

Week 5

5th Grade

Name:

Teacher:

Monday Week 5, Assignment 1- Informational Text Quiz

* Required

1. Email address *

2. Name: *

3. Please read pages 470-471 in your textbook and select three features of an informational text. Hint: Use your anchor chart on page 471!! 3 points

Check all that apply.

- Lists
- Science fiction characters
- Titles
- Visuals
- Characters that personify forces of nature

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Monday Week 5 Assignment 2-Vocabulary Preview

Please guess the meaning of each word. Then, use your book (pages 473-487) or a dictionary to write the correct definition in a complete sentence.

Word	My Guess	Correct Definition
Abundant (page 474)		
Substance (page 475)		
Condenses (page 478)		
Altitude (page 482)		
Trickles (page 484)		

Tuesday Week 5 Assignment 3 Word Study

Syllable Patterns

A syllable is a word part that contains a single vowel sound. To read multisyllabic words, divide syllables according to syllable patterns. Some familiar syllable patterns include vowel teams; VCe syllables; open syllables and closed syllables, such as V/CV and VC/V; final stable syllables, such as syllables ending in -/e; and r-controlled syllables.

Syllables can be divided between consonants or between vowels.

Directions: Use your knowledge of syllable division patterns to read each word. Then, use a / symbol to correctly divide each word.

at/mo/sphere	evaporate
beautiful	particle
circulate	saturated
cycle	weather

Tuesday Week 5 Assignment 4 Predictions

Before reading “ Earth’s Water Cycle” on pages 473-487, please make 2 predictions about what the story will be about or what information may be included in the text.

Prediction 1:

Prediction 2:



from **EARTH'S
WATER
CYCLE**

by Diane Dakers



AUDIO



ANNOTATE

BACKGROUND

Water is everywhere. It is on Earth in rivers, oceans, and glaciers. It is above Earth in the atmosphere and clouds. It is under Earth as groundwater. The water cycle describes the way water changes and moves through the three states of liquid, gas, and solid.

CLOSE READ

Interpret Text Features

Underline text features that are used to group and separate information.

Photos can often better illustrate information than words alone.

Underline information in the caption that the photograph shows.

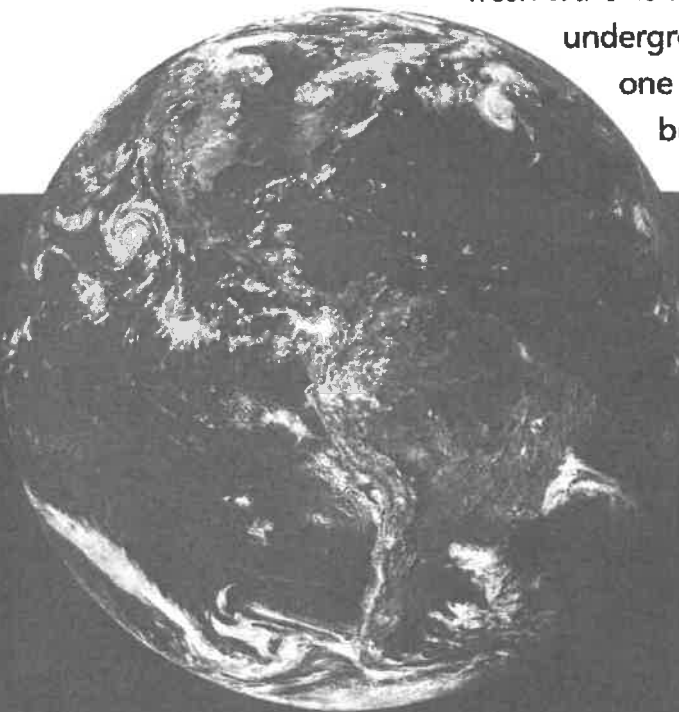
abundant existing in large amounts; plentiful

Water, Water, Everywhere

- 1 Water is all around us. About 70 percent of Earth is covered with water. Look at a photo of the planet from space. All the blue parts are water. That's why Earth is sometimes called the "blue planet." Water is the most abundant, or plentiful, substance on Earth, and one of the most important.

Water World

- 2 About 97 percent of all the water on Earth is contained in five oceans—the Atlantic, Pacific, Indian, Arctic, and Antarctic. Ocean water is salt water. Only about 3 percent of the planet's water is fresh water. That's the kind of water that people and animals drink.
- 3 About two-thirds of Earth's fresh water is not available to drink because it is frozen as ice in the Arctic and in Antarctica. Just one-third of all fresh water is found in rivers and lakes and underground. This adds up to only about one percent of all the world's water being available as drinking water.



This photo from space shows Earth's western hemisphere. It also dramatically illustrates why we call our world, which is 70 percent covered with water, the "blue planet." The clouds that swirl around the planet are also filled with water. They play a major role in Earth's weather patterns and in the water cycle.

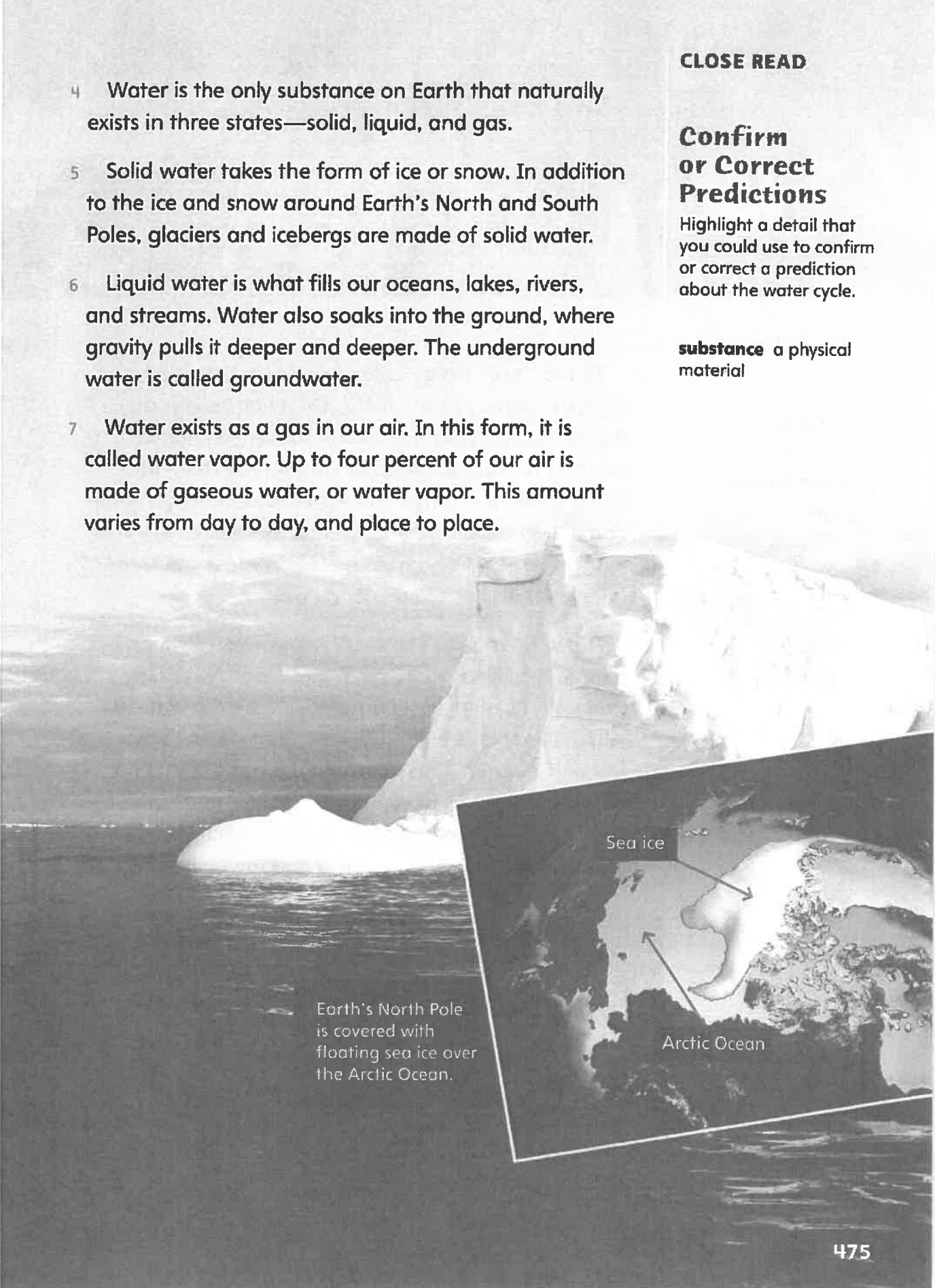
- 4 Water is the only substance on Earth that naturally exists in three states—solid, liquid, and gas.
- 5 Solid water takes the form of ice or snow. In addition to the ice and snow around Earth's North and South Poles, glaciers and icebergs are made of solid water.
- 6 Liquid water is what fills our oceans, lakes, rivers, and streams. Water also soaks into the ground, where gravity pulls it deeper and deeper. The underground water is called groundwater.
- 7 Water exists as a gas in our air. In this form, it is called water vapor. Up to four percent of our air is made of gaseous water, or water vapor. This amount varies from day to day, and place to place.

CLOSE READ

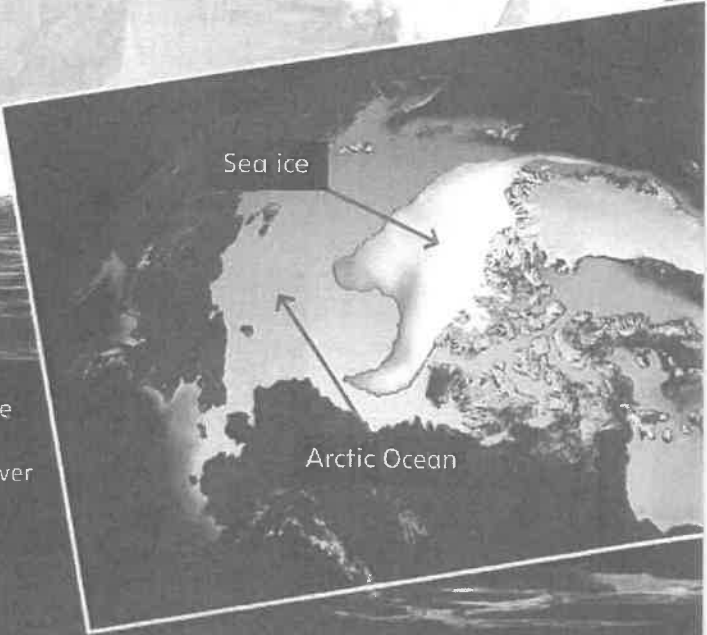
Confirm or Correct Predictions

Highlight a detail that you could use to confirm or correct a prediction about the water cycle.

substance a physical material



Earth's North Pole is covered with floating sea ice over the Arctic Ocean.



Sea ice

Arctic Ocean



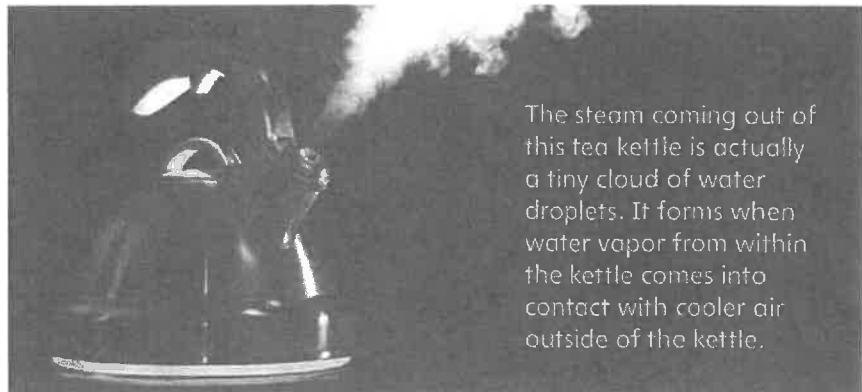
CLOSE READ

Confirm or Correct Predictions

Highlight text that you can use to confirm or correct a prediction about water vapor.

8 You can't see water vapor, or smell it, or taste it, but sometimes you can feel it. On a hot, muggy day, it is the water vapor that makes the air feel humid, clammy, or "damp." Another way you can tell that liquid water has turned into water vapor is to hang wet laundry on the clothesline. Eventually, the laundry is no longer wet. That's because the liquid water has turned into vapor and escaped into the air.

9 The only time you can "see" water vapor is when a lot of it collects in one place and starts to cool. At that point, water vapor turns into steam. For example, when a tea kettle boils, a tiny cloud of steam comes out of the spout. That's because the hot water in the kettle quickly turns to vapor, collects in a small area, and immediately begins to cool. The steam is actually a collection of tiny water droplets floating in the air.



The steam coming out of this tea kettle is actually a tiny cloud of water droplets. It forms when water vapor from within the kettle comes into contact with cooler air outside of the kettle.

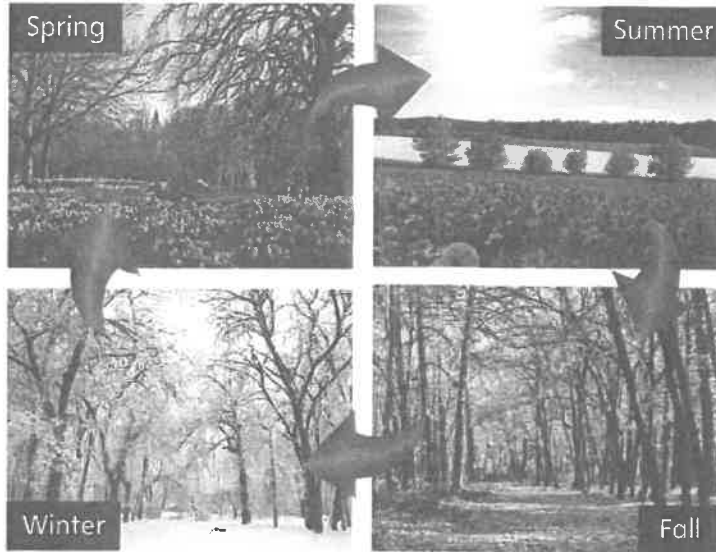
CLOSE READ

Cycles Make the World Go 'Round

- 10 A cycle is a pattern of related processes or events that happens over and over again. Like a circle, a cycle has no beginning and ending. It just keeps going and going and going. . . .

Cycles of Life

- 11 Every day, our planet performs many cycles. In fact, every day is a cycle, and so is every year. One very obvious cycle is the changing of the seasons. This cycle occurs as Earth orbits, or travels around, the Sun. Spring, summer, fall, winter. That's a cycle that happens over and over again, year after year.

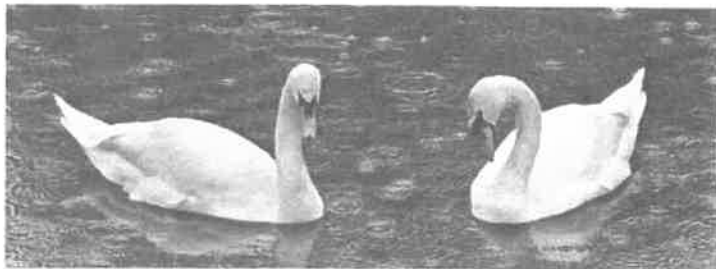


Interpret Text Features

Underline details in a text feature that help you interpret how water changes over time.

The Water Cycle

- 12 Some of Earth's cycles are quite complicated. The water cycle, for example, has many steps. Powered by energy from the Sun and by gravity, water is in constant motion. As a natural substance that cannot be created or destroyed, all the water that exists on the planet moves through its three states, cycling from Earth to the sky and back to Earth—again and again in a never-ending cycle.



The raindrops falling in this pond may have been part of an ocean wave just a few weeks ago.

