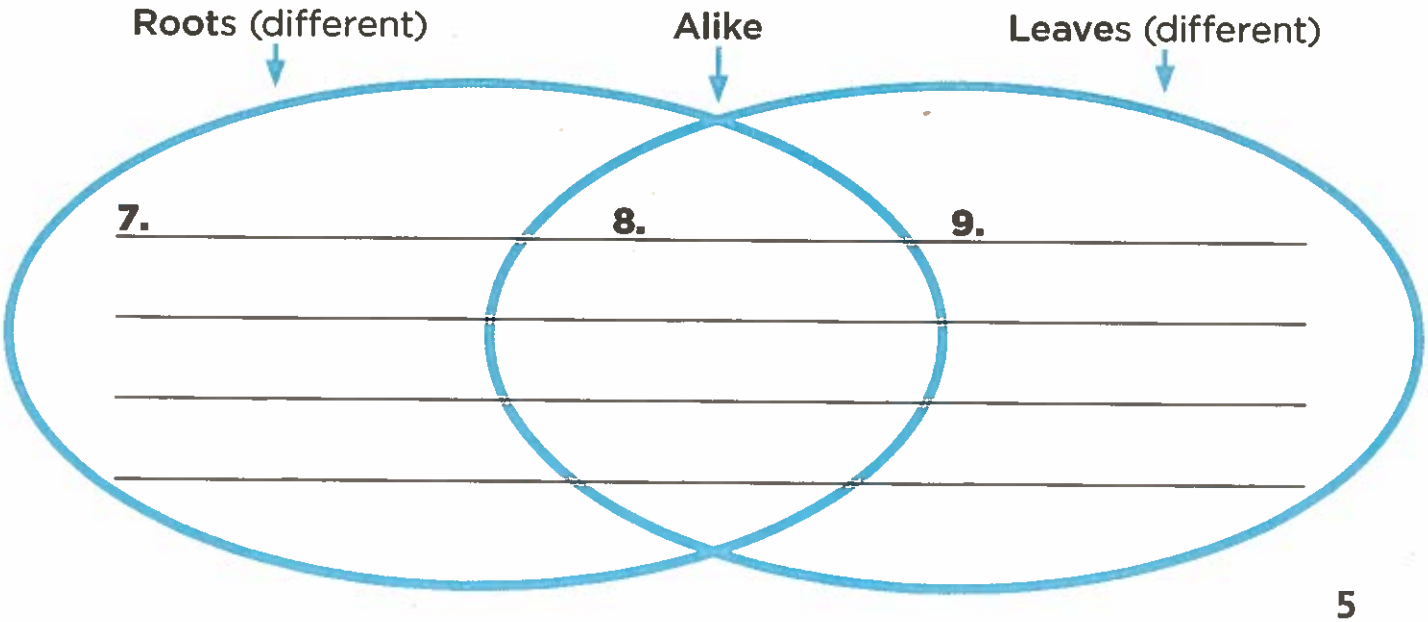
6. _____ A green material in plants

a. chlorophyll

b. energy

c. sugar

How are roots and leaves alike? How are they different?



Why are plants important?

Remember, the energy for living things comes from the Sun. Plants can trap this energy. Plants use this energy to make food and oxygen. Food and oxygen are important to animals.

Animals depend on plants for food.

Food

Animals need energy to live. They get energy from food. Animals cannot make their own food. They eat food that comes from plants. Here's how:

How Food Is Passed	Example
Plants make their own food.	A leaf makes food.
Some animals eat plants for food.	A grasshopper eats the leaf.
Some animals eat the animals that eat plants.	A bird eats the grasshopper.

With the food, energy goes from plant to animal to animal.

Quick Check

Label each *True* or *False*. If it is false, correct it.

10. Animals can make their own food. _____

_____

11. Animals need energy to live. _____

_____

This environment is a rain forest. It is crowded with plants.

Oxygen

Plants make oxygen for themselves and other living things. Animals need oxygen, but cannot make it. Most animals cannot live without oxygen for more than just a few minutes.

Plants Everywhere

Plants live in environments all over Earth. An **environment** is everything that surrounds a living thing. Plants live in all kinds of environments from deserts to oceans. Plants provide energy in food for the living things around them.

Quick Check

Complete this sentence.

12. Animals need plants because _____

_____

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What is a food chain?

Living things get energy from food. A **food chain** is the path energy takes in the form of food going from one living thing to another.

Here's the path of a food chain:

- The chain starts with energy from the Sun. A plant uses the energy to make its own food. The plant in a food chain is a **producer** because it makes, or produces, its own food.
- Next, an animal such as an insect eats the plant. Energy from the plant passes to the insect. Then another animal, such as a bird, eats that insect. So energy passes from the insect to the bird.

Mountain Food Chain

Food chains start with energy. Energy from the Sun makes life possible on Earth.

A mustard plant takes in energy from the Sun to make its own food. ▼

The insect and the bird are consumers. An animal is a **consumer** because it must eat, or consume, plants or other animals for food.

- Another consumer, such as a wolf, may eat the bird. The chain continues until consumers die.
- At the end of the chain are decomposers. **Decomposers** are tiny living things that break down dead plants and animals. That is, they make dead plants and animals rot. Then they return materials from the dead plants and animals to the soil. Worms and many insects are examples of decomposers.

Quick Check

Show the order of living things in a food chain.

Producers

↓

13. _____

↓

14. _____

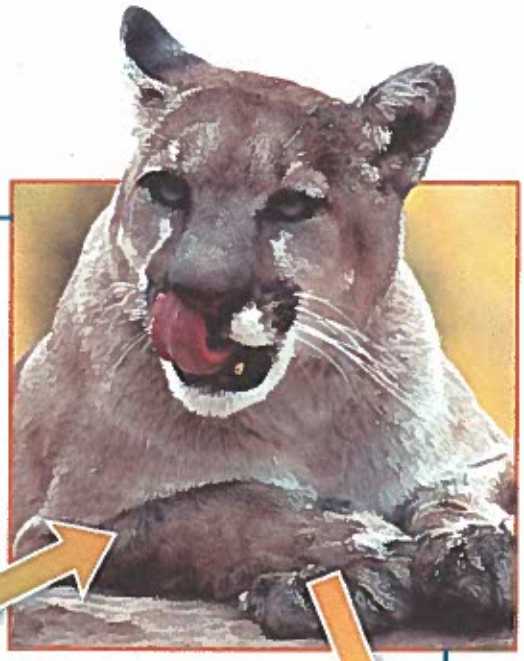
Reading Diagrams

Arrows show the path of energy from the Sun to each living thing in the food chain.

▲ A gopher eats the mustard plant.

A weasel eats the gopher. ▶

A mountain lion eats the weasel. ▶



When the mountain lion dies, decomposers break down its body. ▶

What are herbivores?

In a food chain, the first consumer is an animal that eats a plant. For example, a gopher is a plant eater. A gopher is a herbivore (HUR•buh•vawr). A **herbivore** is an animal that eats mostly plants.

Deer, rabbits, grasshoppers, squirrels, and cows are herbivores. Herbivores are food for other animals. The word for an animal that is hunted by another animal for food is *prey*. All the animals here are prey for some larger or stronger animal.

▲ Herbivores can be as small as this caterpillar.

▲ Antelopes are herbivores. They are also prey to many other animals, such as lions.

◀ The African elephant is Earth's largest land animal. It is a herbivore that eats mostly grasses. It eats from 100 to 200 kilograms (220 to 440 pounds) a day.

Quick Check

15. How do herbivores get energy? _____

_____

_____

What are carnivores and omnivores?

Lions and hawks eat other animals. They are carnivores. A **carnivore** (KAR•nuh•vawr) is an animal that eats other animals.

Some animals eat plants and animals. For example, a bear eats berries, leaves, mice, and squirrels. A bear is an omnivore (AHM•nuh•vawr). An **omnivore** is an animal that eats plants and animals. Raccoons and wasps are omnivores. People are omnivores.

Some animals hunt the animals they eat. Animals that hunt other animals for food are *predators*.

▲ A bear is an omnivore.

▲ A heron is a carnivore.

Quick Check

Write the letter of the food for each kind of animal.

16. _____ herbivore — **a.** mostly animals

17. _____ carnivore — **b.** plants and animals

18. _____ omnivore — **c.** mostly plants

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What are decomposers?

Decomposers are living things at the end of a food chain. They break down plants and animals that have died. The once-living material becomes part of the soil. This material helps other plants to grow. Then food chains can start all over.

There are many kinds of decomposers. Earthworms are decomposers. Insects, such as flies and beetles, are decomposers.

This beetle feeds off things that were once alive. The beetle breaks down "once-living" things.

These earthworms are eating dead plants. They pass materials from the dead plants to the soil. ▶

Quick Check

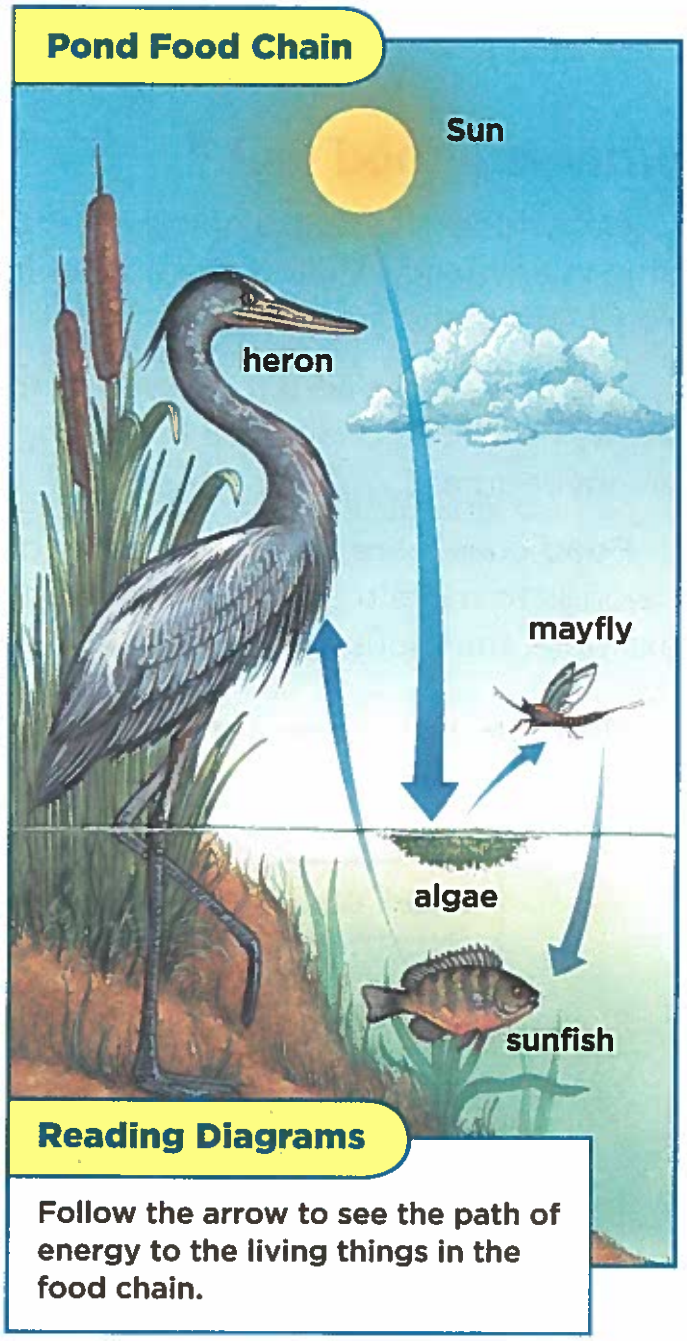
19. What job do decomposers have in a food chain?

More Food Chains

Here is a food chain in a pond. The producers in this pond are *algae* (AL•jee). Algae are living things that look like tiny plants. They float at the top of a pond or stream or ocean.

Follow the food chain:

1. Sunlight is trapped by algae. Algae make food.
2. Algae are eaten by mayflies.
3. Mayflies are eaten by sunfish.
4. Sunfish are eaten by herons.
5. Decomposers breakdown the herons when they die.



Quick Check

Fill in the blanks to show the path of energy in the pond food chain.

The Sun → **20.** _____ → mayfly → **21.** _____ →

22. _____ → decomposers

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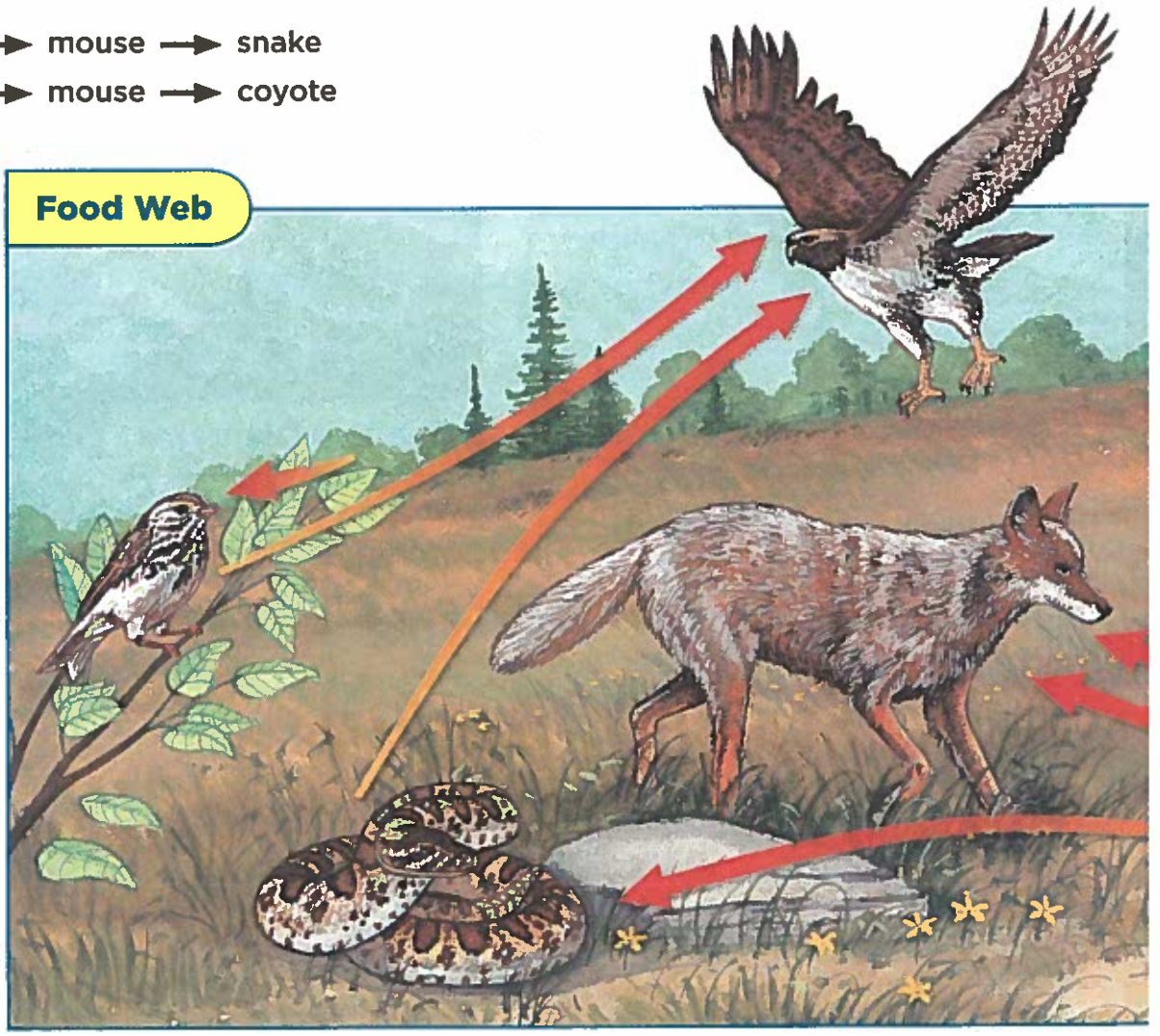
What is a food web?

