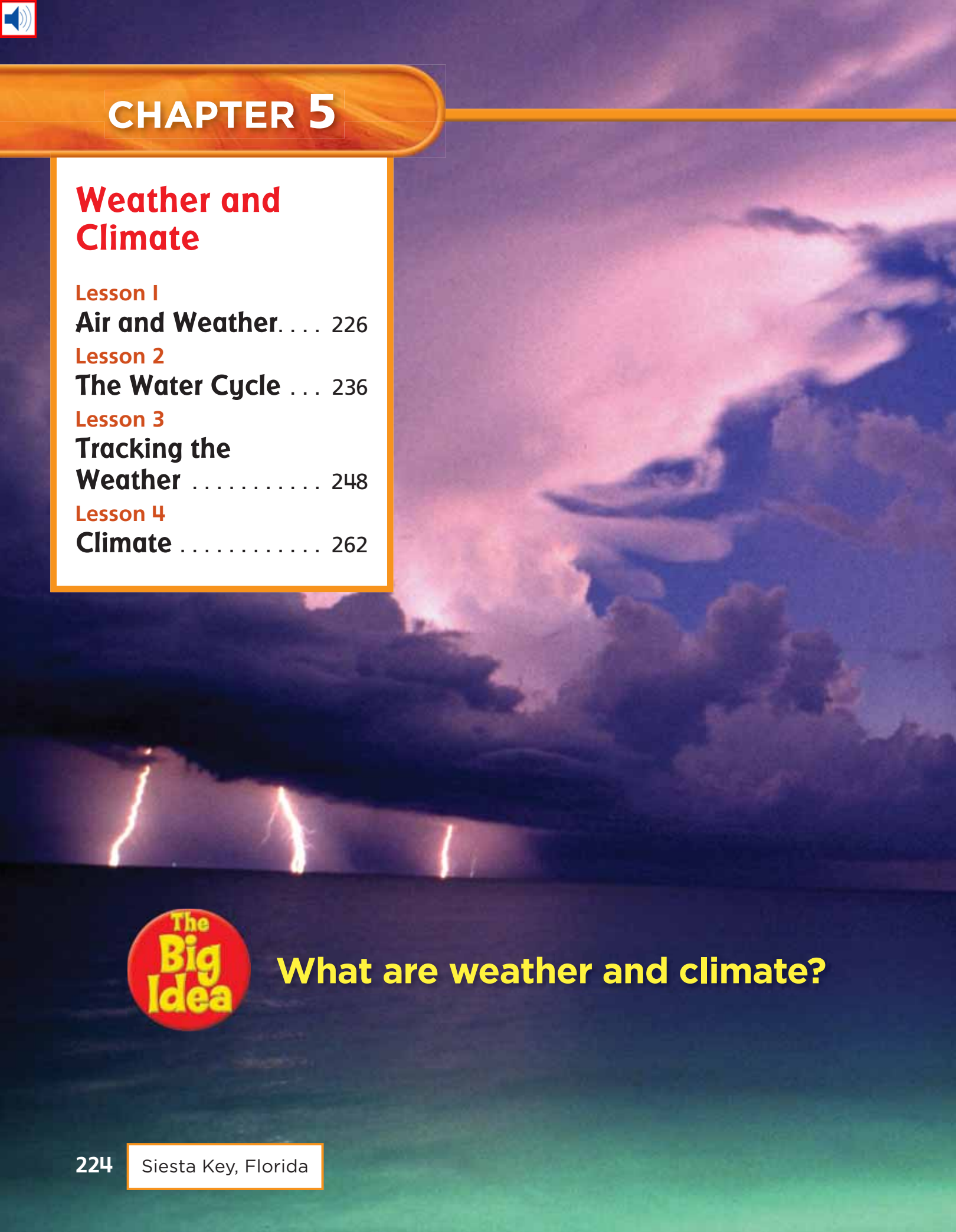


CHAPTER 5

Weather and Climate

The Big Idea

What are weather and climate?

224 Siesta Key, Florida

Key Vocabulary

atmosphere
the blanket of gases that surrounds Earth (p. 228)

condensation
the process of a gas changing to a liquid (p. 239)

cloud
a collection of tiny droplets or ice crystals that hangs in the air (p. 239)

air mass
a large region of the atmosphere where the air has similar properties throughout (p. 250)

front
a boundary between air masses with different temperatures (p. 251)

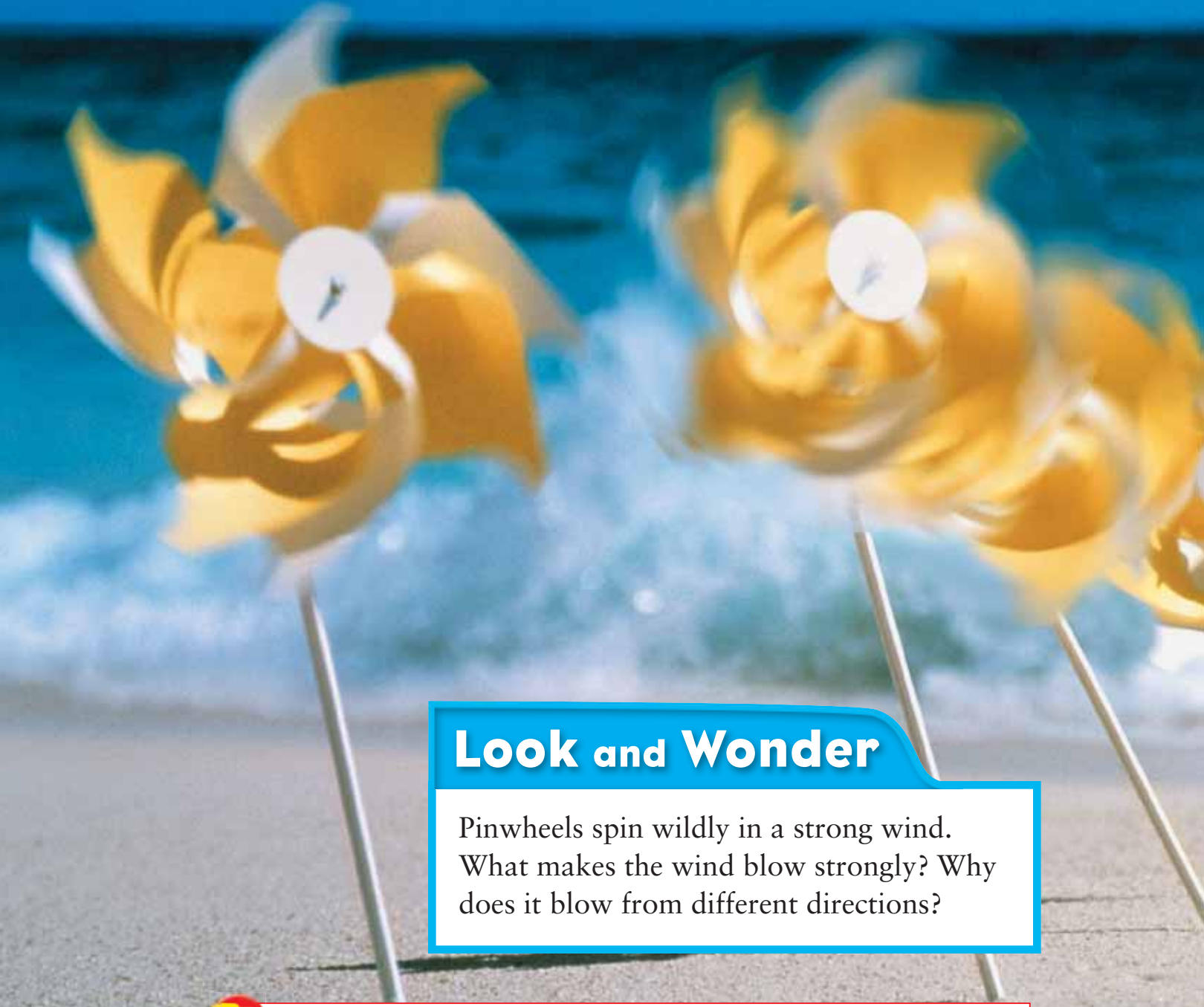
climate
the average weather pattern of a region over time (p. 264)

More Vocabulary

temperature, p. 230
humidity, p. 230
air pressure, p. 231
thermometer, p. 232
barometer, p. 232
wind vane, p. 232
evaporation, p. 238
water vapor, p. 238
freeze, p. 239
precipitation, p. 239
water cycle, p. 240
melt, p. 244
warm front, p. 251
cold front, p. 251
stationary front, p. 251
forecast, p. 253
current, p. 266

Lesson 1

Air and Weather



Look and Wonder

Pinwheels spin wildly in a strong wind. What makes the wind blow strongly? Why does it blow from different directions?

4-4.5. Carry out the procedures for data collecting and measuring weather conditions (including wind speed and direction, precipitation, and temperature) by using appropriate tools and instruments.

Explore

Inquiry Activity

How does the wind move?

Make a Prediction

Air can move from place to place. When you open a sealed bottle of liquid that is under pressure, air moves. Does the air move into or out of the bottle? Why? Write your prediction.

Test Your Prediction

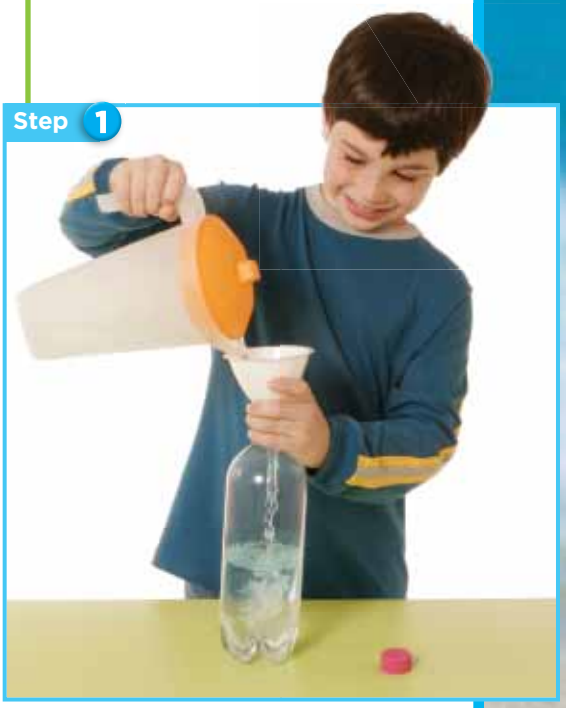
1. **Make a Model** Fill an empty plastic bottle halfway with very warm water from a faucet.
2. **Be Careful.** Pour warm liquids carefully. Place the cap on the bottle. Shake the bottle several times. Pour the water out. Replace the cap and set the bottle on a table. Observe it for several minutes.
3. **Observe** Hold the bottle near your ear. Remove the cap slowly. Listen carefully.

Draw Conclusions

4. Did air move into or out of the bottle? What happened to the pressure inside the bottle before the cap came off? After it came off?
5. **Infer** How might air pressure affect the direction from which winds blow? Use evidence from your model in your answer.

Materials

- bottle with cap
- funnel
- very warm water



Explore More

Suppose you warm the air inside a capped bottle. What will happen to the air pressure inside the bottle? Write a prediction. Try it!

4-I.7. Use appropriate safety procedures when conducting investigations.

Read and Learn

Main Idea 4-4.5

Earth's atmosphere has properties that we can measure to describe weather.

Vocabulary

atmosphere, p. 228

temperature, p. 230

humidity, p. 230

air pressure, p. 231

thermometer, p. 232

wind vane, p. 232

barometer, p. 232

rain gauge, p. 232

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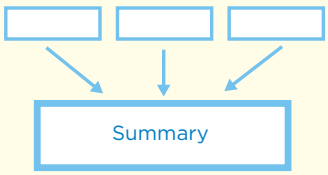
Reading Skill

Summarize



What is in the air?

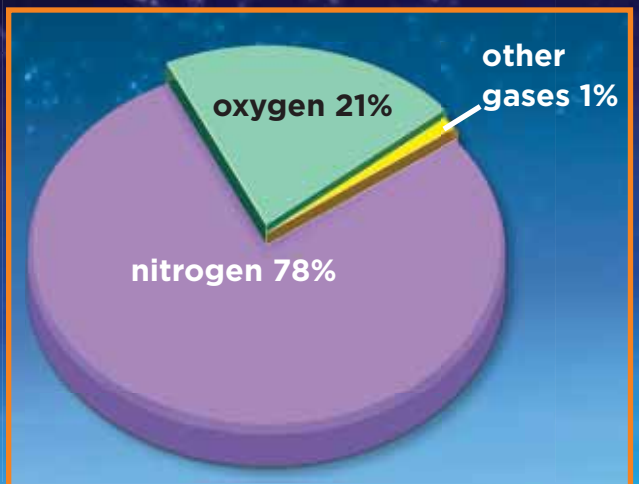
When you think of wind, what comes to mind? Wind is really just air in motion. In fact, air surrounds Earth like a thin blanket. This blanket of air is the **atmosphere** (AT•muhs•feer).

Gases

The atmosphere is a mix of different gases. You can tell from the pie chart that most of the atmosphere is made of nitrogen (NYE•truh•juhn) and oxygen. Without these gases, life could not exist on Earth!

The atmosphere also has a few other gases, including carbon dioxide and water vapor. These gases are important to Earth's water cycle.

Layers of Earth's Atmosphere



Most of the air we breathe in the troposphere is oxygen and nitrogen.

The Troposphere

Earth's atmosphere is made up of layers. The layer closest to Earth's surface is the *troposphere* (TROHP•uh•sfeer). Compared to the rest of the atmosphere, the troposphere is very thin. Yet all of Earth's life exists here.

The troposphere is also where all of Earth's weather takes place. Here the air is always on the move. Air that moves from place to place is called *wind*. Wind can be as gentle as a light breeze. It can be as fierce as a tornado. Any change in the wind brings a change in the weather.

Other Layers of the Atmosphere

The diagram shows three other layers of Earth's atmosphere. The stratosphere (STRAT•uhs•feer) is the layer above the troposphere. There, temperatures get warmer as you go higher. Temperatures get colder in the mesosphere (MEZ•uh•sfeer) and thermosphere (THURM•uh•sfeer).

Quick Check

Summarize How are the troposphere and the atmosphere related?

Critical Thinking In what way is Earth's atmosphere like an orange peel? How is it different?

Read a Diagram

Which layer of the atmosphere is thickest?

Clue: Use subtraction. The numbers tell you the height of each layer above Earth's surface.

What are some properties of weather?

Wind is an important part of Earth's weather. *Weather* is the condition of the atmosphere at a given time and place.

Air Temperature

Temperature (TEM•puhr•uh•chuhr) describes how hot or cold something is. When the Sun's energy heats Earth's surface, the surface warms the air above it. The temperature of the air rises. If the air temperature changes, the air moves. Winds start to blow. Temperature affects wind speed and wind direction.

Humidity

If the air around us feels damp and sticky, we call the weather humid (HYEW•mid). **Humidity** (hyew•MID•i•tee) is a measure of how much water vapor is in the air. Deserts usually have very low humidity. Rain forests have very high humidity.