CLOSE READ

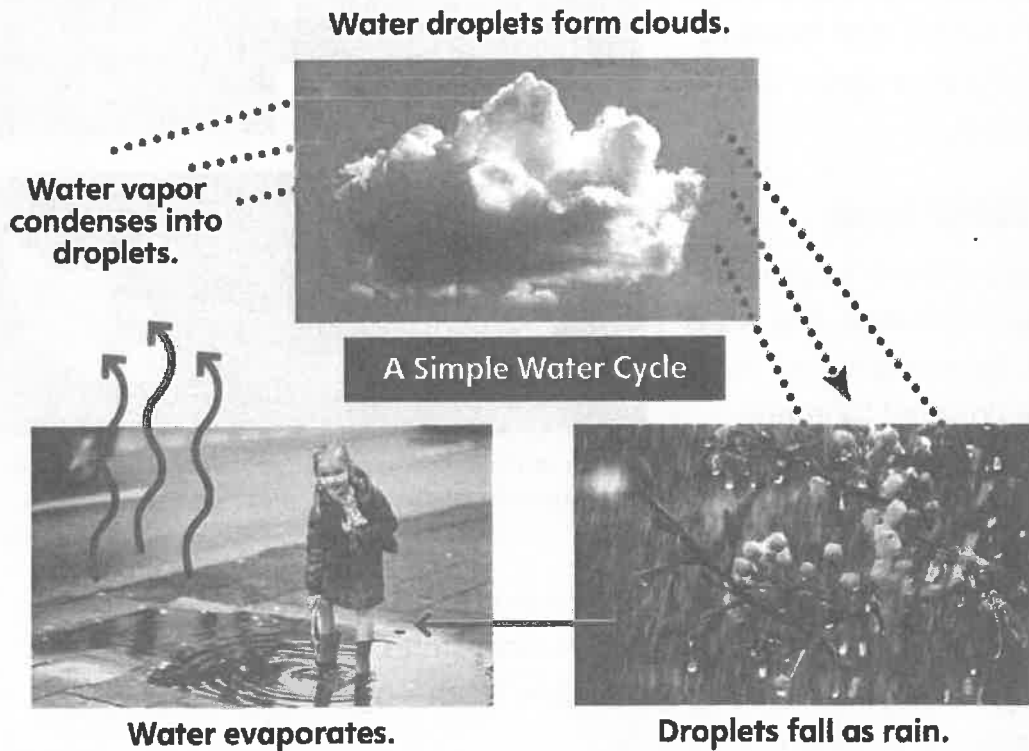
Interpret Text Features

Underline a sentence that supports your understanding of the water cycle diagram.

condenses to make or become more close; compact

The Never-Ending Cycle

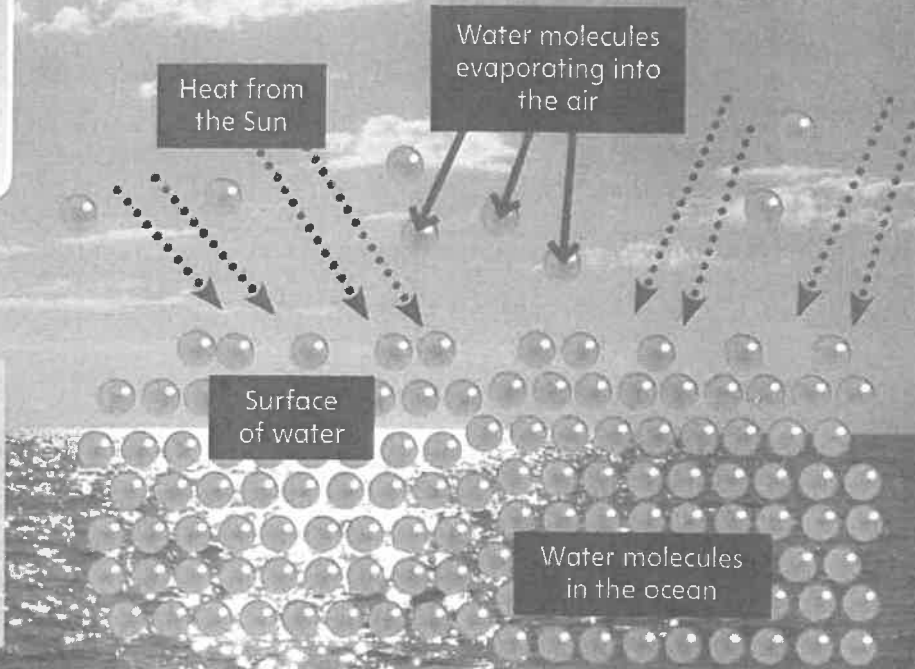
13 After a rainfall, water sits in a puddle. The puddle water eventually evaporates into the air, where water vapor cools, condenses, and collects into droplets and forms clouds, until it rains again. That's a super-simple version of the water cycle. The path of that puddle water is part of a never-ending cycle that is constantly moving all the water on our planet, from the sky to the Earth, and back to the sky. The cycle includes not only bodies of water, the land, and the sky, but also all of Earth's plants and animals. Let's look at the water cycle one step at a time, beginning with the biggest water source on the planet—the oceans.



Did You Know?

When ocean water evaporates, salt in the seawater stays behind. This means that the water vapor is fresh water.

As heat from the Sun warms water near the ocean's surface, it gives water molecules the energy to evaporate into the air as water vapor.



Into the Air

- 14 All the water that exists on Earth has been here for millions of years. Even though water changes states, most of it is, and has always been, contained in liquid form in the world's oceans. The surface area of Earth's oceans is vast, so it absorbs a huge amount of sunlight every day.
- 15 The energy in that sunlight warms the seawater near the surface, giving water molecules the energy they need to escape, or evaporate, into the air. The warmer the air, the warmer the water, and the more liquid converts to gas, or water vapor. This step in the water cycle is evaporation, and it also happens in lakes, rivers, and other freshwater bodies.

CLOSE READ

Confirm or Correct Predictions

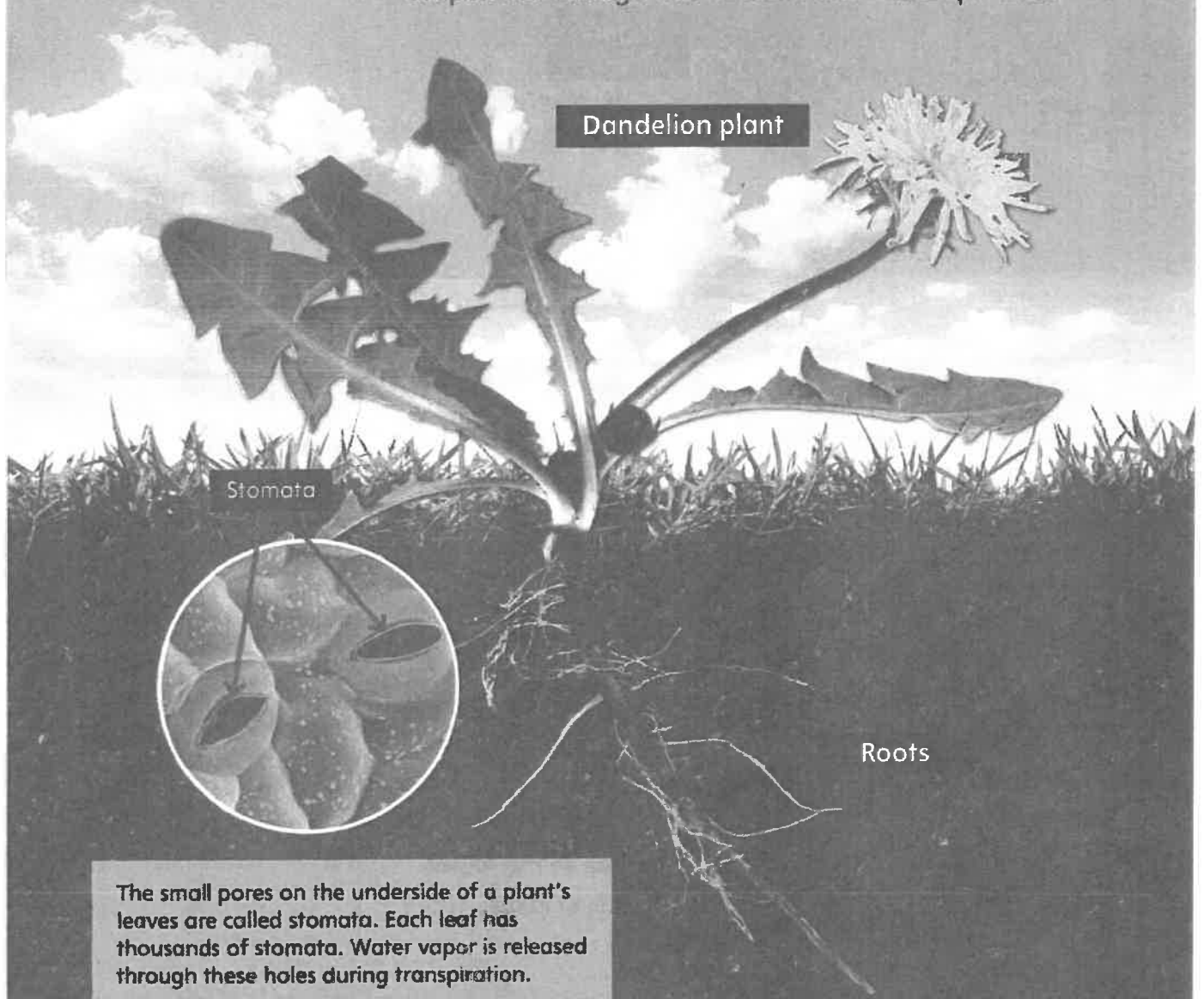
Highlight details that confirm or correct a prediction you made about evaporation.

CLOSE READ

Interpret Text Features

Underline information in a text feature on these pages. Interpret how it helps you understand the main ideas of the text.

16 This isn't the only way that liquid water becomes water vapor, though. Remember that plants contain a lot of water, too! A plant takes in water from the soil through its roots. The water then travels up the stem and to all parts of the plant, eventually reaching the leaves. From there, some of the water evaporates through small holes, or pores, on the underside of the leaves, moving into the air. This process, by which water travels from the roots throughout the plant and then evaporates through the leaves, is called transpiration.



The small pores on the underside of a plant's leaves are called stomata. Each leaf has thousands of stomata. Water vapor is released through these holes during transpiration.

CLOSE READ

17 **From Ice to Vapor**

Water may also change into water vapor through a process called sublimation.

- 18 Even in ice, water molecules are in constant motion. They just move more slowly when water is in its solid state. Still, some of the molecules at the surface of ice will eventually escape. During sublimation, some of the molecules change from snow or ice directly to water vapor, without melting into water first. When it's windy, or when the Sun is shining, sublimation happens faster. This is why, on bitterly cold, bright sunny days, ice often disappears from sidewalks and highways.

- 19 Sublimation also happens in your freezer! Look at a tray of shrunken ice cubes that have been left in the freezer for a really long time. They have shrunk because of sublimation. There is no liquid water in the ice tray, but the ice cubes are smaller. That's because the water molecules in the ice have transformed directly into water vapor.

- 20 In the opposite process, water vapor changes directly into ice, such as snowflakes or frost, without first becoming a liquid. This process, called deposition, also occurs when temperatures are very cold.

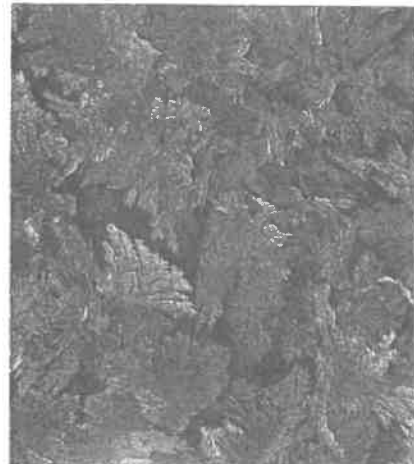
What Goes Up Must Come Down

- 21 Once water vapor is in the air, wind moves it around and lifts it high into the sky. Thanks to the wind, water vapor can travel a long way from where it started! As the vapor rises, it cools and forms tiny droplets of water. This transformation from water vapor to liquid water is called condensation.

Vocabulary in Context

Context clues are words and phrases that help a reader understand an unfamiliar word. Context clues appear in or around the unfamiliar word.

Underline context clues that help you define *transformed*.



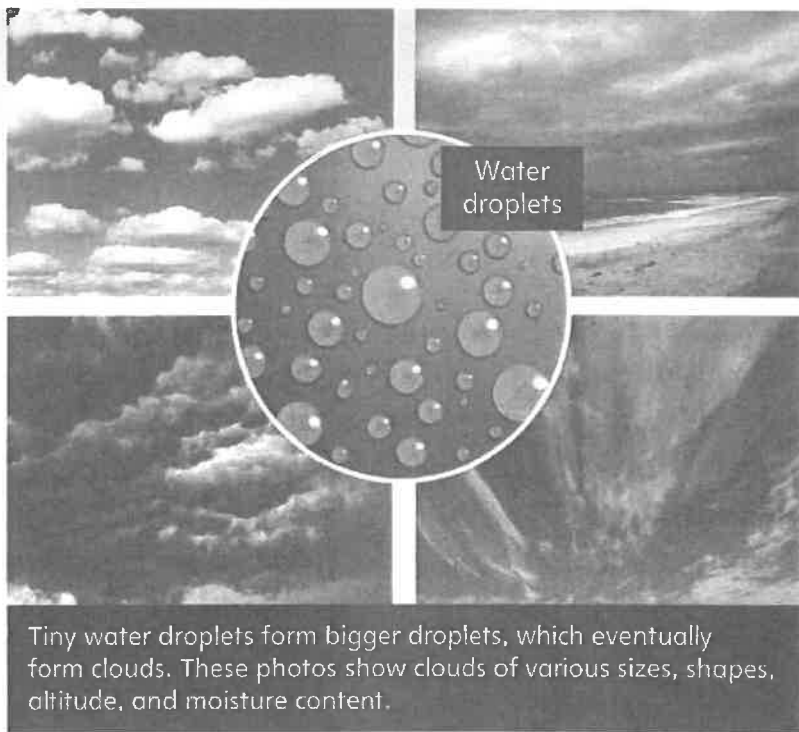
During deposition, water vapor comes into contact with a cold window pane and changes to frost, creating these beautiful patterns.

CLOSE READ

Confirm or Correct Predictions

Highlight details in the caption that confirm or correct your prediction about how clouds form.

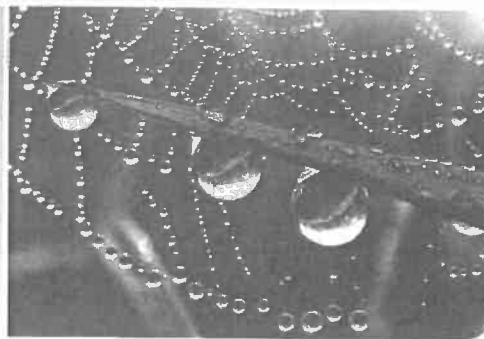
altitude position
of height



- 22 High in the chilly sky, droplets bump into each other and join together to form bigger droplets. They also form around dust, pollen, and other particles that attract the water droplets. These particles help water vapor condense faster.
- 23 When billions of these droplets join together, they form clouds. Eventually, the water droplets become too heavy to stay in the air. Gravity pulls them toward Earth, and they fall as rain.
- 24 If the temperature in the cloud is below the freezing point of water, the vapor in the air forms ice crystals instead of water droplets. These tiny ice crystals bond together to form larger crystals. When these crystals become too heavy to stay in the cloud, they fall as snow. Under some weather conditions, rain and partially melted snow may become a slushy, wintery mix. In other conditions, water may freeze into ice pellets, sometimes called sleet. These pellets make tapping or “hissing” sounds as they hit objects on the ground.

Dew Drops

Sometimes, when you get up in the morning, you see water droplets on the grass or on spider webs. Those drops are called dew. Dew is formed by the condensation of water vapor in the air. When the air cools down at night, some of that water vapor condenses and becomes liquid water. In the morning, the water has collected into the little droplets you see.

