

Lesson 2 | Weather Patterns

Student Labs and Activities	Page
Launch Lab	25
Content Vocabulary	26
Lesson Outline	27
MiniLab	29
Content Practice A	30
Content Practice B	31
Language Arts Support	32
Math Skills	34
School to Home	35
Key Concept Builders	36
Enrichment	40
Challenge	41
Skill Practice	42

**Launch Lab****LESSON 2: 10 minutes**

How can temperature affect pressure?


Air molecules that have low energy can be packed closely together. As energy is added to the molecules, they begin to move and bump into one another.

Procedure

1. Read and complete a lab safety form.
2. Close a **resealable plastic bag** except for a small opening. Insert a **straw** through the opening and blow air into the bag until it is as firm as possible. Remove the straw and quickly seal the bag.
3. Submerge the bag in a **container** of **ice water** and hold it there for 2 minutes. Record your observations in your Science Journal.
4. Remove the bag from the ice water and submerge it in **warm water** for 2 minutes. Record your observations.

Think About This

1. What do the results tell you about the movement of air molecules in cold air and in warm air?

2.  **Key Concept** What property of the air is demonstrated in this activity?

Content Vocabulary

LESSON 2

Weather Patterns

Directions: Explain the differences between/among each set of terms on the lines provided. You must include the terms below in your answer.

1. high-pressure system, low-pressure system

2. tornado, hurricane

3. blizzard, winter storm

4. air mass, front

5. thunderstorm, dominate, dissipate

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.

Lesson Outline**LESSON 2****Weather Patterns****A. Pressure Systems**

1. A(n) _____ is a large body of circulating air that has low pressure at its center and higher pressure on the outside.
 - a. Air moves from _____ pressure to low pressure.
 - b. In a low-pressure system, air moves away from the _____ of the system.
 - c. Air in the center of the system _____, and the water vapor in it condenses and forms clouds.
2. A(n) _____ is a large body of circulating air that has high pressure at its center and lower pressure on the outside.
 - a. High-pressure air at the center _____ and moves toward low-pressure areas.
 - b. High-pressure systems bring _____ skies.

B. Air Masses

1. _____ are large bodies of air that have distinct temperature and moisture characteristics.
2. An air mass forms when a(n) _____ system lingers in one area for a few days.
 - a. Continental polar air masses are _____ and _____.
 - b. _____ air masses are warm and humid.
 - c. _____ air masses are very cold and dry. They form over _____ or arctic ice.

C. Fronts

1. A weather _____ is the boundary between two air masses.
2. A(n) _____ front forms when a colder air mass moves toward a warmer air mass. It often brings severe _____ and cooler temperatures.
3. A(n) _____ front forms when a warmer air mass moves toward a cooler air mass.
 - a. As the warm air rises, water vapor condenses, and _____ often occurs.

Lesson Outline continued

- b. A warm front brings _____ temperatures and shifting winds.
- 4. A(n) _____ front forms when the boundary between two air masses stalls. It brings _____ skies and light rain.

D. Severe Weather

- 1. A low-pressure system can provide the warm temperatures, moisture, and rising air needed for a(n) _____ to form.
 - a. The _____ stage of a thunderstorm starts with cloud formation and updrafts.
 - b. The _____ stage of a thunderstorm contains heavy winds, rain, and lightning.
 - c. During the _____ stage of a thunderstorm, wind and rain subside.
 - d. Lightning is caused by oppositely _____ particles in clouds and on the ground.
- 2. A violent, whirling column of air that contacts the ground is a(n) _____.
 - a. Tornadoes form when updrafts from thunderstorms begin to _____.
 - b. _____ is the name for the part of the United States that has the most tornadoes.
- 3. A(n) _____ is an intense tropical storm with winds exceeding 119 km per hour.
 - a. Hurricanes typically form in late summer over warm, tropical _____ and are the largest type of severe storm.
 - b. When a hurricane moves over land or _____ water, it loses energy.
- 4. A(n) _____ is a severe winter storm, characterized by freezing temperatures, strong winds, and blowing snow.
- 5. The U.S. National Weather Service issues a(n) _____ when severe weather is possible. It issues a(n) _____ when severe weather is already occurring.