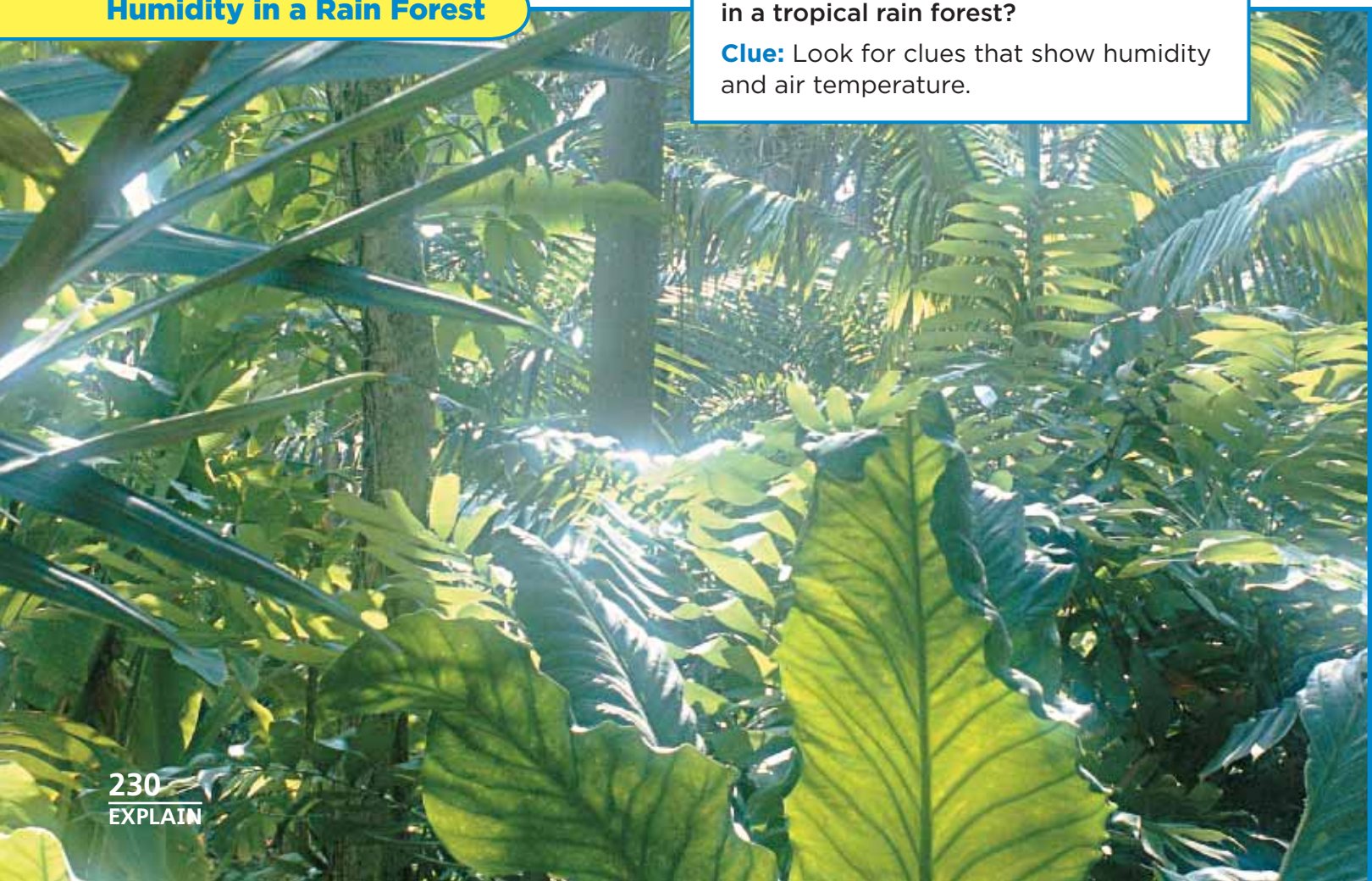
Air always has some amount of water vapor. Most of it comes from ocean water that evaporates from a liquid to a gas. This is why the air over oceans and lakes is humid.

Read a Photo

What can you infer about the weather in a tropical rain forest?

Clue: Look for clues that show humidity and air temperature.

Humidity in a Rain Forest



Mountain climbers use special equipment to deal with low temperature and low air pressure.

Air Pressure

We live at the bottom of the troposphere. Here, the weight of the entire atmosphere pushes down on us. The force of air pushing on an area is called **air pressure**.

Particles of cool air are closer together than particles of warm air. In the same amount of space, cool air weighs more than warm air. Air that weighs more has greater air pressure. Therefore, cool air has higher air pressure than warm air.

Precipitation

Any form of water that falls from clouds is *precipitation* (pree•sip•uh•TAY•shuhn). The term includes rain, snow, sleet, and hail. The amount of precipitation is an important property of weather.

Quick Lab

Humidity in a Cup

1. Pour 5 mL of water in each of two cups. Cover each cup with plastic wrap.
2. Place one cup in the refrigerator for ten minutes. Keep the other cup on a flat surface.

3. **Observe** Remove the cup from the refrigerator. Set it beside the other cup. Observe and compare the water in both cups. What differences do you notice?
4. **Infer** Which cup do you think has greater humidity—the warm cup or the cold cup? How do you know?

Quick Check

Summarize What properties can you use to describe the weather?

Critical Thinking What role does the Sun play in Earth's weather?

FACT Humidity on Earth's surface never reaches zero.

How can you measure weather?

Weather scientists often collect data from a place called a weather station. You can set up your own weather station! All you need are a few of the tools shown on this page.

A *hygrometer* (hye•GROM•i•tuhr) measures humidity. ▲

◀ A thermometer measures air temperature in degrees Celsius (°C) or degrees Fahrenheit (°F).

A wind vane points in the direction from which the wind is blowing. ▶

A barometer measures air pressure. ▶

An *anemometer* (an•uh•MOM•i•tuhr) measures wind speed. The faster the wind blows, the faster the cups spin. ▼

◀ A rain gauge (GAYJ) is a tube that collects water. It shows the amount of rainfall.

Quick Check

Summarize What tools could you use to measure the weather?

Critical Thinking Why do scientists use different tools to measure weather?

Lesson Review

Visual Summary

Earth's atmosphere is made of gases. It has several layers. The troposphere is the layer where weather forms.

We can describe the **properties of weather** using air temperature, humidity, air pressure, precipitation, and wind.

Scientists use many different **tools to measure weather**, such as hygrometers and thermometers.

Make a FOLDABLES™ Study Guide

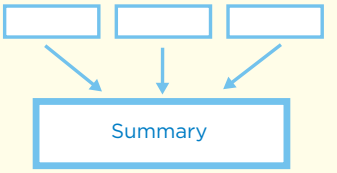
Make a Three-Tab Book. Use it to summarize what you read about air and weather.

Think, Talk, and Write

1. **Main Idea** What properties describe the weather? How can you measure them?

2. **Vocabulary** A(n) _____ measures the speed of the wind.

3. **Summarize** What are the different parts of Earth's atmosphere?



4. **Critical Thinking** Compare and contrast two examples of weather that you have experienced. Your comparison should include the vocabulary terms from this lesson.

5. **Test Prep** **In which layer of the atmosphere do we experience weather?**

   A the thermosphere
   B the stratosphere
   C the mesosphere
   D the troposphere

Math Link

Find the Average Rainfall
It rains 4 cm on Monday, 8 cm on Tuesday, and 6 cm on Wednesday. What is the average rainfall for the three days?

Health Link

Report on Staying Healthy
How do people stay healthy when the air temperature is very cold or very hot? Research the answers. Report on your findings.

WATCHING SPRING WEATHER

Spring weather can be very different from day to day. Last week, we had a stretch of sunny and mild spring weather. Temperatures were in the seventies. At night, they dropped to the mid-sixties. The air was pretty still, with a gentle breeze moving in every now and then.

Then the barometer started to fall rapidly. This signaled an approaching storm.

Yesterday strong winds swept in from the northwest. A heavy rain began to fall. The temperature was 41°F at noon. At night, it fell to the low thirties.

Today it is cloudy and overcast. The temperatures are in the high forties. The wind speed is 23 miles per hour.

Don't put away your winter coat yet. The weather forecasters predict more cold weather to come. We might have a light snowfall tonight.

Expository Writing

Good expository writing

- develops the main idea with facts and details
- uses transition words to connect ideas
- draws a conclusion based on the information

Write About It

Expository Writing Observe the weather in your area every day for two weeks. Record the temperature, air pressure, precipitation, clouds, and wind speed. Write a newspaper article about the changes you observed.

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

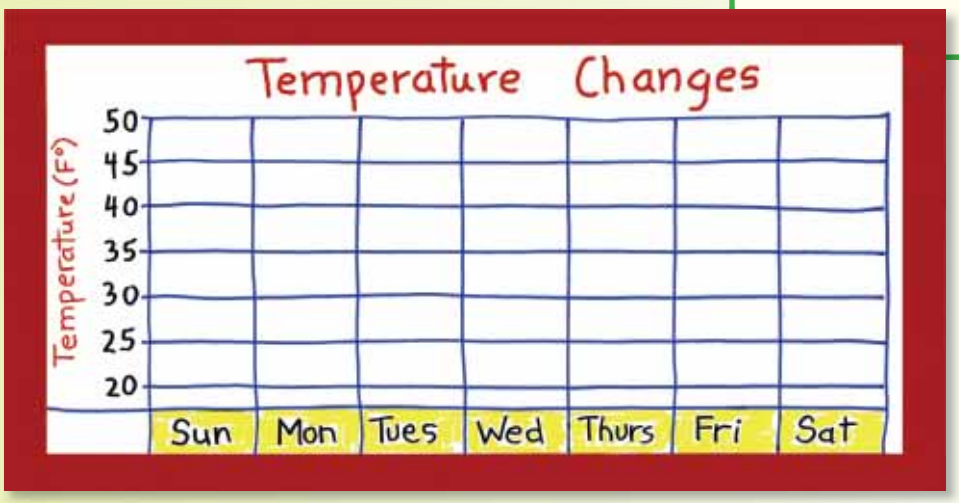
Graphing Weather Changes

You can use line graphs to show how things change over time. Record the high and low temperatures in your area every day for seven days. Use the Internet, newspapers, television, or radio broadcasts to collect your data. Then plot the data on a line graph.

First, title your graph *Temperature Changes*. Label the bottom and left side as shown below. Start the temperature scale with a lower number than the lowest temperature you recorded. Then, mark off equal spaces in intervals of 5. Write the days of the week across the bottom.

Plotting Points on a Line Graph

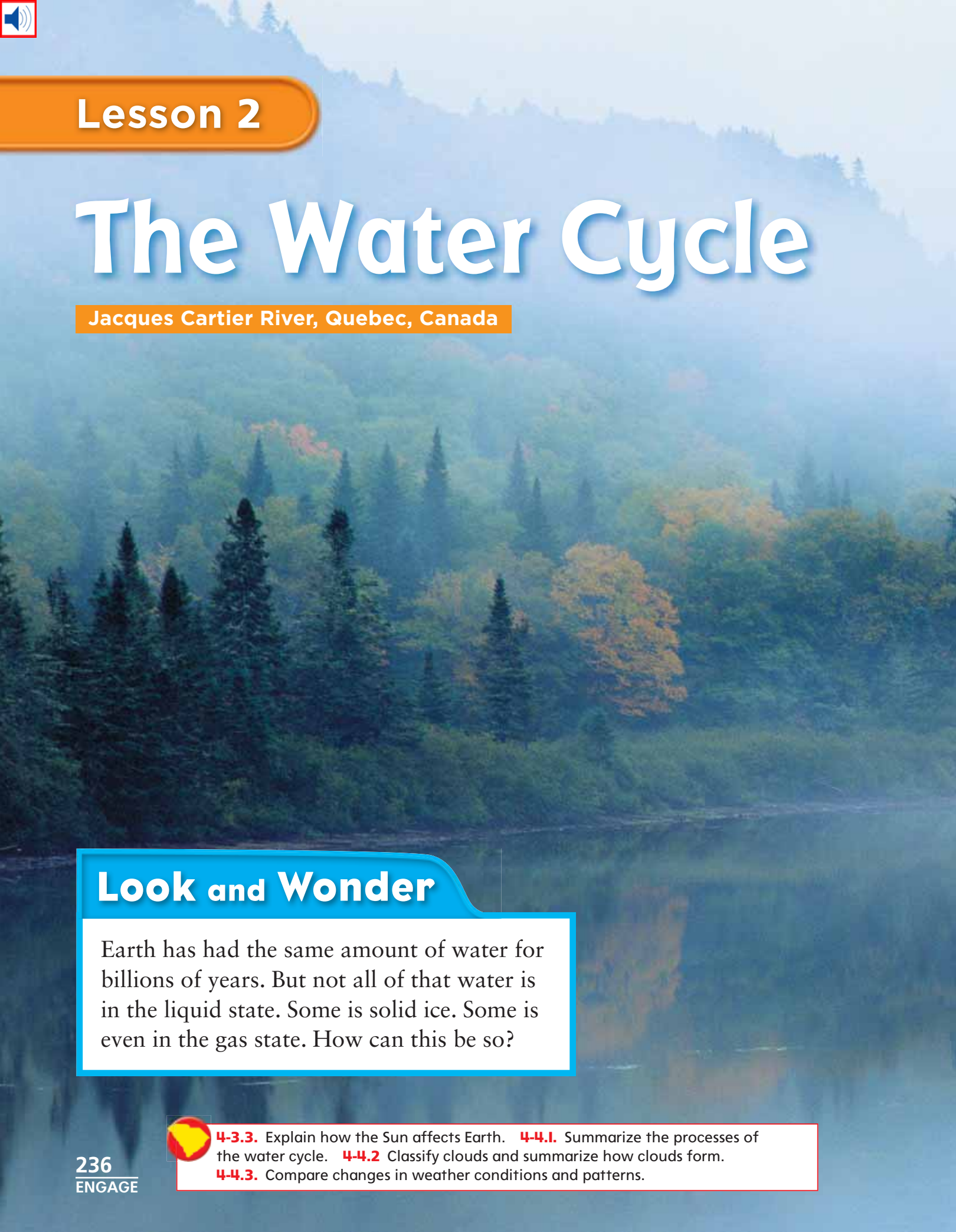
- Use two different colors for high and low temperatures.
- Find the high temperature for your first day. If it is between two markings, make an estimate. Slide your finger over to the day. Mark that spot with a point.
- Continue plotting all the high and low temperatures. Use straight lines to connect all of the highs. Use another line to connect all of the lows.



Solve It

Plot your data on the graph you made. Describe the temperature pattern shown on your graph.

4-I.5. Recognize the correct placement of variables on a line graph. **4-I.6.** Construct and interpret diagrams, tables, and graphs made from measurements.



Lesson 2

The Water Cycle

Jacques Cartier River, Quebec, Canada

Look and Wonder

Earth has had the same amount of water for billions of years. But not all of that water is in the liquid state. Some is solid ice. Some is even in the gas state. How can this be so?

4-3.3. Explain how the Sun affects Earth. **4-4.1.** Summarize the processes of the water cycle. **4-4.2** Classify clouds and summarize how clouds form. **4-4.3.** Compare changes in weather conditions and patterns.

Explore

Inquiry Activity

How does water change from a liquid to a gas?

Form a Hypothesis

What variables affect how water changes from a liquid to a gas? Write a hypothesis.

Test Your Hypothesis

1. **Communicate** Work in a small group. Discuss examples of water changing from a liquid to a gas. What might affect how fast this change occurs? Consider temperature, wind, area, and volume of water.
2. **Use Variables** Using the materials, design an experiment to test one of the variables you discussed. Use two water samples. One will test the independent variable. The other water sample is your control.
3. **Experiment** Conduct your experiment. Record your observations at each step.

Draw Conclusions

4. Was your hypothesis correct? Does the variable you tested affect how water changes from a liquid to a gas? Give evidence to support your conclusion.
5. **Classify** Share your results as a class. Classify the variables you tested into those that affect the change and those that do not.

Materials

- water
- 2 plastic containers with lids
- spoon
- salt

Explore More

Choose a different variable that might affect how liquid water changes to a gas. Form a new hypothesis. Design an experiment to test it. Then conduct your experiment. Share your findings with the class.

4-I.3. Summarize the characteristics of a simple scientific investigation that represent a fair test.

Read and Learn

Main Idea 4-3.3 4-4.1 4-4.2 4-4.3

In the water cycle, water changes state as it moves between Earth's surface and atmosphere.

Vocabulary

evaporation, p. 238

water vapor, p. 238

condensation, p. 239

cloud, p. 239

freeze, p. 239

precipitation, p. 239

water cycle, p. 240

melt, p. 244

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Reading Skill

Sequence

First → Next → Last

Why does water change state?