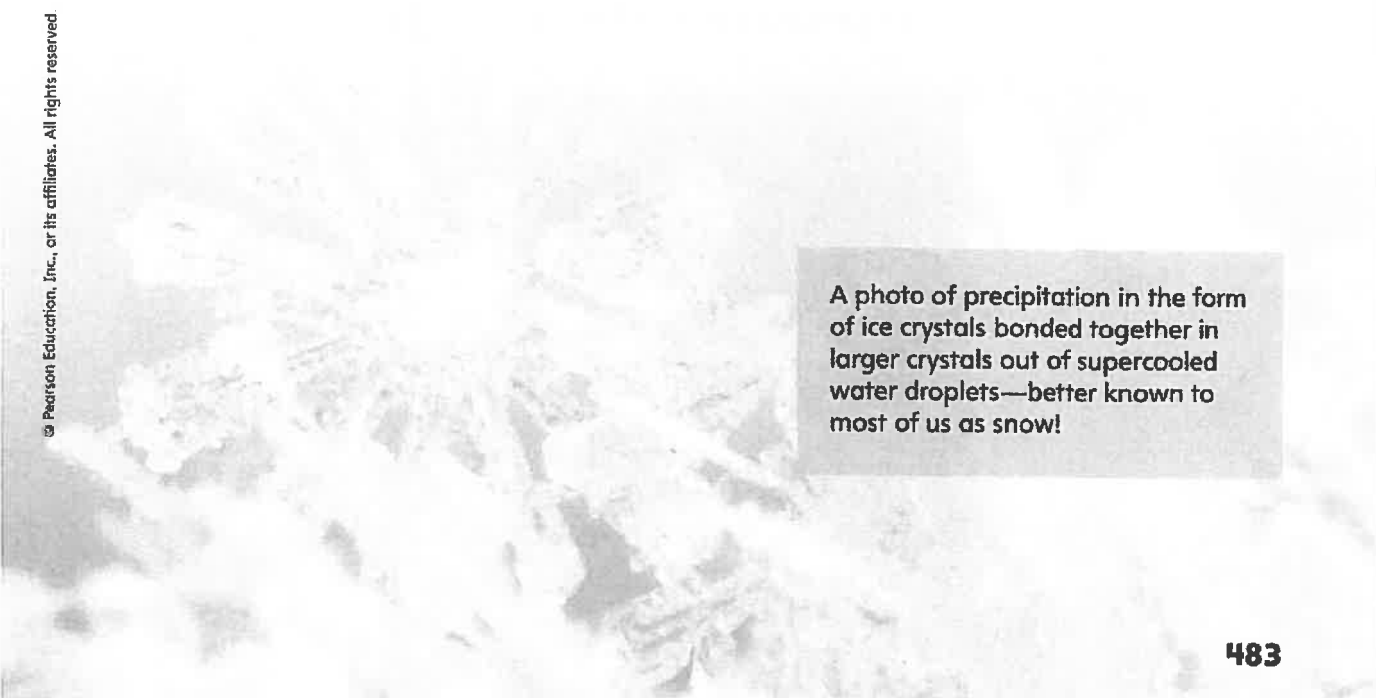


- 25 Ice may also strike the ground in the form of hail. Hail usually occurs during warmer times of the year, when thunderstorms carry droplets high into the atmosphere. There, the temperatures are cold enough for droplets to join together as they freeze and form hailstones. The size depends on how much water freezes around it before it falls to the ground. We sometimes hear hail banging on cars and roofs during the summer!
- 26 The various forms of rain and ice crystals falling from the sky are all types of precipitation, the name of this part of the water cycle.

CLOSE READ

Confirm or Correct Predictions

Highlight details in the text feature that confirm or correct a prediction you made about how dew forms.



A photo of precipitation in the form of ice crystals bonded together in larger crystals out of supercooled water droplets—better known to most of us as snow!

CLOSE READ

Interpret Text Features

Underline part of a text feature that supports your understanding of water runoff.

Use this example to interpret the role of runoff in the water cycle.

trickles flows or falls in drops

Underground Water

- 27 Once water has fallen back to Earth as precipitation, it has to go somewhere before it starts to evaporate and begin the cycle all over again. This step in the cycle is called collection.
- 28 Because 70 percent of our planet is covered with water, most of the precipitation ends up back in those bodies of water—oceans, lakes, rivers, and streams. Some, though, falls onto land.
- 29 In certain regions, the water trickles down hillsides, mountains, and slopes until it runs into a river or lake. This water is called runoff, and sooner or later it finds its way back to an ocean.
- 30 About 20 percent of water that falls to Earth soaks into the ground. It seeps through the top layers of soil and is pulled deeper by the force of gravity.



Making Sense of Cycles

Clouds come in different sizes, shapes, and colors, and they can be found at many different altitudes, or heights. For example, fog is a cloud that is close to the ground. The size and shape of a cloud may depend on temperature and wind in the sky, as well as how high the cloud is. Based on facts and pictures in this book, think about why certain clouds might be different colors and shapes. What do you think makes some clouds thin and wispy, and others heavy looking, and some almost completely white and others very dark?

The water in this spectacular waterfall in Norway started out as precipitation falling to Earth and collecting into small mountain streams. As shown here, those streams flow into larger rivers, which eventually find their way to the sea.

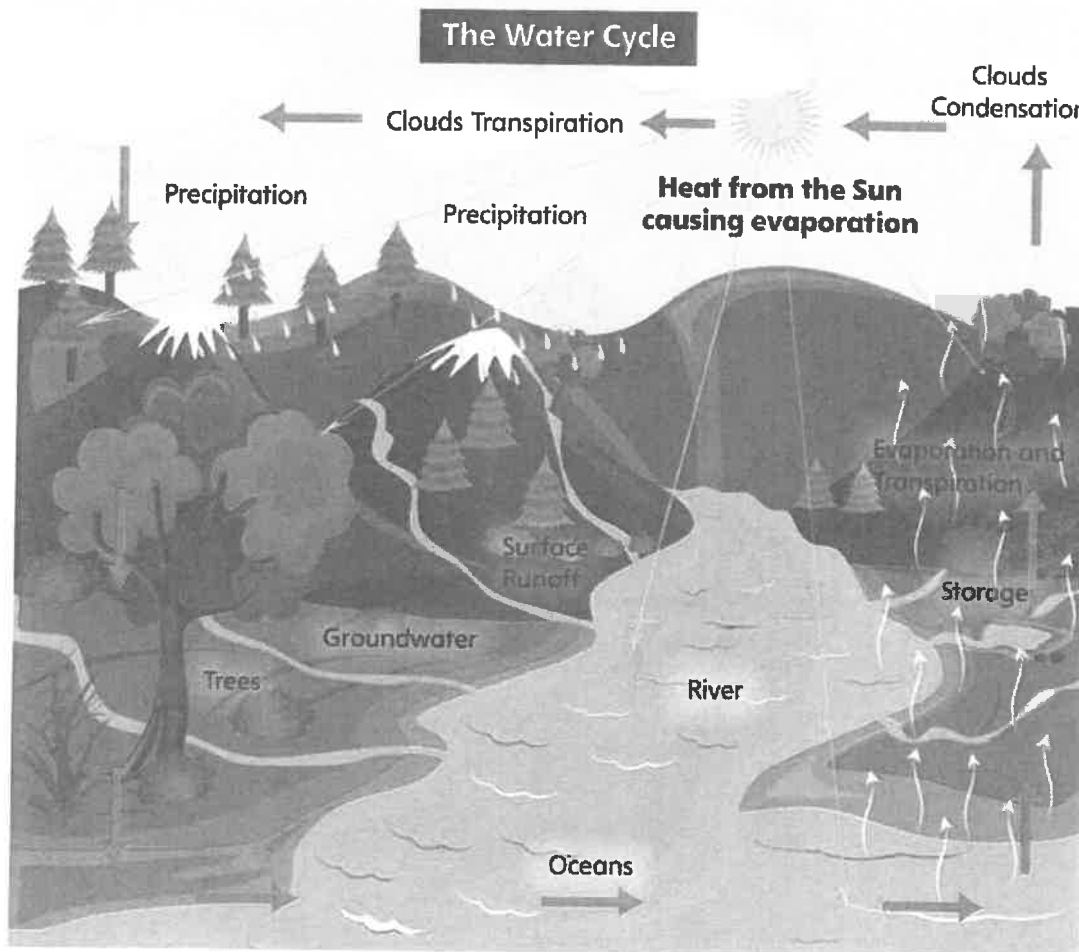
Watering the Animals

All animals, including humans, need water to survive. Many animals get it by drinking fresh water or by eating plants, which contain water. Water constantly circulates throughout an organism, bringing nutrition and energy to every organ and cell in every part of the body. It eventually leaves the organism and returns to the water cycle. Humans and other mammals sweat, which releases water into the air—and, therefore, into the water cycle. Mammals and other types of animals, even insects, also urinate, which releases liquid water into the water cycle. Fish take in and get rid of water through their gills. Other animals, such as frogs and lizards, absorb and release moisture through their skin. Every type of animal has to get rid of waste material somehow, and they all do it in different ways!

CLOSE READ

Confirm or Correct Predictions

Highlight details that confirm or correct a prediction that you made from reading the heading of the text feature.



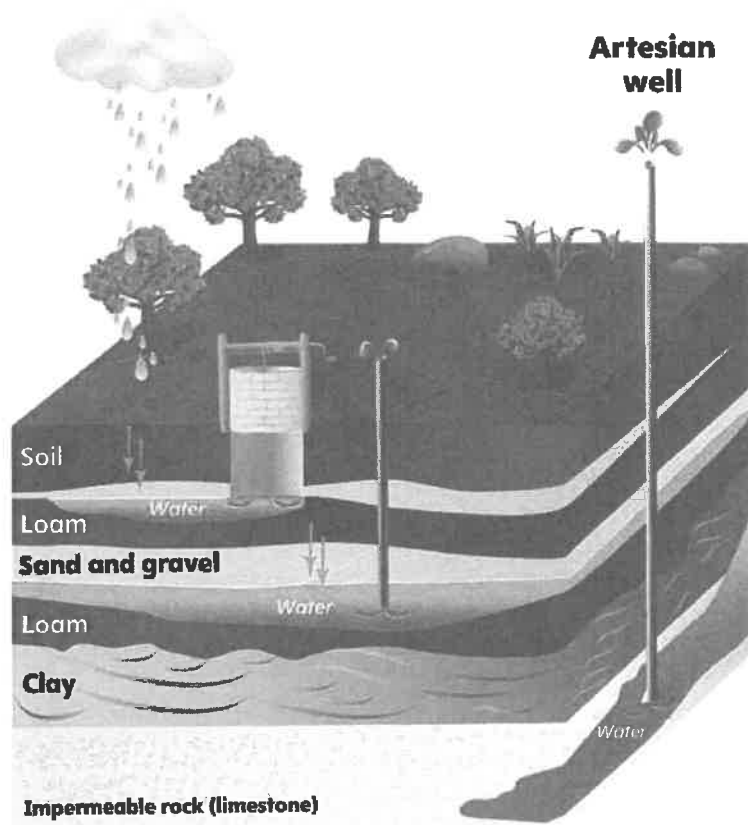
CLOSE READ

Interpret Text Features

Underline words and phrases that help you interpret the water table diagram.

- 31 Eventually, the water reaches a level called the water table. The depth of the water table varies from location to location. Above the water table, the underground water trickles around rocks, stones, and sand, flowing downward.
- 32 Below the water table, every crack, pore, and air pocket in the ground is completely filled with water. This area is called the saturated zone, because it is saturated with, or full of, groundwater.
- 33 This is a source of drinking water for many people around the world. They dig wells, searching for an aquifer in the saturated zone. An aquifer is an underground area that contains a great deal of groundwater—enough to serve the people of a community, or to irrigate farmland.

This diagram shows how groundwater collects below the surface.



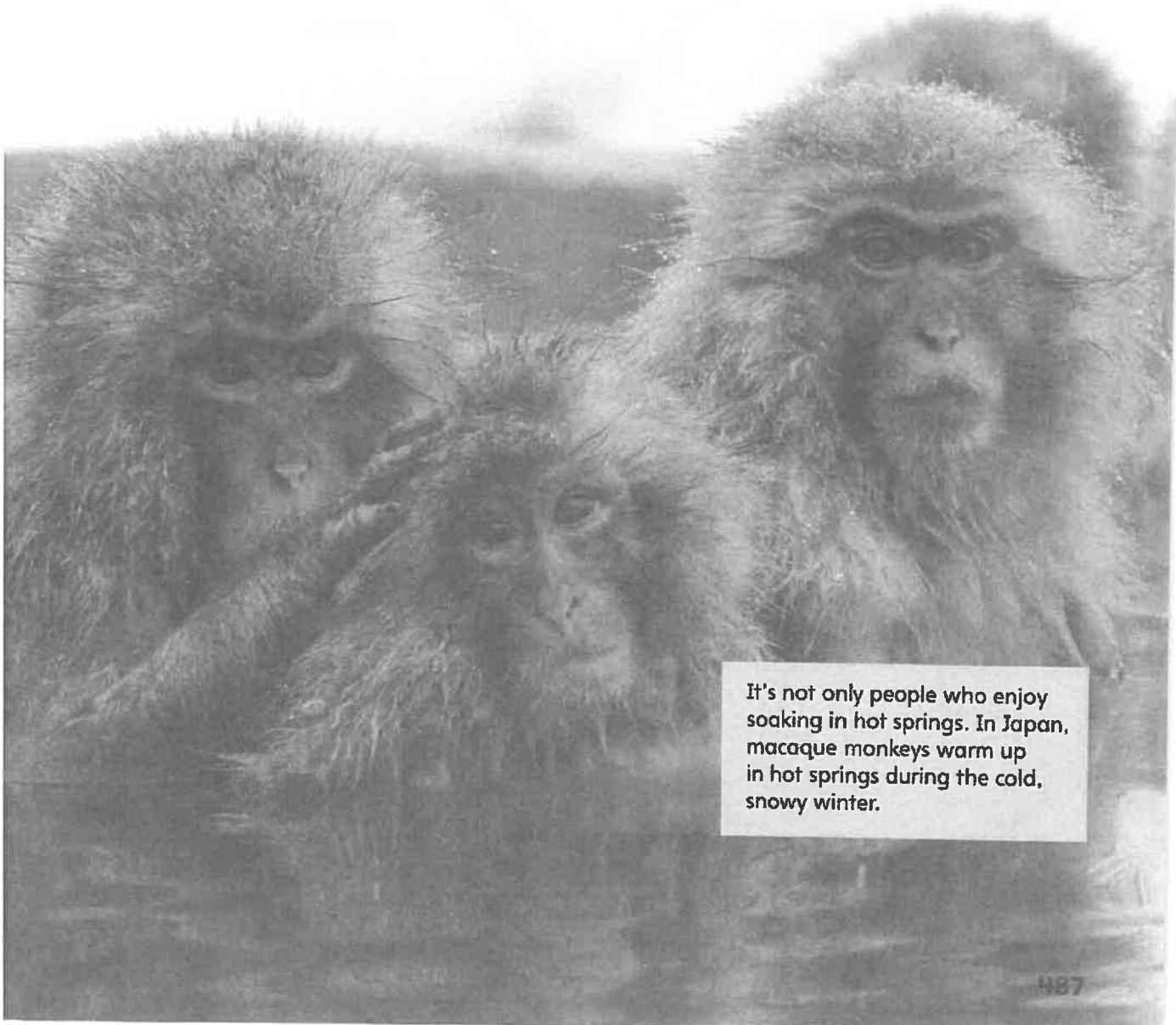
In Hot Water

The deeper underground that groundwater goes, the hotter it gets. Sometimes groundwater is pulled so deep into Earth's crust that its temperature can reach the boiling point. In some places, this water then returns to the surface in pools called hot springs. Sometimes, a cold spring feeds into the same pool. This cools down the water, so people can enjoy soaking in the hot spring. Sometimes, people add cooler water to control the heat. In other cases, as the hot water circulates back to the surface, it naturally cools down again, making the hot spring a suitable temperature for human relaxation.

CLOSE READ

Interpret Text Features

Underline details that support your understanding of how mammals use hot springs.



It's not only people who enjoy soaking in hot springs. In Japan, macaque monkeys warm up in hot springs during the cold, snowy winter.