Inquiry **MiniLab**

LESSON 2: 20 minutes

How can you observe air pressure?


Although air seems very light, air molecules do exert pressure. You can observe air pressure in action in this activity.

Procedure   

1. Read and complete a lab safety form.
2. Seal an empty **plastic bottle**.
3. Place the bottle in a **bucket of ice** for 10 minutes. Record your observations in your Science Journal.

Analyze and Conclude

1. **Interpret** how air pressure affected the bottle.

2.  **Key Concept** Discuss how changing air pressure in Earth's atmosphere affects other things on Earth, such as weather.

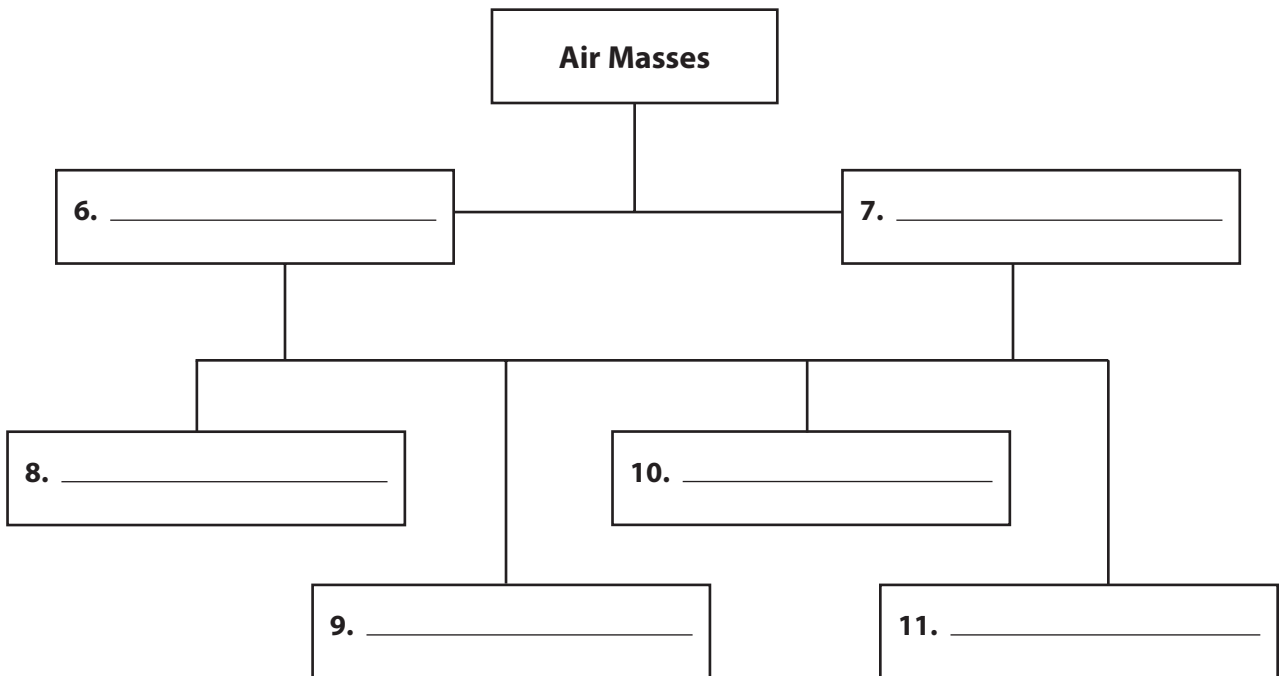
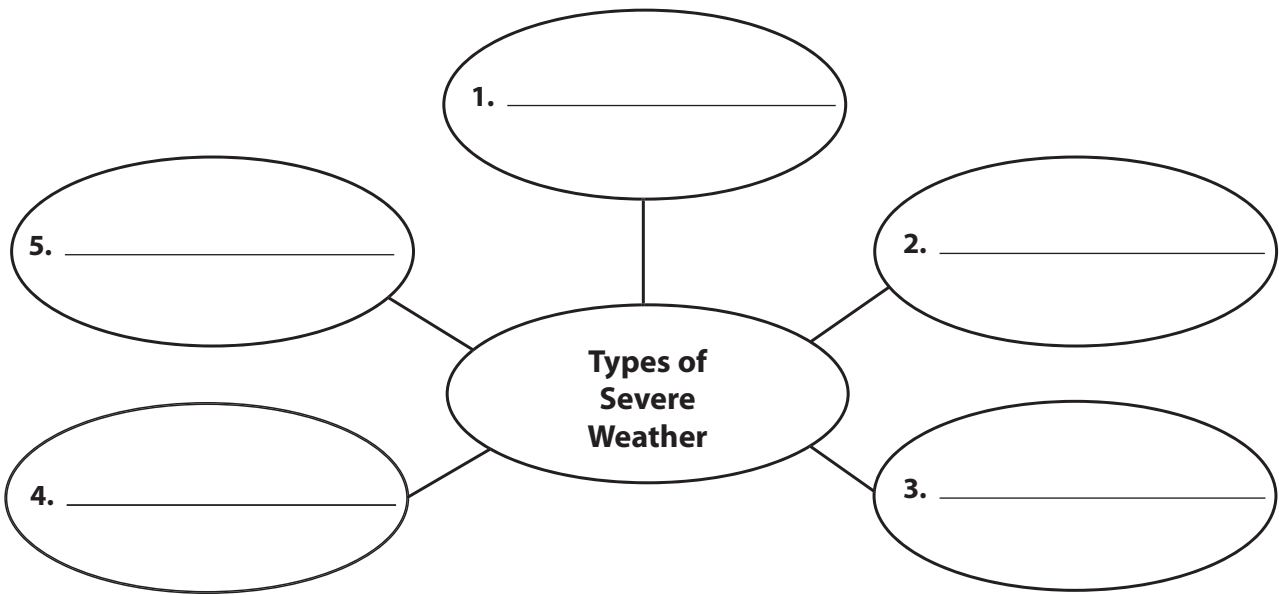
Content Practice A