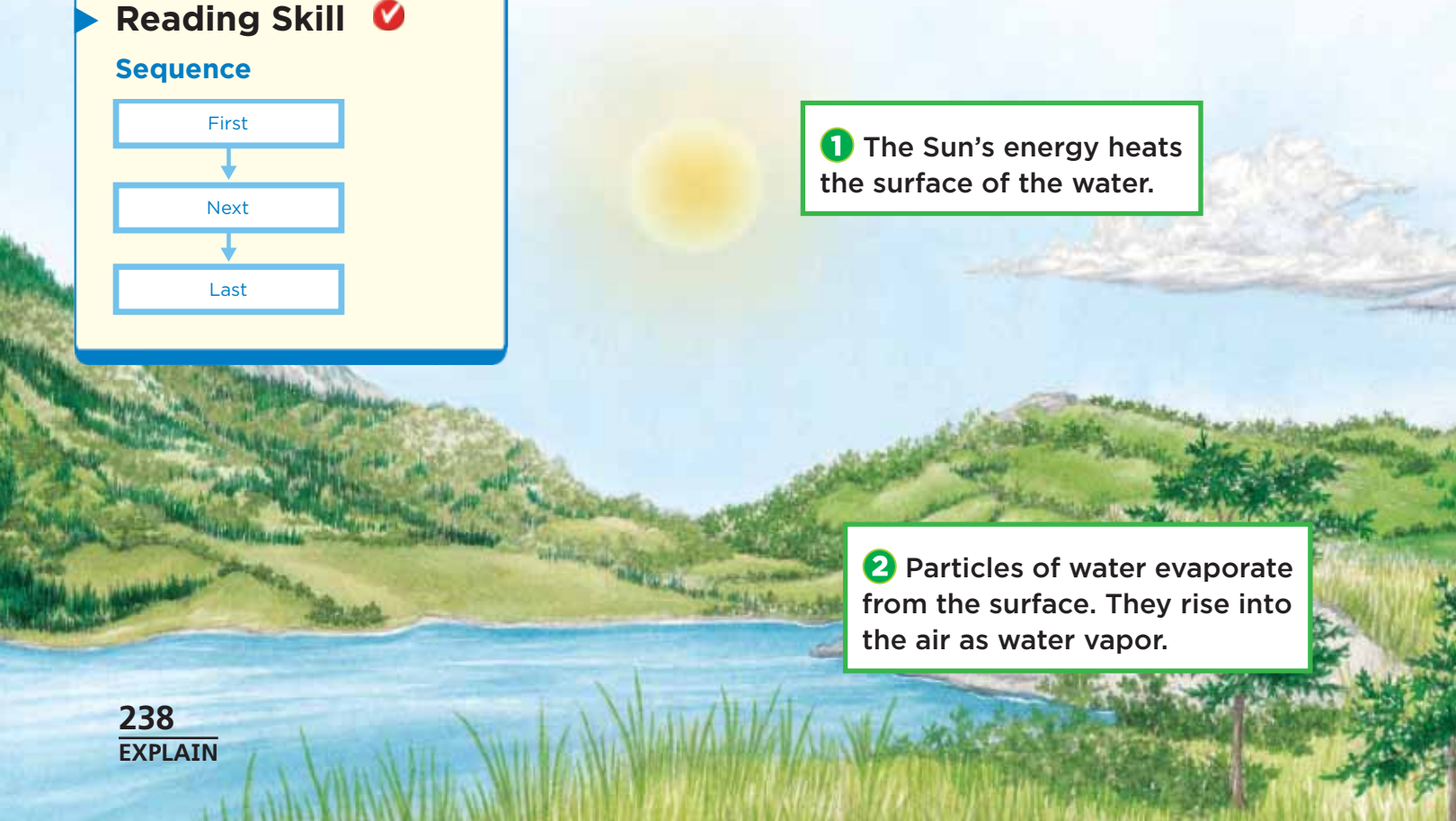
Water moves from Earth's surface into the atmosphere. Then it moves back to the surface. Water changes state as it moves.

Evaporation

Water seems to disappear when it evaporates (ee•VAP•uh•rayts). **Evaporation** is the term for a liquid changing slowly to a gas. Liquid water doesn't really disappear. It just changes to a gas.

Water vapor is water in the gas state. You cannot see water vapor, but it is part of the air around you.

Water is always evaporating from oceans, streams, lakes, rivers, and ponds. The Sun's heat causes particles of water at the surface to move rapidly. The more heat energy they take in, the faster and farther apart they move. Some of the particles rise into the air as a gas—water vapor.

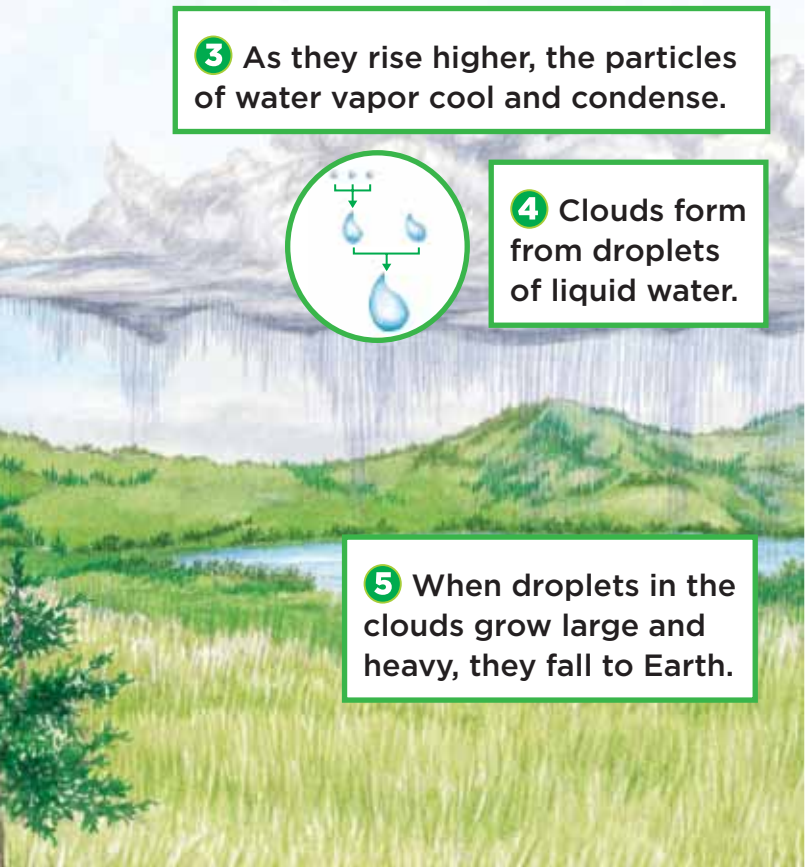


Condensation

As particles of water vapor rise into the air, they cool. The particles lose energy. They move more slowly. High in the atmosphere, the water vapor *condenses* (kuhn•DEN•sez) to liquid water. **Condensation** is when a gas changes to a liquid.

Dew is a familiar kind of condensation. Dew forms when water vapor cools and condenses onto a surface. Have you ever seen drops of water cover the grass on a cool morning? Those drops are dew.

Water vapor can also condense onto dust particles in the air. The tiny drops, or *droplets*, form clouds. A **cloud** is a group of water droplets in the atmosphere. The droplets are pure water in liquid form.



Dew can form on spiderwebs in the early morning.

Precipitation

Inside a cloud, small water droplets may join together and form larger ones. If it is very cold, some droplets freeze into ice. To **freeze** is to change from a liquid to a solid.

The droplets and bits of ice grow larger and heavier. When they are too heavy, they fall to Earth's surface. **Precipitation** (pri•sip•i•TAY•shuhn) is the term for water that falls from clouds down to Earth.

Quick Check

Sequence Explain the steps in evaporation and condensation.

Critical Thinking What happens to a puddle of water on a sunny day? Why?

Where does water go?

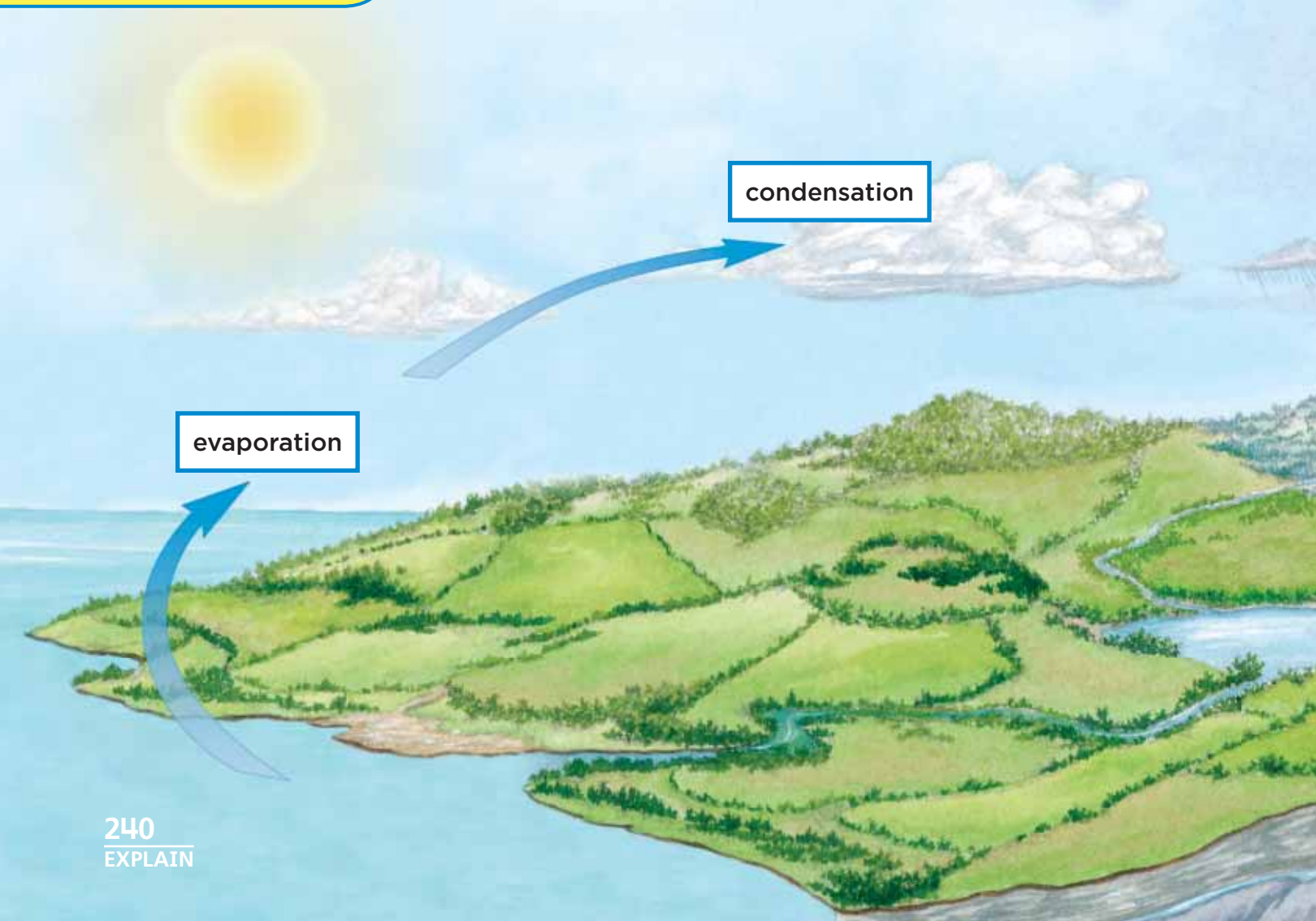
By now you know a lot about water. You know that water can be found in many places. You know it has three different states.

Water is always moving from place to place, in one form or another. The **water cycle** is the movement of water between Earth's surface and the air. Evaporation, condensation, and precipitation help water move through the cycle. The diagram shows you how.

In the Air

In the water cycle, water changes state between liquid, gas, and solid. The Sun is the energy source for this cycle. The Sun's energy causes water to evaporate from lakes, oceans, and other bodies of water. Water also evaporates from the leaves of plants. This is called *transpiration* (trans•puh•RAY•shuhn). As it rises in the air, the water vapor condenses. Clouds form. During precipitation, water falls from the clouds over land and water.

The Water Cycle



On and Below the Ground

Precipitation can fall as rain, snow, sleet, or hail. When it rains, water flows over Earth's surface as *runoff*. Runoff gathers in lakes, oceans, rivers, and streams. Over time, water collects in glaciers and ice caps.

Rainwater also soaks into the ground. Plants take up some of the water from soil. The rest collects in small cracks and spaces below the ground. This groundwater can stay above the bedrock, flow, or slowly evaporate.

Quick Check

Sequence How does water enter and leave the atmosphere?

Critical Thinking How does the Sun's energy affect Earth's weather?

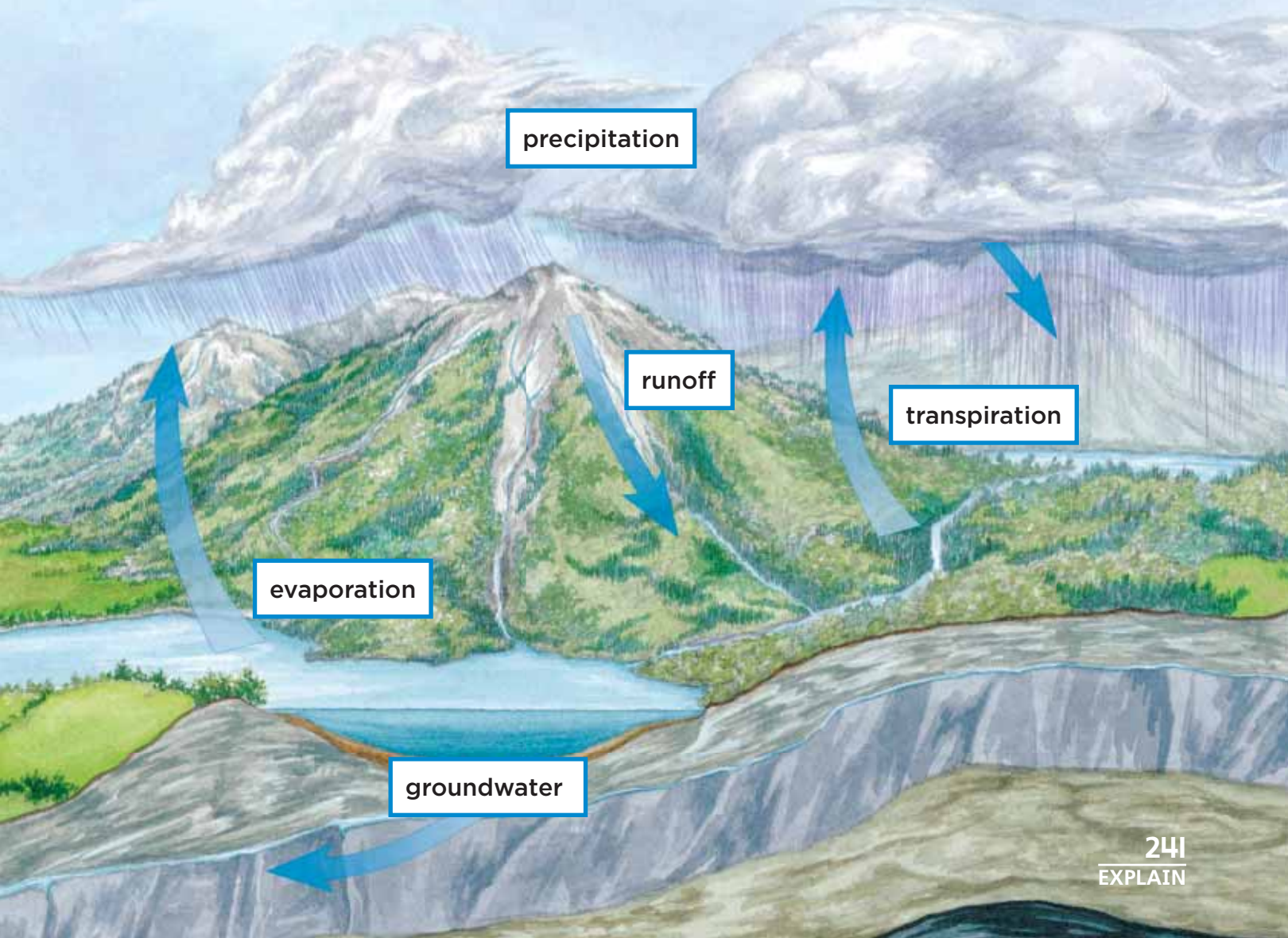
CLICK HERE

Read a Diagram

Describe one path through the water cycle.

Clue: Follow the arrows.

LOG ON *Science in Motion* Watch how the water cycle works at www.macmillanmh.com



Quick Lab

Cloud in a Jar

1. Pour very warm water into a jar so that it is about 1 cm deep. Seal the jar tightly. Then shake it several times.
2. Open the jar and quickly place a plastic sandwich bag inside it. Using a rubber band, seal the bag tightly around the mouth of the jar.
3. **Observe** Reach into the bag. Gently pull it up. Then release the bag. Observe and describe what happens in the jar. Repeat this step several times.
4. **Interpret Data** When does the cloud form? When does it disappear? Why do you think this happens?