Wednesday Week 5 Assignment 6 Quiz

* Required

1. Email address *

2. Choose 3 text features that are found in the story "Earth's Water Cycle" on pages 473-487 of your textbook. Hint: Use your anchor chart on page 471. * 3 points

Check all that apply.

- Diagrams
- Photographs
- Captions
- Basketball
- Close reading

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Thursday Week 5. Assignment 7 Text Features

Use "Earth's Water Cycle" on pages 473-487 of your textbook to identify 3 text features and their purpose. Hint: Use the anchor chart on page 471 for help!

Page Number	Text Feature	How it helps me to understand the text

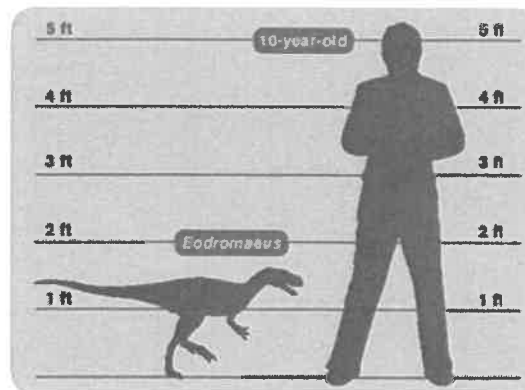
Tiny Terror

Scientists unearth one of the oldest known dinosaurs.

Millions of years ago, a bloodthirsty dinosaur roamed Earth. The rough reptile terrorized its prey, viciously ripping apart animals with its sharp claws and knife-like teeth. Who was this fierce hunter? No, not *Tyrannosaurus rex*. It was *Eodromaeus*-a dinosaur the size of a dog!

Scientists recently introduced the teeny meanie, which they discovered in Argentina. That is a country in South America. Experts say *Eodromaeus* (ee-oh-DROH-mee-uhss) is one of the oldest dinosaurs ever discovered. It lived during the Triassic Period about 230 million years ago. The dinosaur's name means "dawn runner."

The pint-sized predator was four feet long from nose to tail and weighed less than fifteen pounds. Though *Eodromaeus* was small, it may hold big clues about the world's first dinosaurs.



Fotolia

"We're looking at a snapshot of early dinosaur life," says Paul Sereno. He is a paleontologist who helped find the reptile.

A Meaty History

Eodromaeus has a history that scientists can really sink their teeth into. The dinosaur was one of the very first **theropods**. A theropod was a meat-eating dino that walked on two legs.

The great-granddaddy of *T. rex* shared some key features with later **carnivores**, or meat eaters. The reptile had sharp, narrow teeth. "They have small, steak knife-like [edges] so that when they are jabbed into flesh, they open a wound," Sereno explained to *WR News*. *Eodromaeus* most likely chowed down on small dinosaurs and the young of other reptiles.

Also like later meat eaters, the dinosaur had hands that were perfect for grabbing its dinner. "The bones behind the claws are very long, so it can get the claw around something," Sereno explains.

In addition, the end of the dino's tail was stiff to let *Eodromaeus* keep its balance while running.

The Big Reveal

Eodromaeus is helping scientists learn about other early dinosaurs. The reptile shared its turf with a similar-looking dinosaur called *Eoraptor* (ee-oh-RAP-tor). For years, experts **suspected**, or thought, that *Eoraptor* ate meat. But after comparing *Eoraptor's* and *Eodromaeus's* features, they determined that *Eoraptor* was an **herbivore**, or plant eater.

Despite the dinos' different diets, they had a lot in common, including their size, experts say. "I think if they [ran] by, you might not even know the difference except that one might want to rip your arm off and the other one might ... hide in a bush," Sereno says.

The fact that the dinosaurs shared so many features could mean that they are also very similar to the world's first dinosaur, Sereno says. Experts believe that dino roamed Earth ten million years earlier than *Eoraptor* and *Eodromaeus* did. That may seem like a long time, experts say, but it is relatively short compared with the 183 million years that dinosaurs existed.

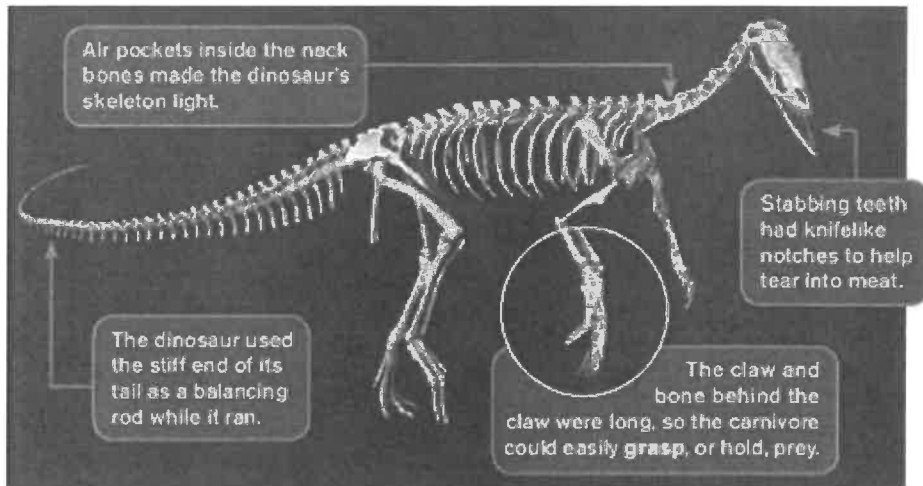
Digging Deeper

Sereno and his team found both *Eodromaeus* and *Eoraptor* in northern Argentina. They believe the country may hold even more fossils-including the remains of the very first dinosaur.

"We're going to go back," Sereno says. He's pretty sure some fossils will turn up. "They always come out to say hi when we come!"

Profile of a Predator

Small animals, beware! *Eodromaeus's* skeleton shows certain features that are common in all meat-eating dinosaurs, including *T. rex*.



Mike Hettwer

Dino Hunter

Paleontologist Paul Sereno is dino-mite at discovering dinosaurs. He has found the ancient reptiles on five continents! *WR News* talked to Sereno about his work.

WR News: How did it feel to find your first dinosaur, *Herrerasaurus*, in 1998?

Paul Sereno: It was unbelievable. ... I was afraid it was going to disappear in front of my eyes. ... There we were, ... standing over something 230 million years old waiting for us to walk up and discover it.



Mike Hettwer

WR News: How do you name the dinosaurs you discover?

PS: If there's nothing like a giant horn or something that's utterly **peculiar** [or unusual] on the animal you're describing, then you have to think harder about what is its way of life, what's special about it.

WR News: Why is patience important for paleontologists?

PS: It took years to find [*Eodromaeus*]. ... If we had cut corners anywhere, at any point along the way, we would know less than we know now.

Name: _____ Date: _____

1. What dinosaur did scientists recently introduce?

- A. Eodromaeus
- B. Tyrannosaurus rex
- C. Eoraptor
- D. Herrerasaurus

2. To organize the text, the author divides it into sections with subheadings. What does the author describe in the section with the subheading "A Meaty History"?

- A. the location of Argentina in South America
- B. the key features that confirm Eodromaeus was a meat eater
- C. the height and weight of the dinosaur Eodromaeus
- D. the discovery of even more fossils in Argentina

3. Read this sentence from the text:

"Eodromaeus was a carnivore, or meat eater."

What evidence from the text supports this conclusion?

- A. The reptile shared its turf with a similar-looking dinosaur called Eoraptor.
- B. Eodromaeus had sharp, narrow teeth that had edges like those of steak knives.
- C. Eodromaeus was four feet long and weighed less than fifteen pounds.
- D. Scientists found both Eodromaeus and Eoraptor in northern Argentina.

4. Read this sentence from the text:

"Though Eodromaeus was small, it may hold big clues about the world's first dinosaurs."

Based on this information, what can you infer about Eodromaeus and the world's first dinosaurs?

- A. Scientists can learn about the world's first dinosaurs by studying Eodromaeus.
- B. Most of the world's first dinosaurs were as small as Eodromaeus.
- C. Eodromaeus started out small but grew to be much bigger than it once was.
- D. Unlike Eodromaeus, the world's first dinosaurs did not eat meat.

5. What is the main idea of this text?

- A. Tyrannosaurus rex was a bloodthirsty hunter that roamed Earth millions of years ago.
- B. Dinosaurs have been discovered on five different continents.
- C. Most dinosaurs are named after unusual features they have, like a giant horn.
- D. Scientists have discovered Eodromaeus, one of the oldest known dinosaurs.

6. The diagram on the first page compares the size of Eodromaeus to that of a ten-year-old human. Why might the author have included this diagram?

- A. to show the reader the average height of a ten-year-old
- B. to confuse the reader with unrelated statistics and facts
- C. to convince the reader that Eodromaeus would have made a great pet
- D. to emphasize to the reader how small Eodromaeus was

7. _____ Eodromaeus and Eoraptor had different diets, they still had a lot in common, including their size.

- A. Although
- B. Because
- C. Since
- D. Unless

8. Unlike the meat-eating Eodromaeus, Eoraptor was a plant eater. What is another name for a plant eater?

9. For years, scientists believed Eoraptor was a carnivore. How did they determine that this was not true?

10. Explain how studying Eodromaeus can help scientists learn about other dinosaurs as well.

Name : _____

Score : _____

Teacher : _____

Date : _____

** Pick any 12 problems **

$$\begin{array}{r} 12 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 13 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \\ \times 11 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 14 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ \times 1 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 14 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \times 1 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ \times 15 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 11 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \\ \times 14 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ \times 11 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ \times 8 \\ \hline \end{array}$$



1.3 Multiplying Whole Numbers

Example 3: Multiply: 256×73 **Step 1:** Line up the ones digits. Multiply 256×3 .

$$\begin{array}{r} \overset{1}{2} \overset{1}{5} 6 \\ \times 7 \underline{3} \\ \hline 7 \ 6 \ 8 \end{array} \left\{ \begin{array}{l} 3 \times 6 = 18, \text{ write } 8 \text{ and carry the one} \\ 3 \times 5 = 15, \text{ add the } 1 \text{ that was carried to get } 16, \\ \text{write } 6 \text{ and carry the one} \\ 3 \times 2 = 6, \text{ add the } 1 \text{ that was carried to get } 7, \\ \text{write } 7 \end{array} \right.$$

Step 2: Multiply 256×7 . Remember to shift the product one place to the left. Then add.

$$\begin{array}{r} \overset{3}{2} \overset{4}{5} 6 \\ \times \underline{7} 3 \\ \hline 1 \ 7 \ 9 \ 2 \\ \leftarrow \\ 1 \ 8,6 \ 8 \ 8 \\ \leftarrow \\ \hline \text{Add} \end{array} \left\{ \begin{array}{l} 7 \times 6 = 42, \text{ write } 2 \text{ and carry the } 4 \\ 7 \times 5 = 35, \text{ add the } 4 \text{ that was carried to get } 39, \\ \text{write } 9 \text{ and carry the } 3 \\ 7 \times 2 = 14, \text{ add the } 3 \text{ that was carried to get } 17, \\ \text{write } 17 \end{array} \right.$$

The answer is 18,688.

Double Check: You can double check your answer by dividing the product

by either of the factors using your calculator: $\frac{18,688}{73} \div 256$ $\frac{18,688}{256} \div 73$

Multiply.

1. ~~$\begin{array}{r} 258 \\ \times 72 \\ \hline \end{array}$~~

5. ~~$\begin{array}{r} 841 \\ \times 27 \\ \hline \end{array}$~~

9. ~~$\begin{array}{r} 156 \\ \times 95 \\ \hline \end{array}$~~

13. ~~$\begin{array}{r} 942 \\ \times 24 \\ \hline \end{array}$~~

2. $\begin{array}{r} 742 \\ \times 44 \\ \hline \end{array}$

6. $\begin{array}{r} 324 \\ \times 19 \\ \hline \end{array}$

10. $\begin{array}{r} 765 \\ \times 94 \\ \hline \end{array}$

14. $\begin{array}{r} 247 \\ \times 84 \\ \hline \end{array}$

3. ~~$\begin{array}{r} 785 \\ \times 32 \\ \hline \end{array}$~~

7. ~~$\begin{array}{r} 921 \\ \times 23 \\ \hline \end{array}$~~

11. ~~$\begin{array}{r} 581 \\ \times 25 \\ \hline \end{array}$~~

15. ~~$\begin{array}{r} 468 \\ \times 43 \\ \hline \end{array}$~~

4. $\begin{array}{r} 679 \\ \times 36 \\ \hline \end{array}$

8. $\begin{array}{r} 454 \\ \times 56 \\ \hline \end{array}$

12. $\begin{array}{r} 827 \\ \times 56 \\ \hline \end{array}$

16. $\begin{array}{r} 456 \\ \times 47 \\ \hline \end{array}$

Name : _____

Score : _____

Teacher : _____

Date : _____

$$\begin{array}{r} 1.5 \\ \times 5.9 \\ \hline \end{array}$$

$$\begin{array}{r} 4.3 \\ \times 4.5 \\ \hline \end{array}$$

$$\begin{array}{r} 1.5 \\ \times 9.9 \\ \hline \end{array}$$

$$\begin{array}{r} 1.2 \\ \times 8.4 \\ \hline \end{array}$$

$$\begin{array}{r} 1.4 \\ \times 9.2 \\ \hline \end{array}$$

$$\begin{array}{r} 2.2 \\ \times 5.4 \\ \hline \end{array}$$

$$\begin{array}{r} 4.7 \\ \times 1.7 \\ \hline \end{array}$$

$$\begin{array}{r} 9.9 \\ \times 8.6 \\ \hline \end{array}$$

$$\begin{array}{r} 8.2 \\ \times 4.9 \\ \hline \end{array}$$

$$\begin{array}{r} 9.5 \\ \times 9.4 \\ \hline \end{array}$$

$$\begin{array}{r} 9.7 \\ \times 6.6 \\ \hline \end{array}$$

$$\begin{array}{r} 8.3 \\ \times 8.5 \\ \hline \end{array}$$

2.3 Remainders

The **remainder** is the part that is left over after long division.

Example 4: Divide $97 \div 4$

$$\begin{array}{r} 24 \text{ r}1 \\ 4 \overline{)97} \\ \underline{-8} \\ 17 \\ \underline{-16} \\ 1 \end{array}$$

We cannot divide 4 into 1, so it is listed as the remainder. We do this by inserting an "r" and the remaining amount, 1. r1

Check:

$$\begin{array}{r} 24 \\ \times 4 \\ \hline 96 + 1 = 97 \checkmark\checkmark \end{array}$$

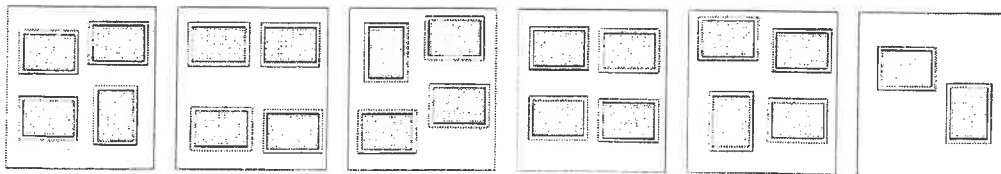
Sometimes when your answer contains a remainder, you have to round up or down to solve the problem correctly.

Example 5: Dawn has 22 pictures to put in her album. She can fit 4 on each page.

How many pages will she need to fit all 22 pictures in her album?

$$\begin{array}{r} 5 \text{ r}2 \\ 4 \overline{)22} \\ \underline{-20} \\ 2 \end{array}$$

In this example, she will round up to 6 pages. 5 pages will have 4 pictures. 1 page will have the 2 remaining pictures on it.



$$\begin{aligned} &4 \text{ pictures} + 4 \text{ pictures} + 4 \text{ pictures} + 4 \text{ pictures} + 4 \text{ pictures} + 2 \text{ pictures} \\ &= 22 \text{ pictures} \end{aligned}$$

Answer: 6 pages

Quotients with remainders can be shown as mixed numbers or decimals.