LESSON 2

Weather Patterns

Directions: Complete these charts by choosing terms from the word bank and writing them in the correct spaces.

- | | | | |
|---------------|----------------|------------------|-------------|
| blizzards | cold front | freezing rain | humidity |
| hurricanes | occluded front | stationary front | temperature |
| thunderstorms | tornado | warm front | |



Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.

Content Practice B**LESSON 2****Weather Patterns**

Directions: On the blank line, write the term from the word bank that correctly completes each sentence. Some terms may be used more than once or not at all.

air mass	continental	denser	front
high-pressure system	hurricane	lighter	low-pressure system
maritime	occluded	stationary	thunder
thunderstorm	tornadoes	tropical	warm

1. A(n) _____ is the most destructive storm on Earth.
2. A(n) _____ forms when a large, high-pressure system lingers over an area for several days.
3. An example of a(n) _____ air mass is a polar air mass that forms over the northern Atlantic Ocean.
4. A boundary between two air masses is a(n) _____.
5. In a(n) _____, rising air cools and water vapor condenses, forming clouds.
6. Cold air pushes underneath warm air because it is _____.
7. In a(n) _____ front, warm air glides over cold air.
8. A(n) _____ front forms when a fast-moving cold front catches up with a slow-moving warm front.
9. The first stage of a(n) _____ is when clouds form; this is the cumulus stage.
10. Rapidly expanding air molecules near a bolt of lightning cause a sound that is referred to as _____.
11. Dry air masses that form over land are called _____ air masses.
12. More _____ occur in the United States than anywhere else.
13. An air mass that forms near the equator is a(n) _____ air mass.
14. Other names for a(n) _____ are tropical cyclone and typhoon.