Many food chains are going on at the same time in any place. Follow the arrows in the picture. You'll find many food chains.

The picture shows a food web. A **food web** shows how food chains are linked together in an environment.

Food chains are linked when any one animal belongs to more than one food chain. For example, the mouse belongs to two food chains:

plant → mouse → snake
plant → mouse → coyote



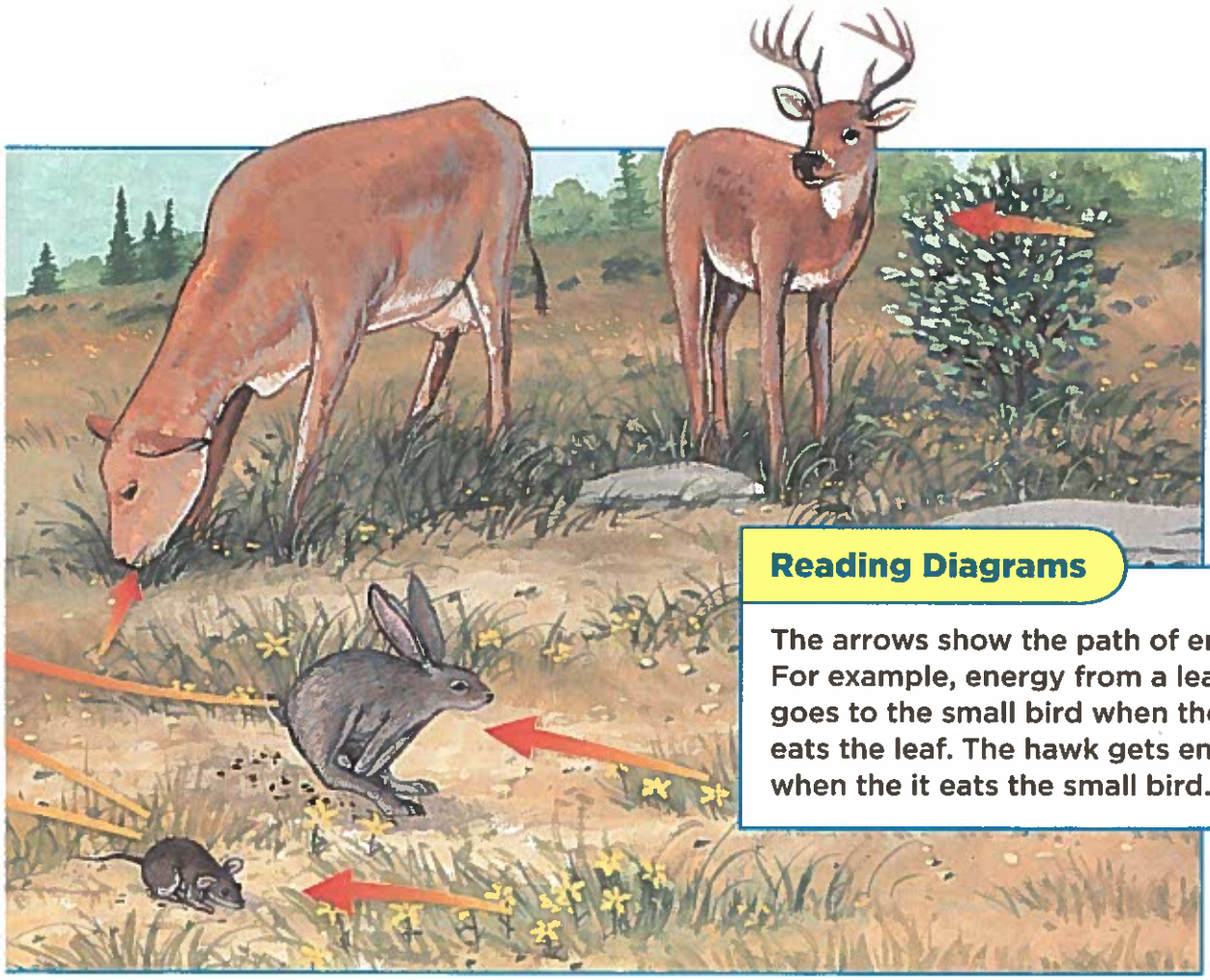
Food chains show how different living things compete. When living things **compete**, they try to get the same thing, such as food. For example:

- both snakes and coyotes eat mice
- both mice and rabbits eat grass.

Quick Check

23. Two animals that the hawk eats are **(a)** _____ and **(b)** _____.

Two animals that can eat the mouse are **(c)** _____ and **(d)** _____.



Reading Diagrams

The arrows show the path of energy. For example, energy from a leaf goes to the small bird when the bird eats the leaf. The hawk gets energy when the it eats the small bird.

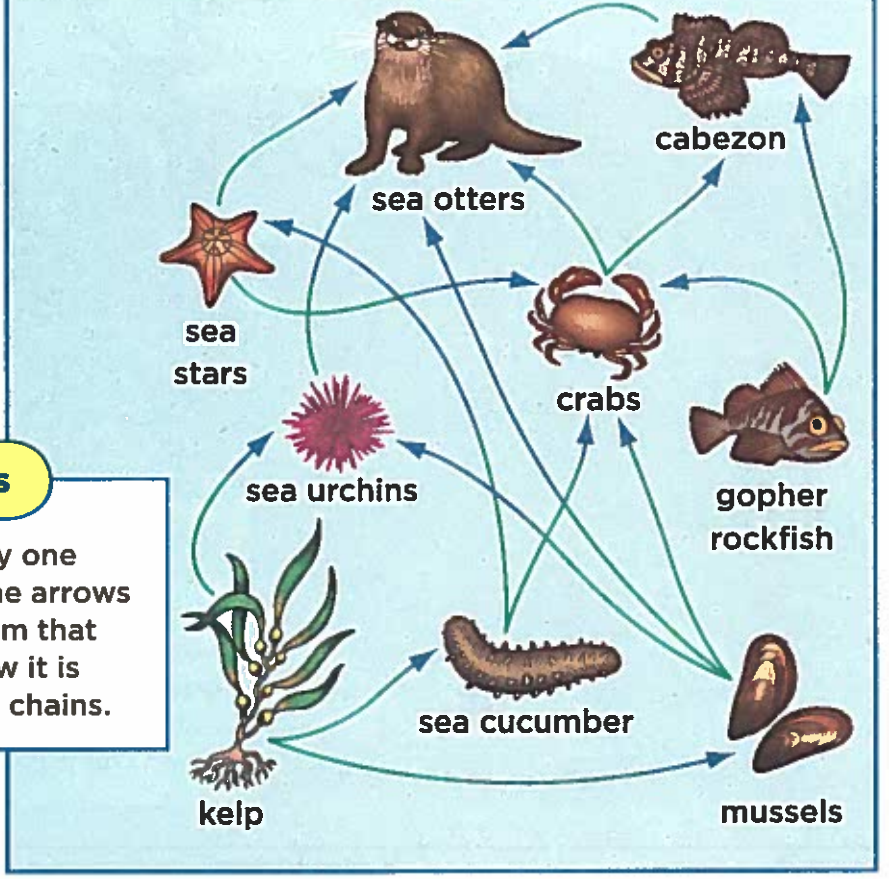
How can food webs change?

Look at the kelp forest food web. Try to find as many food chains as you can. Start with the kelp in the lower left corner. Kelp is a kind of seaweed. Kelp grows in underwater forests. Many kinds of living things eat the kelp.

For example, here are just three food chains. They all start with kelp:

1. kelp → sea urchins → sea otters
2. kelp → sea cucumbers → crabs → sea otters
3. kelp → mussels → crabs → sea otters

Kelp Forest Food Web



Reading Diagrams

Put your finger on any one living thing. Follow the arrows point to and away from that living thing to see how it is part of different food chains.

A change in one kind of living thing in a food web causes other kinds of living things to change. For example, over 200 years ago, sea otters were hunted for their fur. So there were fewer and fewer sea otters in the food web.

Look at the kelp forest food web. Sea otters eat sea urchins. Without sea otters, fewer sea urchins were being eaten.

kelp → sea urchins → sea otters

Soon there were too many sea urchins in the kelp forest. They were eating up the kelp. Other living things, such as mussels, could not get the kelp they needed. The mussels began to die out. Then crabs, which eat mussels, began to die out as well.

Many ocean animals eat kelp.

Quick Check

Complete these food chains. Use the kelp forest food web on p. 16.

kelp → mussels → **24.(a)** _____ → sea otters

kelp → sea cucumbers → sea stars → **24.(b)** _____

How do new organisms change food webs?

A food web can change when a living thing is added to a place. For example, in Australia, over 70 years ago, insects were eating sugar cane plants. Farmers brought in large toads to eat the insects and save the sugar cane.

The farmers hoped that lizards and birds would eat the some of the toads. They wanted to keep the number of toads from growing.

However, the toads did not eat the insects. They ate the birds and lizards instead! The toads grew in number. They ate just about everything they could, even pets. What's more, the insects kept eating the sugar cane.

The cane toad was brought in to eat insects. Instead, they ate just about everything else. They are still a problem today. ▶

Quick Check

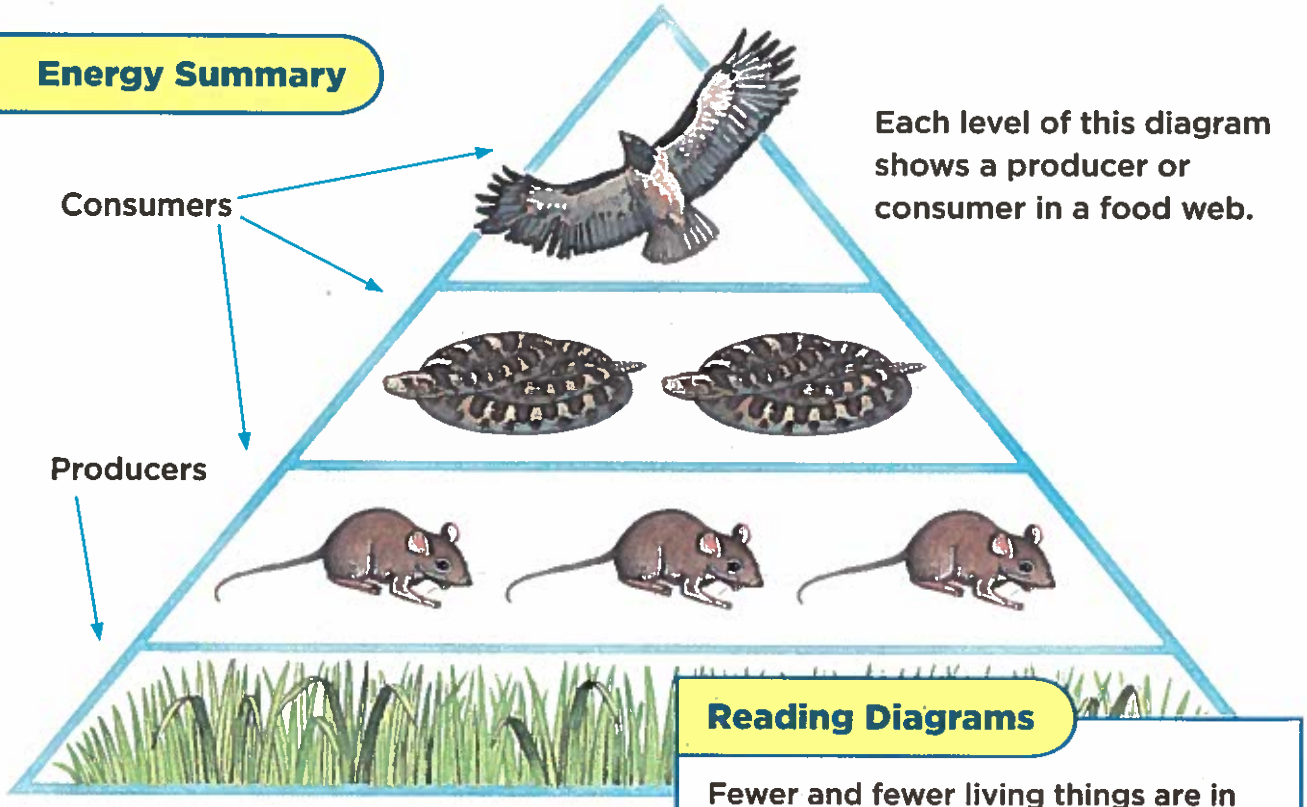
25. Why did farmers bring large toads to Australia over 70 years ago?

How does energy flow in a food web?

This diagram is a summary of what happens to the energy in a food web. The bottom of the diagram shows a producer—grass. Remember, producers get energy from the Sun. Producers make up the biggest part of the diagram.

The other levels are all consumers. Energy is passed to each level on top when the animal eats the food below it. The levels get smaller as you go to the top. Many producers are needed for the energy of just one living thing at the top.

Energy Summary



Each level of this diagram shows a producer or consumer in a food web.

Reading Diagrams

Fewer and fewer living things are in each layer as you look from bottom to top. The more powerful consumers are higher up in the diagram.

Quick Check

Fill in the blanks to the food chain in this diagram.

grasses → **26.** _____ → **27.** _____ → hawk

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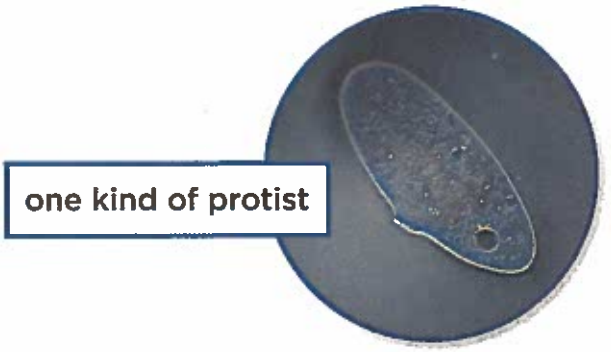
What is a microorganism?

You cannot see them, but there are tiny living things everywhere. They live on food. They live inside and on the outside of your body. They live in ponds, lakes, and oceans. They live in soil. They live on dust in the air.

Tiny living things too small to be seen with just our eyes are called **microorganisms** (migh•kroh•AWR•guh•niz•uhms). You need a microscope to see them. Microscopes let you see things much bigger than they really are. With a microscope, you can find microorganisms in a drop of pond water.



Put a drop of water on a glass plate under the lens. Look through the eyepiece. You can see microorganisms in the water. ▶

Among the smallest kinds of microorganisms are **bacteria** (bak•TEER•ee•uh). Some bacteria are helpful. For example, some help your body break down food that you eat. However, some bacteria cause disease.

Protists (PROH•tists) are microorganisms that are a little larger than bacteria. Some protists help you. They eat harmful bacteria. Other protists can cause disease.

Your body is protected against microorganisms that cause disease. You can help keep your body stay safe from them. For example, wash and cover a cut to keep harmful bacteria out of your body.

Stay Safe from Disease

disease	cause	how you can help
tooth decay	bacteria	brush and floss teeth
Lyme disease	bacteria in ticks	wear long pants on hikes

Quick Check

28. How are bacteria and protists alike? _____

_____

_____

29. How are bacteria and protists different? _____

_____

_____

Which microorganisms are producers and consumers?