What are some types of clouds?

Clouds form at different heights above Earth's surface. Scientists classify clouds into three main types based on how and where they form.

Cumulus

Cumulus (KYEW•myuh•luhs) clouds are puffy, white clouds that look like cotton balls. They often have a flat bottom.

You have probably seen clouds grow dark before a rainstorm. If a cumulus cloud becomes dark and thick, it is called a *cumulonimbus* (kyew•myuh•loh•NIM•buhs) cloud. This kind of cloud causes precipitation.

Cloud Types

Stratus

Stratus (STRAT•uhs) clouds form in layers. The layers look like sheets or blankets. Stratus clouds are often the lowest clouds in the sky. What we call fog is really a stratus cloud near Earth's surface. Like cumulonimbus clouds, stratus clouds can form precipitation.

Cirrus

Cirrus (SIR•uhs) clouds look thin, wispy, or feathery. They are made of tiny bits of ice. Cirrus clouds are usually found very high in the sky.

Observing Clouds

In the diagram at right, you can see other cloud types. Often, you can find more than one cloud type in the sky at one time.

Quick Check

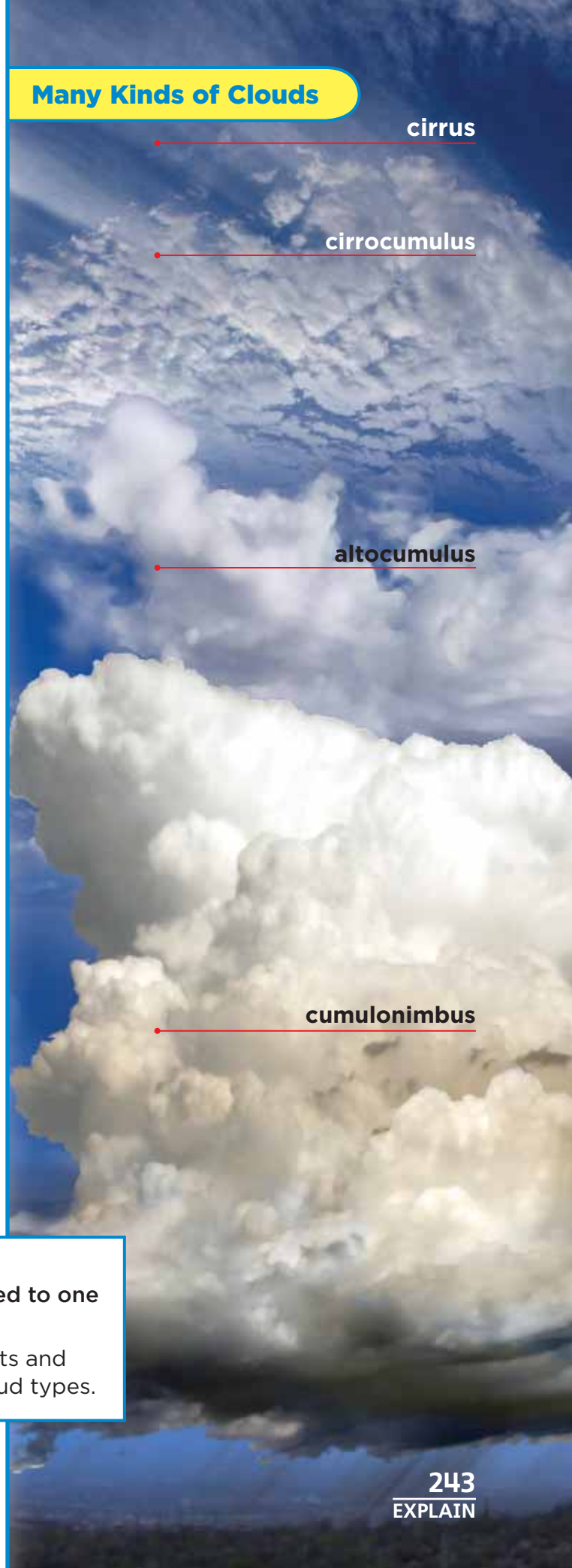
Sequence How might clouds change as a morning rain shower turns into a sunny day?

Critical Thinking Classify the types of clouds you see in the sky today.

Read a Diagram

Which cloud types are related to one another?

Clue: Compare the word parts and pictures for the different cloud types.



What are other forms of precipitation?

Rain is just one form of precipitation. Water can change state as it moves through the air. When this happens, other kinds of precipitation may fall.

Snow

When water reaches a temperature below 0°C (32°F), it freezes into ice. Remember, to freeze is to change from a liquid to a solid. Bits of ice can collect in a cloud. If they get too heavy, they fall as snow.

Snow may melt as it falls to the ground. To **melt** is to change from a solid to a liquid. Melting happens when sunshine or warm air heats the icy snowflakes. The heat makes the snow change to rain.

Sleet and Hail

Sometimes rain falls from clouds as a liquid but freezes along the way. The rain turns into small chunks of ice. The ice that falls to the ground is called *sleet*.

Hail is made of ice, too. The ice chunks are much larger than sleet. Hail forms inside the tall clouds of a thunderstorm. Most hailstones are the size of peas. However, some are bigger than baseballs!

Quick Check

Sequence How does snow form?

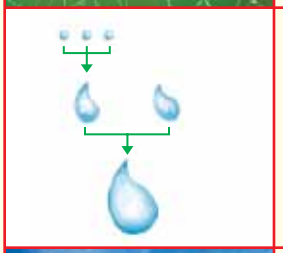
Critical Thinking Do all pieces of ice that fall to the ground come from icy clouds? Explain.

Most hailstones are small. Large ones can be dangerous! How wide is the hailstone on the left?

FACT Hail can fall in spring and summer.

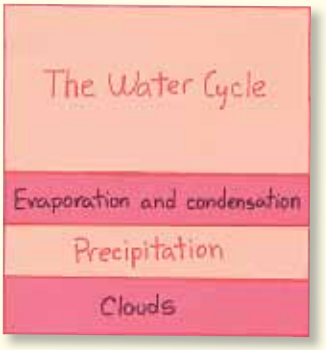
Lesson Review

Visual Summary

	Water changes from a liquid to a gas through **evaporation**. It changes from a gas to a liquid through **condensation**.
	In the **water cycle**, water travels by runoff, evaporation, condensation, and **precipitation**.
	**Clouds** form at different heights above Earth's surface. They are classified by how and where they form.

Make a FOLDABLES™ Study Guide

Make a Layered-Look Book. Use it to summarize what you read about the water cycle.

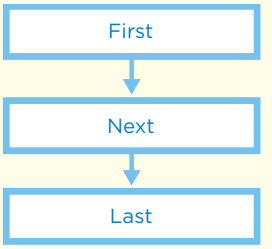


Think, Talk, and Write

1. **Main Idea** How does water travel through the water cycle?

2. **Vocabulary** Water vapor becomes liquid water through _____.

3. **Sequence** Describe the path of water from the ocean to a raindrop.



4. **Critical Thinking** How are hail and sleet alike? How are they different?

5. **Test Prep** **Clouds form when water vapor**
   - **A** evaporates.
   - **B** condenses.
   - **C** precipitates.
   - **D** transpires.

6. **Test Prep** **Puffy, white clouds with flat bottoms are**
   - **A** cumulus clouds.
   - **B** cirrus clouds.
   - **C** stratus clouds.
   - **D** cirrostratus clouds.

Writing Link

Write a Cloud Poem
Write a poem about clouds. Choose ones you have seen or ones you would like to see. Include several different cloud types in your poem.

Art Link

Water Cycle Diorama
Make a diorama that shows how the water cycle works. Label the places where water goes. Write captions to describe how water changes state.

Focus on Skills

Inquiry Skill: Make a Model

You've seen water collect in puddles during a heavy rainstorm. You've learned that evaporation causes puddles to dry up. Does the size of a puddle affect how fast it evaporates? To answer this question and still stay dry, you can **make a model**.

▶ Learn It

When you **make a model**, you build something to represent an object or event. A model helps you learn more about the real object or event you are investigating. It is important to record your observations about your model. Then you can make inferences about the real thing.

▶ Try It

Make a model to study how the size of a puddle affects evaporation.

Materials **whole kitchen sponge, half kitchen sponge, two-pan balance, paper clips, water, measuring cup, lamp**

1. Place the whole sponge in one balance pan and the half sponge in the other. The sponges represent puddles.
2. Add paper clips to the pan with the half sponge until both sides of the balance are equal in mass.
3. Add equal amounts of water to each sponge.
4. Place the lamp so it will shine on both "puddles." Turn on the lamp. This models the Sun.
5. Observe the sponges after 5 minutes. Read the measurement on the balance. Record your observations in a data table like the one shown.

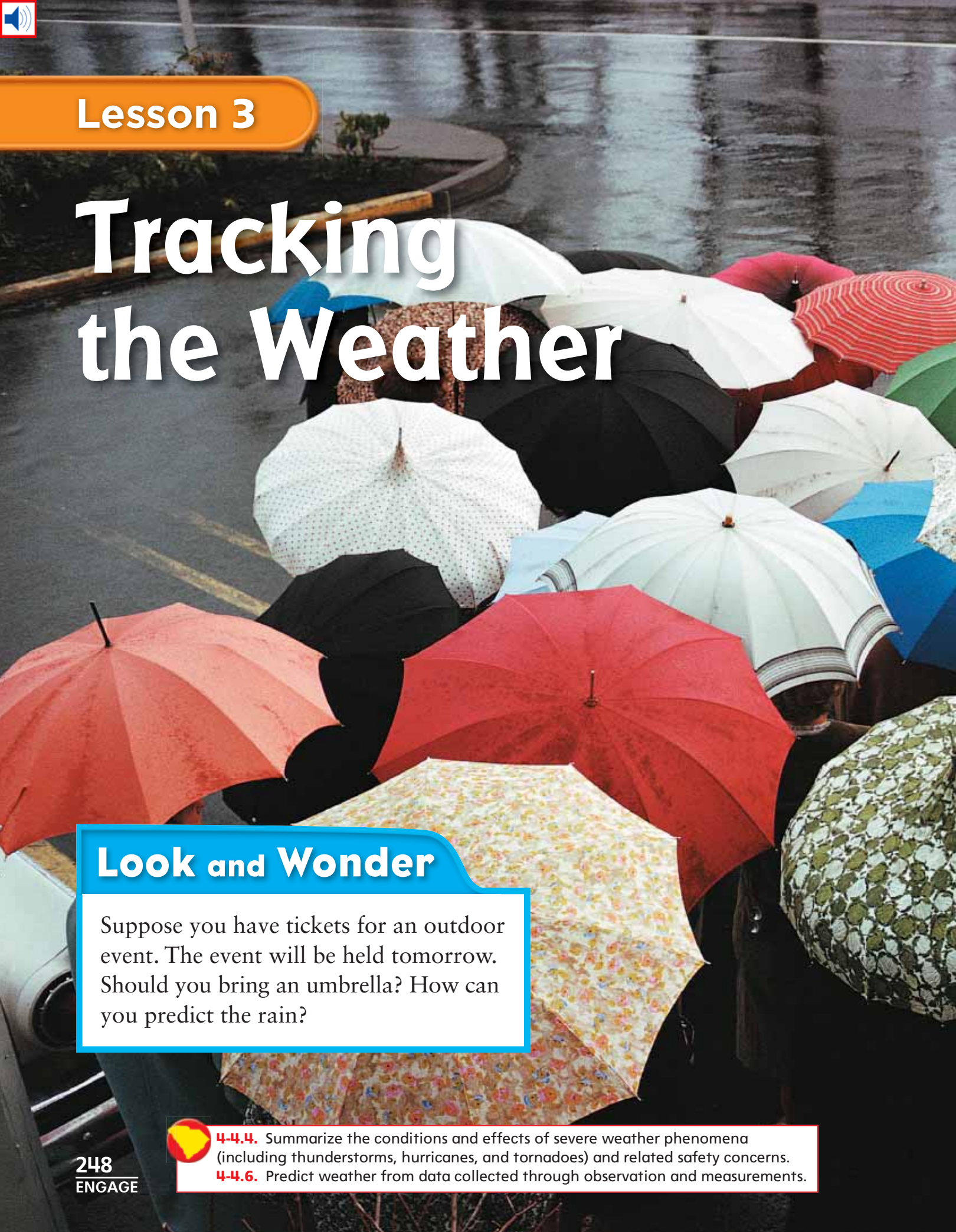
6. Continue to read the balance every 5 minutes for 15 minutes. Record your observations.
7. Look at your results. Which sponge became lighter first? Why do you think it did?
8. How are your model puddles like real rain puddles? How are they different?

▶ Apply It

Now **make a model** to test the effect of wind on evaporation. Use two rectangular plastic containers.

1. Pour the same amount of water into each container. Place a fan so that it will blow across the surface of only one container. Turn the fan on. Use a low setting.
2. Wait 10–15 minutes. Then measure the amount of water in each container.
3. How much water evaporated from each container? What does this tell you about wind and evaporation?

4-I.I. Classify observations as either quantitative or qualitative.



Lesson 3

Tracking the Weather

Look and Wonder

Suppose you have tickets for an outdoor event. The event will be held tomorrow. Should you bring an umbrella? How can you predict the rain?

4-4.4. Summarize the conditions and effects of severe weather phenomena (including thunderstorms, hurricanes, and tornadoes) and related safety concerns.
4-4.6. Predict weather from data collected through observation and measurements.

Explore

Inquiry Activity

How do raindrops form?

Form a Hypothesis

How do changes in air temperature affect water in the liquid and gas states? Write a hypothesis.

Test Your Hypothesis

1. Pour just enough water into each jar to cover the bottoms of the jars.
2. **Use Variables** Place one lid upside down on one jar. Put three or four ice cubes in that lid. Place the other lid upside-down on the second jar. Do not add ice cubes to that lid.
3. **Observe** Wait 2 minutes. Then look closely at the parts of the lids inside the jars. Record your observations every 2 minutes over the next 10 minutes.
4. Draw a diagram that shows what happened to the water inside the jars. Add labels and arrows to explain how the water changed.

Draw Conclusions

5. Why did water droplets form mostly underneath the lid? Why didn't they form inside the jar or on the upside-down lid?
6. **Predict** What if you shined a heat lamp on the water in the jars before step 3? Predict how your results would change.

Materials

- 2 jars with lids
- water
- ice cubes

Explore More

What would happen if you used ice instead of water in step 1? Make a prediction. Then repeat the activity with the ice. Explain your results.

4-I.3. Summarize the characteristics of a scientific investigation that represent a fair test.

Read and Learn

Main Idea 4-4.4 4-4.6

Air masses and fronts cause weather patterns to form and change.