Language Arts Support**LESSON 2****Word-Usage Activity: Understanding Latin Roots**

The word *precipitate* is a verb that comes from the Latin root *praecipitatus*, which means “to cast down headfirst.” *Precipitate* has various meanings including “to increase the occurrence of something” or “to cause something to happen suddenly.”

The storm damage *precipitated* an argument about the way government should respond to disasters.

The word *precipitate* is related to each of these words.

precipitation *n.* products of condensation in the air, such as rain, snow, and hail

The *precipitation* that fell during the storm was unusually heavy.

precipitous *adj.* extremely or impassably steep

The *precipitous* trails in the nearby mountains make them difficult to climb.

precipitate *n.* substance that is not soluble and condenses out of a solution

She observed that a white *precipitate* formed when she mixed the two colorless solutions.

precipitant *adj.* hasty or rash

The result of his *precipitant* action is an example of why it is wise to think before you act.

Directions: On each line, write the term from the word bank that correctly completes each sentence.

precipitate

precipitous

precipitation

precipitant

1. The weather report says that today's _____ includes rain mixed with snow.
2. Think carefully before you act so you do not make a _____ decision.
3. The sure-footed mountain goats do not appear to be bothered by the _____ mountain paths.
4. A solid produced during a chemical reaction in a solution is a _____.

Language Arts Support

LESSON 2

Word-Usage Activity: Using Scientific Words in Speech and Writing

Directions: Write four complete sentences describing how weather influences people or how people perceive weather. Use the following terms in your sentences.

cold front

hurricane

relative humidity

warm front

Example: A hurricane caused people to seek shelter from the high winds and rain.

1.

2.

3.

4.

Math Skills **LESSON 2****Conversions**

Fahrenheit ($^{\circ}\text{F}$) units and Celsius ($^{\circ}\text{C}$) units are used to measure temperature. The Celsius scale is the standard unit of temperature used in nearly all countries in the world. To convert between Fahrenheit degrees and Celsius degrees, use these equations.

$$C = \frac{(F - 32)}{1.8} \quad F = (C \times 1.8) + 32$$

The news report says that it is 42°F outside. What is the temperature in Celsius?

Step 1 Select the correct equation.

$$C = \frac{(F - 32)}{1.8}$$

Step 2 Substitute the given value.

$$C = \frac{(42 - 32)}{1.8}$$

Step 3 Subtract and then divide.

$$C = \frac{10}{1.8}$$

$$C = 5.6^{\circ}$$

Practice

- The thermometer on the classroom wall reads 20°C . What is the temperature in degrees Fahrenheit?
- It is 100°F on a summer day in San Antonio, Texas. What is the temperature in degrees Celsius?
- It is 17°C in San Francisco, California, and 79°F in Cincinnati, Ohio. In which city is the temperature higher?
- It is -11°C in Detroit, Michigan, and -3°F in Milwaukee, Wisconsin. In which city is the temperature lower?

Weather Patterns

Directions: Use your textbook to answer each question.

- 1. High- and low-pressure systems cause air in a certain location to move. The movement of the air leads to certain weather conditions.**

What kind of weather do low-pressure systems create? What kind of weather do high-pressure systems create?

- 2. Air masses are large bodies of air that have distinct temperature and moisture characteristics.**

How are air masses classified?

- 3. A weather front is a boundary between two air masses.**

What are the four types of weather fronts?

- 4. Severe weather can cause major damage. Severe weather includes thunderstorms, tornadoes, hurricanes, and winter storms.**

Where and how do hurricanes form?