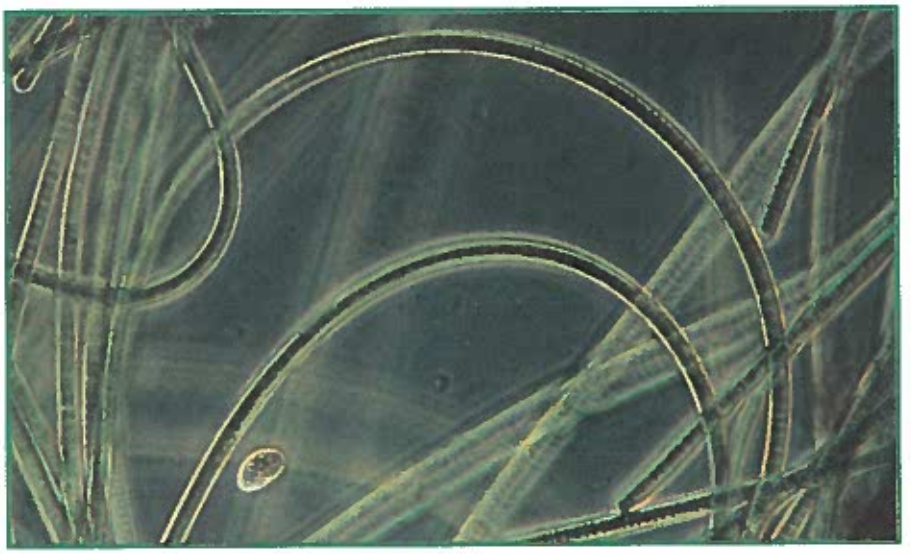
Some microorganisms act like plants. Some act like animals.

Producers

Plants are producers. Remember, producers are the first step in a food chain. They take in energy from the Sun and make their own food. They also give off oxygen to the air.

Some microorganisms are producers. For example, *algae* (AL•jee) are producers that grow in large numbers at the top of ponds, lakes, and the ocean. Algae are important because they make much of the oxygen for living things.

Algae and other tiny producers act like plants, but they are not plants. They do not have the parts plants have. They do not have roots, stems, and leaves.



▲ **These algae are seen under a microscope. Unlike plants, they have no roots, stems, and leaves. However, they do make food and oxygen.**

Consumers

Remember, animals cannot make their own food. Animals are consumers. They move about to get food.

Some microorganisms act like animals. For example, an *amoeba* (uh•MEE•buh) is a protist. It acts like an animal. It moves its body to get food. It can wrap around the food to catch it.

The body of an amoeba flows in different directions. The body seems to reach out toward food. The body can flow around the food.

Producers and Consumers

Euglena (yew•GLEE•nuh) is a protist that lives in ponds. It acts like a plant and like an animal. In sunlight, it can make its own food—like a plant. It can also move around to get food—like an animal.

Euglena has a body part that looks like a tail. It whips this part as it moves.

Quick Check

Complete this main idea chart.

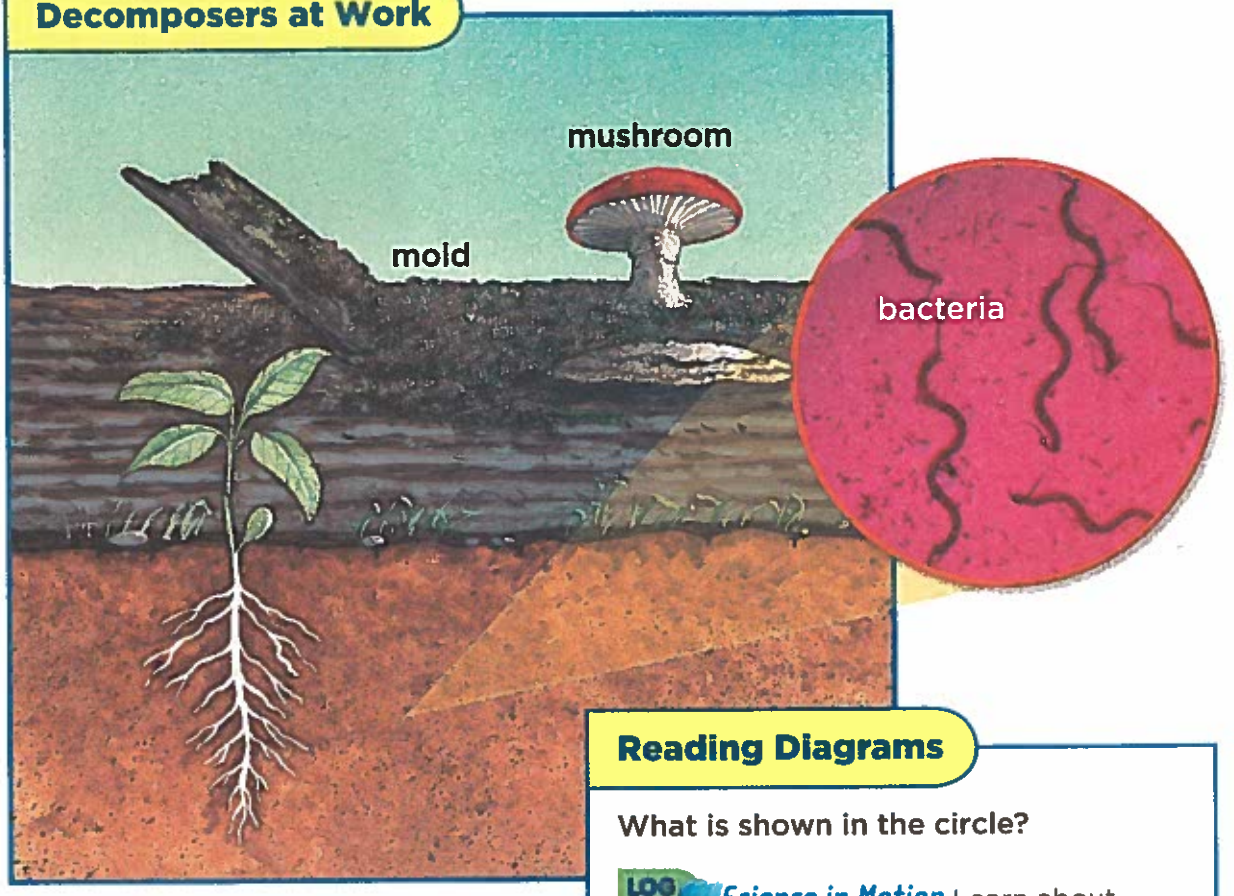
Main Idea	Details
Tiny living things can act like plants or animals, or both.	Some can make food, like plants.
	30. _____

Which microorganisms are decomposers?

Remember, decomposers are the last step in a food chain. They break down dead plants and animals. The diagram shows three decomposers on a dead tree. One is a large living thing, the mushroom. The two other decomposers are microorganisms. They are mold and bacteria.

A mushroom is a fungus (FUNG•guhs). A **fungus** is a living thing that may look like a plant. However, a fungus does not make its own food as plants do. It gets food by feeding off a dead thing.

Decomposers at Work



Reading Diagrams

What is shown in the circle?

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The diagram on page 24 shows two other decomposers: mold and bacteria. Both are microorganisms. Mold is a type of fungus. A single mold is too small to see. However, you can see mold growing in large numbers on dead wood and other once-living things. They make the once-living things rot.

Bacteria are much smaller than mold. You can see them only with a microscope. There may be billions of bacteria in just a teaspoonful of soil. Many bacteria in soil are decomposers.

When the tree is broken down, it becomes part of the soil. The soil is then ready for new plants to grow.

Molds are growing on this apple. Mold grow fast in warm temperatures.

Quick Check

List the three decomposers in order from largest to smallest.

31. _____

32. _____

33. _____

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Vocabulary Review

Living Things Need Energy

Choose the letter of the best answer.

1. One way to show how food chains in any place are linked together is to draw a(n)
   - **a.** photosynthesis
   - **b.** living thing
   - **c.** food web
   - **d.** producer

2. Microorganisms that are larger than bacteria are
   - **a.** protists
   - **b.** fungus
   - **c.** producers
   - **d.** consumers

3. An animal that eats both plants and animals is a(n)
   - **a.** bacteria
   - **b.** decomposer
   - **c.** herbivore
   - **d.** omnivore

4. Any living thing that makes its own food is a(n)
   - **a.** producer
   - **b.** protist
   - **c.** bacteria
   - **d.** fungus

5. Everything that surrounds a living thing is called a(n)
   - **a.** food chain
   - **b.** competition
   - **c.** food web
   - **d.** environment

6. When animals try to get the same thing that others need or want, they
   - **a.** produce
   - **b.** eat
   - **c.** compete
   - **d.** surround

7. The way plants use sunlight to make food is called
   - **a.** decomposer
   - **b.** photosynthesis
   - **c.** omnivore
   - **d.** food chain

consumer	fungus	bacteria	herbivore
carnivore	decomposer	food chain	

Use each word just once to fill in the blanks.

1. A living thing that breaks down dead plants and animals is called a(n) _____.

2. An animal that eats mostly plants is a(n) _____.

3. The smallest of the microorganisms is _____.

4. An animal that eats other animals is called a(n) _____.

5. The path of energy in the form of food from one to another is called the _____.

6. A plantlike living thing that breaks down dead plants and animals is _____.

7. A living thing that eats other living things is a(n) _____.

CHAPTER 2

Living Things and Their Environment

Vocabulary

ecosystem all the living and nonliving things working together in an area

climate the kind of weather an area has over time

emergent layer the tops of trees in a rain forest

canopy the layer just under the tops of the trees in a rain forest, where most plants and animals live

pollen a powdery material that flowers need to make seeds

stamen the part of a plant where pollen comes from

pistil the part of a plant where seeds are made

pollination the movement of pollen to the seed-making part of a flower

The Big Idea: How do living things depend on one another and the environment?

nectar a sweet liquid formed inside flowers

endangered few left of this kind of living thing

extinct none of this kind of living thing left alive today

adaptation a body feature or way of acting that helps a living thing survive in its environment

camouflage how a living thing might not be seen because it blends into its surroundings

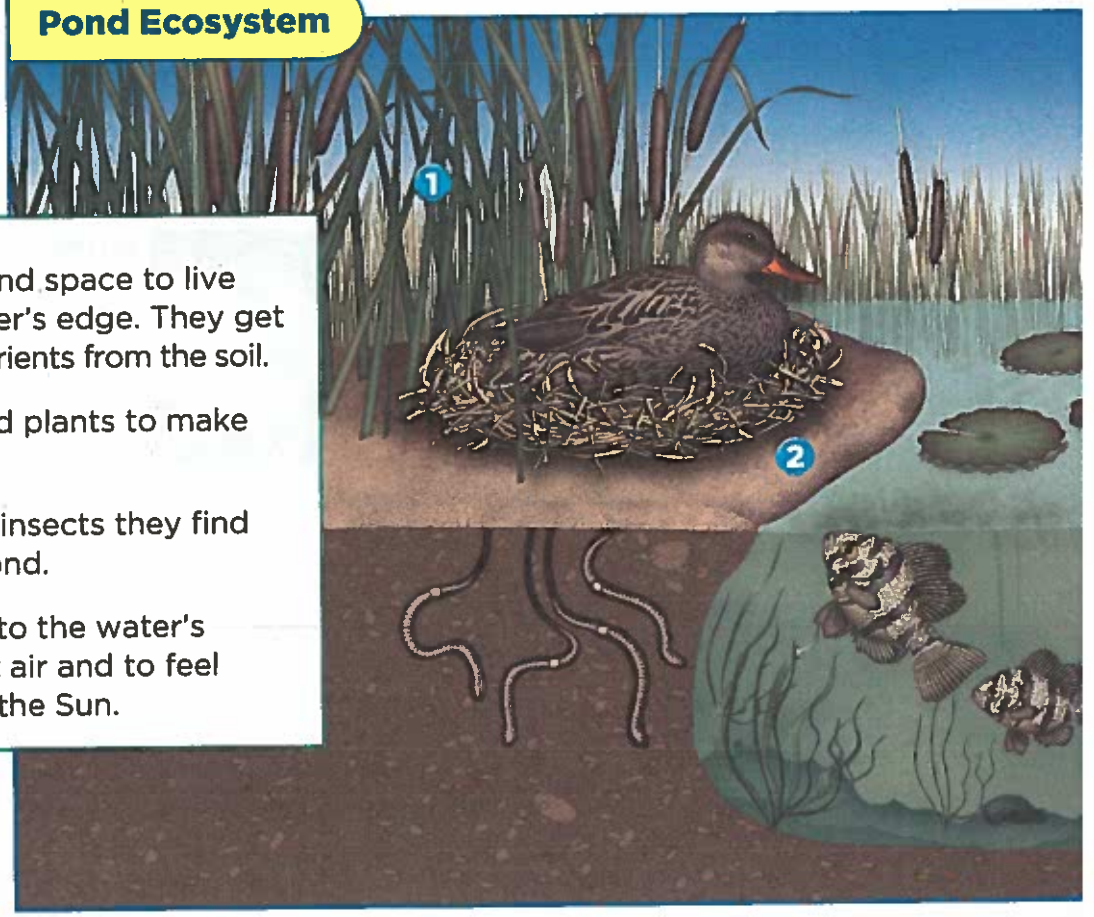
mimicry how an animal may look like some kind of other living thing

What is an ecosystem?

Plants grow from the soil. They need water to grow. Some birds use plants to make nests. Some animals eat plants. Tiny living things, bacteria, may break down dead plants. These are ways plants, animals, bacteria, soil, and water *interact*. *Interact* means "one thing uses or needs another."

All the parts interacting in any place make up an **ecosystem** (EK•oh•sis•tuhm). Some parts may be living. For example, plants are living. Some parts, such as water, are nonliving.

Pond Ecosystem



1. Many plants find space to live along the water's edge. They get water and nutrients from the soil.
2. Birds use pond plants to make their nests.
3. Frogs eat the insects they find around the pond.
4. Turtles come to the water's surface to get air and to feel warmth from the Sun.

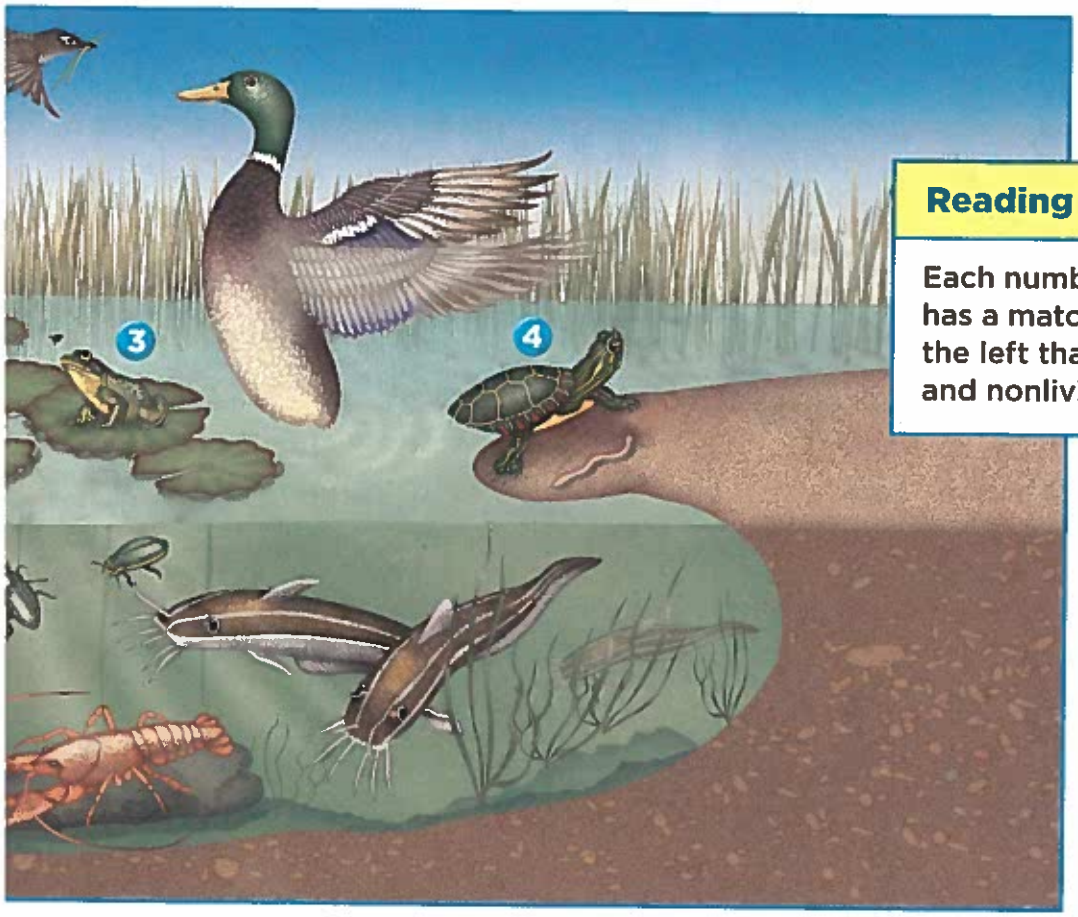
Living Things	Nonliving Things
• animals—such as birds, frogs, turtles, fishes, crayfish, insects, earthworms • plants—such as lily pads on the water, cattails on the shore • tiny living things—such as algae and bacteria	• sunlight • air • water • soil • climate (KLIGH•mit) **Climate** is the kind of weather an area has over time. The climate is the temperature and the amount of rain and snow the area has.