Example 6: Show the answer for $13 \div 4$ as a mixed number and as a decimal.

$$13 \div 4 = 3 \text{ r}1$$

Remainder as a mixed number: $3\frac{1}{4}$. The remainder 1 becomes the numerator. The divisor 4 becomes the denominator. Add this to the whole number in the answer, 3, to get $3\frac{1}{4}$.

Remainder as a decimal: 3.25. Divide the remainder 1 by the divisor 4 to find the decimal: $1 \div 4 = 0.25$. Add this to the whole number in the answer, 3, to get 3.25.

Note: Any remainder expressed as a fraction within a mixed number **does not** have to be expressed in lowest terms. For instance, an answer of $4\frac{8}{12}$ does not have to be reduced to lowest terms of $4\frac{2}{3}$. Leave your answer as $4\frac{8}{12}$.

Solve the problems. Show your answers as decimals.

- ① Olivia has 15 flowers. She was asked to place 2 on each table. How many tables can she put 2 flowers on?
- ② Paul has 22 books. He is to put 4 books in each box, how many boxes will he need for all the books?
- ③ Craig's class is going on a field trip. There are 23 students in his class. Each car can carry 4 students. How many cars will they need?
- ④ Denzel has 15 toy cars. He wants to put 4 toy cars on each shelf in his bedroom. How many shelves can he put the toy cars on?
- ⑤ April has a book case with 5 shelves. Each shelf will hold 6 dolls from her collection of 28 dolls. How many shelves will she fill with dolls?

Divide and show your answers as mixed numbers.

$$\textcircled{6} \quad 4 \overline{)61}$$

$$\textcircled{9} \quad 5 \overline{)128}$$

$$\textcircled{12} \quad 4 \overline{)91}$$

~~$$15. \quad 9 \overline{)815}$$~~

$$\textcircled{7} \quad 3 \overline{)67}$$

$$\textcircled{10} \quad 7 \overline{)814}$$

~~$$13. \quad 3 \overline{)23}$$~~

~~$$16. \quad 3 \overline{)632}$$~~

$$\textcircled{8} \quad 6 \overline{)127}$$

$$\textcircled{11} \quad 2 \overline{)87}$$

~~$$14. \quad 8 \overline{)49}$$~~

~~$$17. \quad 2 \overline{)51}$$~~

Divide and show your remainders in your answers as whole numbers.

~~$$18. \quad 826 \div 13$$~~

~~$$19. \quad 473 \div 22$$~~

~~$$20. \quad 638 \div 27$$~~

~~$$21. \quad 951 \div 8$$~~

Study Guide

DIRECTIONS Fill in the missing information in these paragraphs. Use the terms below to help you complete the paragraphs.

Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
proclamation	treason	monopoly	olive branch	grievances
alliances	imperial policies	blockade	commander	independence
delegates	boycott	petition	in chief	resolution
	representation		earthworks	

Lesson 1 In the French and Indian War, Britain and France fought over land claims in North America. Both sides made _____ with Native Americans. At a meeting in Albany, New York, Benjamin Franklin asked the British colonies to join together to fight the French. The _____ did not approve his plan. After Britain won the war, its king made a _____ that set aside certain lands for Native Americans.

Lesson 2 The French and Indian War was costly for Britain. Britain decided to tax colonists to raise money. Many colonists said that Parliament could not tax them because the colonists had no _____, or voice, in Parliament. When Patrick Henry argued that colonists should not pay, some people accused him of _____. Many others agreed with Henry, though. More and more colonists began to _____ British goods and protest Britain's _____. Fights broke out as colonists protested new taxes.

© Harcourt

(continued)

Lesson 3 The Tea Act gave Britain a _____ on tea in the colonies. In response, the Sons of Liberty threw boxes of British tea into Boston Harbor. British leaders were so angry that they ordered the British navy to _____ the harbor. Colonial leaders met at the First Continental Congress and decided to send a _____ to the king, stating colonists' rights.

Lesson 4 The Second Continental Congress set up the Continental Army and named George Washington its _____. The war's first major battle had already taken place at Lexington and Concord. At Breed's Hill, colonists fired at British soldiers from defenses called _____. The British won the Battle at Breed's Hill, mistakenly called the Battle of Bunker Hill. However, more than 1,000 British soldiers died. Congress later asked King George III for peace. Its petition was named after the _____, an ancient symbol of peace.

Lesson 5 Conflicts between Britain and the colonies grew, and more and more colonists wanted _____ from Britain. In Congress, Richard Henry Lee called for a _____ to free the colonies. Congress chose a committee to write a declaration to King George III. This statement became known as the Declaration of Independence. It listed many _____, or complaints, that the colonists had against the king and Parliament.

1776
Thomas Paine
publishes
Common Sense

1776
The Declaration of
Independence is issued

1777
The Articles of
Confederation
are written



WHAT TO KNOW
How did the 13 colonies
cut their ties with Britain?

VOCABULARY

- independence p. 325
- resolution p. 325
- declaration p. 325
- preamble p. 326
- grievance p. 326

PEOPLE

- Thomas Paine
- Richard Henry Lee
- Thomas Jefferson
- Abigail Adams

PLACES

- Independence Hall



CAUSE AND EFFECT

Cause	Effect

Declaring Independence



Your friend waves a pamphlet in your face. "This will change the course of history!" You notice that the short book's title is *Common Sense*. Your friend says, "In here are all the reasons we should be our own country."

The year is 1776, and battles between the colonists and British soldiers have already taken place. Your friend tells you, "*Common Sense* is going to make everyone want to be free of Britain."

► **THOMAS PAINE** In *Common Sense*, Thomas Paine argued that the colonies should claim their independence.



COMMON SENSE;
ADDRESSED TO THE
INHABITANTS
OF
A M E R I C A,
On the following interesting
S U B J E C T S.
I. Of the Origin and Design of Government in general with concise Remarks on the English Constitution.
II. Of Monarchy and Hereditary Succession.

Moving Toward Independence

More colonists were starting to think that their problems with Britain could not be settled. One person who helped shape the colonists' ideas was **Thomas Paine**. In *Common Sense*, Paine wrote that the colonists should rule themselves.

Congress Debates Independence

From Georgia to New Hampshire, people talked about Paine's ideas. Many began to call for **independence**—the freedom to govern themselves.

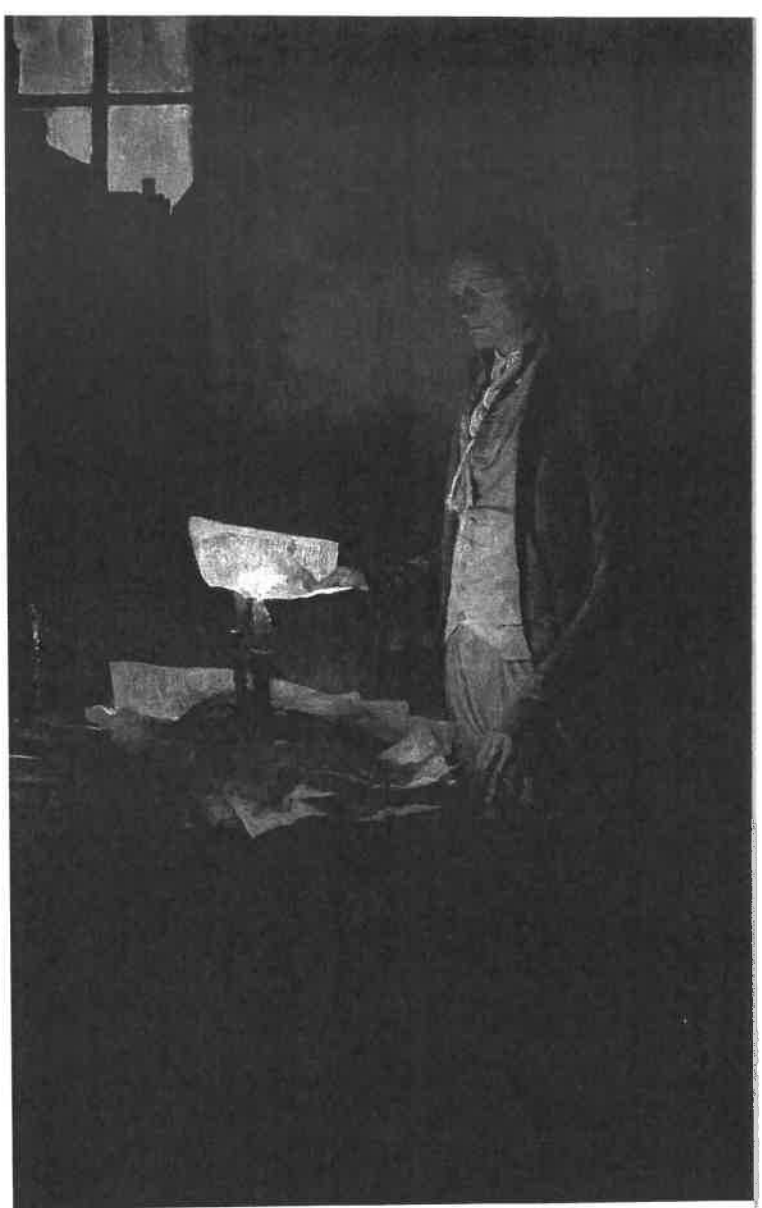
Delegates at the Second Continental Congress in Philadelphia also started to talk about independence. John Adams of Massachusetts argued strongly for it. He said independence was the only way for the colonists to have liberty. In time, more and more of the delegates came to agree with Adams's point of view.

On June 7, 1776, **Richard Henry Lee** of Virginia slowly rose from his chair at the Second Continental Congress. He told the other delegates that the 13 colonies no longer owed loyalty to the king. Lee then called for a **resolution**, or a formal group statement, of independence:

“Resolved: That these united colonies are, and of right ought to be, free and independent states.”

A Declaration Is Written

Congress debated Lee's resolution. It also chose a committee to write a **declaration**, or official statement, about independence to be sent to the king.



► **THOMAS JEFFERSON** Members of Congress respected Thomas Jefferson's talents as a writer.

The committee asked **Thomas Jefferson** of Virginia to write the first draft. Jefferson was a 33-year-old lawyer who had studied government and law. He used this knowledge to explain his ideas. The other members of the committee also added ideas, but Jefferson was the main author. Every evening for about 17 days, he wrote and rewrote the draft of the Declaration of Independence.

READING CHECK ⚙️ CAUSE AND EFFECT

What were some of the reasons why many people in the colonies called for independence?

The Declaration of Independence

Thomas Jefferson carefully planned the Declaration of Independence. In the **preamble**, or first part, Jefferson told why the Declaration was needed. He also explained why the colonies had the right to break away from Britain and form a new nation.

Rights and Grievances

The next part of the Declaration of Independence describes the colonists' main ideas about government. It also states that all people have certain rights that governments cannot take away. Jefferson wrote that people have the right to live, be free, and seek their own happiness. These words have become some of the most famous in United States history:

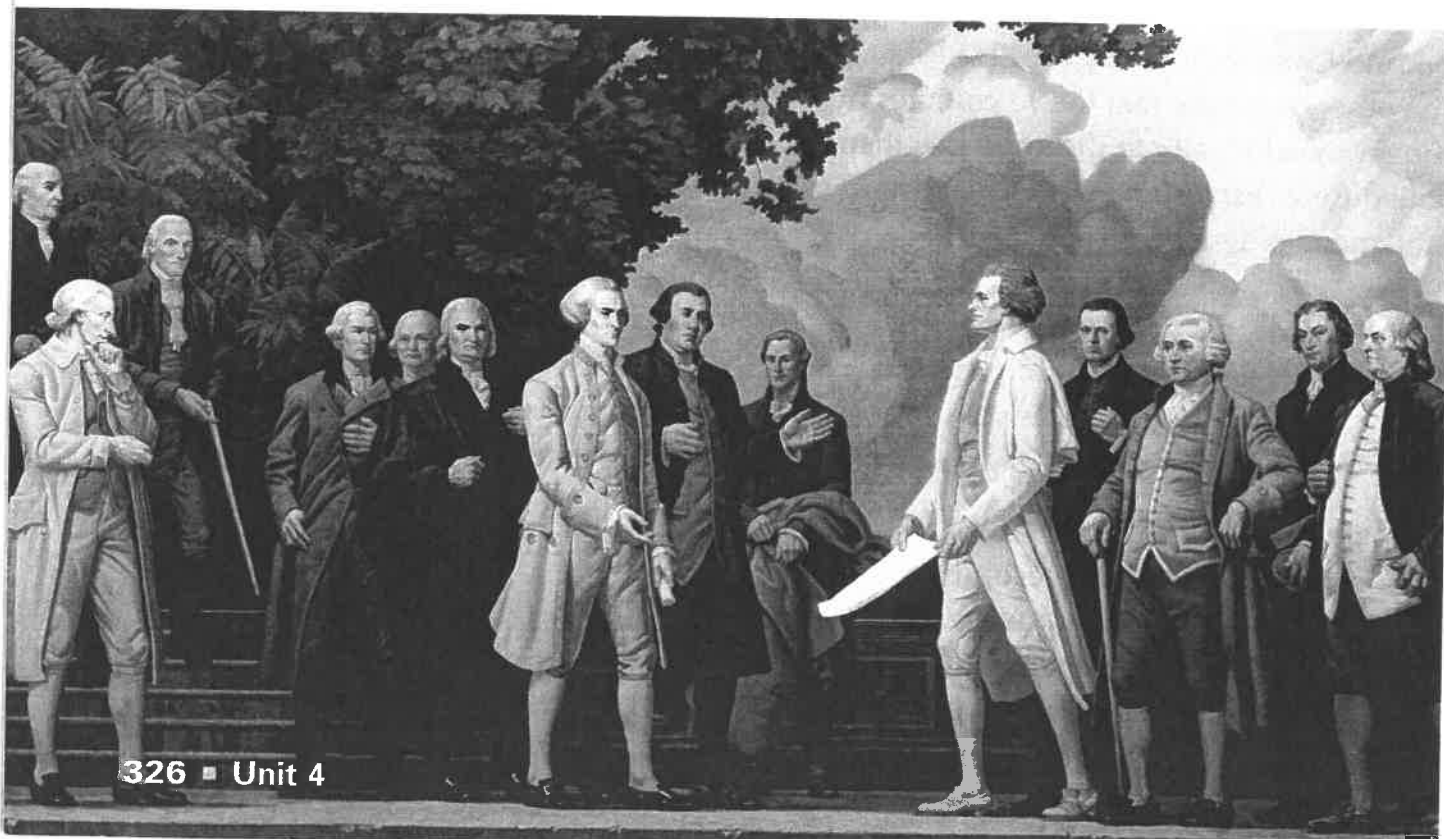
“We hold these truths to be self-evident, that all men are created equal, that they are endowed [provided] by their Creator with certain unalienable Rights, that among these are Life, Liberty, and the pursuit of Happiness.”

The longest part of the Declaration lists the colonists' **grievances**, or complaints, against King George III and Parliament. It also lists the ways the colonists had tried to settle their differences with Britain peacefully. In the last part of the Declaration, Jefferson stated that the colonies were free and independent states.