Vocabulary

air mass, p. 250

front, p. 251

warm front, p. 251

cold front, p. 251

stationary front, p. 251

forecast, p. 253

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Reading Skill

Predict

My Prediction	What Happens

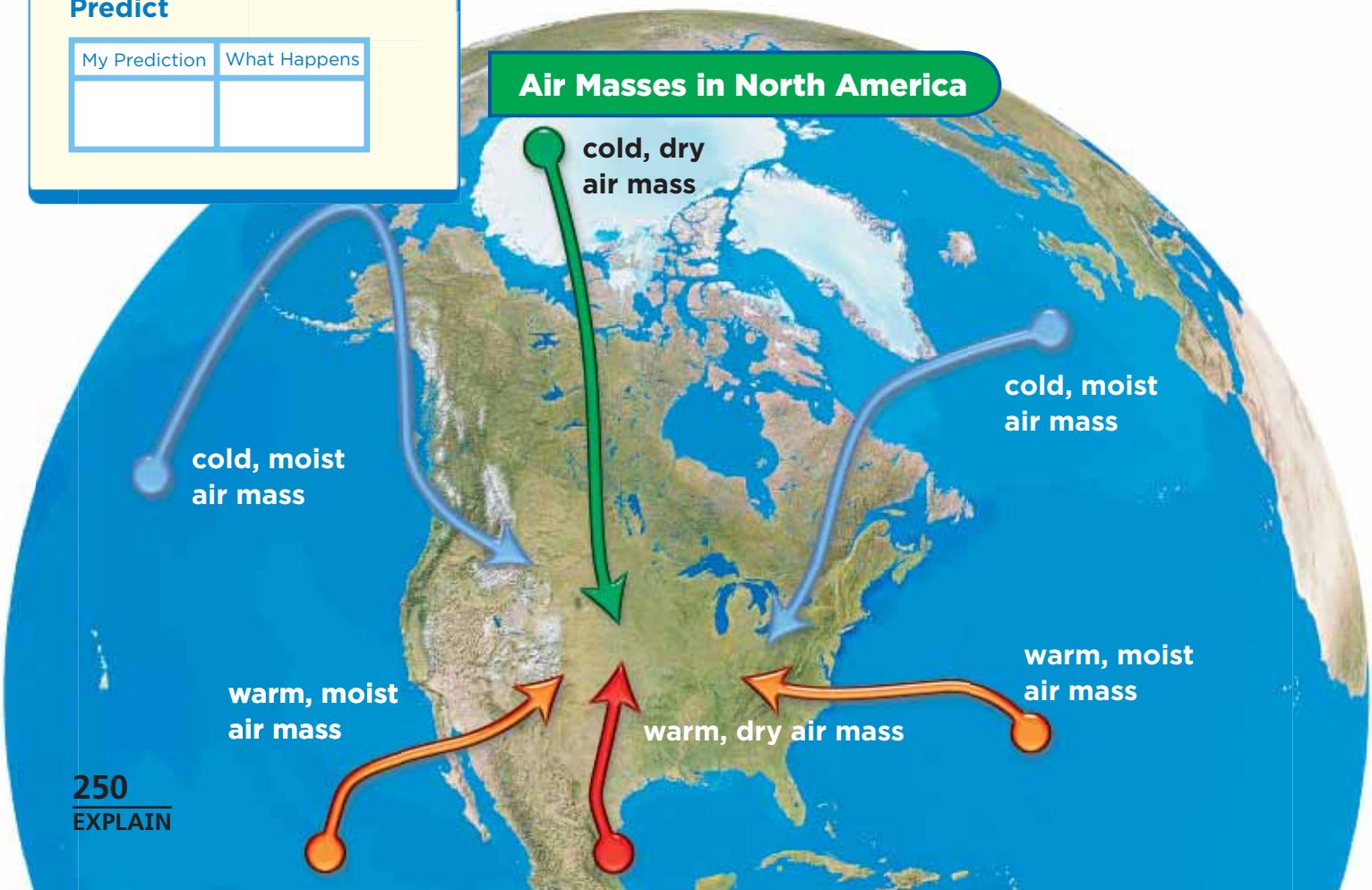
What are air masses and fronts?

The wettest place on Earth is in the state of Hawaii. Rain falls over one of the islands on about 350 days of the year. One of the driest places in the world is a desert in South America. Some parts have not seen rain for centuries! Why is it so rainy in some places and dry in others?

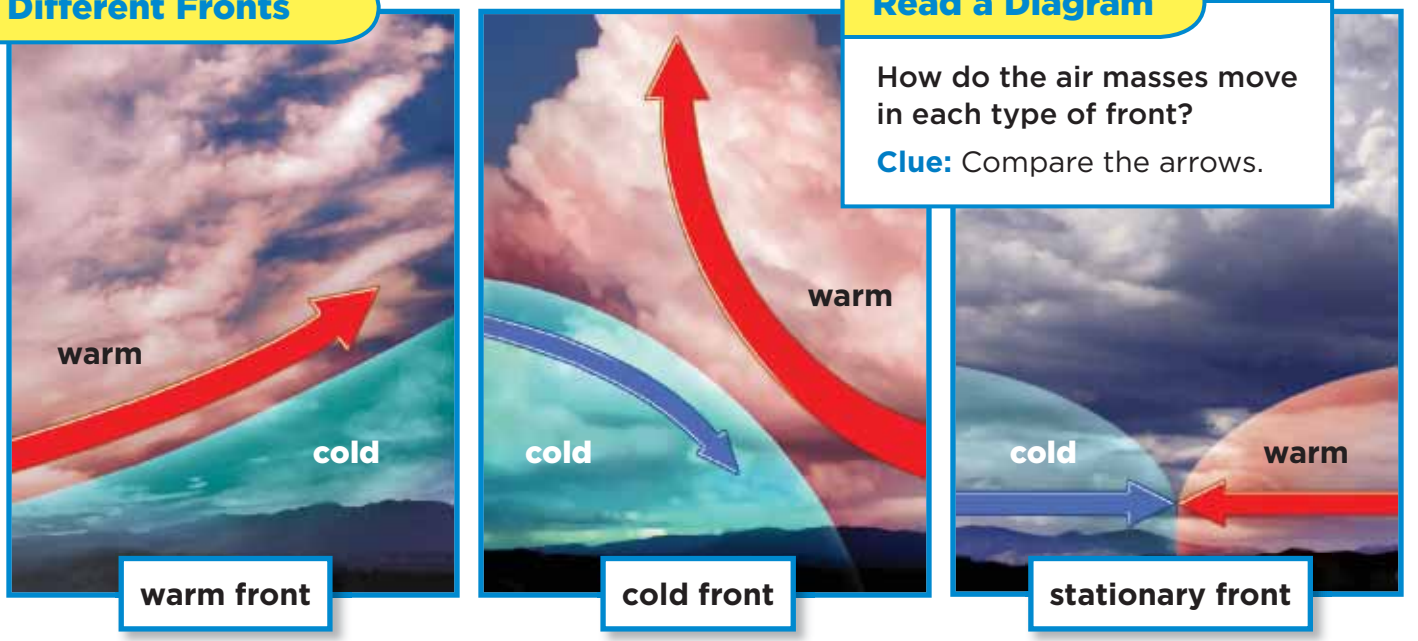
Air Masses

The properties of the air in different places on Earth vary. Large areas of air have nearly the same properties. These regions are called **air masses**. Weather in one part of an air mass is like the weather throughout the rest of the air mass.

Air masses form all the time, usually near the poles or the equator. They move across Earth, covering it like an ever-changing blanket. The map shows some of the common paths they take.



Different Fronts



Read a Diagram

How do the air masses move in each type of front?

Clue: Compare the arrows.

Fronts

As an air mass moves, it brings weather with it. What happens when different air masses meet? Like two cars in a crash, the air masses slam into each other. The area where they meet is called a front.

A **front** is the boundary between two air masses that have different temperatures. Fronts usually cause a change in the weather.

Warm Fronts

When a warm air mass pushes into a cold air mass, a **warm front** forms. As the diagram shows, the warm air mass slides up and over the cold air mass. Layers of clouds form. The cold air retreats.

A warm front often brings light, steady rain. After the front passes, the air temperature rises.

Cold Fronts

A **cold front** forms when a cold air mass pushes under a warm air mass. The cold air mass forces the warm air mass upward quickly. Thick clouds form as the warm air rises and cools. Cold fronts often bring stormy weather.

Stationary Fronts

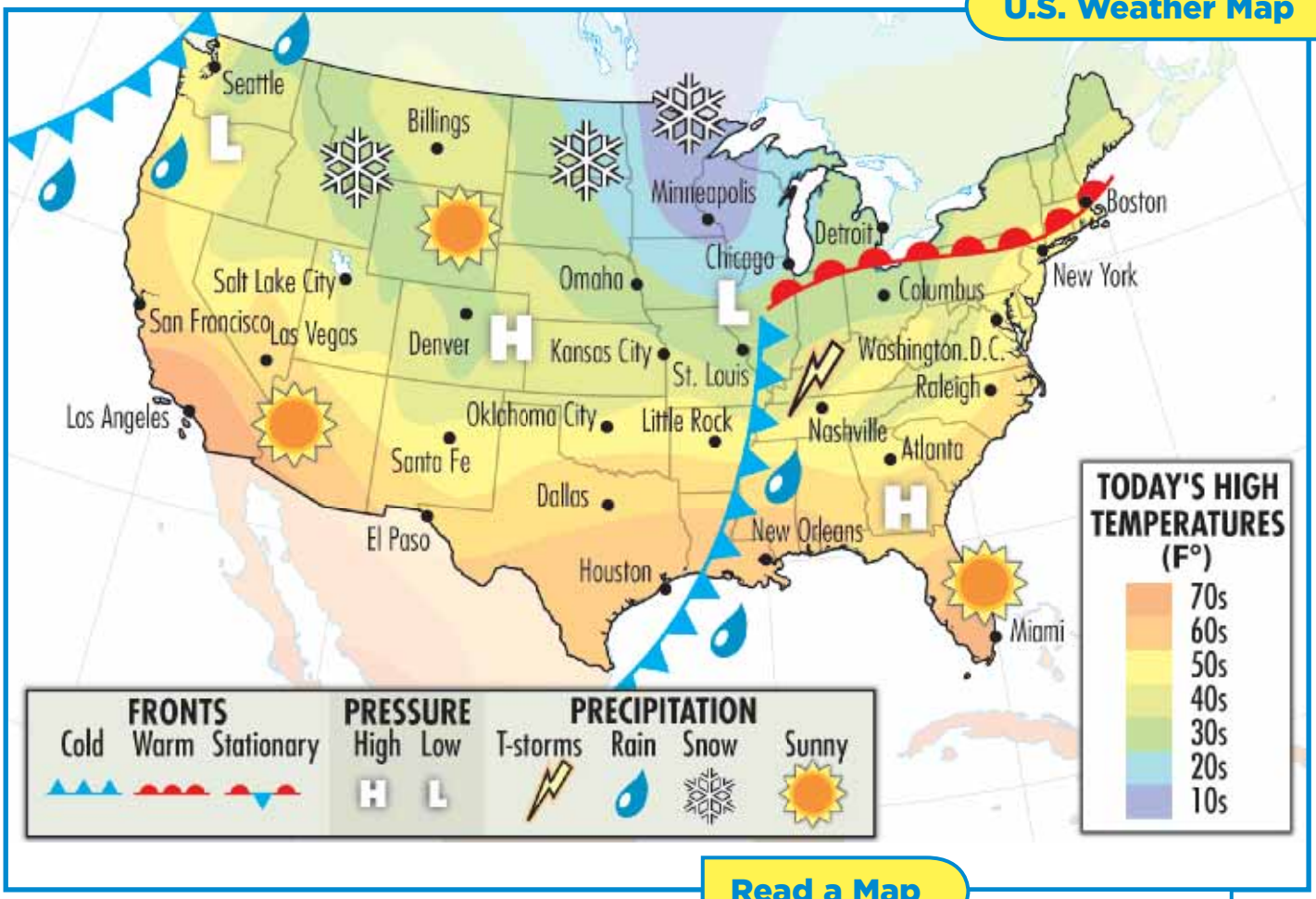
Sometimes rainy weather lasts for days. This can be caused by a stationary front. A **stationary front** is a boundary between air masses that are not moving.

Quick Check

Predict What will happen if a cold air mass pushes into a warm air mass?

Critical Thinking How do warm fronts differ from cold fronts?

U.S. Weather Map



Read a Map

What does this map show about the weather in Nashville?

Clue: Use the legends to find the meanings of the colors and symbols.

What does a weather map show?

Every day, scientists make and share weather maps like the one above. Weather maps show weather conditions at a certain time and place. They tell about air temperature, pressure, precipitation, and winds.

Weather maps may also show the locations of fronts. The fronts appear as a line of triangles or half circles. In the map above, rain and thunderstorms have formed along the two cold fronts.

Forecasting

Maps can help us answer questions. Scientists use weather maps to make forecasts. To **forecast** is to predict weather conditions.

Temperature, air pressure, and the direction of moving fronts give important clues for forecasts. Look at the map again. Do you see the cold front from St. Louis to Houston? The triangles point toward the east. Like most fronts in the United States, this one is moving from west to east. A forecast based on this map may predict a chance of rainy weather for New Orleans.

Scientists use many technologies in forecasting. Satellites in orbit around Earth take pictures of the atmosphere. Computers help scientists analyze weather data and produce better weather maps.

Quick Lab

Weather Forecast

1. Study a weather map from today's newspaper or the Internet. Compare it to maps from yesterday and the day before, if they are available.
2. **Communicate** Describe today's weather in your region and in surrounding regions.
3. **Predict** Use the weather map to predict tomorrow's weather. Explain your prediction.
4. Study the weather map tomorrow. Compare it to your prediction. How close was your forecast to the actual weather?

Quick Check

Predict How can weather maps be used to predict the weather?

Critical Thinking How likely are you to see the same cold front for several days in one place? Why?

What are thunderstorms?

Lightning flashed through the sky, and thunder rumbled over the city. Heavy rain fell during the storm, flooding the streets. Thunderstorms like this one take place all over the world. A *thunderstorm* is a rainstorm that includes lightning and thunder.

Before a thunderstorm can occur, warm air must rise. The air must carry moisture. Any movement of air upward is called an *updraft*. Updrafts in a thunderstorm cause a cloud to grow taller. The result is a huge, dark cloud called a thunderhead.

As rain falls, a downdraft may occur. A *downdraft* is a sudden downward movement of cool or cold air.

Lightning and Thunder

Lightning is the spark caused by a buildup of electricity in a thunderhead. Lightning can jump from cloud to cloud. It can also travel from a cloud to the ground.

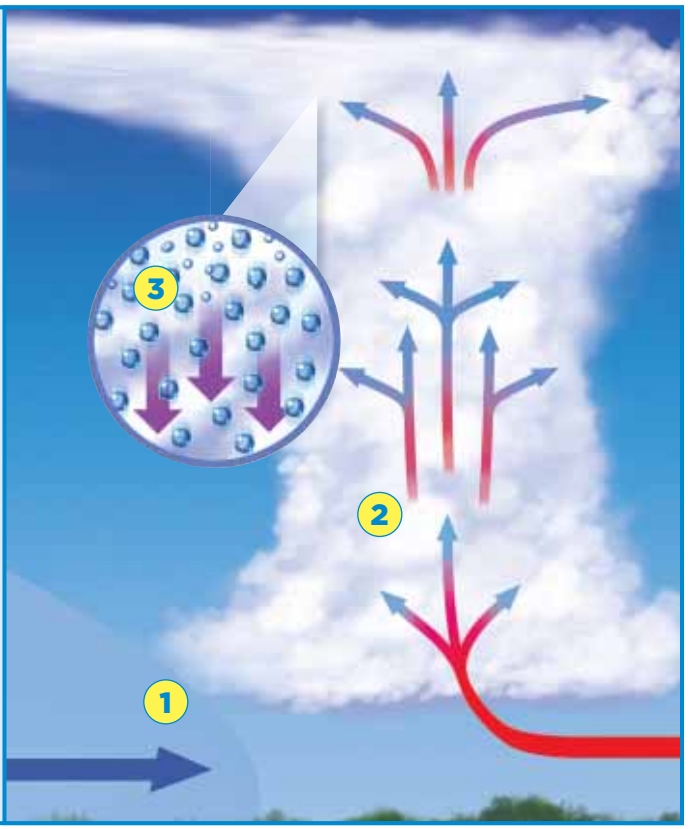
Lightning may be caused by the movement of particles of ice and rain. Particles moving downward rub against particles moving upward. As they rub together, the particles become charged with static electricity.

How a Thunderstorm Forms

1 **Fronts** A cold front moves in and pushes warm, moist air upward. As the air rises, it cools and water vapor condenses.

2 **Thunderheads** Energy released during condensation warms the air. This causes updrafts. A thunderhead forms. The top of the thunderhead flattens out when it reaches winds high in the atmosphere.

3 **Precipitation** Rain falls.



This buildup is similar to what happens when you shuffle across a carpet. A charge of static electricity builds up in your body. If you then touch your finger to a metal object, a spark jumps between you and the object. That spark is a discharge of electricity.

Danger from Storms

Lightning raises the temperature of the air around it. It becomes much hotter than the surface of the Sun. This burst of heat makes the air expand violently. *Thunder* is the sound of the rapidly expanding air.

In thunderstorms the danger comes from lightning. Danger also comes from things blown by the wind and from flooding. Stay indoors and away from windows. If you are outside, stay away from tall objects.

Quick Check

Predict What are the signs of a thunderstorm?