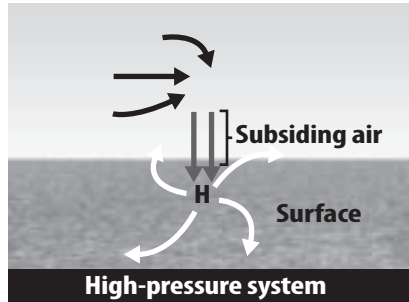
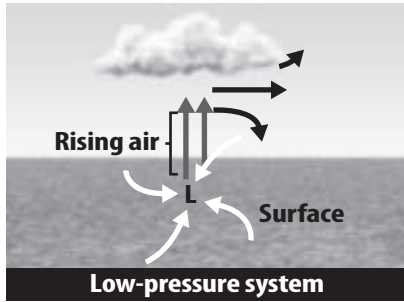
Key Concept Builder 

LESSON 2

Weather Patterns

Key Concept What are two types of pressure systems?

Directions: Use the diagrams to answer each question.



1. Where does air on the outside of a low-pressure system travel—toward the center or outward? _____
2. Does air on the inside of a low-pressure system rise or fall? _____
3. Where does air on the inside of a high-pressure system travel—toward the center or outward? _____
4. Does air on the inside of a high-pressure system rise or fall? _____

Directions: Answer each question on the lines provided.

5. What is a low-pressure system?

6. What is a high-pressure system?

Key Concept Builder 

LESSON 2

Weather Patterns

Key Concept What drives weather patterns?

Directions: Work with a partner to answer each question on the lines provided.

Air Masses		
Arctic	Polar	Tropical
<p>1. Over what area does this air mass form?</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>2. What type of air does it contain?</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>3. How low does the air temperature reach?</p> <p>_____</p>	<p>Continental:</p> <p>4. Where do these air masses form?</p> <p>_____</p> <p>_____</p> <p>5. What type of air do they contain?</p> <p>_____</p> <p>6. What kind of temperatures does this type of air mass bring?</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>Continental:</p> <p>10. Where do these air masses form?</p> <p>_____</p> <p>_____</p> <p>11. What type of air do they contain?</p> <p>_____</p> <p>12. When do they usually form?</p> <p>_____</p> <p>_____</p> <p>13. What type of weather do they bring?</p> <p>_____</p> <p>_____</p>
	<p>Maritime:</p> <p>7. Where do these air masses form?</p> <p>_____</p> <p>_____</p> <p>8. What type of air do they contain?</p> <p>_____</p> <p>9. What type of weather do they bring?</p> <p>_____</p> <p>_____</p>	<p>Maritime:</p> <p>14. Where do these air masses form?</p> <p>_____</p> <p>_____</p> <p>15. What type of air do they contain in the summer?</p> <p>_____</p> <p>16. What type of winter weather do they bring?</p> <p>_____</p> <p>_____</p>

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.

Key Concept Builder 

LESSON 2

Weather Patterns

Key Concept Why is it useful to understand weather patterns?

Directions: Work with a partner. Put a check mark in the space to identify the correct front(s).

Weather Event	Front			
	Cold	Warm	Stationary	Occluded
1. A colder air mass moves toward a warmer air mass.				
2. An approaching front stalls.				
3. Warm air glides above a cold air mass.				
4. A fast-moving cold front catches up with a slow-moving warm front.				
5. The boundary between two air masses stalls.				
6. The wind becomes gusty and changes directions.				
7. A wide blanket of clouds is created.				
8. A few days of warm weather occur.				
9. Warm air is forced to rise.				
10. This is present at the edge of an approaching air mass.				
11. This front moves faster than a warm front.				
12. This usually brings precipitation.				

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.

Key Concept Builder 

LESSON 2

Weather Patterns

Key Concept What are some examples of severe weather?

Directions: Answer each question in the space provided.

Thunderstorms				
1. What happens in the cumulus stage?	2. What happens in the mature stage?	3. What happens in the dissipation stage?	4. What should you do to stay safe?	
Tornadoes				
5. How do tornadoes start?	6. How is a funnel cloud created?	7. What happens when the funnel cloud reaches the ground?	8. What should you do to stay safe?	
Hurricanes				
9. What happens first?	10. How do the winds rotate?	11. What type of storm forms?	12. When does the storm become a hurricane?	13. What should you do to stay safe?
Winter Storms				
14. What happens when there is freezing rain?		15. Why are blizzards dangerous?		