READING CHECK SUMMARIZE

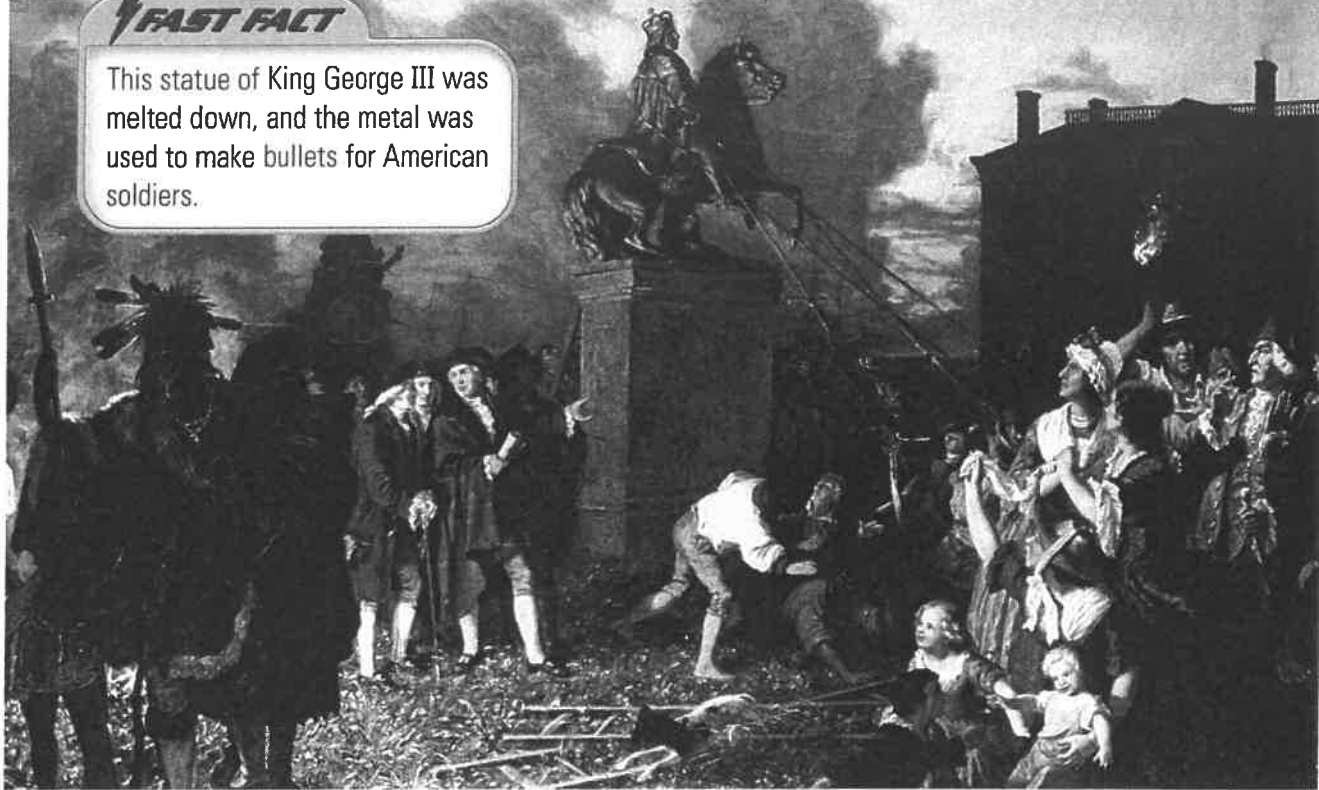
What important ideas did Thomas Jefferson give in the Declaration of Independence?

► **PRESENTING THE DECLARATION** This mural shows Thomas Jefferson handing a draft of the Declaration of Independence to John Hancock.



FAST FACT

This statue of King George III was melted down, and the metal was used to make bullets for American soldiers.



► **NEW YORK CITY** Historical paintings give an artist's view of an event. The women, children, and Native Americans shown in this painting would not have been present at this event.

Congress Approves the Declaration

When he finished writing, Thomas Jefferson gave his draft of the Declaration of Independence to Congress. On June 28, it was read aloud to the delegates. They discussed it for several days and made edits. Then, on July 2, the delegates voted to approve Richard Henry Lee's resolution to cut ties with Britain. The colonies now thought of themselves as independent states. They felt they were free to make their own laws.

A Public Reading

On July 4, 1776, Congress voted to accept the Declaration's final wording. Four days later, on July 8, large crowds

gathered outside the Pennsylvania State House, today called **Independence Hall**. Bells rang out, and Colonel John Nixon gave the first public reading of the Declaration of Independence. Members of the Second Continental Congress also listened as Nixon read.

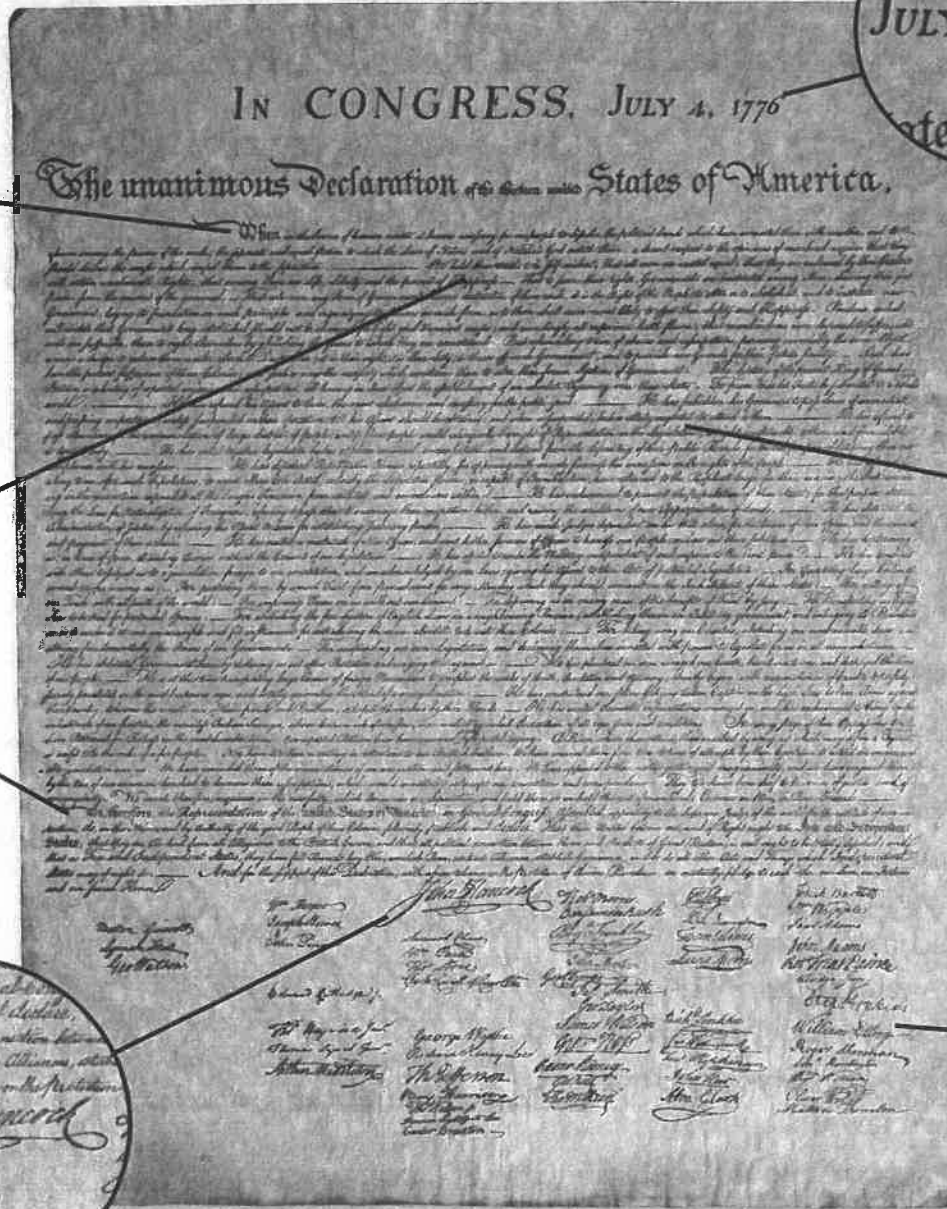
News of the Declaration quickly spread across the former colonies. Many people who supported independence tore down pictures and statues of King George III. They sang songs, rang bells, and fired cannons in celebration.

John Adams was so pleased when he heard of these celebrations that he wrote about them in a letter to **Abigail Adams**, his wife. He said that Independence Day should be celebrated "by succeeding generations . . . from this time forward."

Primary Sources

The Declaration of Independence

Background This important document includes the idea that a government gets its power from the consent of the people. You can read the full text of the Declaration on pages R23–R26.



JULY 4, 1776
ates of A

Preamble

Date

Statement of rights

Charges against the king

Statement of independence

Signers of the Declaration

John Hancock
Signature

DBQ Document-Based Question How is John Hancock's signature different from those of the other signers?

Forming a New Government

The Second Continental Congress set up another committee to plan how to unite the 13 states. John Dickinson was chosen to head the committee. It decided that each state would govern itself, but all would work together on national issues. This first plan of government for the United States was called the Articles of Confederation. It was a big change from being governed by a king.

The Articles of Confederation

The Articles of Confederation were approved by Congress in 1777 and later by the states. Under the Articles, each state elected representatives to serve in a national legislature. It was called the Confederation Congress. Each state,

whether large or small, had one vote in Congress.

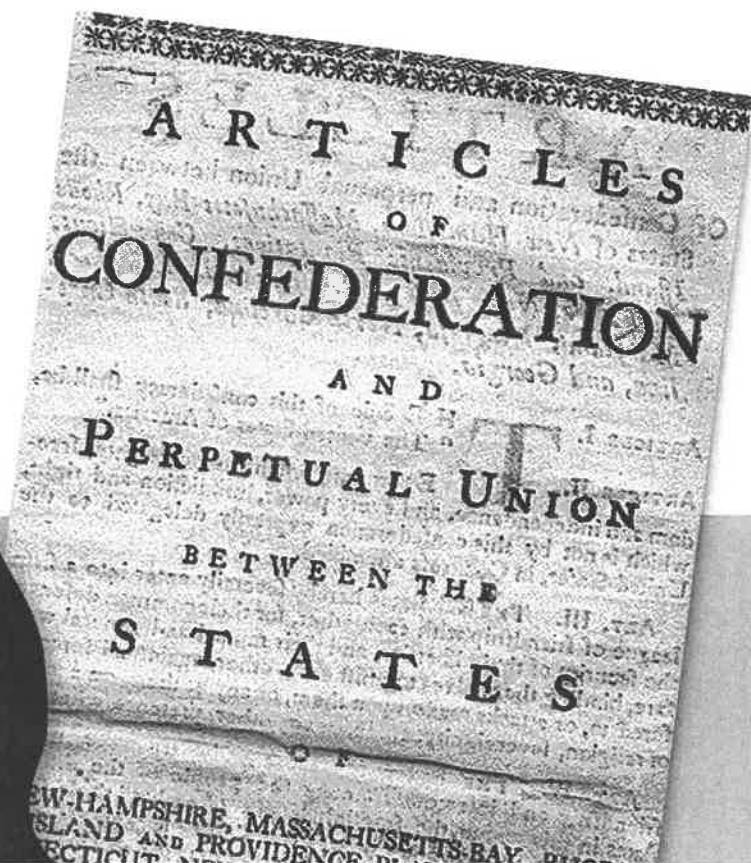
Until 1789, this Congress made laws for the new nation. It helped keep the states together during the Revolutionary War. However, the Articles had weaknesses that caused problems for the new government.

Weaknesses of the Articles

Americans were fighting a war to win their independence. They feared that a strong national, or central, government might threaten their freedom. As a result, the Articles of Confederation left most power with the states.

Before Congress could pass any law, representatives from at least 9 of the 13 states had to approve it. However, the representatives rarely agreed. No state wanted to be under the control of the other states. Even if the representatives

► JOHN DICKINSON helped write the Articles of Confederation.



A Dangerous Decision

By August 2, a copy of the Declaration was ready to be signed by the members of the Second Continental Congress. The first to sign it was John Hancock, the president of the Congress. He said that he wrote his name large enough so that King George III could read it without his glasses. The way he signed it became so famous that the term *John Hancock* now means “a person’s signature.”

Signing the Declaration was dangerous. King George III had promised to do whatever was necessary to end the rebellion. If the Americans lost the war, the British would try the signers for treason, a crime punishable by death. Benjamin Franklin joked about this when it was his turn to sign the Declaration. “We must all hang together,” he said, “or . . . we shall all hang separately.” He knew the signers had to unite against the British.

The Declaration’s Importance

When the Declaration of Independence was approved in 1776, only white men who owned property could vote. Some people believed that was unfair. In a letter to her husband in March 1776, Abigail Adams wrote about her belief that Congress should recognize women’s rights. She wrote, “In the new code of law which I suppose it will be necessary for you to make, I desire you would remember the ladies. . . .”

It would take many years for women, African Americans, Native Americans, and other groups of Americans to share fully in the promise of the Declaration of Independence. However, the Declaration has inspired people around the world to work for freedom and equal rights.

READING CHECK CAUSE AND EFFECT

Why were the delegates worried about signing the Declaration?

► **A HISTORIC ROOM** The Declaration of Independence was first presented in the Assembly Room of the Pennsylvania State House.



approved a law, Congress did not have the power to enforce it.

The Articles limited the powers of the national government in other ways, too. For example, Congress had the power to declare war, make treaties, and borrow money. However, it could not control trade or collect taxes. To cover expenses, such as debts from the war, Congress could only ask the states for money. It could not force the states to pay.

The Articles also made Congress depend on the states for the nation's defense. Congress could ask for an army, but the states had to provide the soldiers.

READING CHECK CAUSE AND EFFECT

Why were the new states afraid of a strong national government?

► **EARLY MONEY** Most states printed their own money. This money might not be accepted in other states.


Summary

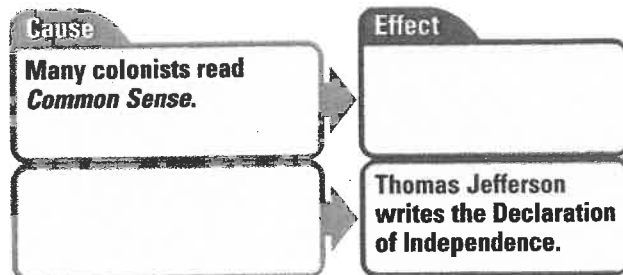
Partly because of Thomas Paine's *Common Sense*, many colonists began to call for independence. Thomas Jefferson wrote the Declaration of Independence. Later, Congress passed the Articles of Confederation, the country's first plan of government.



REVIEW

- 1. WHAT TO KNOW** How did the 13 colonies cut their ties with Britain?
- 2. VOCABULARY** Use the words **preamble** and **grievance** in a sentence about the Declaration of Independence.
- 3. CIVICS/GOVERNMENT** What are some of the ideas described in the Declaration of Independence?
- 4. CRITICAL THINKING Make It Relevant** How do the ideas in the Declaration of Independence affect your life?
- 5. WRITE A PERSUASIVE LETTER** Imagine it is 1776. Write a letter to the local newspaper. Tell why you do or do not support independence for the 13 colonies. Include evidence that supports your argument.

- 6. CAUSE AND EFFECT**  On a separate sheet of paper, copy and complete the graphic organizer below.





Identify Multiple Causes and Effects

Why It Matters To understand why things happen, it is important to identify multiple causes and effects.

► LEARN

Sometimes events in history have more than one cause and more than one effect. A **cause** is an event or an action that makes something happen. An **effect** is what happens as a result of that event or action. You can use these steps to help you identify multiple causes and their effects.

Step 1 Look for the effects. Decide whether there is more than one effect.