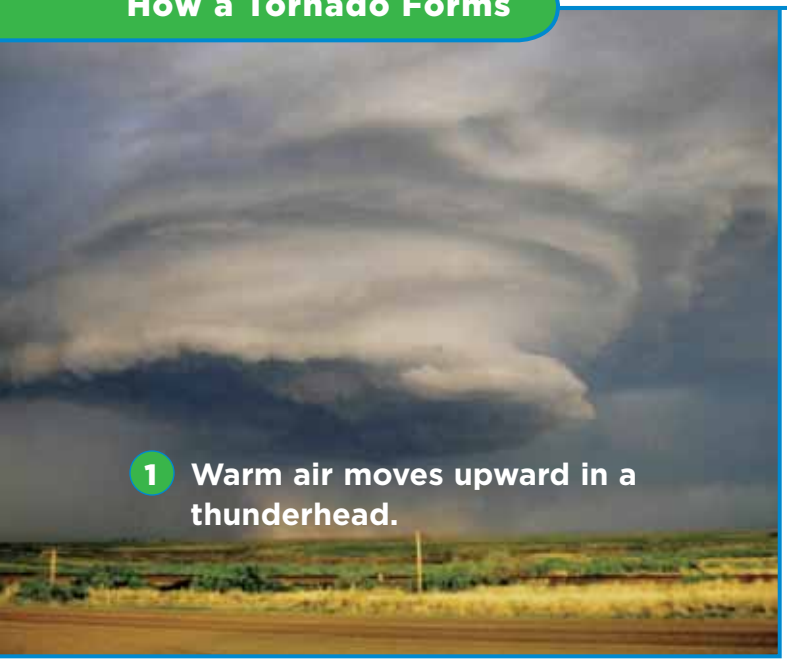
Critical Thinking How is thunder similar to the "pop" produced by a pricked balloon?

A lightning strike left a scar on this oak tree.

How Lightning Forms

Static electricity is released as lightning.

How a Tornado Forms



1 Warm air moves upward in a thunderhead.

2 A funnel cloud forms when the air starts spinning.

What are tornadoes?

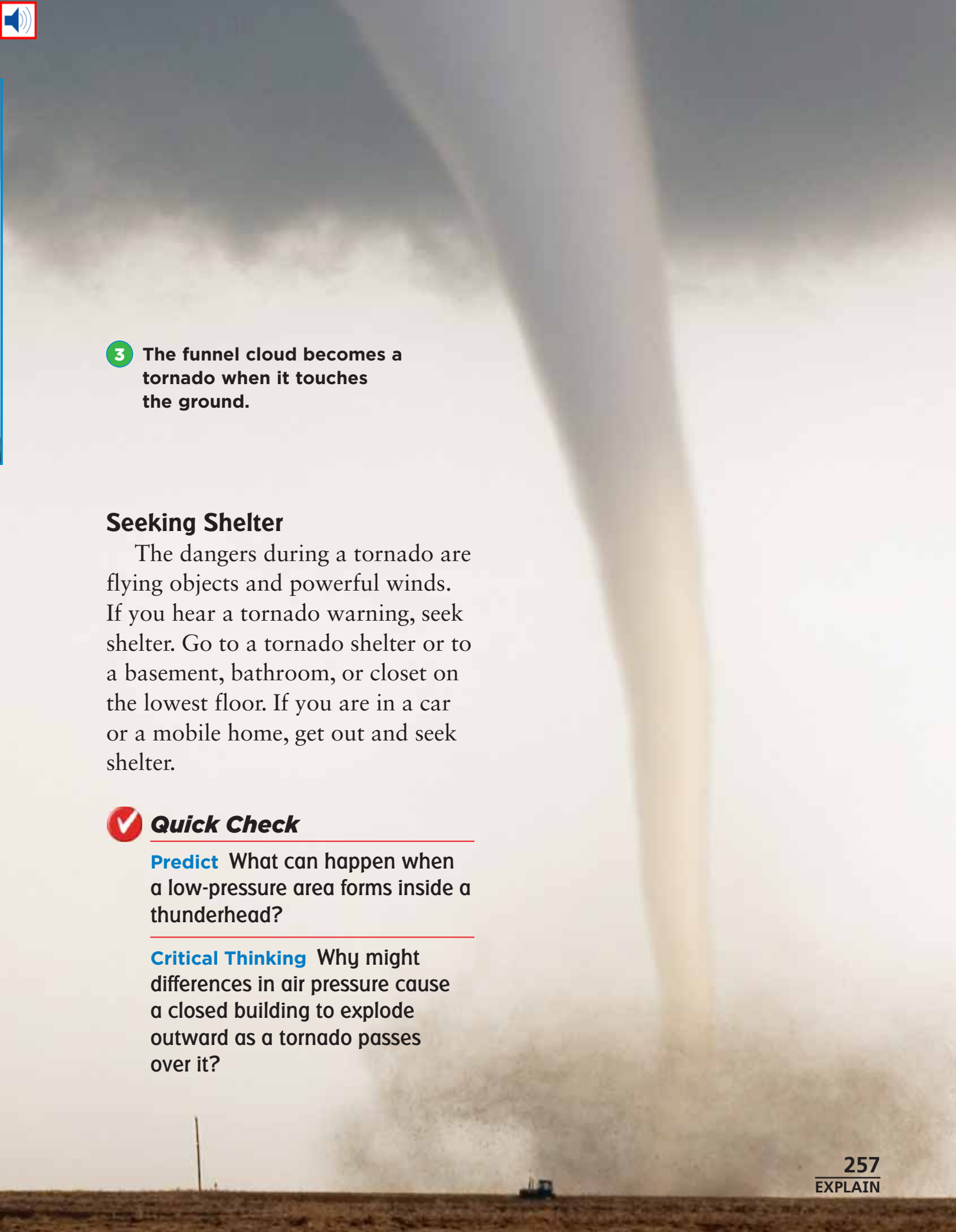
Under the right conditions, a thunderstorm can turn into a *tornado* (tor•NAY•doh). A tornado is a funnel-shaped cloud with wind speeds up to 500 kilometers (300 miles) per hour. People often call these storms "twisters."

How Tornadoes Form

Tornadoes begin to form when warm air moves upward in a thunderhead. The movement creates an area of low pressure. This low air pressure draws air inward and upward. As air flows into the low-pressure area, it spins around faster and faster.

From the ground, the shape of the cloud looks like a funnel. Warm air rises up the center of the spinning funnel cloud. Rain falls outside of the cloud. When the tip of the funnel cloud touches the ground, it becomes a tornado.

Only a small section of the tornado actually touches the ground. For this reason, tornadoes have been known to destroy houses on one side of a street while leaving houses on the other side untouched.



3 **The funnel cloud becomes a tornado when it touches the ground.**

Seeking Shelter

The dangers during a tornado are flying objects and powerful winds. If you hear a tornado warning, seek shelter. Go to a tornado shelter or to a basement, bathroom, or closet on the lowest floor. If you are in a car or a mobile home, get out and seek shelter.

Quick Check

Predict What can happen when a low-pressure area forms inside a thunderhead?

Critical Thinking Why might differences in air pressure cause a closed building to explode outward as a tornado passes over it?

What are hurricanes?

Thunderstorms can turn into a tropical storm. A *tropical storm* has rotating winds with low pressure at the center. The storm forms near the equator, where the ocean is warm. When water evaporates from the ocean, warm, moist air rises. Then cooler air flows toward the space where the warm air had been.

Water continues to evaporate, making the air pressure even lower. High-pressure air moves into the area of low air pressure and causes rotating winds.

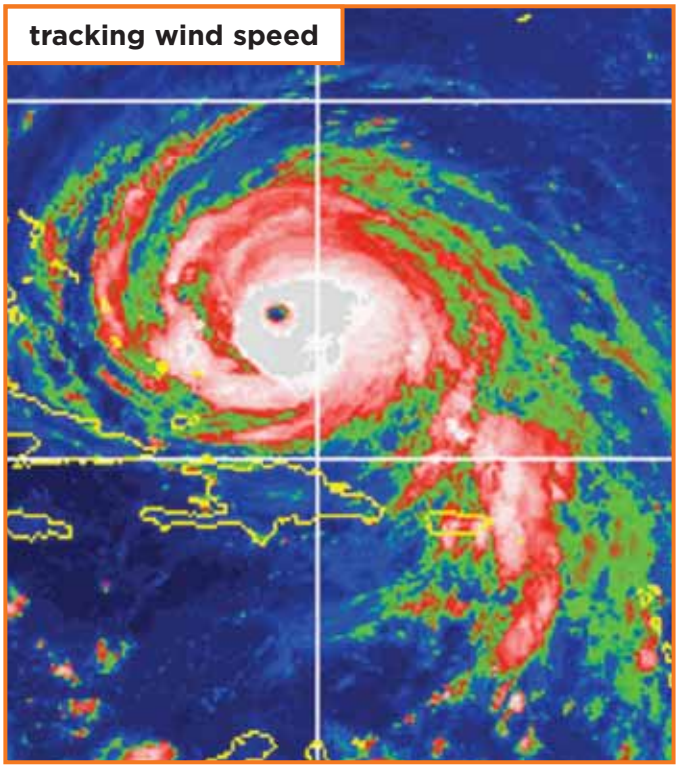
A tropical storm turns into a *hurricane* (HUR•uh•cayn) when the wind speed of the storm reaches more than 119 kilometers (74 miles) per hour. From space, a hurricane looks like a spiral of clouds with a hole in its middle. The hole is the center of the low-pressure area. This is the "eye" of the hurricane, which has no wind or rain.

Winds near the eye can reach speeds of almost 300 kilometers (190 miles) per hour. Hurricanes also bring very heavy rains. If a hurricane moves across land, it can cause severe damage.

Quick Check

Predict What might happen if a hurricane strikes the land?

Critical Thinking What is the difference between a tropical storm and a hurricane?


tracking wind speed


tracking location

Lesson Review

Visual Summary

When two **air masses** meet, a **front** forms between them. Fronts usually bring a change in the weather.

Scientists use weather maps to make **forecasts** about the weather to come.

Thunderstorms, tornadoes, and hurricanes are three kinds of **severe storms**.

Make a FOLDABLES™ Study Guide

Make a Three-Tab Book. Use it to summarize what you read about tracking the weather.

Think, Talk, and Write

1. **Main Idea** How do air masses affect the weather?

2. **Vocabulary** To _____ is to predict the weather.

3. **Predict** Study today's weather map. Forecast the weather for tomorrow.

My Prediction	What Happens

4. **Critical Thinking** How can a battery-powered radio help you stay safe during a storm?

5. **Test Prep** **A storm usually forms**
   - **A** inside an air mass.
   - **B** along a front.
   - **C** over tall buildings.
   - **D** over a river.

6. **Test Prep** **Which term describes a funnel-shaped cloud?**
   - **A** a hurricane
   - **B** a tornado
   - **C** a cold front
   - **D** a thunderhead

Writing Link

Write a Short Essay
Write an essay about a storm that you experienced. You may instead ask an adult to tell you about a storm they remember. Include facts about the storm and how it affected people.

Social Studies Link

History Report
Research and write a report on a severe weather event in history. If possible, write about an event in your area. Include information about how people solved problems caused by the event.

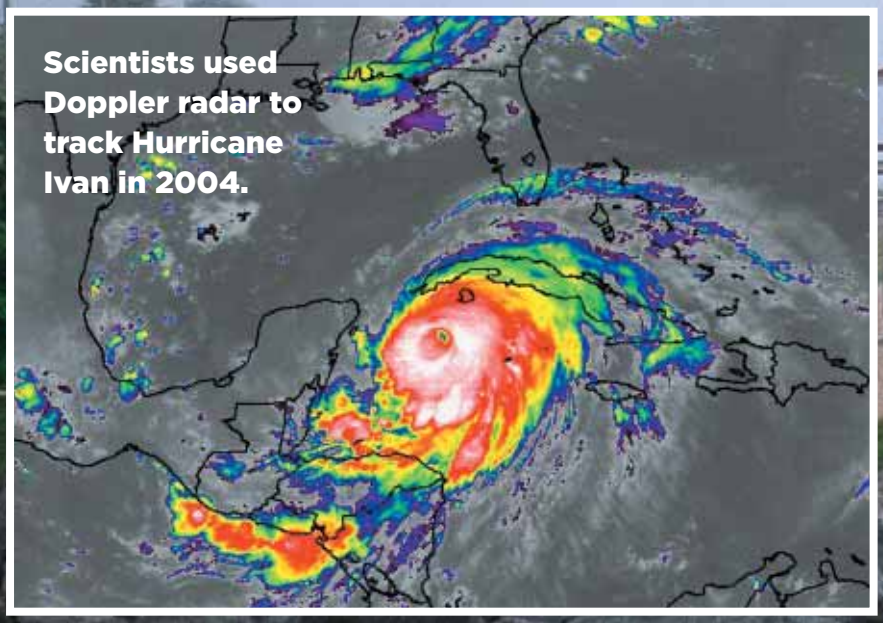
Real World Reading in Science

Hurricane Season

June is the beginning of a busy time for the National Hurricane Center in Miami, Florida. That's when hurricane season begins, and the scientists at the center are ready for action.

Hurricanes develop at sea under particular conditions. These include warm ocean water, low pressure, moist air, and light winds. They usually happen in the Atlantic and northeast Pacific Oceans from June through November. When a hurricane forms, it can bring violent winds, large waves, floods, and lots of damage.

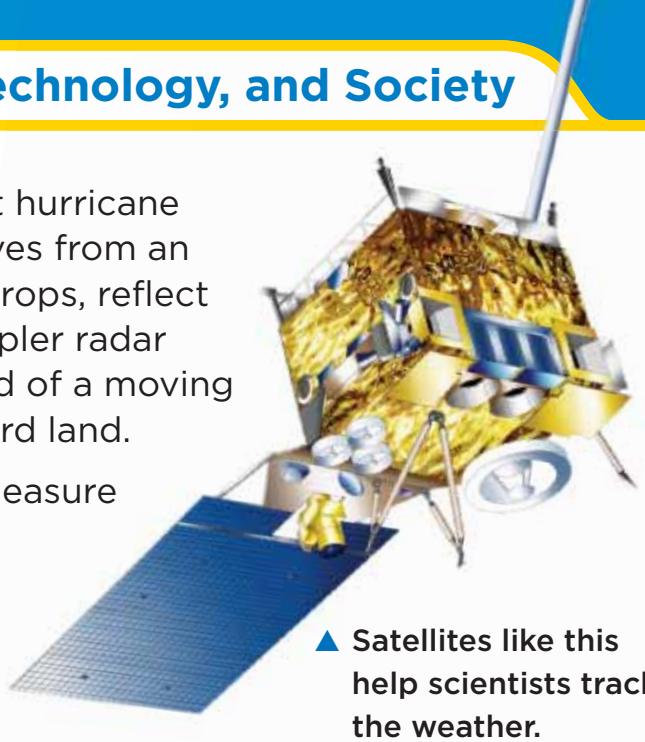
To study a hurricane, scientists gather large amounts of data. Satellites that orbit Earth collect information about cloud patterns. They record temperatures on top of clouds and at the sea surface. Satellites also measure the direction and speed of winds above the ocean. This information helps scientists track the size, path, and intensity of a storm.



Scientists used Doppler radar to track Hurricane Ivan in 2004.

Doppler radar is another tool that hurricane scientists use. It sends out radio waves from an antenna. Objects in the air, like raindrops, reflect the waves back to the antenna. Doppler radar can measure the direction and speed of a moving object, like a hurricane moving toward land.

Buoys spread across the ocean measure conditions like surface wind, waves, temperature, and fog. Planes fly to the center of a hurricane to gather data about wind, pressure, temperature, and humidity.



▲ **Satellites like this help scientists track the weather.**

Scientists enter all of this data into supercomputers to create a model of the hurricane. This model helps them predict the wind speed, size, and direction of the hurricane, and where and when it might hit land. Accurate predictions of a hurricane's path can reduce the loss of life and property.