Quick Check

1. Cross out any part that is not a living part of a pond.

duck catfish beetle water sunlight frogs air

2. List two more parts of a pond. _____

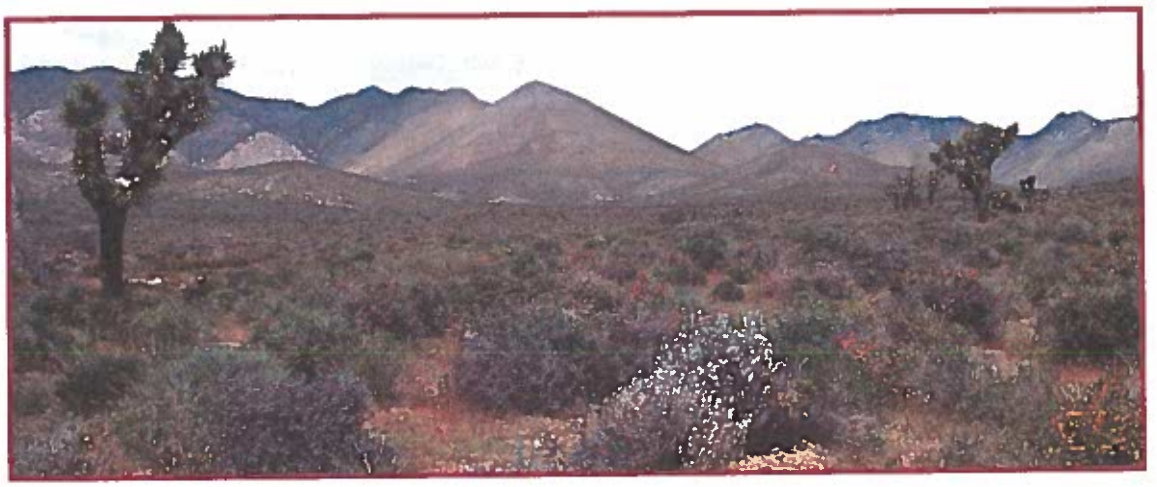


Reading Diagrams

Each number in the diagram has a matching statement at the left that tells how living and nonliving things interact.

What is a desert ecosystem?

All deserts are dry. They get little rain. Some deserts are hot. Others are cold. Some deserts are almost lifeless. Some have many living things. Living things of the deserts have ways of surviving the little water and the hot or cold temperatures.



California's Mojave Desert is dry and hot. It gets about 13 centimeters (5 inches) of rain a year. Many plants and animals can live here.

The fennec fox lives without water for a long time. It stays underground in the day and looks for food at night when it is cool.

The desert tortoise spends much of the time underground. That keeps it safe when temperatures change from day to night.

Quick Check

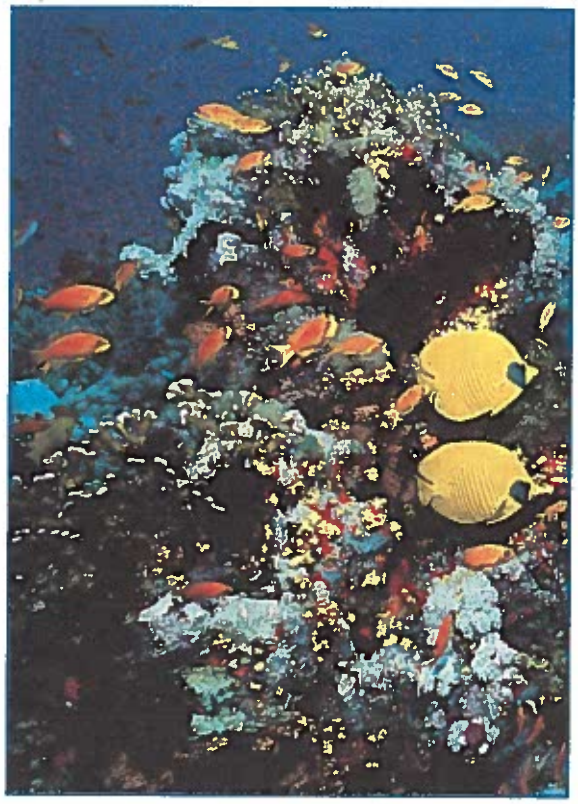
3. How can deserts be different? _____

_____

What is a coral reef ecosystem?

Coral reefs are warm ecosystems. They are found in shallow water. Their temperatures stay warm all year, from 70 to 85°F (21 to 29°C). The warm temperatures allow many ocean animals to live here.

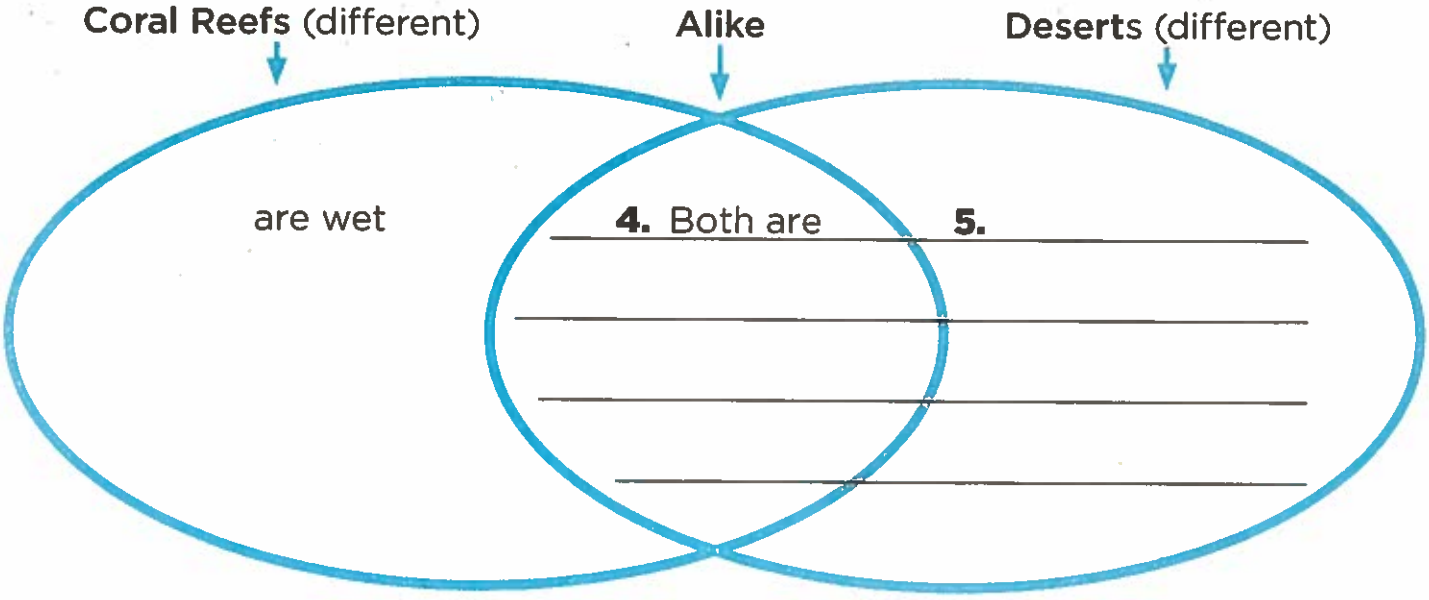
The reefs were made from the parts of tiny animals, coral polyps (POL•ips). After the animals die, their skeletons are left behind. The skeletons form the reefs.



Fishes swim across the reef. Many colorful sea animals grow attached to the reef. They may look like plants, but they are animals.

Quick Check

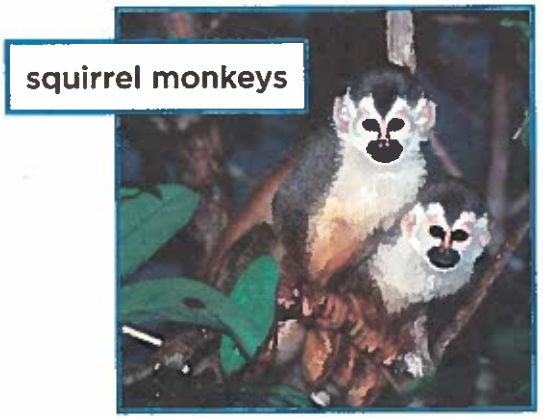
Show how deserts and coral reefs are alike and different.

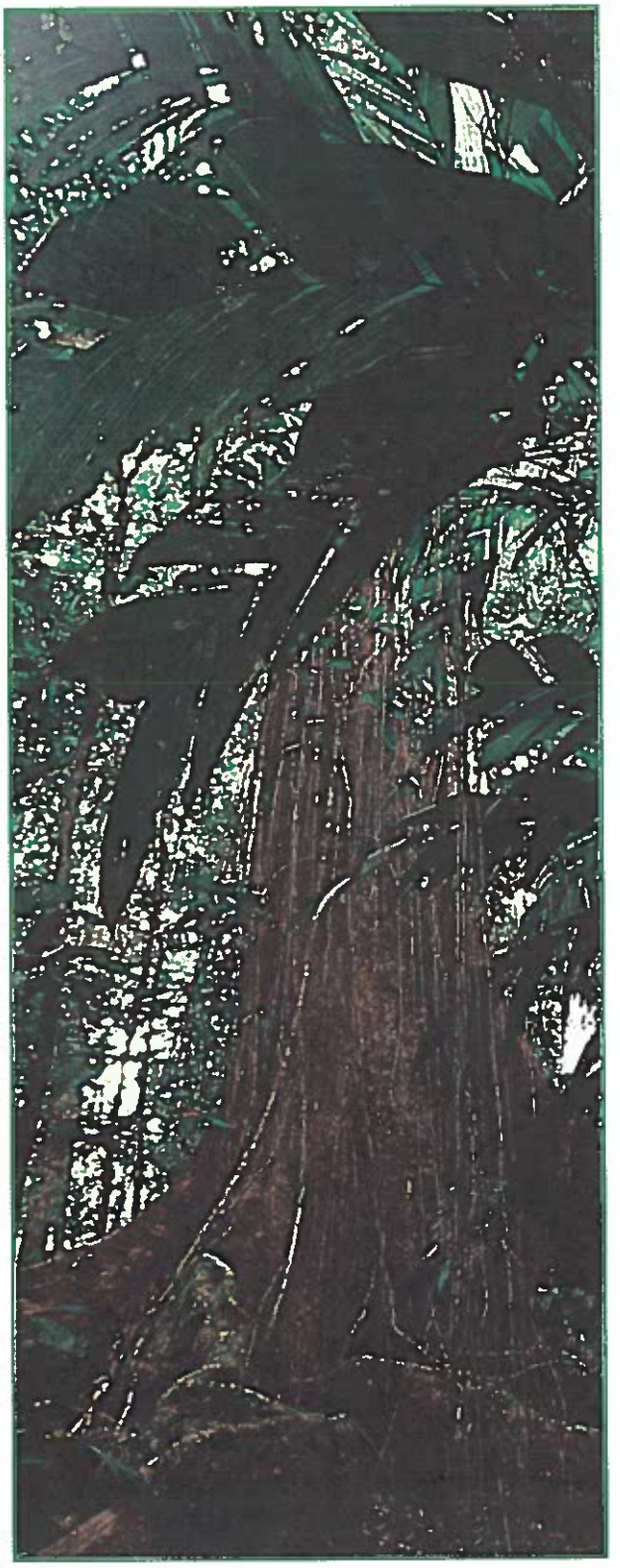


What is a rain-forest ecosystem like?

Rain forests are hot and wet. They can get up to 457 centimeters (180 inches) of rain a year. Compare that to only 13 centimeters (5 inches) of rain a year in the Mojave Desert.

Although the soil is thin, these forests are thick with tall trees. Rain forests are filled with many kinds of life. Different living things make their homes at all parts of the trees, from the tops to the bottom.





▲ The rain forest is made of different layers, from the sunny tops to the shady bottom.

Layers of the Rain Forest

layer	location	description
emergent layer (ee•MER•jent)	tops of tallest trees	• very sunny • high temperatures • strong winds
canopy (kan•UH•pee)	just below the tree tops	• sunny • most crowded with life, including snakes, tree frogs, and toucans
understory	beneath the canopy	• shady • home of jaguars, leopards, frogs and many insects
forest floor	bottom of the trees	• dark, little sunlight • filled with decomposers—living things that break down dead plants and animals

The forest floor is filled with dead leaves and other once-living things. Decomposers work quickly breaking them down and returning the remains to the soil.

Quick Check

Write the letter of the living things for each layer.

6. _____ canopy

7. _____ understory

8. _____ forest floor

a. decomposers

b. snakes, toucans

c. leopards

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How do animals depend on plants?

Plants can trap energy from the Sun. They use that energy to make their own food. As they make food, they also give off oxygen.

Plants as Food

Animals cannot make their own food. One way or another, animals depend on plants for food. They also depend on plants for oxygen.

Some animals eat plants directly. For example, rabbits eat leaves. Some beetles eat roots and stems. Monkeys and birds eat fruits and seeds. Snails and earthworms feed off dead plants.

Some animals are meat eaters. However, even meat eaters depend on plants because they may eat animals that are plant eaters.

▲ Squirrels use nuts for food. The nuts are seeds, parts of plants.

◀ Caterpillars eat leaves as a source of food energy.

Plants as Shelter

Many animals depend on plants for shelter. Many squirrels, for example, may live in tree holes. They line the holes with leaves. Many birds build nests in trees. They use twigs and leaves for the nests. They use the nests to keep their young safe.

Many animals hide in plants to stay safe. For example, a rabbit jumps into bushes if danger is near. Leafhoppers hide in grass.

Grass as Protection

Reading Photos

The color and shape of the snake blends the animal in with the grass.

Quick Check

Fill in one idea in each empty box to explain the summary.

9. _____ | oxygen | **10.** _____

Summary: Animals depend on plants for three things.