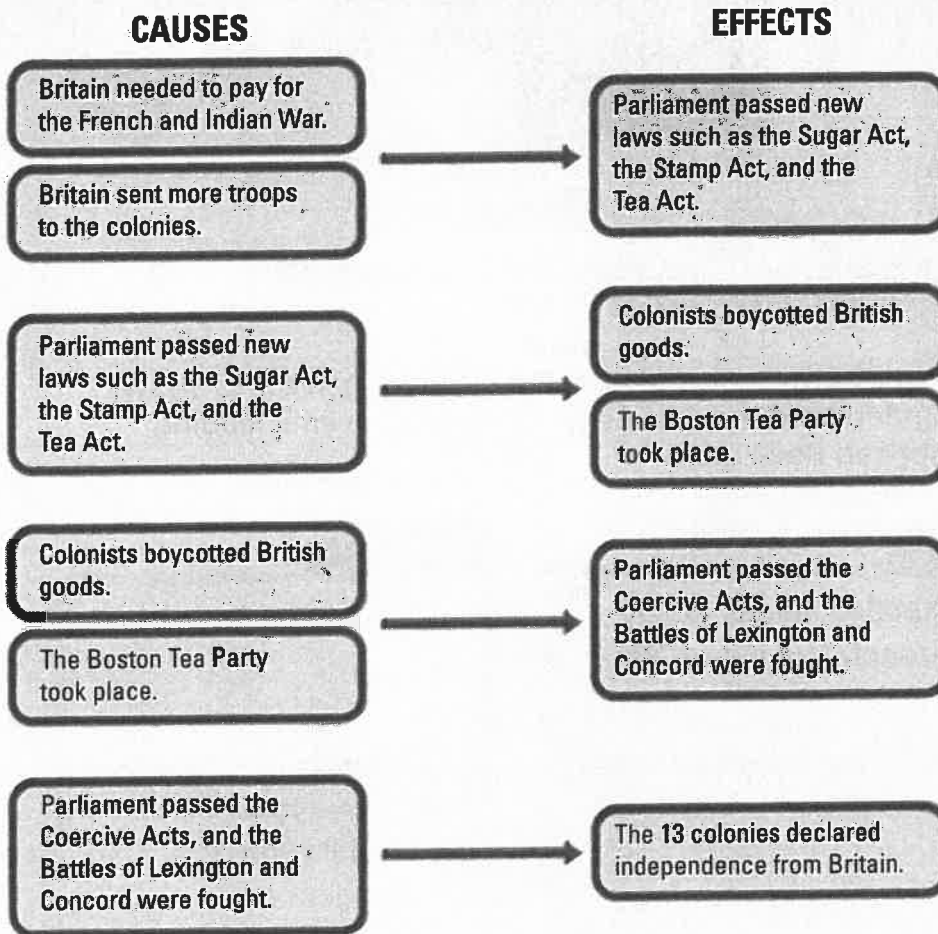
Step 2 Look for the causes of the effects.

Step 3 Think about the connections between the causes and their effects. An effect of one event can become the cause of another event.

► **THE BATTLE OF LEXINGTON** What were some effects of the event shown here?



Multiple Causes and Effects of the Revolution



► PRACTICE

The chart above lists many of the causes and effects of British actions toward the colonies. Use the chart to answer these questions.

- 1 What caused new taxes such as the Stamp Act to be passed?
- 2 What were the effects of new tax laws being passed?
- 3 What effect did the Coercive Acts and the Battles of Lexington and Concord have?

► APPLY

Review this chapter. Find at least one multiple cause-and-effect relationship other than those shown in the chart. Then share your findings with a classmate.

1750

1760

Visual Summary



1754
The French and Indian War begins

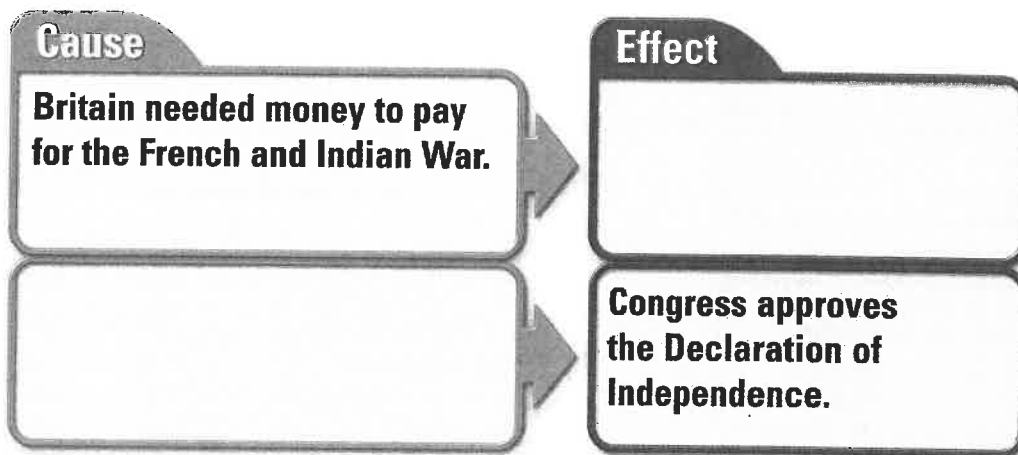


1765
Parliament passes the Stamp Act

Summarize the Chapter



Cause and Effect Complete this graphic organizer to show that you understand the causes and effects of events leading to the American Revolution.



Vocabulary

Identify the term from the word bank that correctly matches each definition.

- to refuse to buy
- the act of working against one's own government
- a sudden change of government
- a plan for spending money
- the act of speaking or acting for someone else
- freedom to govern on one's own

- a formal agreement among groups or individuals
- a signed request

Word Bank

- | | |
|------------------------------|----------------------------|
| alliance p. 296 | boycott p. 304 |
| budget p. 299 | petition p. 313 |
| representation p. 303 | revolution p. 315 |
| treason p. 303 | independence p. 325 |

1770

1780

1790



1775

The Battles of Lexington and Concord are fought



1776

Declaration of Independence is signed



Time Line

Use the chapter summary time line above to answer these questions.

- In what year did the French and Indian War start?
- Did the first battles of the Revolutionary War start before or after the Declaration of Independence was signed?



Facts and Main Ideas

Answer these questions.

- What was the purpose of the Proclamation of 1763?
- Why did many colonists boycott British goods?
- How did the Battle of Bunker Hill change Britain's view of the colonists?

Write the letter of the best choice.

- Who was chosen to be the commander in chief of the Continental Army?
 - Samuel Adams
 - Thomas Gage
 - Thomas Jefferson
 - George Washington
- Who headed the committee that wrote the Articles of Confederation?
 - George Washington
 - John Dickinson
 - Thomas Jefferson
 - Richard Henry Lee



Critical Thinking

- What effects did the Committees of Correspondence have on the colonies?
- What were some of the benefits of declaring independence? What were the costs?



Skills

Compare Historical Maps

- Study the maps on page 301. Explain how Britain's land claims changed as a result of the French and Indian War.

Identify Multiple Causes and Effects

- Draw a chart like the one on page 333 to show the causes and effects of the French and Indian War.

writing



Write a Persuasive Letter

Imagine that you are a member of the First Continental Congress. Write a letter to persuade King George III that he ought to respect the colonists' rights.



Write a Narrative

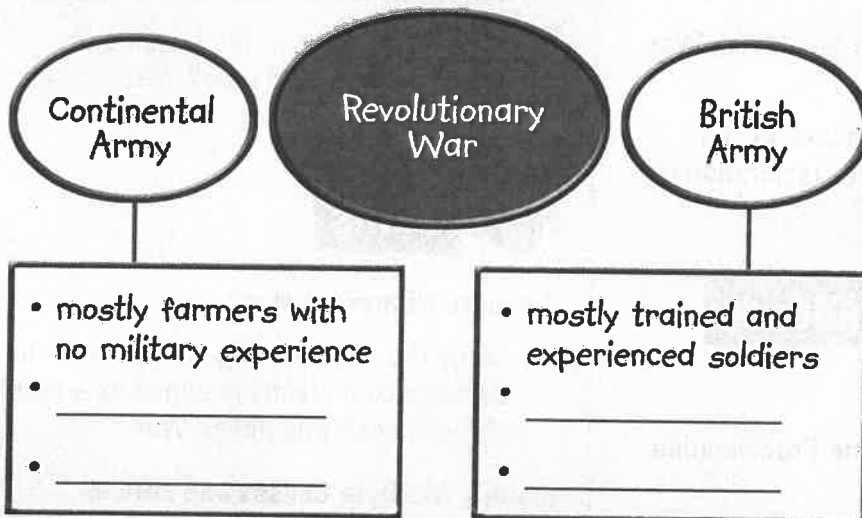
Imagine that you are a newspaper reporter assigned to write about the Boston Massacre. Write a narrative describing the events. Use details from your reading and Paul Revere's engraving on page 308 to help you.

STUDY SKILLS

ORGANIZE INFORMATION

Graphic organizers can help you organize information.

- **Graphic organizers help you categorize, or group, information.**
- **Putting people, places, and events into categories makes it easier to find facts and understand what you read.**



PREVIEW VOCABULARY



Patriot p. 339



mercenary p. 347



campaign p. 349

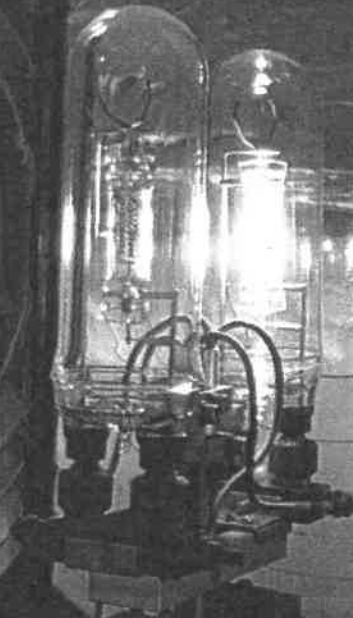
Essential Question

What Are Some Properties of Light?

Engage Your Brain!

Find the answer to the following question in this lesson and record it here.

Why do lighthouses use lenses?



Active Reading

Lesson Vocabulary

List the terms. As you learn about each one, make notes in the Interactive Glossary.

<hr/>	<hr/>
<hr/>	<hr/>
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Compare and Contrast

Many ideas in this lesson are connected because they explain comparisons and contrasts—how things are alike and different. Active readers stay focused on comparisons and contrasts when they ask themselves, How are these things alike? How are these things different?

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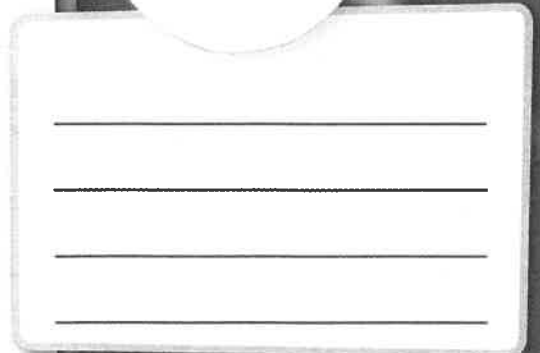
Just Passing Through

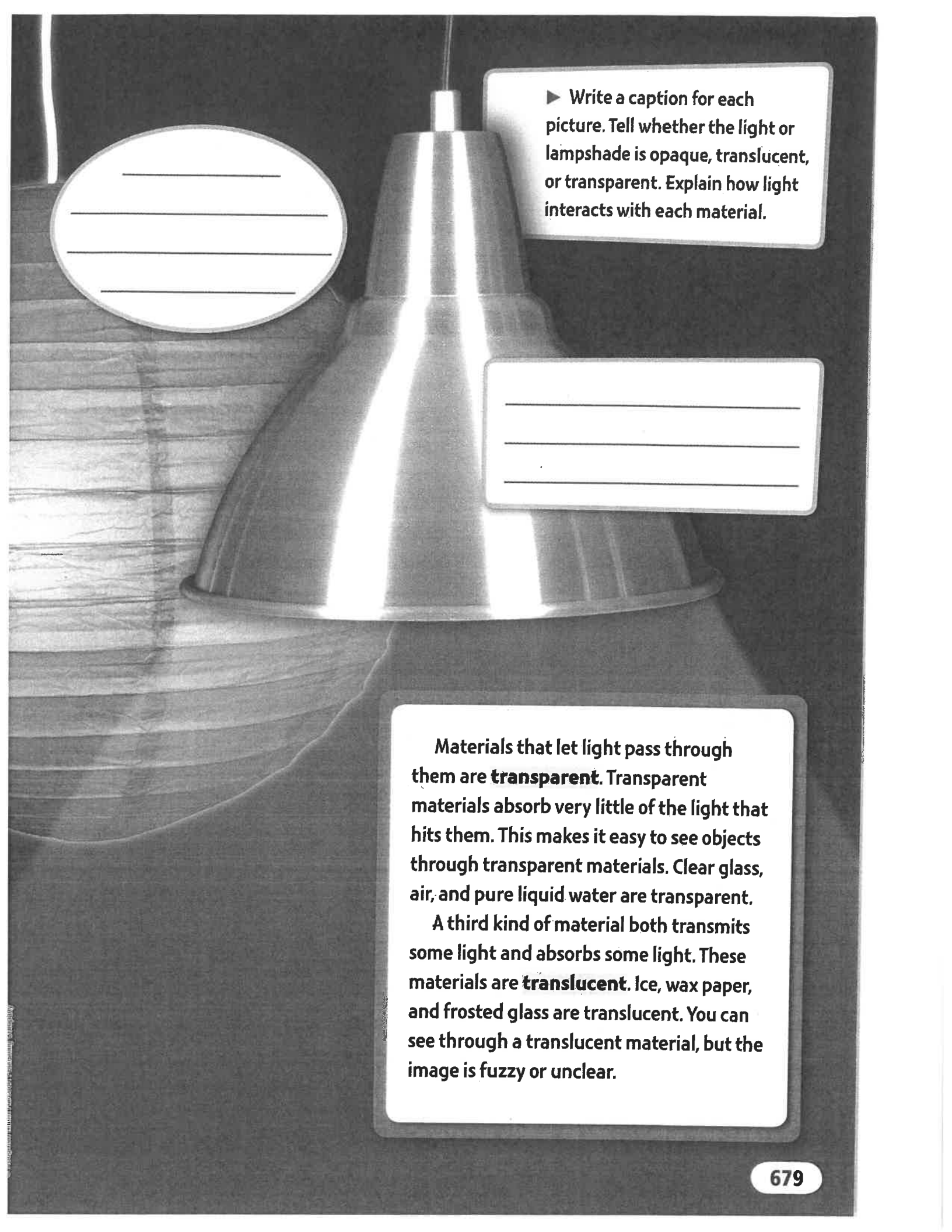
Light acts differently when it strikes windows, thin curtains, or brick walls. How does each material affect the light that strikes it?

Active Reading As you read these two pages, underline sentences that provide details about how light acts when it strikes different materials.

Light travels outward in all directions from its source until it strikes something. Light behaves in different ways depending on the kind of matter it meets. Most objects absorb some of the light that hits them. The amount of light absorbed depends on the material the object is made of.

Opaque materials do not let light pass through them. Instead, the material absorbs light—light enters the material but doesn't leave it. When a material absorbs light, the energy from the light is transferred to the material. Many solid objects are opaque because they are made of materials such as metal, wood, and stone that do not allow light to pass through. Objects that are opaque cause shadows to occur because the objects absorb or reflect all of the light that hits them.





► Write a caption for each picture. Tell whether the light or lampshade is opaque, translucent, or transparent. Explain how light interacts with each material.

Materials that let light pass through them are **transparent**. Transparent materials absorb very little of the light that hits them. This makes it easy to see objects through transparent materials. Clear glass, air, and pure liquid water are transparent.

A third kind of material both transmits some light and absorbs some light. These materials are **translucent**. Ice, wax paper, and frosted glass are translucent. You can see through a translucent material, but the image is fuzzy or unclear.

Mirror, Mirror

Did you look at yourself in a mirror as you got ready for school? The properties of light enabled you to see your image.

Active Reading As you read these two pages, draw boxes around the words or phrases that signal when things are being contrasted.

The bouncing of light off an object is known as **reflection**. When light traveling from an object strikes a smooth, shiny surface, such as a mirror, all of the light hitting the surface from one direction is reflected in a single new direction. Your eyes detect the reflected light, and you see a clear, reversed image of the object—a reflection. In contrast, you can't see an image in something with a rough surface, such as cloth or wood, because the roughness causes light to reflect in many directions.