Fact and Opinion

- **Facts tell you about something that has really happened.**
- **Opinions are what someone thinks about facts or events.**

Write About It

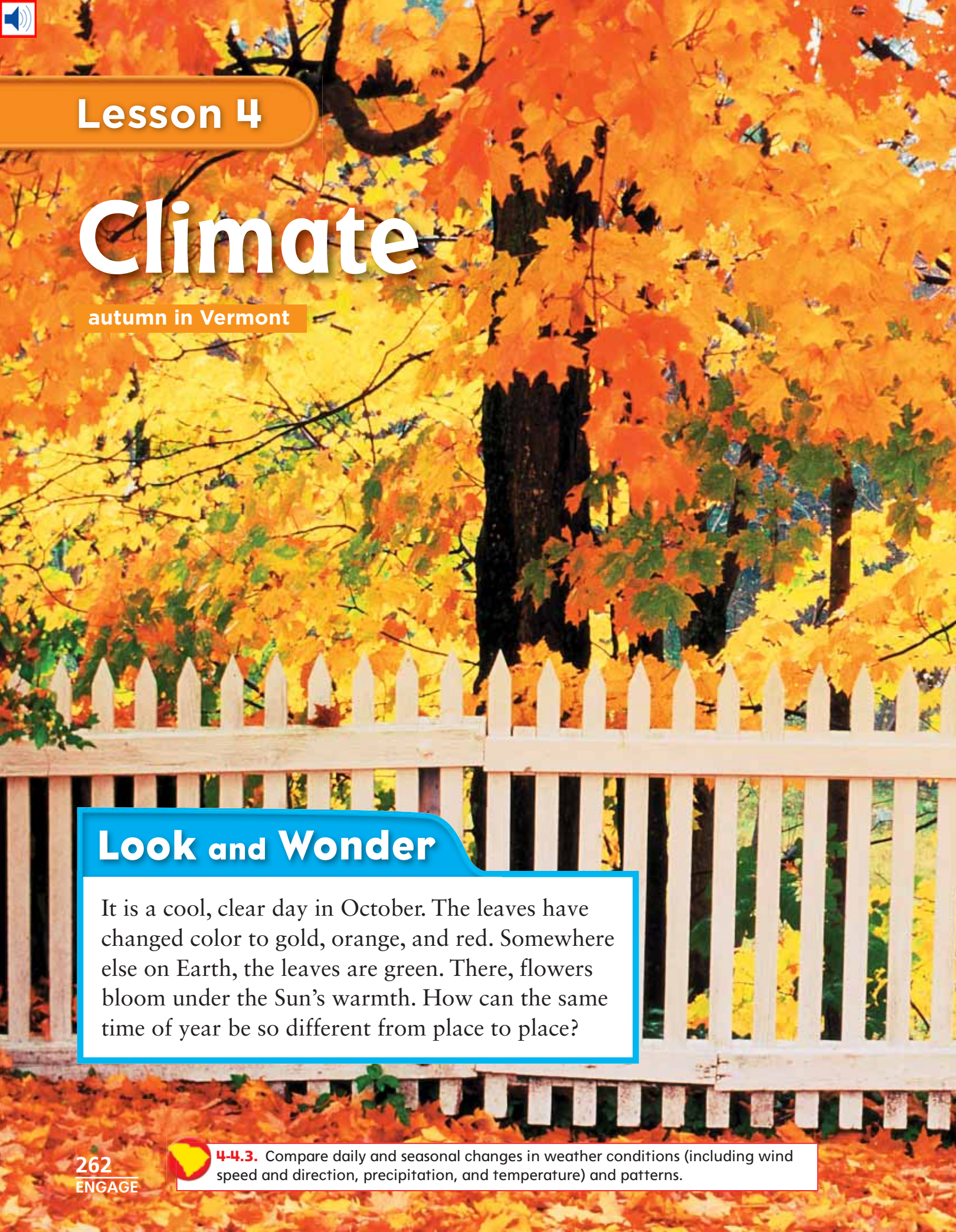
Fact and Opinion

1. What technologies help scientists study hurricanes?
2. What do you think would happen during a hurricane in your neighborhood?

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

4-4.4. Summarize the conditions and effects of severe weather phenomena and related safety concerns.

American Museum of Natural History



Lesson 4

Climate

autumn in Vermont

Look and Wonder

It is a cool, clear day in October. The leaves have changed color to gold, orange, and red. Somewhere else on Earth, the leaves are green. There, flowers bloom under the Sun's warmth. How can the same time of year be so different from place to place?

4-4.3. Compare daily and seasonal changes in weather conditions (including wind speed and direction, precipitation, and temperature) and patterns.

Explore

Inquiry Activity

What affects weather patterns?

Purpose

Explore the factors that determine the weather patterns in different places.

Procedure

1. Locate the cities of Chicago, Miami, Phoenix, and Seattle on a map.
2. **Predict** The data table shows the yearly temperature and precipitation for these four cities. Predict where each belongs in the table.
3. **Classify** Copy the table. Research the weather patterns of the four cities. Fill in the cities where they belong.
4. Find out the yearly temperature and precipitation for the place where you live. Add this data to your table.

Materials

- paper
- markers

City	Yearly Temperatures	Yearly Precipitation
1	Hot summers mild winters	Very little rain
2	Hot summers warm winters	A lot of rain
3	Hot or warm summers cold winters	Much rain and snow
4	Warm summers mild winters	A lot of rain
5 My Community		

Draw Conclusions

5. Compare the table to your prediction in step 2. How does it compare?
6. **Interpret Data** Which cities are near oceans? How does their data compare to the other cities? Which cities are farthest south? How do they compare to the northern cities?

Explore More

Look at today's weather map. Compare the weather in each of the four cities with your data table. Is today's weather similar to or different from yearly patterns? Can you explain any differences?

4-I.6. Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

Read and Learn

Main Idea 4-4.3

Climate is the weather pattern of an area. Many factors affect the different climate regions of the world.

Vocabulary

climate, p. 264

current, p. 266

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Reading Skill

Fact and Opinion

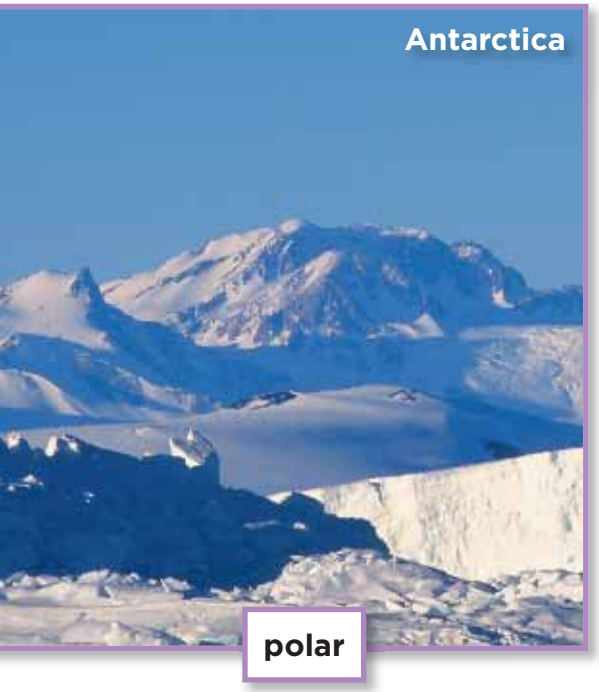
Fact	Opinion

What is climate?

The weather where you live may change from day to day. Yet you can predict what the weather will be like each season. The pattern of seasonal weather that happens year after year is called **climate** (KLYE•mit).

Climate is not the same everywhere on Earth. The city of Phoenix is in the southwest United States. The climate there is warm and dry all year. Snow and rain rarely fall. Seattle is in the northwest United States. There the climate is cool and wet.

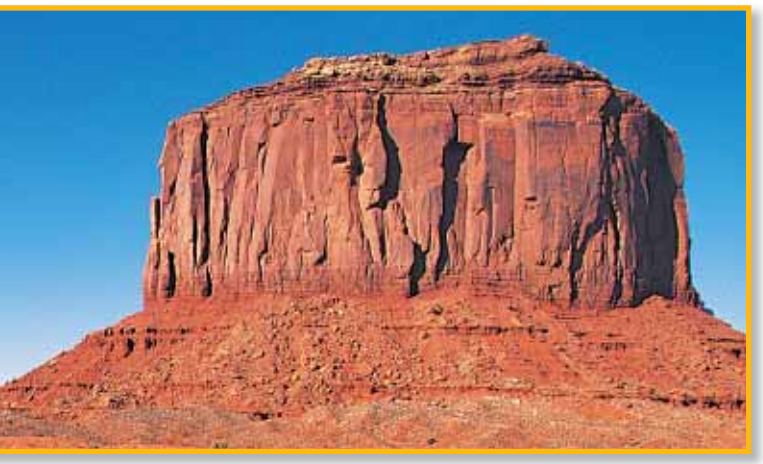
Farmers depend on climate to grow their crops. Some crops grow well in cool climates with steady rain. Other crops need dry climates. Still others need warm, humid climates.



Climate Regions

Think of climate as the average weather in a certain place for a long period of time. It has similar patterns of temperature, humidity, precipitation, and wind. We can call such an area a *climate region*.

Polar regions have cold climates with low precipitation. Tropical regions are near the equator. There, the climate is warm, humid, and rainy. *Temperate* regions lie between polar and tropical regions. Temperate climates often have four seasons. Some have just two seasons—a dry one and a rainy one. Still other regions are dry or cool.

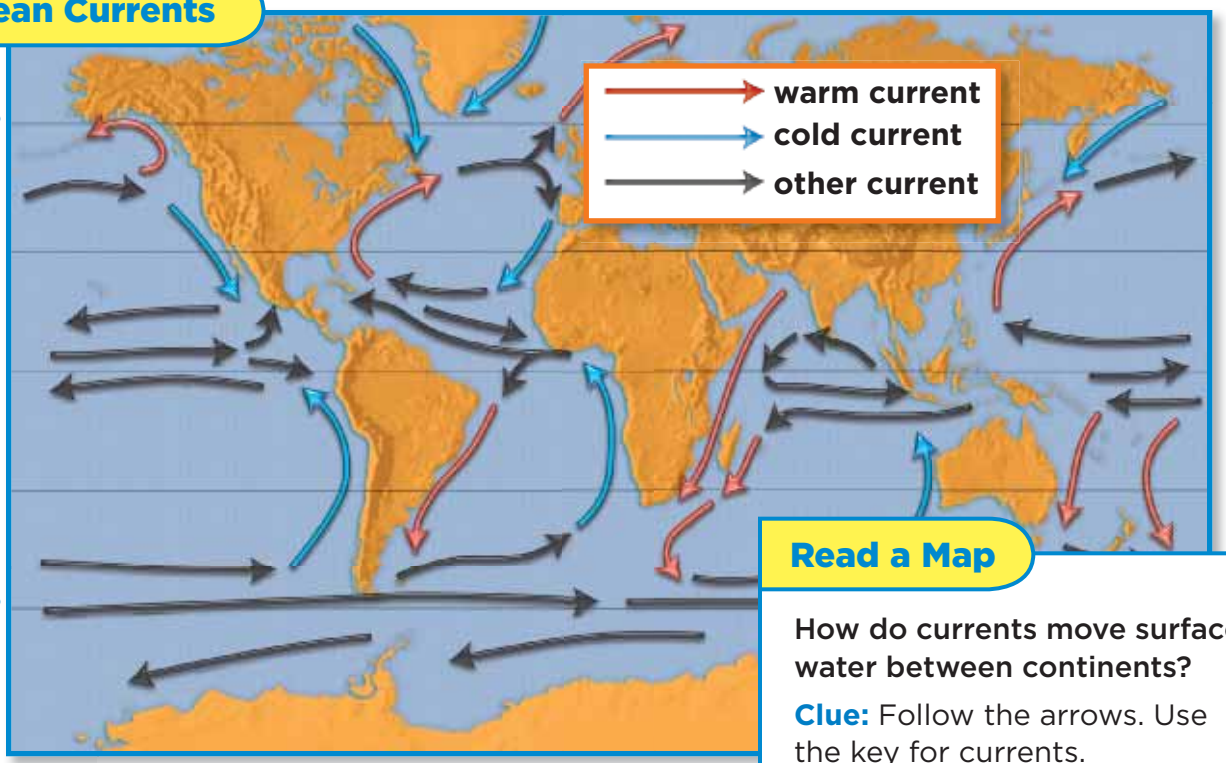


Quick Check

Fact and Opinion *Cool climate regions are best.* Is this statement a fact or an opinion? Explain.

Critical Thinking Describe the climate of your region.

Ocean Currents



Read a Map

How do currents move surface water between continents?

Clue: Follow the arrows. Use the key for currents.

What determines climate?

Several things affect a climate region over time. These include latitude, winds, and currents.

Latitude

The thin lines that run east and west across some maps are lines of latitude. *Latitude* is a measure of how far a place is from the equator. The equator's latitude is set at zero degrees. Latitude increases as you move north or south from there. The highest latitude is at the North and South Poles. Both are 90 degrees.

Climates near the equator are warm and rainy. Between the equator and the poles, the climate is mild or temperate. Near the poles, the climate is cold all year.

Global Winds

Temperature differences between latitudes cause *global winds*. These are winds that move air between the equator and poles. Warm air near the equator rises and moves toward the poles. Cold air near the poles sinks and moves toward the equator.

Ocean Currents

A **current** is a directed flow of a gas or a liquid. Some ocean currents move warm water from the equator to the poles. Others move cold water from the poles toward the equator. There are also currents that move along lines of latitude. Together, these currents form circular patterns in the oceans.

Distance from Water

Do you like to swim at the beach in summer? You may have noticed that the water stays cool even on the hottest days. That is because water heats up more slowly than land does. Water cools more slowly, too.

Remember that more than 70 percent of Earth's surface is covered by water. Land and water heat and cool at different rates. These differences affect the air temperature and precipitation nearby.

Climates near lakes and oceans are cloudier and rainier than regions farther inland. Summers are cooler. Winters are warmer. Nearness to water reduces temperature extremes. It also increases moisture in the air.

Quick Lab

Climate in Two Cities

1. Study the data table. It shows climate information for Seattle, WA, and Fargo, ND. Locate these two cities on a map.
2. **Communicate** Describe the climates of the two cities. How do the climates compare?
3. **Infer** What factor best explains the differences between the two climates? Why do you think so?

Month	Property	Seattle	Fargo
July	high temperature	75°F	83°F
July	precipitation	19 mm	69 mm
December	high temperature	45°F	20°F
December	precipitation	150 mm	17 mm

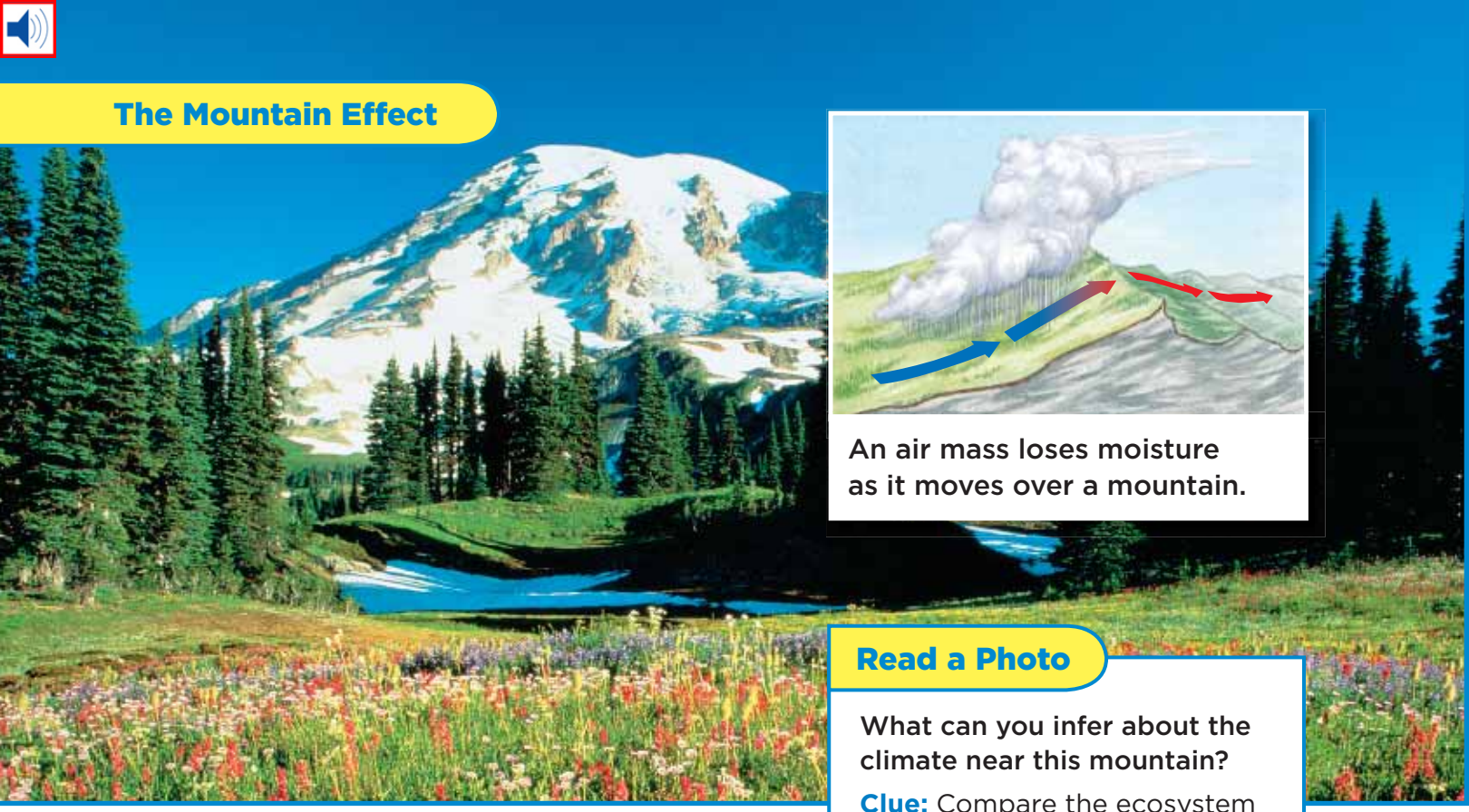
Quick Check

Fact and Opinion *The equator has a warm climate.* Is this statement a fact or an opinion? Explain.