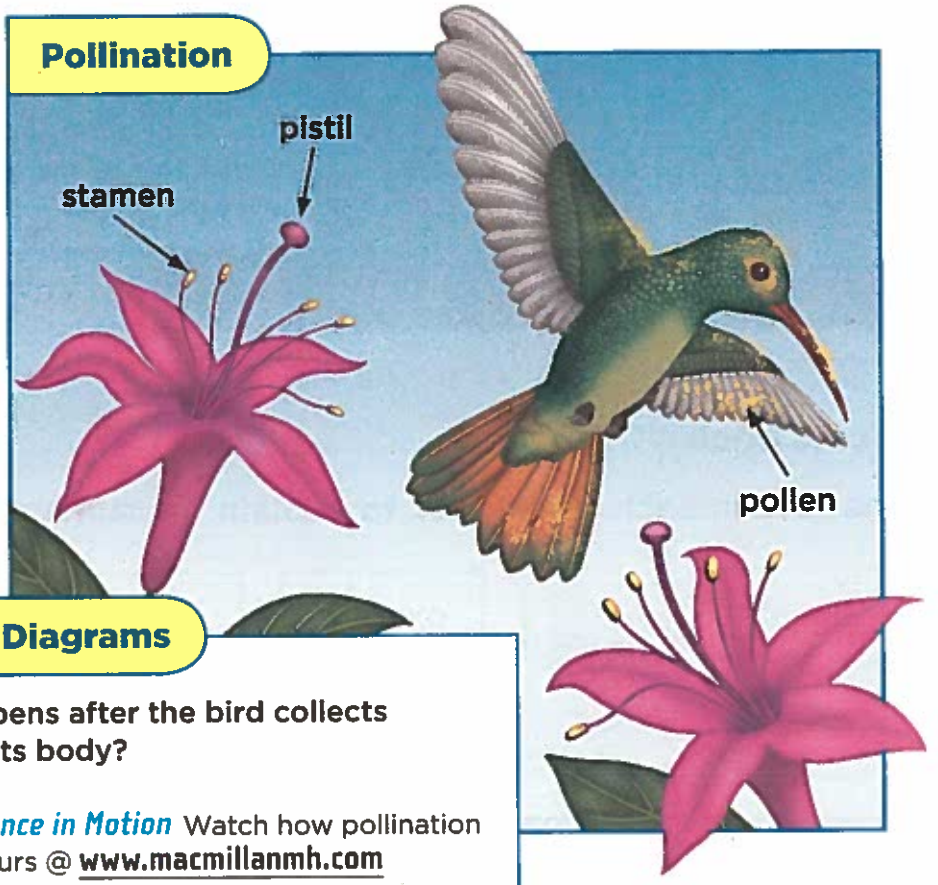
How do some plants depend on animals?

Flowering plants make seeds when they reproduce. Animals can help the plants make seeds.

A flowering plant needs **pollen** (POL•uhn) to make seeds. Pollen is like a fine powder. The diagram shows what happens to pollen.

- Find the **stamen** (STAY•muhn) in the diagram. The stamen is the part of a flower that makes pollen. Pollen collects at the tip.
- Find the **pistil**. The pistil is where seeds are made.
- A flower can make a seed only if pollen reaches the pistil. The diagram shows one way pollen reaches a pistil.

Pollination



Reading Diagrams

What happens after the bird collects pollen on its body?

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Pollination (POHL•uh•nay•shuhn) is the movement of pollen to the pistil. Wind can blow pollen from a stamen to a pistil.

Also, animals can move pollen:

- Birds, bats, and many insects travel from flower to flower. They collect a sweet drink from flowers called **nectar** (NEK•tar).
- When an animal visits a flower to collect nectar, pollen can rub onto its body.
- When the animal visits another flower, the pollen drops off.

Animals carry seeds to places where seeds can grow. Some animals carry seeds on their fur. In time the seeds fall onto the ground.

Plants store seeds inside fruits. Animals may eat a fruit that has seeds inside. The seeds are left on the ground when animals leave waste.

Pollen from the flower collects on the bee's body as the bee looks for nectar.

This iguana eats a fruit with seeds in it.

Quick Check

Fill in the blanks to tell two ways how plants depend on animals.

Animals can move **11.** _____ and carry

12. _____.

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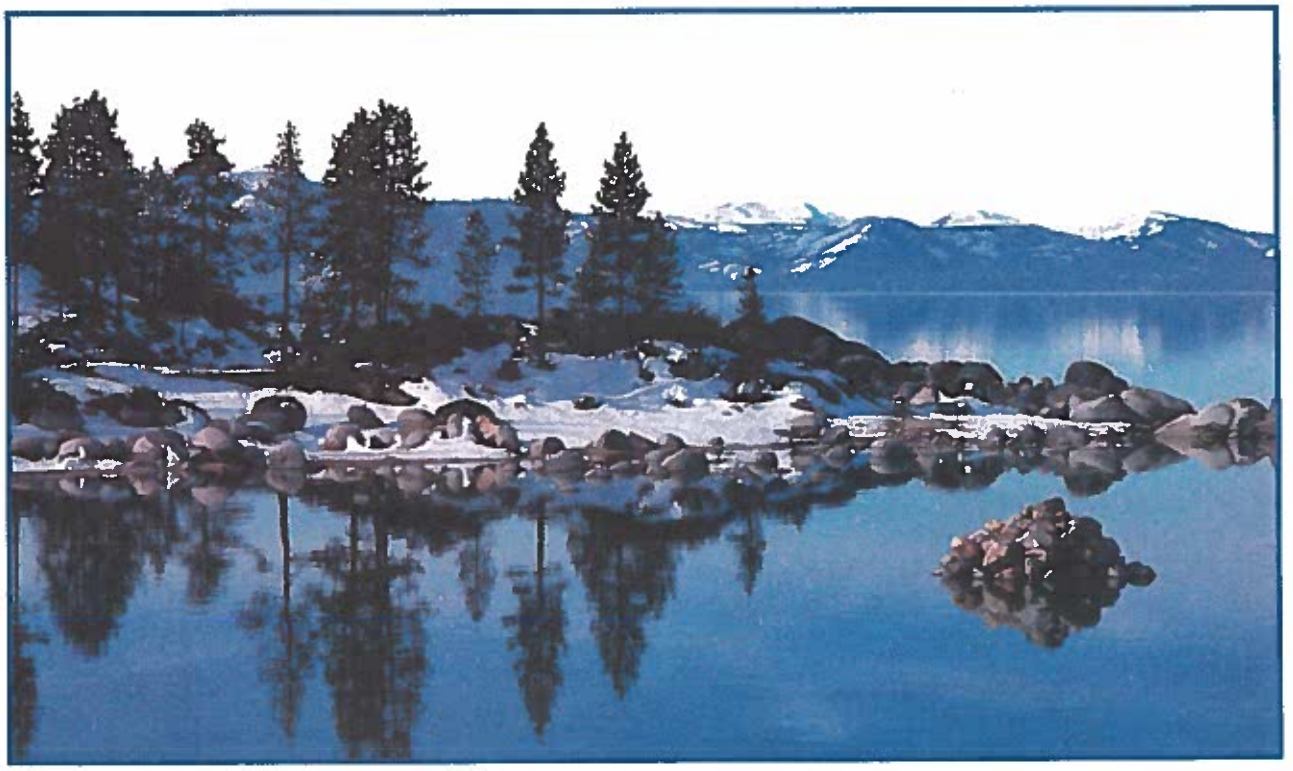
How can ecosystems change?

Remember, an ecosystem is made up both of living and nonliving things working together. Living things, like plants, need nonliving things, like soil, water, and sunlight. When one part of an ecosystem changes, such as the amount of water, all parts of the ecosystem can change.

Ecosystems can change over time. They can become wetter or drier. They can become colder or warmer. A lake can dry up or fill in. Any kind of change can make it harder for living things to survive.



▲ Lake Tahoe in California has changed slowly over thousands of years to look the way it does today. It also changes from season to season.

▲ **Cars give off wastes that causes pollution.**

Natural Events

Changes in weather can affect ecosystems. Storms, like hurricanes, can destroy ecosystems. Lightning can start a fire and turn a forest to ash.

The climate may change. Climate is the weather over time. An area may become drier, for example. A grassland can dry up.

Humans

People can cut down forests to make farms or build towns. Entire ecosystems can be destroyed. People can cause pollution (pol•LEW•shuhn). Pollution means putting materials to the air, land, or water that can make it harder for plants and animals to live.

Quick Check

Two ways ecosystems can change are:

13. _____ and

14. _____.

What happens when ecosystems change?

A fire destroys a forest. What happens to the living things that are left?

- Some living things change they way they live. They may find new kinds of food. They may find news ways to build homes.
- Some animals move to other places.
- Some kinds of animals may slowly die out.

A living thing that has few of its kind left is **endangered** (en•DAYN•juhrd). A living thing is **extinct** (ek•STINGT) when it dies out and there are none of its kind left.

Quick Check

Fill in the "effect" side to tell two ways the deer can keep alive after a fire destroys their home.

Cause → Effect	
Fire →	**15.** _____
Fire →	**16.** _____

How can people protect ecosystems?

People are finding ways to protect ecosystems. For example they are finding ways to cut down on pollution. People are looking for new fuels and passing laws against polluting the land, water and air.

Laws are also being passed to protect forests from being cut down. Laws can protect animals from being hunted.

People had destroyed the homes of the California condor. Now people are carefully raising them in safe environments.

Quick Check

Fill in the right side of the table.

Saving Ecosystems

What Can I Do?	How It Helps
Turn off water while brushing teeth.	to save water
Do not litter.	**17.** _____
Walk or ride a bike instead of riding a car.	**18.** _____

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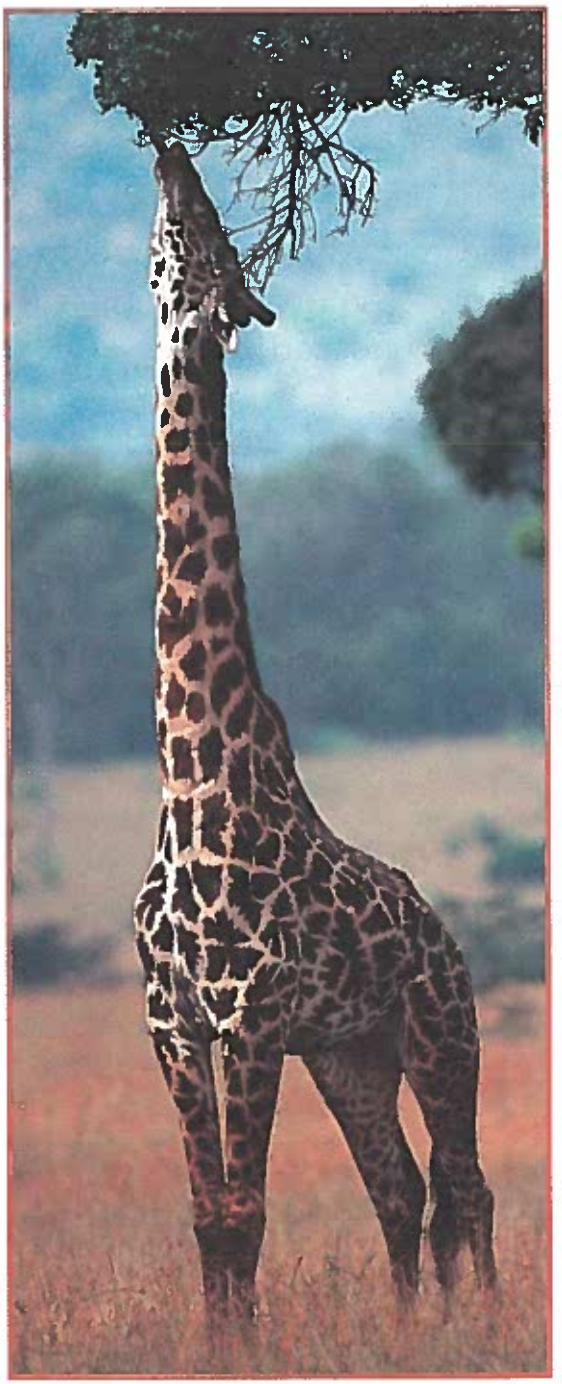
What is an adaptation?

A giraffe's long neck helps it reach high branches. A dolphin's tail and fins help it swim quickly in the ocean. An eagle's keen eyesight helps it spot food. These body features are adaptations (a•dap•TAY•shuhnz). **Adaptations** are body features or ways of acting that help living things survive in their environment.

Adaptations can help animals move and catch food. Adaptations can help animals and plants live in hot or cold climates.

▲ A dragonfly's wings help these insects fly fast so they can catch food and escape danger.



A giraffe's long neck helps the animal reach leaves to eat. It also gives the animal a view of danger that may be coming, such as a lion.

Some adaptations help living things stay safe. **Camouflage** (KAM•uh•flahzh) is an adaptation that helps a living thing blend into its environment. For example, if a deer stays still against a brown background, it may not be seen.

Some animals hide by looking like other living things. This adaptation is **mimicry** (MIM•i•kree).

The Indian leaf butterfly is an example of mimicry. Its color may help you spot the insect. However, its shape makes it look like a leaf.

Quick Check

Two adaptations that help this eagle catch a fish are

19. _____

20. _____

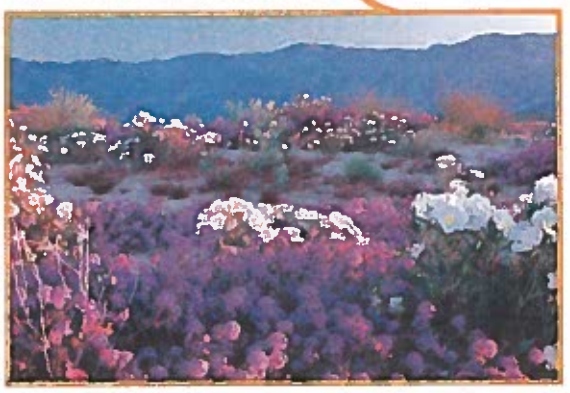
barrel cactus

Storing water The barrel cactus has a thick, waxy skin and thick, round stem. These adaptations help it store water in its stem. The prickly spines keep animals from biting into the plant to get the water.

What are some adaptations in a desert?

Deserts get less than 25 centimeters (10 inches) of rain a year. Some places get more than that in a month. Adaptations help desert plants survive dry conditions.

wildflowers



Seeds Desert plants bloom quickly after a sudden rain. The bright colors attract insects. The insects help in pollination.

More Desert Plants

Creosote (KREE•oh•soht) bushes have shallow roots. These roots help the plant take in water from the little rain that falls.

Ocotillo (oh•koh•TEE•oh) plants drop their leaves during very dry times to keep from drying out. Leaves grow back after the next rainfall.

kangaroo rat

Storing water Many animals have kidneys. Kidneys help the body get rid of liquid wastes. However, the kangaroo rat's kidneys also help store water in the animal's body

chameleon

Temperature control A chameleon (kah•MEE•lee•uhn) raises its belly off the hot desert ground as a way of cooling down.

Desert animals have adaptations that help them survive with little water. In hot deserts, animals have adaptations to help them stay cool.

More Desert Animals

Many desert animals, including the great horned owl are active at night when it is cooler. They rest or sleep during the day.

The jackrabbit has very long, thin ears to help keep cool. The blood carries body heat into the ears. The blood loses heat as it flows through the ears.

Quick Check

Two living things that have adaptations for storing water are:

21. _____ **22.** _____

Two animals that have adaptations for surviving in heat are:

23. _____ **24.** _____

What are adaptations in the arctic and in oceans?

In the arctic and the oceans, living things have ways of surviving the most harsh conditions.

The Arctic

polar bear

Skin and fur The outer fur of a polar bear is waterproof. The thick inner fur keeps the bear warm. Black skin beneath the white fur helps the bear take in heat from the Sun.

arctic fox

Camouflage The arctic fox in winter has a white coat. The coat helps it blend in with the snow. In summer its coat is brown.

Other Arctic Animals and Plants

The large size of a musk ox and polar bear helps them to keep warm.

Arctic plants grow low near the ground. This adaptation protects them from the wind. They often have bright flowers. The colors attract animals that help in pollination.

