

# 3.2

## KEY CONCEPT

# Low-pressure systems can become storms.

### BEFORE, you learned

- Moving air masses cause changes in weather
- A low-pressure system brings stormy weather

### NOW, you will learn

- How hurricanes develop
- About the dangers of hurricanes
- About different types of winter storms

## VOCABULARY

tropical storm p. 87  
hurricane p. 87  
storm surge p. 89  
blizzard p. 90

## EXPLORE Hurricanes

### What things make hurricanes lose strength?

#### PROCEDURE

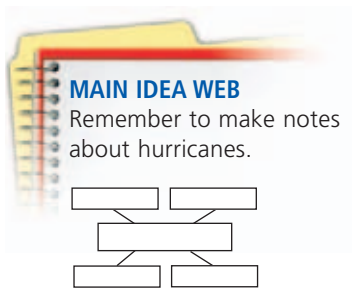
- 1 Crumple a piece of paper, then flatten it out. Crumple and flatten it out again.
- 2 Spin the top on the flattened paper. Count the seconds until it stops spinning.
- 3 Spin the top on a smooth surface. Count the seconds until it stops spinning.

#### MATERIALS

- sheet of paper
- top

#### WHAT DO YOU THINK?

How does the texture of the surface affect the rate at which the top loses energy?



## Hurricanes form over warm ocean water.

Near the equator, warm ocean water provides the energy that can turn a low-pressure center into a violent storm. As water evaporates from the ocean, energy moves from the ocean water into the air. This energy makes warm air rise faster. Tall clouds and strong winds develop. As winds blow across the water from different directions into the low, the Coriolis effect bends their paths into a spiral. The winds blow faster and faster around the low, which becomes the center of a storm system.

A **tropical storm** is a low-pressure system that starts near the equator and has winds that blow at 65 kilometers per hour (40 mi/h) or more. A **hurricane** (HUR-ih-KAYN) is a tropical low-pressure system with winds blowing at speeds of 120 kilometers per hour (74 mi/h) or more—strong enough to uproot trees. Hurricanes are called typhoons or cyclones when they form over the Indian Ocean or the western Pacific Ocean.

**i** **VISUALIZATION**  
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Watch the progress of a hurricane.

## Formation of Hurricanes

In the eastern United States, hurricanes most often strike between August and October. Energy from warm water is necessary for a low-pressure center to build into a tropical storm and then into a hurricane. The ocean water where these storms develop only gets warm enough—26°C (80°F) or more—near the end of summer.