Critical Thinking What kinds of evidence might sailors in the past have used to learn about currents?

Indiana is an inland state. Winters there are cold and snowy.

The Mountain Effect



An air mass loses moisture as it moves over a mountain.

Read a Photo

What can you infer about the climate near this mountain?

Clue: Compare the ecosystem at the base of the mountain to its peak.

How do mountains affect climate?

Latitude, water,and winds are not the only factors that affect climate. Mountains also have an effect.

Altitude

Climate at the base of a mountain is always warmer than at its peak. The higher the altitude, the lower the air temperature. *Altitude* is a measure of the height of a place above sea level.

What happens when an air mass meets a mountain? The air rises up the side of the mountain. As the altitude gets higher, temperature gets cooler. Water vapor in the air condenses into clouds.

Clouds and Precipitation

As a cloud moves up a mountain, its water droplets get heavy. Precipitation falls. By the time the air mass passes over the mountain, the air is dry. For this reason, the climate on one side of a mountain tends to be wet. The climate on the other side is often dry.

Quick Check

Fact and Opinion State one fact and one opinion about mountains and climate.

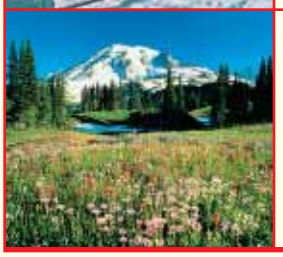
Critical Thinking How can a mountain "dry out" the air?

Lesson Review

Visual Summary

Climate regions have regular patterns of air temperature, humidity, precipitation, and wind.

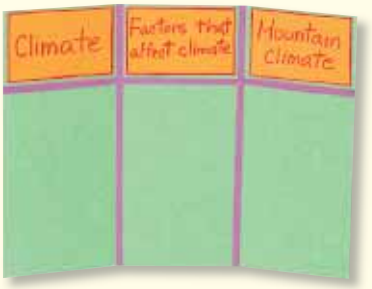
Factors that affect climate are latitude, global winds, ocean currents, and distance from oceans and lakes.



Altitude affects **mountain climates**. The air temperature gets lower as you move up a mountain.

Make a FOLDABLES™ Study Guide

Make a Trifold Chart. Use it to summarize what you read about climate.



Think, Talk, and Write

1. **Main Idea** What factors affect the climate of a region?

2. **Vocabulary** Ocean _____ move heat from one place to another.

3. **Fact and Opinion** Choose a climate. Why would you enjoy living in this climate? Why would you not enjoy this climate? Include facts from this lesson.

Fact	Opinion

4. **Critical Thinking** How is climate different from weather?

5. **Test Prep** **Latitude is a measure of distance from _____**

   A an air mass.
   B an ocean current.
   C a mountain.
   D the equator.

6. **Test Prep** **Where is altitude highest?**

   A on a mountaintop
   B at the base of a mountain
   C at sea level
   D in a valley

Math Link

Find the Average Temperature
For five years, a weather station recorded high temperatures of 86°F, 89°F, 90°F, 92°F, and 88°F for the same date. What was the average for that date over the five years?

Social Studies Link

Learn About Climate
Choose another country or region. Research and report on its climate. Show how climate affects the people who live there. Find out about the crops they grow.

Be a Scientist

Materials

paper

scissors

string

heat source

Structured Inquiry

How does warmed air affect the weather?

Form a Hypothesis

Large masses of warm air can affect the climate of a region. You can model how warm air moves. What do you think will happen if you hold a spiral of paper over a heat source? Write your hypothesis in the form "If the air warms, then the paper spiral will ..."

Test Your Hypothesis

1. **Be Careful.** Cut a circle of paper to form a spiral.
2. Tie a piece of string to one end of the paper.
3. Have your teacher turn on a heat source, such as a lamp. Carefully hold or hang the spiral about 15 centimeters above the heat source.

4. **Observe** Describe what the spiral does.
5. While holding the spiral above the heat source, turn the heat off. Describe what happens to the spiral.

Draw Conclusions

6. Was your hypothesis correct? How did the paper spiral move when it was heated?
7. **Communicate** What happened to the paper spiral when you turned the heat off? How can you explain this?
8. **Infer** What happens to air over ground that is warmed throughout the day?

Guided Inquiry

Which type of land changes temperature fastest?

Form a Hypothesis

Air is warmed by heat released from the land or water. Of soil, sand, or rock, which type of land holds heat longest? Write your answer in the form of a hypothesis.

Test Your Hypothesis

Design an investigation to find out which type of land holds heat longest. Write out the materials you will need and the steps you will follow. Record your results and observations.

Draw Conclusions

Did your results support your hypothesis? Why or why not?

Open Inquiry

What else would you like to learn about air, heat, and climate? Design an investigation to answer your question. Your investigation must be written so that another group can repeat the investigation by following your instructions.

Remember to follow the steps of the scientific process.

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

4-I.3. Summarize the characteristics of a scientific investigation that represent a fair test.

CHAPTER 5 Review

Visual Summary

Lesson 1 Scientists measure the properties of Earth's atmosphere to describe weather.

Lesson 2 Water changes state as it moves between Earth's surface and atmosphere in the water cycle.

Lesson 3 We can predict the weather by observing air masses and fronts.

Lesson 4 Climate is the weather pattern of an area. Many factors affect the different climate regions of the world.

Make a FOLDABLES™ Study Guide

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

Vocabulary

Fill each blank with the best term from the list.

air pressure, p. 231

atmosphere, p. 228

climate, p. 264

cloud, p. 239

condensation, p. 239

evaporation, p. 238

front, p. 251

humidity, p. 230

1. During the process of _____, a liquid changes slowly to a gas. 4-4.1
2. The force of air pushing on an area is called _____. 4-4.6
3. The blanket of air surrounding Earth is called the _____.
4. The pattern of seasonal weather in a region over many years is called _____. 4-4.3
5. A measurement of the amount of water vapor in the air is _____. 4-4.5
6. A group of water droplets in the atmosphere form a(n) _____. 4-4.2
7. A boundary between two air masses that have different temperatures is called a(n) _____.
8. A gas changes to a liquid during _____. 4-4.1

Skills and Concepts

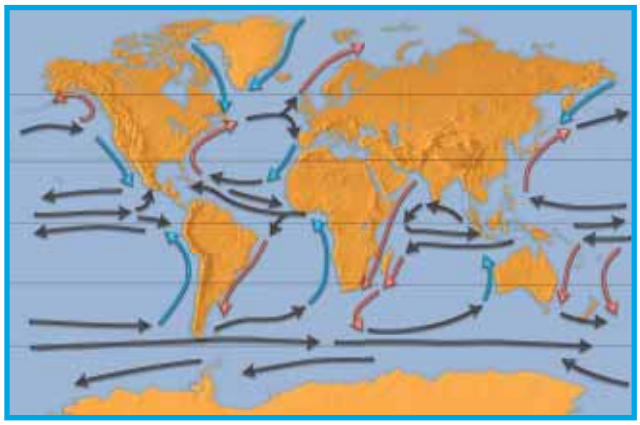
Answer each of the following in complete sentences.

9. **Summarize** Describe the different kinds of fronts.

10. **Make a Model** Construct a simple rain gauge. On an index card, write a short explanation of how it works. 4-4.5

11. **Critical Thinking** A mountain climber goes up a tall peak. At what point in the climb would you expect the air pressure to be the strongest?

12. **Expository Writing** Write a paragraph describing the impact of oceans on climate. 4-4.1



13. **Sequence** What happens to water in a lake during the year? 4-4.1

The Big Idea

14. What are weather and climate? 4-4.3

Performance Assessment

Weather Words

1. Observe the weather at three different points during the day—morning, afternoon, and evening. Write a description of what you observe at each time of day.

2. Look at a weather report on the Internet or on television later that evening. Make a chart comparing your weather observations to those of weather forecasters.

Analyze Your Results

Write a paragraph analyzing your results. How well did your weather observations compare to published reports? How would you explain any differences? 4-4.6

South Carolina Activity

In South Carolina, the high winds and heavy rains of tropical storms and hurricanes can cause great damage. Write a personal narrative about how you or your family prepared for a storm. Did you need any special supplies? Did you have to leave home? If you have never prepared for a storm, write about how you could prepare for future storms.

South Carolina Standards Practice

1 **Which instrument measures wind speed?**

A a wind vane

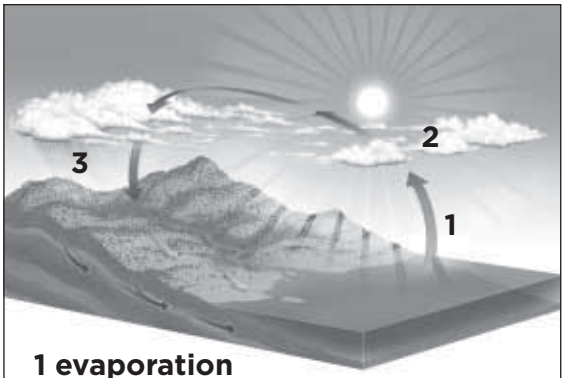
B a barometer

C a hygrometer

D an anemometer

4-1.2, 4-4.5

2 **This diagram shows the processes involved in the water cycle.**



1 evaporation

2 condensation

3 precipitation

What happens after water condenses in the atmosphere?

F It turns to gas.

G It falls to Earth as precipitation.

H It flows to the sea as runoff.

I It evaporates in the atmosphere.

4-1.6, 4-4.1

3 **If clouds are thin, wispy, and high in the sky, they are most likely**

A stratus clouds.

B cumulus clouds.

C cirrus clouds.

D cumulonimbus clouds.

4-4.2

4 **What determines whether a storm is a hurricane?**

F amount of precipitation

G wind direction

H wind speed

I location of origin

4-4.4

5 **Where are tropical climates located?**

A near the equator

B in the middle of continents

C near the poles

D along the coasts

4-4.3

6 **In addition to ocean currents and global winds, which factors influence the climate of a region?**

F elevation and rainfall

G latitude and elevation

H seasons and latitude

I vegetation and distance from water

4-4.3

7 **This table summarizes the weather in a South Carolina city during a week in May.**

Monday	steady rain/high 76°F
Tuesday	light showers/high 81°F
Wednesday	clear skies/high 82°F
Thursday	severe storms/ early high 79°F
Friday	clear skies/high 64°F

Based on the table, on which day did a cold front move in?

A Monday

B Wednesday

C Thursday

D Friday

4-1.6, 4-4.3

8 **If an area is very cold in the winter and very hot in the summer, where is it most likely located?**

F near the coast

G near a lake

H inland

I at the equator

4-4.3

9 **If a stationary front is forecast, what might the residents in that area expect?**

A hot, sunny weather for several days

B brief storms with clearing in between

C several days of rain

D fast-moving, heavy rain or snow

4-4.6

10 **Which of the following is the safest place to be during a tornado?**

F in a car

G in an inside room of a house

H in an outside shelter

I in a mobile home or trailer

4-4.4

11 **Condensation of water vapor onto dust particles in the atmosphere forms**

A dew.

B runoff.

C clouds.

D hail.

4-4.2

12 **If sleet falls, what can you infer?**

F The air outside the cloud is freezing.

G A thunderstorm is occurring.

H The ice in a cloud became too heavy and fell.

I Air temperatures are above freezing.

4-1.4

Literature

TIME FOR KIDS

Magazine Article

Tornado

from *Time for Kids*

Tears Through Midwest

FUJITA SCALE	
F0	branches broken off some trees
F1	surfaces peeled off roofs
F2	whole roofs torn from some houses
F3	most trees in the forest uprooted
F4	well constructed houses destroyed
F5	houses and trucks hurled through the air

Every day you feel the effects of weather. Sometimes the weather changes powerfully. When tornadoes form, the effects might not be forgotten for years. In 2005, one such tornado took Indiana and Kentucky by storm.

Officials estimate its destructive path was about three-fourths of a mile wide and 20 miles long.

Tornadoes are made of strong, spinning winds. The churning storm first struck Evansville. There, it destroyed part of the Eastbrook Mobile Home Park. Indiana officials said that 100 of the 320 mobile homes had been destroyed and 125 others were damaged.

The tornado was rated a severe F3 on what is called the Fujita Scale. Its winds ranged from 158 miles per hour (mph) to 206 mph. The Fujita Scale is named after its creator, Dr. Theodore Fujita. The scale ranges from the weakest, F0, to F5, which is the strongest.

Tornadoes are created when the warm air of a giant storm system rises and hits a current of downward-moving cool air. The crash can cause the wind to start spinning and form a tornado. The center of a tornado is called a vortex. It sucks in air and carries it upward. Most tornadoes are black from picking up dust.

Write About It

Response to Literature What would happen if a tornado struck your community? Write a fictional story. Describe how your community would stay safe. How would it rebuild after the disaster?

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

Careers in Science

Planetarium Technician

Would you like to make star shows that are both educational and fun? Think about being a planetarium technician. A planetarium is a place where people can watch representations of the solar system. These are usually light shows that are projected onto the ceiling and narrated.

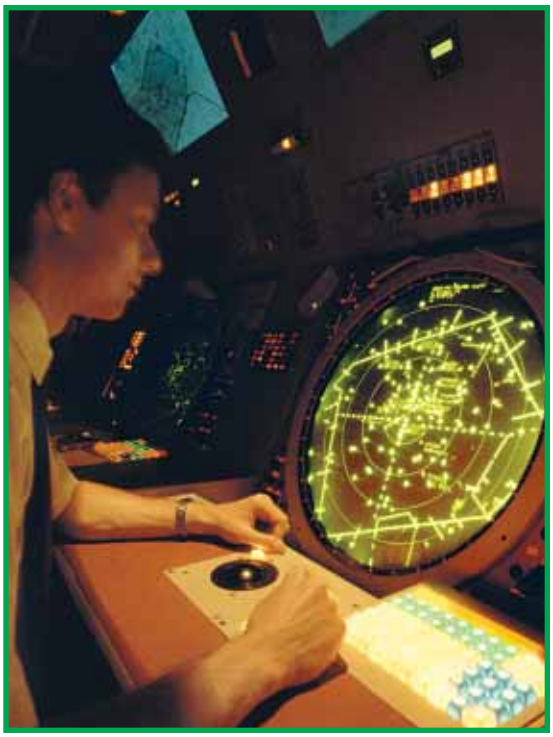
As a planetarium technician, you would operate the audio and light equipment for the shows. You might work with teachers to help plan the programs. You would also get to see and hear the results of your work!

▲ A planetarium technician helps plan exciting star shows.

Air Traffic Controller

People depend on air traffic controllers to keep them safe during air travel. Some air traffic controllers direct planes on the runways. Others direct traffic between airports. All controllers make sure that airplanes keep a safe distance apart.

What does it take to become an air traffic controller? First, you need to be good at math. You should also have good speaking and computer skills. After college, you would train at the Federal Aviation Administration (FAA) Academy. Most graduates of this program have a lifelong career with the FAA.



▲ An air traffic controller keeps flight travel safe.