The Oceans

whale

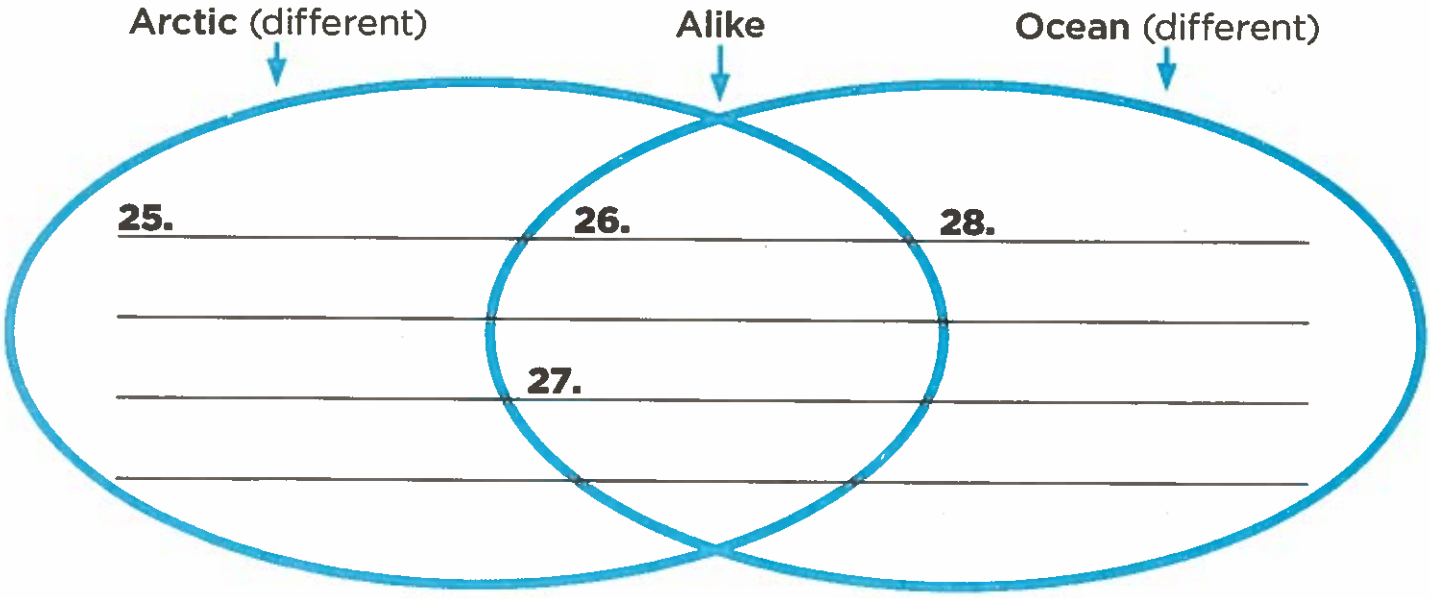
Blubber A whale has blubber, a thick layer of fat. Blubber helps keep a whale's body warm in cold ocean water.

leafy seadragon

Mimicry The leafy seadragon is a kind of fish. However, it looks like the seaweed that surrounds it.

Quick Check

In "Alike," list 2 animals from the arctic and the oceans that have a similar adaptation. In "Different," list an arctic animal and an ocean animal that have different adaptations.



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Vocabulary Review

Living Things and Their Environment

Fill the missing words in the blanks below. Then find and circle those words in the puzzle at the bottom.

1. The layer just under the tops of the trees in a rain forest, where most plants and animals live _____

2. The part of a plant where seeds are made _____

3. A sweet liquid formed inside flowers _____

4. The kind of weather an area has over time _____

5. A living thing that has died out and there are none of its kind left today _____

6. A living thing that has few of its kind left _____

7. The part of a plant that makes pollen _____

T R C S C N Z D T M T U E M Y
M N E F E C G K J N M N X V P
C A E C Y O R X F D B Q T O O
S L T M R Z F Z O P T K I F N
U A I W A I Z L H U L N N Z A
R H L M G T Q C D E H I C E C
Y I B M A V S U S W A P T Q H
K M B E T T U F U W S S I C W
E N D A N G E R E D I V B T N
P T Z B Q V G B L I T S I P S

a. camouflage	c. mimicry	e. pollination	g. ecosystem
b. emergent layer	d. adaptation	f. pollen	

Match the correct letter with the description.

1. _____ The movement of pollen to the seed-making part of a flower

2. _____ The tops of trees in a rain forest

3. _____ How a living thing might not have been seen because it blends into its surroundings

4. _____ A powdery material that flowers need to make seeds

5. _____ All the living and nonliving things working together in an area

6. _____ How an animal might look like some kind of other living thing

7. _____ A body feature or way of acting that helps a living thing survive in its environment

Answer the question. Use at least one word from the box in your answer.

8. What are some ways that animals protect themselves?

_____

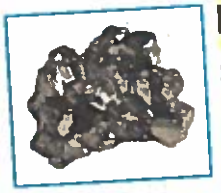
_____

CHAPTER 3

Rocks and Minerals

Vocabulary

mineral one of the parts that a rock is made of



luster the way something shines in the light

streak the color of the powder made when a mineral is scratched on white tile

hardness the ability of a mineral to scratch another mineral

ore a rock that contains a useful mineral

magma hot, melted rock beneath Earth's surface

lava magma that reaches Earth's surface

igneous rock a rock formed from hot, melted rock that cools and hardens

The Big Idea: What are rocks and minerals and where do they come from?

sediment tiny broken bits of rocks, plants, bones, and shells

sedimentary rock a rock formed from tiny pieces of broken rocks pressed together

fossil the remains of a once living thing from long ago

metamorphic rock a rock formed from another rock that is being squeezed and heated

rock cycle the continual changing of one kind of rock into another kind

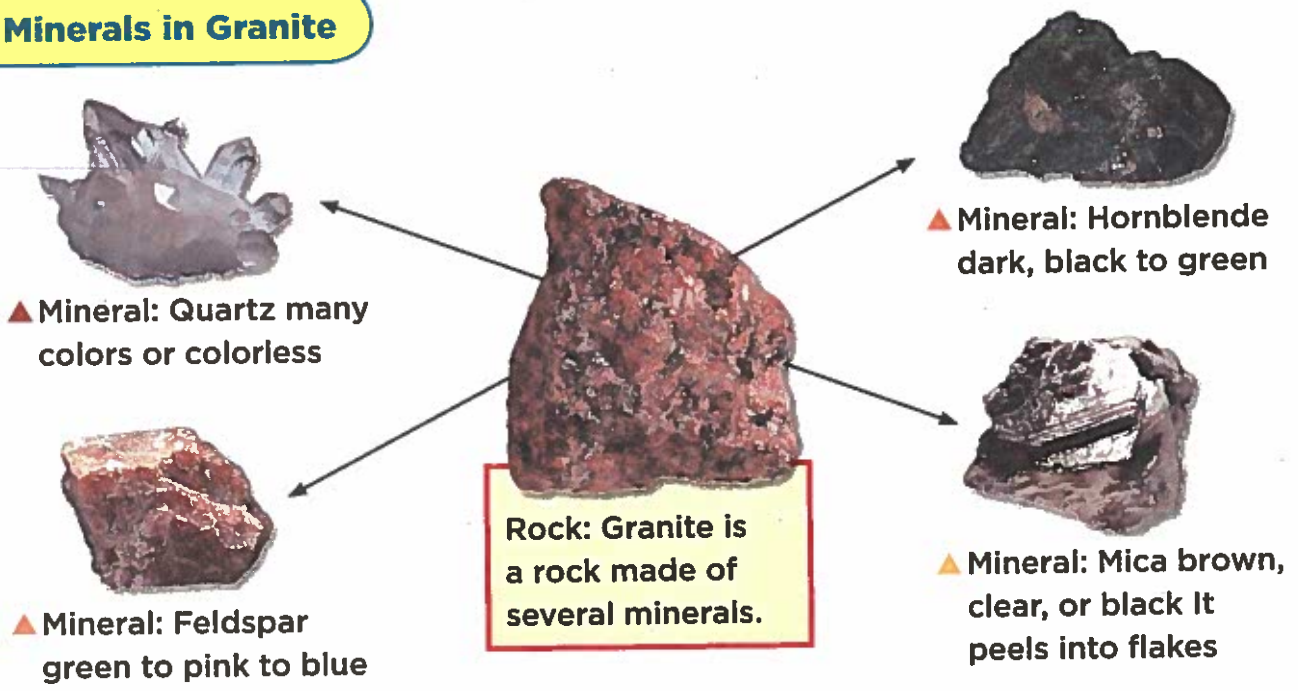
What is a mineral?

Pick up a rock—for example, a chunk of granite. You can see that it is made of small pieces of different colors and shapes.

The pieces in granite are minerals (MIN•uhr•uhlz). **Minerals** are the parts that rocks are made of. Minerals are the building blocks of rocks. Rocks may be made of many minerals or just one.

There are thousands of minerals. They have different shapes and colors. Here are the four minerals that make up granite.

Minerals in Granite



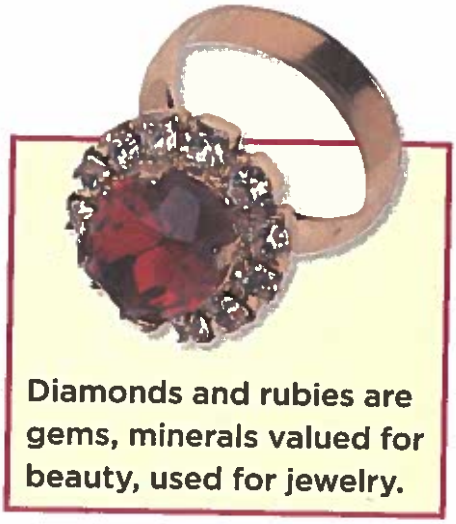
Quick Check

1. How are minerals different?	2. How are minerals alike?
_____	_____
_____	_____
_____	_____

What are minerals used for?

People can take minerals out of rocks. Then we can use the minerals in many ways. From toothpaste to eyeglasses, minerals are used to make many things we use every day.

Many minerals that we use are from ores (AWRZ). **Ores** are rocks that contain useful minerals. The mineral aluminum for example comes from the ore bauxite (BAWK•sight). We use aluminum for cans, pots and pans, and even baseball bats.



Diamonds and rubies are gems, minerals valued for beauty, used for jewelry.

Ways We Use Minerals

mineral	uses
quartz	glass and glass products
gypsum	drywall (for making walls in building)
copper	electrical wires; pots and pans

Quick Check

3. Why are minerals important? _____

_____

How are minerals identified?

When you *identify* something, you are able to name it. How can you identify a mineral?

The color on the outside of a mineral is not the best clue to identify a mineral. Two different minerals can have the same color. For example, calcite and quartz can both be white. Any one mineral may come in many colors. Quartz can be white, purple, or pink.

Pyrite (PIGH•right) was called "fool's gold." It has a yellow color and a metallic luster like gold.

Luster

Luster can help you identify minerals. **Luster** is the way something shines in the light. Some minerals have a shiny or metallic luster, like a metal spoon. Other minerals have a nonmetallic luster. They may be dull or glassy.

Splitting

Some minerals split, or break along flat surfaces. Calcite, for example, splits into boxlike shapes. Remember from page 54 that mica splits into flakes. Some minerals do not split evenly.

Calcite splits into boxlike shapes.

Some minerals, such as quartz, do not split along flat surfaces.

Streak

A helpful clue to identify a mineral is its streak. **Streak** is the color of the powder left when a mineral is rubbed along a rough white tile. Some minerals leave a streak that is the same color of the mineral. Others leave a streak that does not look like the color of the mineral. Pyrite has a yellow color but leaves a greenish-black streak.

Hematite has a black surface. However, it leaves a red streak.

Comparing Color and Streak

Mineral	Color of Outside of Mineral	Streak
gold	yellow	yellow
pyrite	yellow	greenish-black
calcite	white or colorless	always white

Quick Check

Match the clues with the letter of the mineral.

4. _____ black color, reddish streak

5. _____ metallic luster, greenish-black streak

6. _____ splits into flakes

7. _____ splits in boxlike shapes

a. mica

b. calcite

c. hematite

d. pyrite

What is hardness?

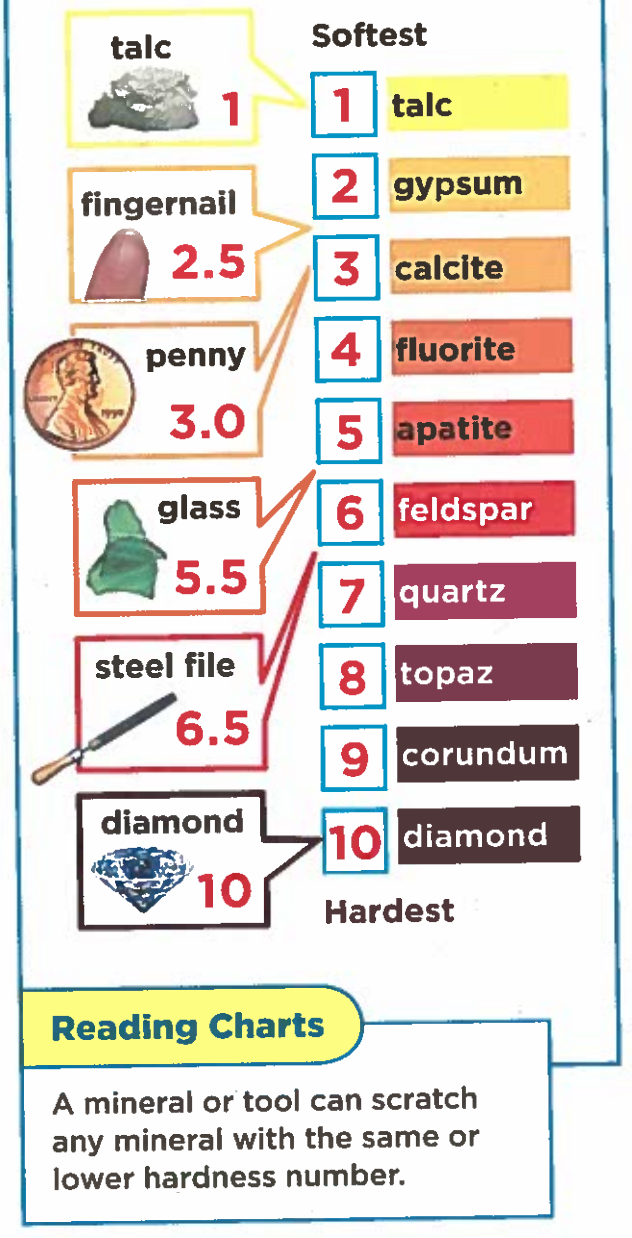
The hardness of a mineral can also help you identify it. **Hardness** is the ability of one mineral to scratch another mineral.

Each mineral has a hardness number. Look at the the chart. Talc is number 1, the softest. Diamond is number 10, the hardest.

A mineral can scratch any other mineral that has the same or a lower hardness number. For example, calcite, number 3, can scratch, any mineral with a hardness number that is 3 or less. Calcite can scratch gypsum and talc.

You can use everyday items to find the hardness of minerals. Your fingernail can scratch gypsum and talc. A penny can scratch calcite, gypsum, and talc.

Hardness of 10 Minerals



Reading Charts

A mineral or tool can scratch any mineral with the same or lower hardness number.

Mineral Identification Table

Mineral	Hardness	Luster	Streak	Color	Splits
quartz	7	nonmetallic	none	colorless, white, pink, purple, brown	breaks unevenly
mica	2–2.5	nonmetallic	none	dark brown, black, or silver-white	flakes
calcite	3	nonmetallic	white	colorless, white	boxlike shapes

The table sums up the clues you can use to identify some minerals. For example, quartz and calcite may both be white. However, quartz is much harder than calcite.

Quick Check

Tell how mica and calcite are alike and different.