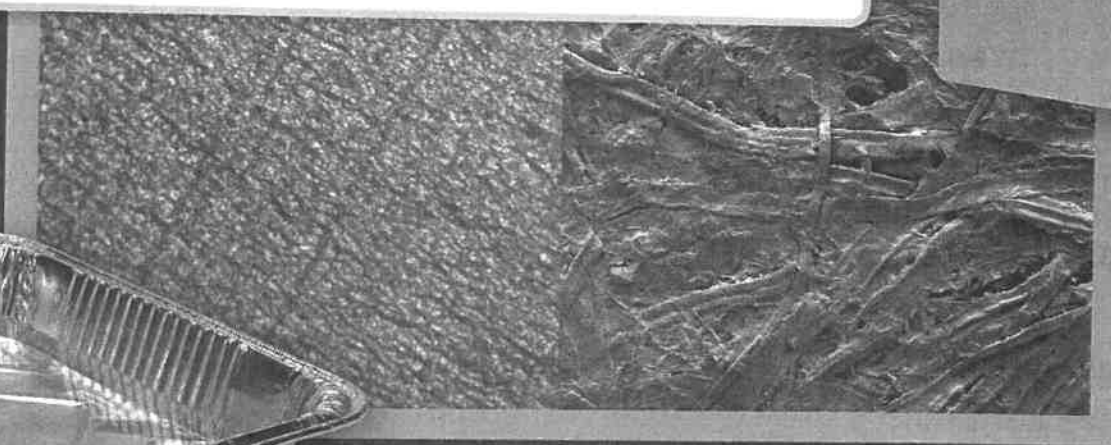
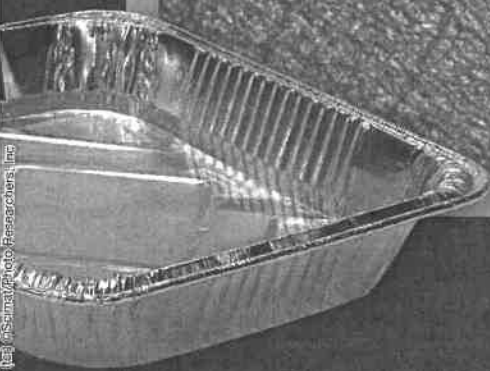
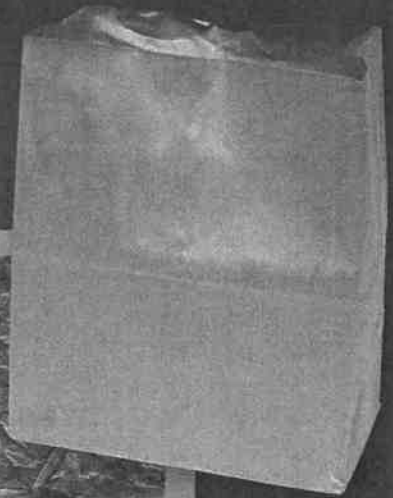


The smooth surface of the water acts like a mirror. Light rays are reflected back in a way that enables you to see a clear, reversed image.



The backpack appears yellow because its material reflects yellow light and absorbs all other colors of light.

► Compare the surfaces of the metal container and the paper bag. The smooth surface reflects light in a single direction back to your eyes. The rough surface reflects light in all directions. Identify the material that would produce the better reflection.



► When we look at these fruits and vegetables, we see a variety of colors.



Choose one fruit or vegetable. Explain why it's the color it is.

How an object reflects light also determines what colors you see. As light strikes the surface of an object, the object absorbs certain colors of light and reflects others. A ripe strawberry absorbs nearly all colors of light, but it reflects red light. So, your eyes see the strawberry as red. Grass reflects green light while absorbing all other colors.

Black objects absorb all colors of light. They also absorb more of the energy in light. White objects, though, reflect all colors of light and absorb less energy. Because white clothes don't absorb as much energy, wearing white rather than dark clothes on a bright, hot day will keep your body cooler.

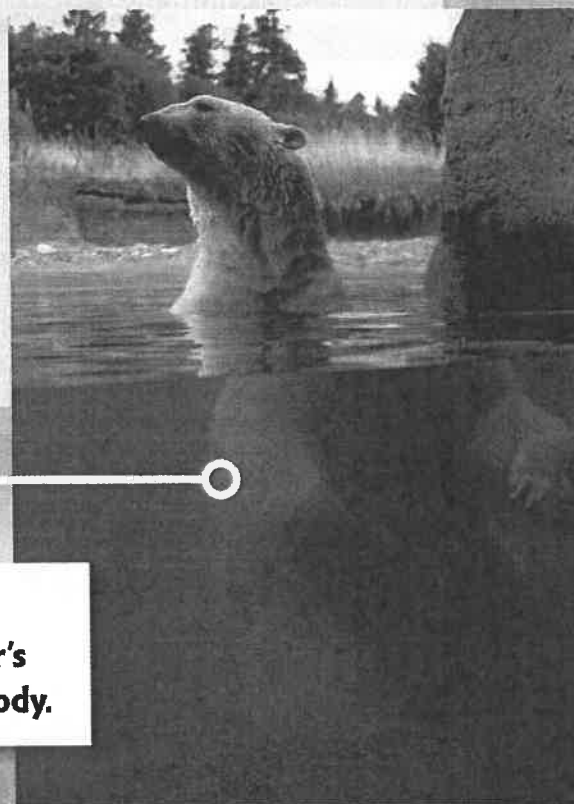
Light Bends

What happened to the straw in the glass? Did someone break it? No! What you are observing is another property of light—refraction.

Active Reading As you read these pages, underline words that identify the cause of refraction. Circle words that identify an effect of refraction.



The bending of light as it passes at an angle from one type of matter into another is called **refraction**. Refraction occurs because the speed of light varies depending on the material through which the light travels. As the light changes speed, it bends. Look at the straw at the top of this page. Light from the top of the straw passes through the air and the glass to your eyes. But light from the bottom part starts out in the water and passes into the glass and then into the air. Each time the light enters a new material, it bends slightly because it changes speed. By the time this light reaches your eyes, it is coming from a different angle than the light from the top of the straw. As a result, the straw appears to be bent or broken.

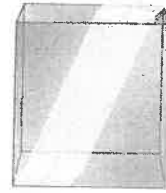


Refraction produced the illusion that this polar bear's head is separate from its body.

Do the Math!

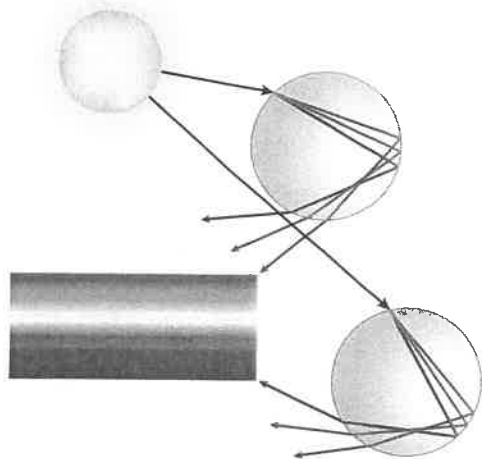
Angles of Refraction

The diagram shows how light bends as it enters and then exits a transparent material. Use a protractor to measure the angles formed as the light is refracted.



A **prism** is a transparent material that separates white light into its component colors by refraction. When white light enters a prism, the different colors of light bend at different angles. The light moves through the prism and exits it as a rainbow.

Light bends in other ways. *Diffraction* is the bending of light around barriers or through openings. If you look at the edges of a shadow cast in bright sunlight, you may notice that the edges of the shadow are blurry. This blurriness is caused by light bending around the edge of the object. The colors of the sunset are a result of diffraction as sunlight bends around particles in the air.



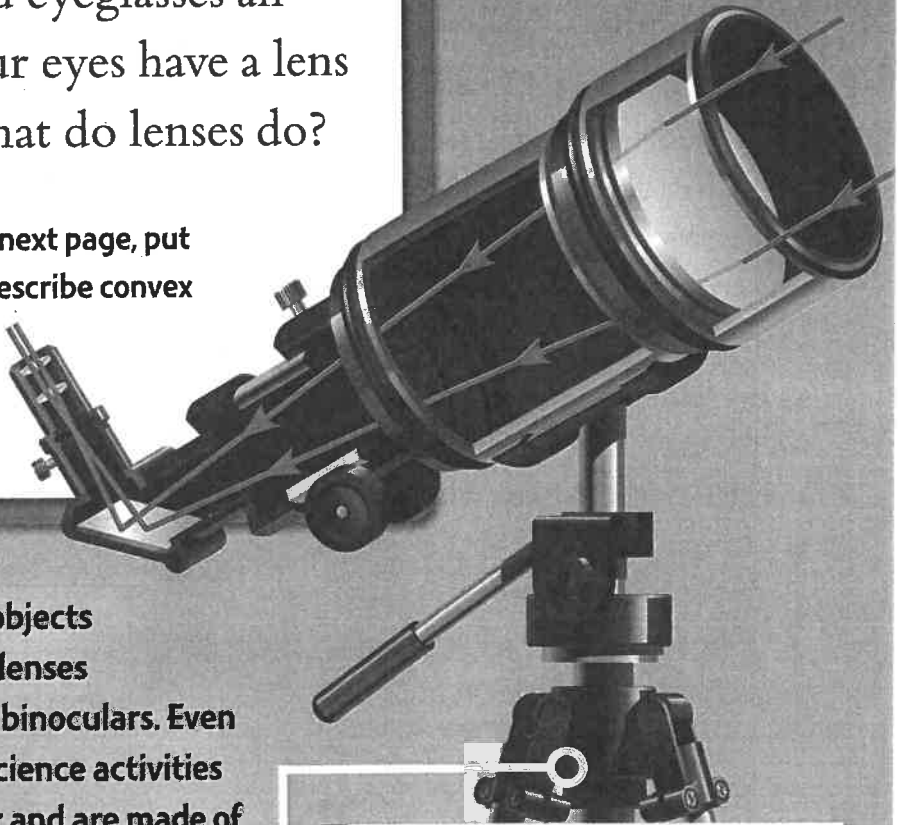
Rainbows are a product of refraction and reflection. Sunlight separates into colors as it passes from the air into a water droplet. The colored light is reflected off the back of the drop, and it is refracted again as it passes into the air. Light from many droplets forms the arcs of color in a rainbow. Red light comes from droplets higher in the air, and violet light comes from lower droplets.

Lenses

Cameras, telescopes, and eyeglasses all contain lenses. Even your eyes have a lens inside each of them! What do lenses do?

Active Reading As you read the next page, put brackets [] around the details that describe convex and concave lenses. Draw a line under the main idea that the details help explain.

Lenses are curved transparent objects that refract light. You can find lenses in DVD players, photocopiers, and binoculars. Even the microscope you use in many science activities has a lens. Most lenses are circular and are made of clear glass or plastic. Many devices use a series of lenses to make images clearer. Lenses vary greatly in size. Microscopes use several tiny lenses to magnify small objects. The Yerkes Observatory in Wisconsin has a reflecting telescope with a lens that is over a meter in diameter!



Telescopes use lenses to magnify objects. Incoming light moves through a convex lens, which bends light toward the center of the tube and brings it into focus. The concave eyepiece lens magnifies the image.



Convex lenses have an outward curve on at least one side. The other side may be curved or flat. These lenses refract light toward a focus, or focal point.



Most concave lenses have an inward curve on both sides. These lenses spread light waves apart.

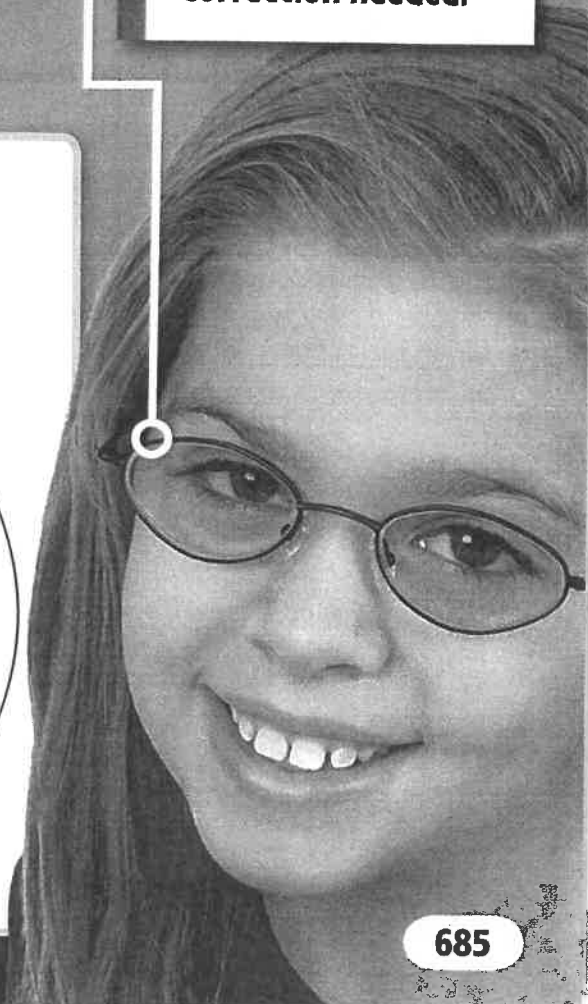
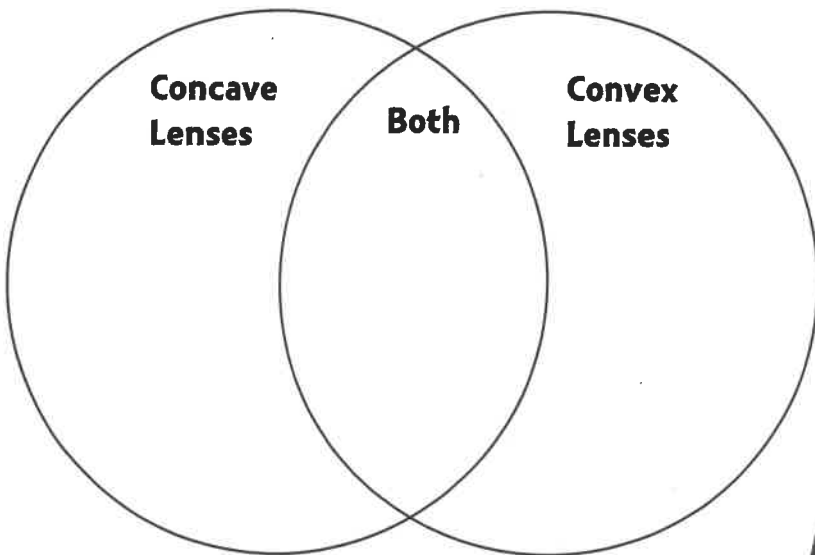
A *convex lens* is a lens that is thicker at the center and thinner at the edges. Convex lenses are sometimes called *positive lenses* because they bring light waves together. In other words, a convex lens focuses light. This bending allows an image to form at a point called the *focal point*.

A *concave lens* is a lens that is thicker at the edges and thinner at the center. Sometimes called *negative lenses*, concave lenses spread light waves apart from a focal point.

Eyeglasses may have concave or convex lenses, depending on the type of vision correction needed.

Concave, Convex, or Both?

Fill in the Venn diagram to compare and contrast concave and convex lenses.



Sum It Up!

When you're done, use the answer key to check and revise your work.

Use the terms below to fill in the graphic organizers about some properties of light.

reflection

translucent

diffraction

opaque

refraction

transparent

Descriptions of Ways Different Materials Absorb Light

1. _____

2. _____

3. _____

The Bouncing or Bending of Light

4. _____

5. _____

6. _____

Name _____

Word Play

1 Use the clues to help you write the correct word in each row. Some boxes have already been filled in for you.

a.			F	R				I		
b.			F	R				I		
c.			F					I		
d.							R	I		
e.			A				R			
f.			A							
g.			A							

Clues

- This makes the edges of a shadow look blurred.
- It's another way of saying "the bending of light."
- This is the word for the bouncing of light off an object.
- This object will separate light into the colors of the spectrum.
- This word describes objects that let light pass through them.
- This word describes objects that let only some light pass through them.
- This word describes objects that let little or no light pass through them.

transparent*

reflection*

prism*

diffraction

translucent*

opaque*

refraction*

* Key Lesson Vocabulary

Bonus

The prefix *con-* means "with." What words with this prefix can you find in the lesson?

Apply Concepts

2

Which is better: checking your appearance in a regular mirror or checking it in a sheet of crumpled aluminum foil? Explain why one reflective surface is better than the other.

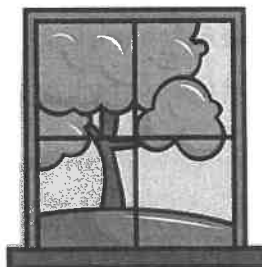
3

Explain why the fisherman is having a hard time catching the fish.



4

Circle the image that shows an opaque material.



Take It Home!

With a family member, walk through the rooms of your home and identify opaque, transparent, and translucent objects. See how many surfaces you can find in which you can see a reflection.