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.

Enrichment**LESSON 2**

The Benefits of Hurricanes

Hurricanes can be destructive, but they have been around as long as Earth has had an atmosphere. They are a natural part of the interactions of the atmosphere and oceans.

Rainfall

As much as 25 percent of the available rainfall in Japan, Southeast Asia, India, and the southeast United States is brought in by tropical storms and hurricanes. Hurricanes can carry enormous amounts of water. Although flooding can be associated with hurricane rains, the precipitation is vital for industries, farming, and drinking water that comes from lakes and groundwater.

Barrier Islands

Barrier islands are strips of sand that form long, narrow islands parallel to the mainland. Over time, wave action forms and changes these islands. Just as dunes of desert sand move with the wind, barrier islands also move with the waves. Even as a hurricane erodes the beaches on the ocean front, it deposits sand on the back side of the island with the storm surge.

Thermal Energy Relief

Earth receives solar radiation most directly along the equator and in the tropics, where most hurricanes are born. Some of this thermal energy is moved around by ocean currents, but most is

distributed by movements in the atmosphere, such as hurricanes. A hurricane is fed by evaporation from the surface of a warm sea. When the water vapor rises, it cools and condenses, releasing thermal energy into the atmosphere. A hurricane acts like an enormous chimney, pulling thermal energy up and out.

Coral Reefs

Hurricanes and coral reefs occur in roughly the same latitudes. Coral reefs thrive in sunlit shallow waters. Hurricanes can destroy a reef, but it is thought that a hurricane can also benefit a coral reef community in several ways.

A hurricane can clear away dead organisms and wash debris outward to deeper water. It also sand-scours algae and breaks off fan and branched coral. These actions accomplish two things. First, they create available habitat in a teeming, crowded ecosystem. After a hurricane, colonization can occur where there was no room before. Second, it spreads broken coral to other areas where it can reproduce and colonize new areas.

An effect of overly warm tropical waters on coral reefs is called bleaching. The algae in the coral die, and this destroys the symbiotic relationship corals and algae have. A hurricane stirs deeper, cooler, restorative waters to the coral and helps prevent bleaching.

Applying Critical-Thinking Skills

Directions: *Respond to each statement.*

- 1. Predict** one possible pathway of ecological succession on a coral reef that has recently undergone some severe scraping and breakage by a hurricane.
- 2. Describe** how a newspaper might report the effects of a massive hurricane going ashore in an unpopulated part of the world.

Challenge**LESSON 2*****Lightning: Facts, Myths, and Safety***

Lightning is the discharge of electric energy as the result of a buildup of positive and negative charges within a cumulonimbus cloud. The discharge moves toward the ground at about 96,000 km/s. Now that's lightning speed!

The discharge, a thunderbolt, has a temperature of about 22,000°C, which is hotter than the surface of the Sun. The surrounding air becomes superheated and suddenly expands. Then it contracts just as quickly. This rapid expansion and contraction produces a loud sound called thunder. It occurs simultaneously with the lightning discharge, but light travels faster than sound. At a distance, the flash will be seen before the sound can be heard. Count the seconds between the flash and the sound. Every 3 seconds represents 1 km.

Myths

The tallest object on a landscape is not always struck first. The path of lightning is not accurately predictable.

Surge protectors will not save your TV, computer, or other electronics from lightning. Surge protectors are designed to prevent damage by power surges between the power company and your house.

Benjamin Franklin was not struck by lightning. He saw the key on the end of his kite reacting to an electric field, so he wasn't struck. It was a dangerous experiment, though.

The rubber tires on a car do not protect you in a lightning storm. But you are relatively safe in a car because the charge travels through the metal around the car and goes to the ground. Just don't touch anything metal inside the car.