8. Mica can have a _____ color and splits into _____.

9. They both have a hardness of _____ or less and have a nonmetallic _____.

10. Calcite can have a _____ color and splits into _____.

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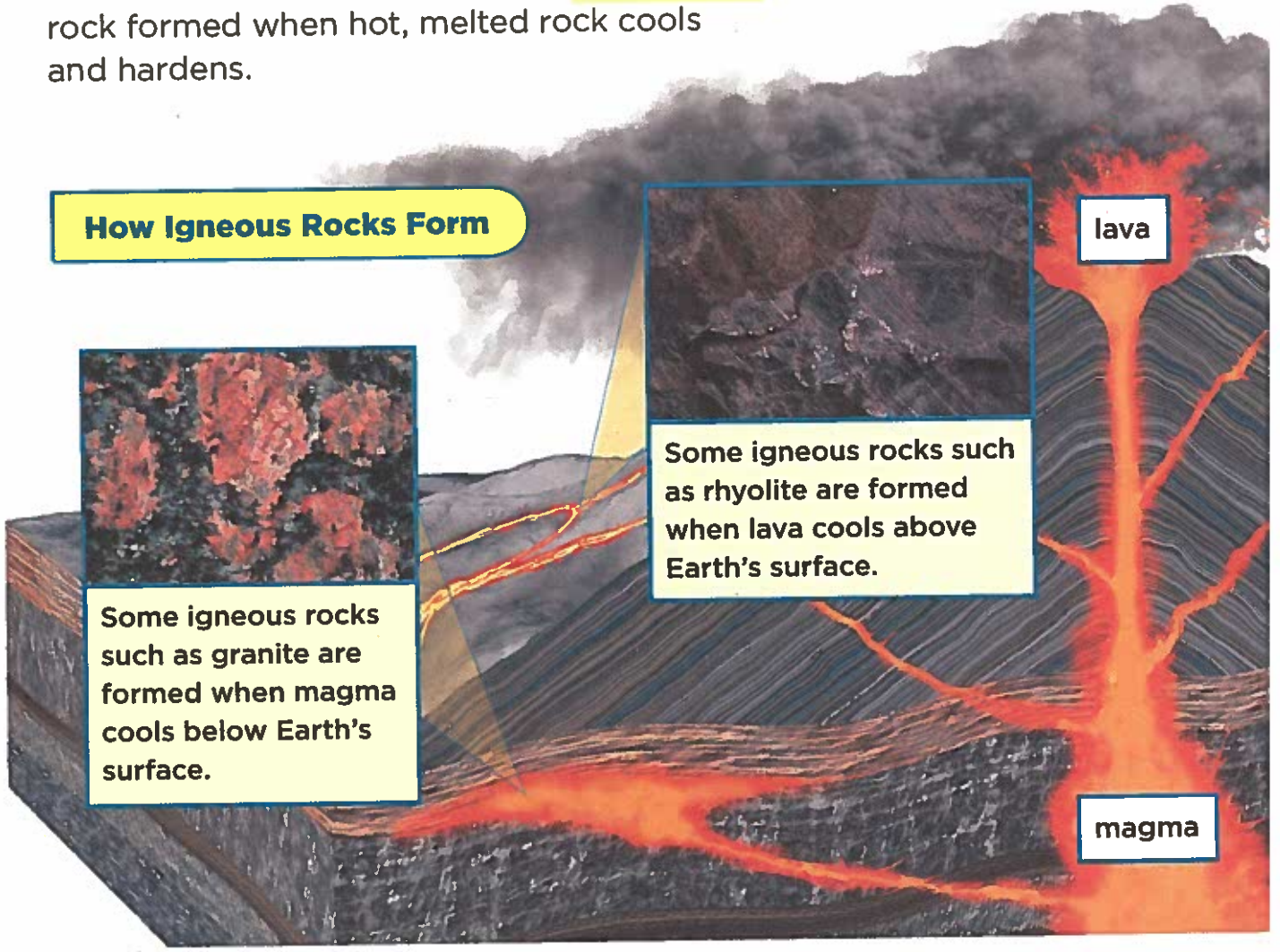
How are igneous rocks formed?

The rocks you know are solids. However, deep below Earth's surface, rock is very hot. It is melted into a liquid. Hot, melted rock below Earth's surface is **magma** (MAG•muh). In some places, magma reaches the surface, as you see in the diagram. Magma that reaches the surface is **lava** (LA•vuh).

Above or even below the surface, the melted rock can cool off. When it cools off, it hardens into a solid, igneous (IG•nee•us) rock. **Igneous rock** is rock formed when hot, melted rock cools and hardens.



Underground Rocks

Magma can rise up from deep underground. It can cool off underground before it gets to the surface. The magma may take many years to cool off underground. It forms igneous rocks that have large pieces of minerals inside. Example:

- granite

Rocks Above Ground

Above Earth's surface, lava cools off quickly, in hours or even minutes. The minerals inside the rock are small. They may be so small that you cannot see each of them. Example:

- rhyolite (RIGH•uh•light)

Quick Check

Write the name of a rock next to each description. Use each rock twice.

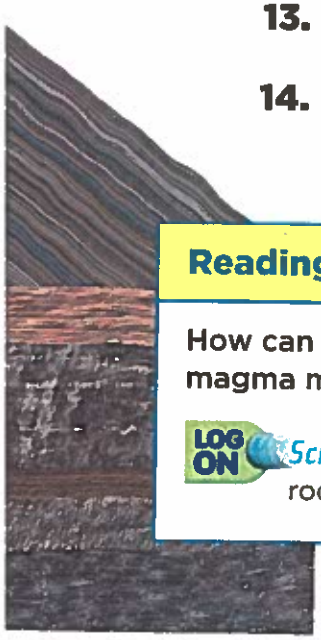
rhyolite **granite**

11. forms underground _____

12. forms above ground _____

13. has small minerals inside _____

14. has large minerals inside _____



Reading Diagrams

How can you tell from the diagram that magma must be hot?

LOG ON *Science in Motion* Watch how igneous rocks form @ www.macmillanmh.com

What are some properties of igneous rocks?

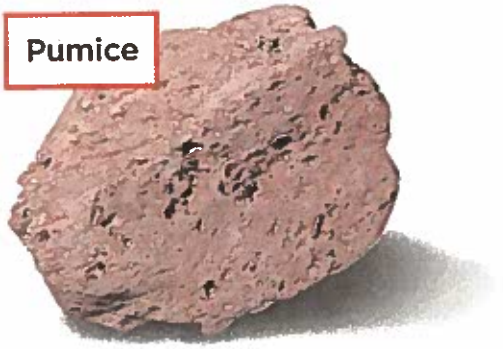
There are many different igneous rocks. They may have different minerals inside. The minerals are large pieces if the rock was formed underground. The minerals are small if the rock was formed above ground.

Granite

- formed underground
- is made of several different minerals
- has large minerals that make it feel rough (coarse)
- comes in many colors because of different colors of minerals inside

Pumice (PUM•is)

- formed above ground
- has tiny holes inside from trapped gases
- very lightweight
- feels scratchy, crumbly



Obsidian (uhb•SID•ee•uhn)

- formed above ground
- feels very smooth like glass
- has a glassy shine (luster)
- dark in color, often black

The Great Wall of China was made from blocks of granite. It was built over 2,000 years ago.

Uses of Igneous Rocks

Igneous rocks are useful in many ways because of their properties.

- Granite is hard and long lasting. It is used to make roads, sidewalks, buildings, and bridges.
- Pumice is scratchy and rough. It is used in cleansers to scrub off dirt.

Quick Check

Write the name of each rock once next to each description.

pumice **obsidian** **granite**

15. hard, used to make buildings _____

16. scratchy, used in cleansers _____

17. like shiny, smooth glass _____

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How are sedimentary rocks formed?

Some rocks are formed from sediments (SED•uh•mentz). **Sediments** are tiny broken bits of rocks, plants, bones, shells, and other animal materials. Rocks formed when sediments are pressed togther into layers are **sedimentary rocks**.

You can see the layers of sedimentary rocks along the Grand Canyon. The colors of these layers come from different kinds of sediments.

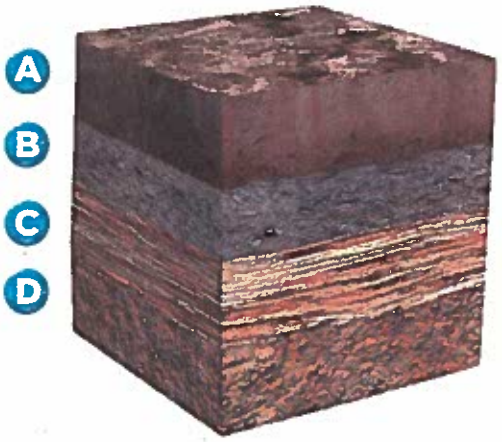
How Layers Form

Layers of sedimentary rocks form in three steps.

- Moving things (wind, rivers, and streams) pick up and carry sediment.
- The moving things drop off sediment and layers form.
- Layers build up, one on top of another. Layers above press down on the layers below. The sediment in the lower layers are cemented together. They become sedimentary rock.

In the sediment that forms in a sedimentary rock, there are often pieces of living things, such as leaves and bones. The remains of living things from long ago are **fossils**.

Layers of Sediments



Reading Diagrams

Younger layers are found above older layers.

This fossil was found in sedimentary rock that was once underwater.

Quick Check

Complete the diagram. With just a few words in each step, summarize how layers form.

First **18.** _____

Next Drop off; layers form.

Last **19.** _____

What are some properties of sedimentary rocks?

There are many different sedimentary rocks. They are made from different kinds and sizes of sediments. Some are softer than others. Some have layers. Some do not show layers. Many kinds contain fossils.

Limestone

- formed at bottoms of oceans
- formed from remains of once-living things, such as bones and shells
- usually white, chalky
- often has fossils

Limestone often contains fossils, such as this ancient fish.

Sandstone

- formed from bits of sand cemented together
- sand is made up of the mineral quartz
- may show ripples if it was formed underwater

This sample of sandstone is reddish from rust. The rust is cementing the sand together. You can see thin layers inside the rock.

Conglomerate (kuhn•GLOM•uhr•it)

- formed from rounded pebbles and stones, which may once have been carried by streams or rivers
- has several sizes and kinds of sediment
- looks chunky and feels rough

Conglomerate shows chunks of other rocks. No layers are visible.

Uses of Sedimentary Rocks

Sedimentary rocks have useful properties.

- Limestone is soft. It is used to make chalk.
- Shale can be molded. It is used for bricks and pottery.
- Soft coal was formed from the remains of ancient plants. The energy stored in soft coal is from ancient plants.

Sedimentary rocks help us piece together Earth's past. Fossils in these rocks show what life was like in the past.

Soft coal contains stored energy from plants that lived long ago.

Quick Check

20. How could you identify a piece of sandstone?

_____

21. How could you identify a piece of conglomerate?

_____

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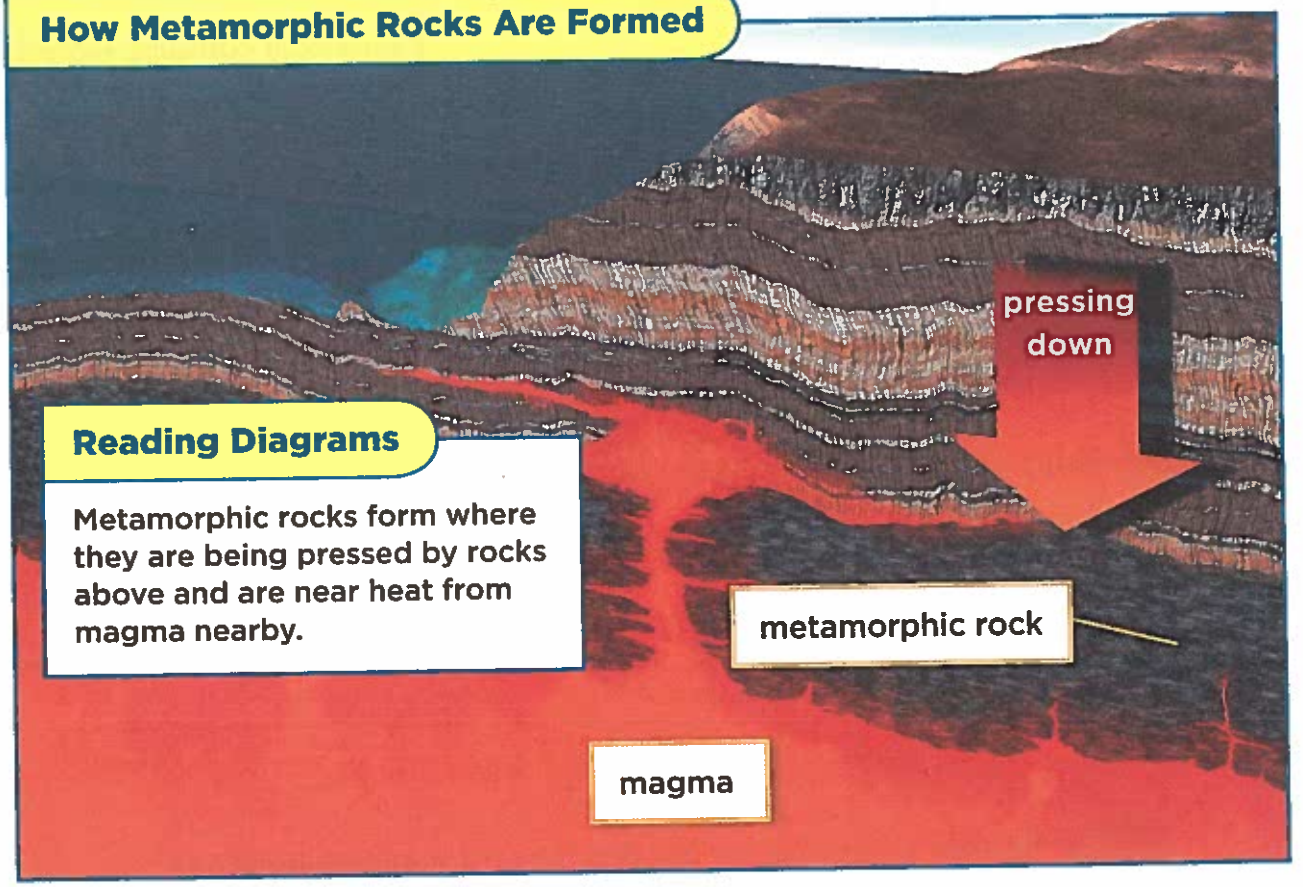
How are metamorphic rocks formed?

Below Earth's surface are many layers of rocks. Layers near the top press down on deeper layers. This pressing squeezes deeper layers together. Also, the deeper layers are heated by the hot magma that is nearby.

Deep inside Earth, rocks that are squeezed and heated can change into other rocks called **metamorphic** (met•uh•MAWR•fik) **rocks**. Metamorphic rocks can be formed from any kind of rocks.

How Metamorphic Rocks Are Formed

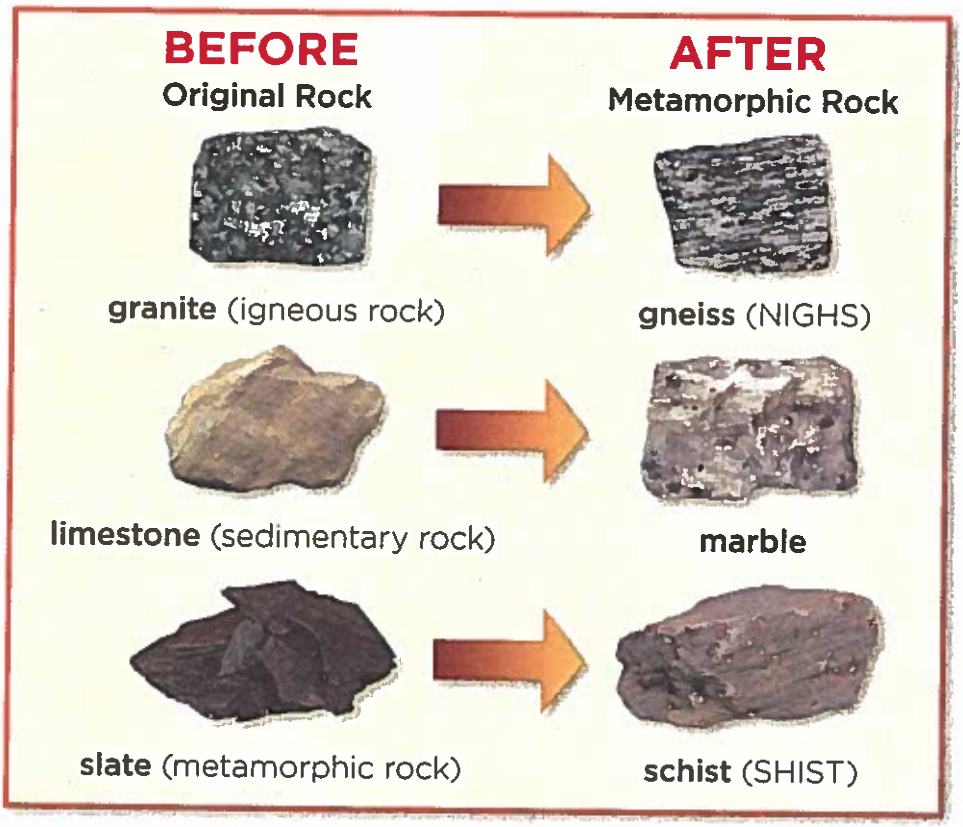


Reading Diagrams

Metamorphic rocks form where they are being pressed by rocks above and are near heat from magma nearby.

Rocks Make-Overs

One metamorphic rock you may know is slate. Slate is a hard rock used to make chalkboards and roofs. It is formed from a soft sedimentary rock, shale. When shale is squeezed and heated deep inside Earth it becomes slate. Slate, in turn, can change into *another* metamorphic rock, schist (SHIST).



Quick Check

Fill in the boxes to show how metamorphic rocks are formed

Deeper rocks are squeezed by rocks above.

Deeper rocks are **22.** _____

_____

Summary

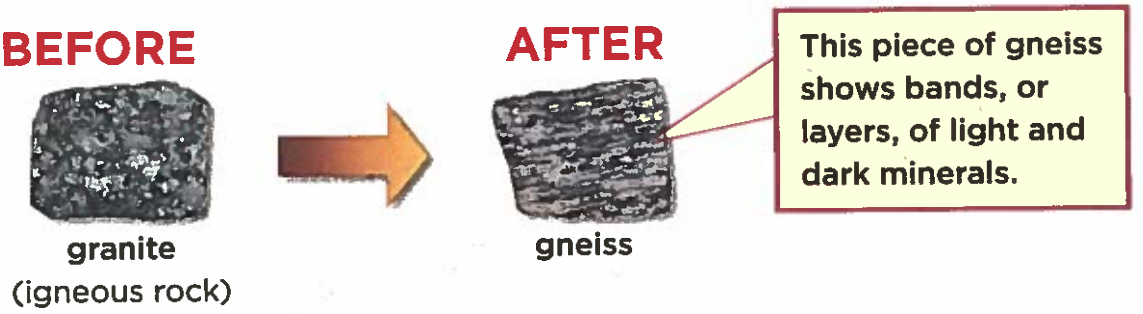
Any rock can be changed into **23.** _____

What are the properties of some metamorphic rocks?

Metamorphic rocks have many different properties because they come from many other kinds of rocks. They may be squeezed and heated differently and end up with different properties.

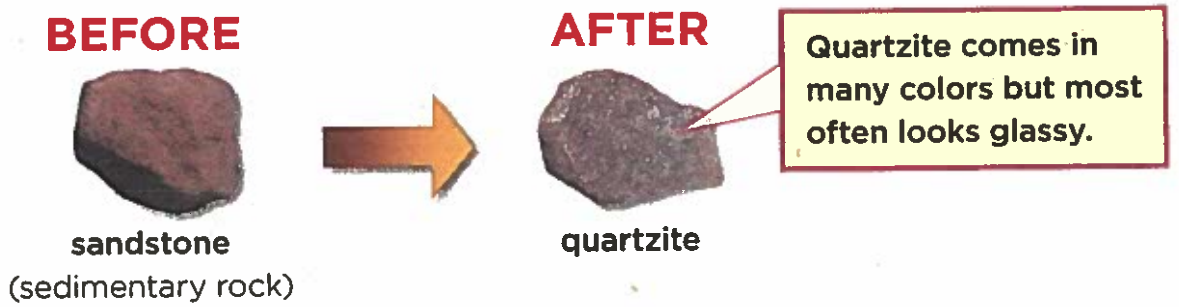
Gneiss

- forms from granite (igneous rock)
- has layers (or bands) across the rock
- has minerals that are large enough to be seen
- feels rough



Quartzite (KWARZ•ight)

- forms from sandstone (sedimentary rock)
- does not have layers (or bands)
- has small minerals inside
- feels smoother than gneiss



Marble

- forms from limestone (sedimentary rock)
- does not have layers (or bands)
- can have small minerals and feel smooth
- can have larger minerals and feel rough

Slate

- forms from shale (sedimentary rock)
- has layers
- has small minerals and feels smooth

Quick Check

Circle the letter of the correct answer.

24. Quarzite

a. feels very rough **b.** has layers **c.** feels smoother than gneiss

25. Marble

a. always is green **b.** may feel rough **c.** has layers

26. Gneiss

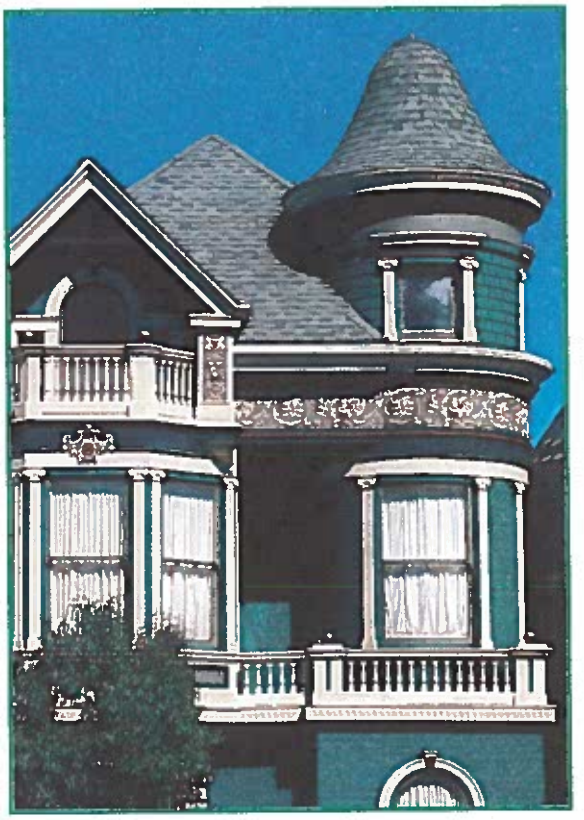
a. has layers **b.** feels smooth **c.** has small minerals

What are some uses of metamorphic rock?

Metamorphic rocks are useful because of their properties. They are used for buildings, sidewalks, statues, and jewelry. Here are some examples:

- Marble is used for buildings and statues because it does not split when it is carved.
- Slate is used for roofs because it is waterproof. It is used for walkways because it is hard and smooth.
- Quartzite is used for making glass and pottery. It is also used for tile floors and stone walls.

A hard form of coal is a metamorphic rock. It is formed from soft coal, which is a sedimentary rock. Hard coal comes from deeper inside Earth than soft coal. It burns cleaner and longer than soft coal.



▲ **This roof is built with shingles. The shingles are small flat pieces of slate.**

Quick Check

Match the rock and its use.

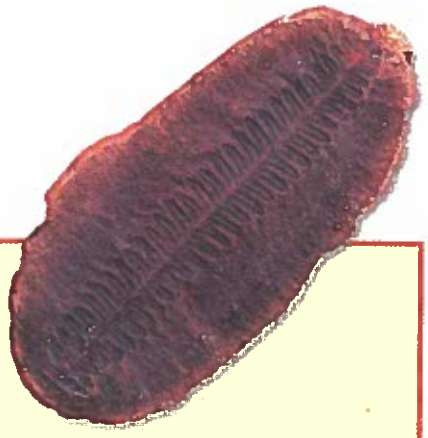
27. _____ slate	**a.** burned for energy
28. _____ marble	**b.** used to make statues
29. _____ quartzite	**c.** used to make glass
30. _____ hard coal	**d.** used to make roofs

How can you be a rock detective?

How can you tell if a rock is an igneous rock? How can you tell a sedimentary rock from a metamorphic rock? You can identify each kind of rock by several clues.

Sedimentary Rocks

- may contain fossils
- often have layers and can break apart



Fossils are found in sedimentary rocks, such as shale, sandstone, or limestone.

Igneous Rocks

- are usually hard
- do not have layers
- may have minerals that twinkle in the light
- may look glassy (obsidian)

Metamorphic Rocks

- may have colored bands

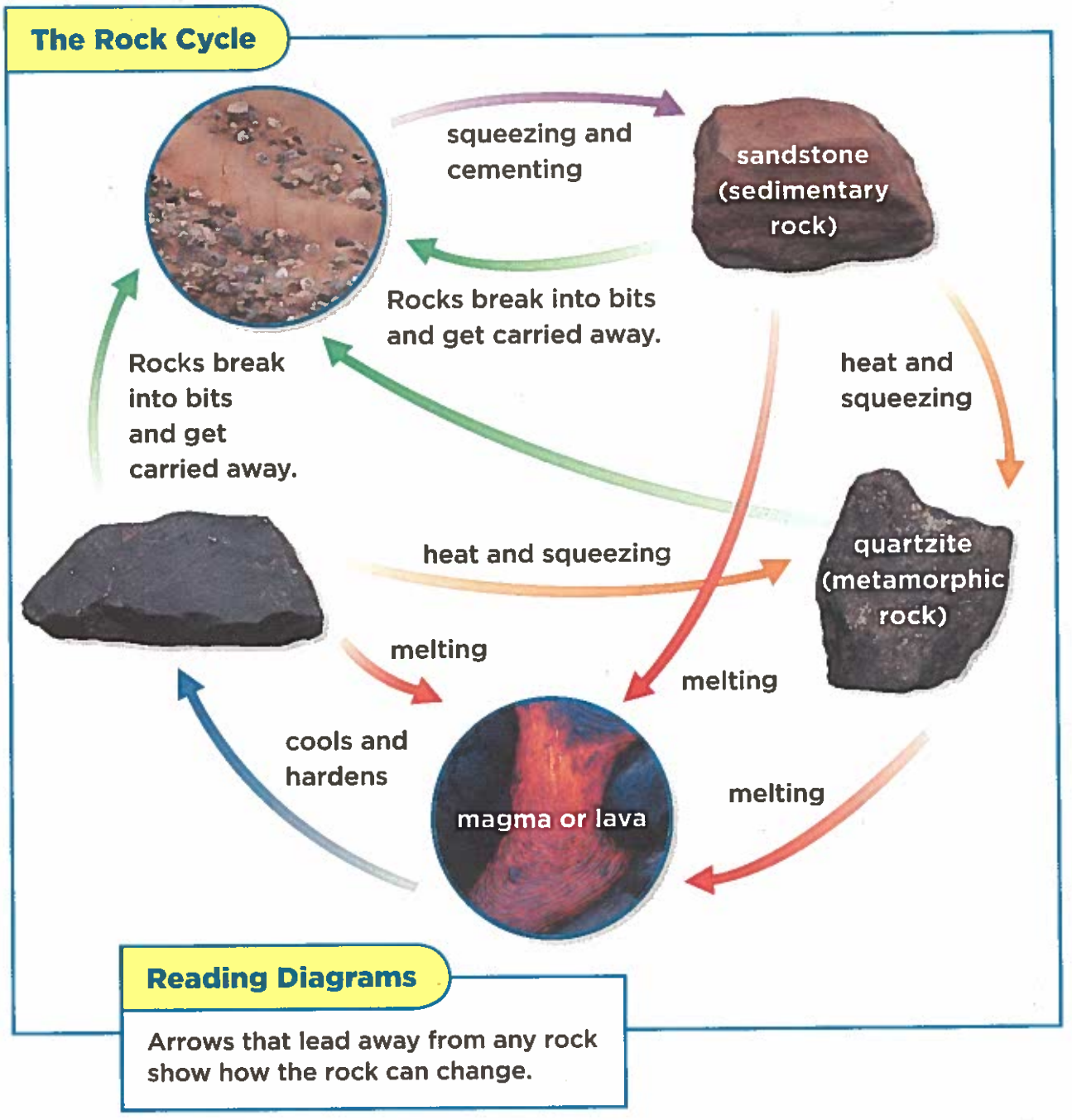
Quick Check

Match the rock and its clue.

31. _____ metamorphic	**a.** may have fossils
32. _____ igneous	**b.** colored bands
33. _____ sedimentary	**c.** is hard and has no layers

The Rock Cycle

Rocks are changing all the time. Any rock is changing into another kind of rock. The continual changing of one kind of rock into another kind is the **rock cycle**. The arrows shows some of the ways kinds of rocks are changing into each other all the time.



Reading Diagrams

Arrows that lead away from any rock show how the rock can change.

How to Read the Rock Cycle

Put your finger on any picture of a rock in the rock cycle. Find the arrows that lead away from the picture. Here is one pathway, following just the outer arrows:

1. Start with "magma or lava" at the bottom of the rock cycle.
2. Follow the blue arrow to the left. Magma or lava cools and hardens and becomes igneous rock.
3. Follow the green arrow leading up from igneous rock to the rock bits. Igneous rocks break into bits and get carried away.
4. Follow the purple arrow leading away from the rock bits. The bits can be pressed and cemented into a sedimentary rock.
5. Follow the gold arrow leading down from sedimentary rock. A sedimentary rock can be heated and squeezed to form a metamorphic rock.

Now follow some of the arrows *inside* the diagram.

Quick Check

Sandstone (sedimentary rock) has three arrows pointing away from it. Read the arrows to tell three things that can happen to sedimentary rock.

34. _____

35. _____

36. _____

Vocabulary Review

Rocks and Minerals

Complete the sentences below. Fill in each blank with one letter.

1. The ability of a mineral to scratch another mineral is called _ O _ O _ _ _ _ _.
2. A rock that is formed from another rock that is squeezed and heated is _ _ _ O _ _ _ _ _ _ O _ _ _ _.
3. Chalk is a _ _ O O _ _ _ O _ _ _ _ _ _ _ _ that is formed from tiny pieces of fossil shells.
4. Some igneous rocks are formed from O _ _ _ _ beneath Earth's crust that has cooled and hardened.
5. Useful minerals can be mined from O _ _.
6. A rock is made of one or more _ _ O _ _ _ O _.

Write out all the letters that are in the circles.

_ _ _ _ _ _ _ _ _ _ _ _

Use the letters from inside the circles above to name two minerals described below. Clue: Look at the table in page 58.

7. If you add the hardness of these two minerals, the sum is 11.

_____

_____

Use the clues below to fill in the crossword puzzle.

ACROSS

2. a rock formed from hot, melted rock that cools and hardens

3. the continual changing of one kind of rock into another kind

5. magma that reaches Earth's surface

6. the remains of a once living thing from long ago

7. tiny broken bits of rocks, plants, bones, and shells

DOWN

1. a part that a rock is made of

4. the way something shines in the light

7. the color of the powder made when a mineral is scratched on white tile