Safety

Lightning is a spectacular show by nature that can be beautiful and awesome. Lightning is also deadly. About 62 people, on average, are killed by lightning each year in the United States. Hundreds more are injured. The National Weather Service reports that for 2007, 45 people were killed and hundreds were injured. Of these,

- 98 percent were outside;
- 89 percent were male;
- 30 percent were males between the ages of 20 and 25;
- 25 percent were standing under a tree; and
- 25 percent occurred on or near the water.

Lightning is a serious danger. Use library resources to discover ways that people can protect themselves and their property. Design a brochure that summarizes the dangers of lightning. In your brochure, present ten rules for being safe in a lightning storm.



Skill Practice

Recognize Cause and Effect LESSON 2: 30 minutes

Why does the weather change?

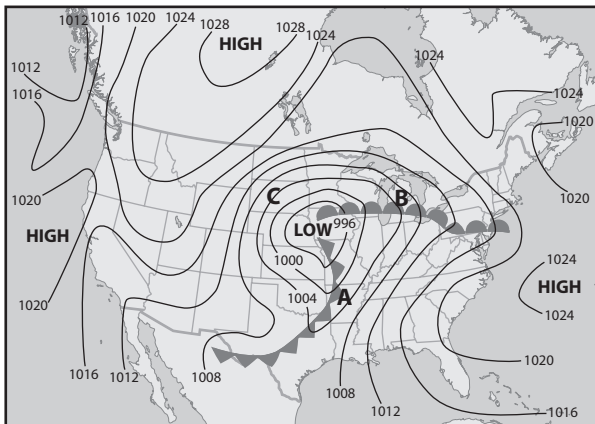
One day it is sunny, and the next day it is pouring rain. If you only look at one spot, the patterns that cause the weather to change are difficult to see. However, when you look on the large scale, the patterns become apparent.

Learn It

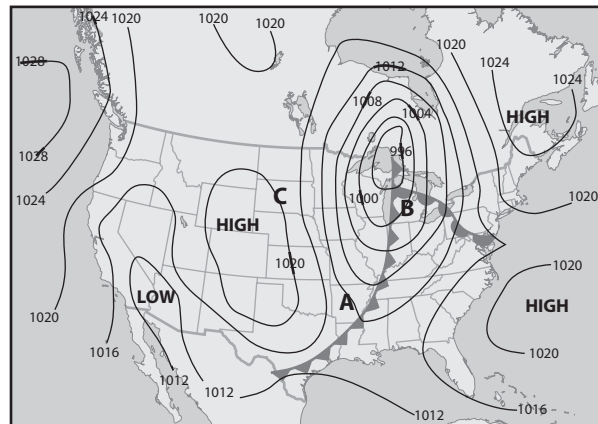
Recognizing cause and effect is an important part of science and conducting experiments. Scientists look for cause-and-effect relationships between variables. The maps below show the movement of fronts and pressure systems over a two-day period. What effect will these systems have on the weather as they move across the United States?

Try It

- Examine the weather maps below. The thin black lines on each map represent areas where the barometric pressure is the same. The pressure is indicated by the number on the line. The center of a low- or high-pressure system is indicated by the word LOW or HIGH. Identify the location of low- and high-pressure systems on each map. Use the key below the maps to identify the location of warm and cold fronts.



Day 1



Day 2

- Find locations A, B, C, and where you live on the map. For each location, describe how the systems change positions over the two days.

KEY	
	Cold front
	Warm front
	Stationary front
	Occluded front
	Precipitation
	Light snow
	Light rain
H	High-pressure system
L	Low-pressure system

Copyright © Glencoe/McGraw-Hill, a division of The McGraw-Hill Companies, Inc.

Skill Practice continued

3. What is the cause of and effect on precipitation and temperature at each location?

Apply It

4. The low-pressure system spawned several tornadoes. Which location did they occur closest to? Explain.

5. The weather patterns generally move from west to east. **Predict** the weather on the third day for each location.

6. One day it is clear and sunny, but you notice that the pressure is less than it was the day before. What weather might be coming? Why?

7.  **Key Concept** How does understanding weather patterns help make predicting the weather more accurate?