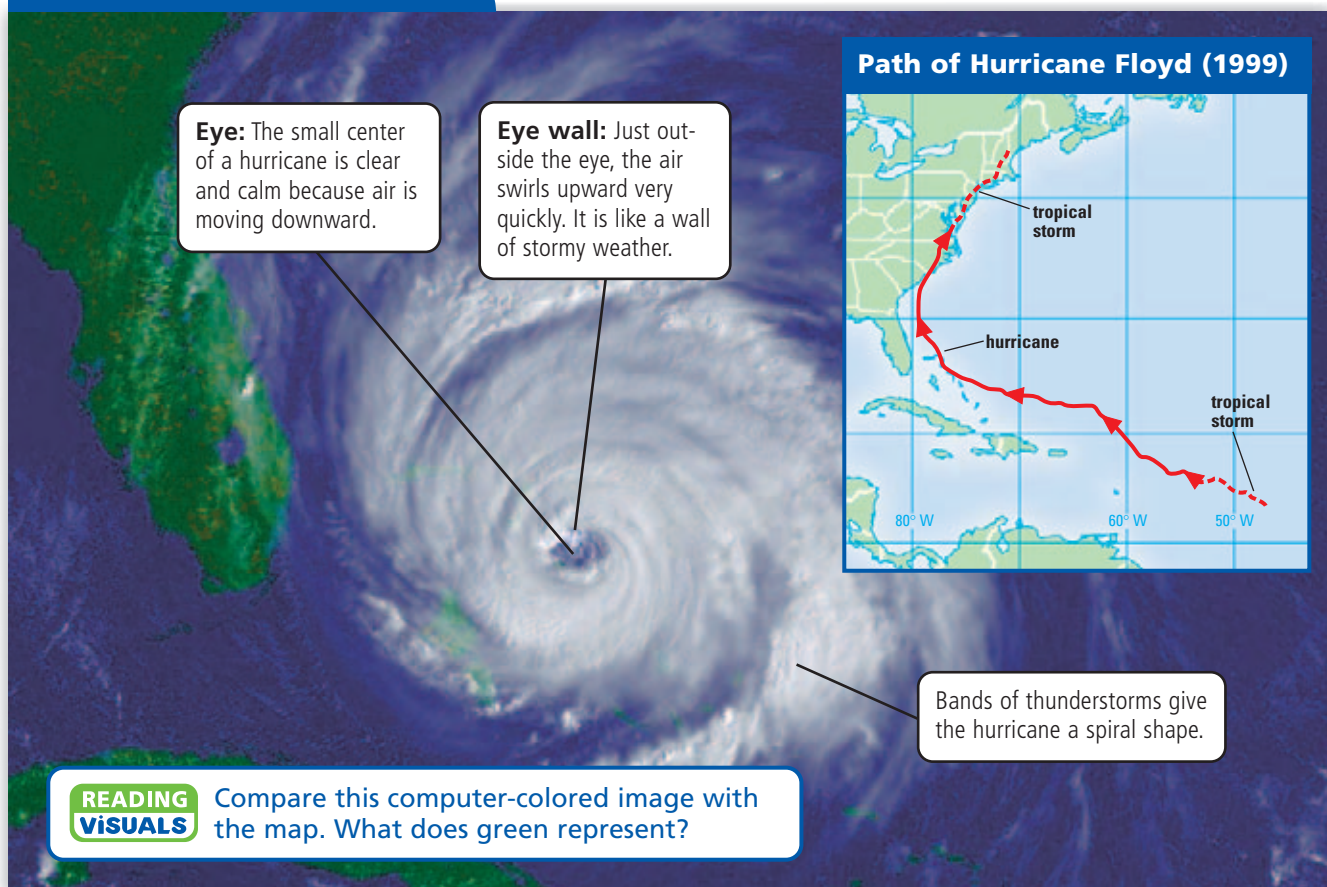
Tropical storms and hurricanes generally move westward with the trade winds. Near land, however, they will often move north, south, or even back eastward. As long as a storm stays above warm water, it can grow bigger and more powerful. As soon as a hurricane moves over land or over cooler water, it loses its source of energy. The winds lose strength and the storm dies out. If a hurricane moves over land, the rough surface of the land reduces the winds even more.

The map below shows the progress of a storm. The tropical storm gained energy and became a hurricane as it moved westward. When the hurricane moved north, the storm lost energy and was called a tropical storm again as its winds slowed.



**CHECK YOUR READING** What is the source of a hurricane's energy?

## Structure of a Hurricane



At the center of a hurricane is a small area of clear weather, 20–50 kilometers (10–30 mi) in diameter, called the eye. The storm’s center is calm because air moves downward there. Just around the eye, the air moves very quickly around and upward, forming a tall ring of cumulonimbus clouds called the eye wall. This ring produces very heavy rains and tremendous winds. Farther from the center, bands of heavy clouds and rain spiral inward toward the eye.



## SAFETY TIPS

### HURRICANES

- Before a storm, prepare a plan to leave the area. Gather emergency supplies.
- Listen to weather reports for storm updates.
- Secure loose objects outside, and cover windows.
- If ordered to evacuate, leave immediately.
- During a storm, stay indoors and away from windows.
- After a storm, be aware of power lines, hanging branches, and flooded areas.

## Effects of Hurricanes

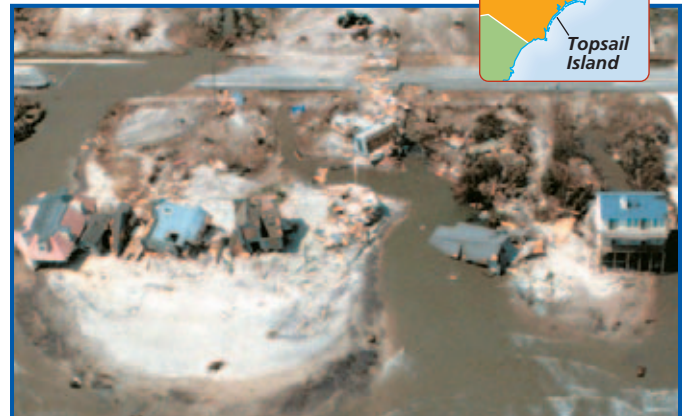
A hurricane can pound a coast with huge waves and sweep the land with strong winds and heavy rains. The storms cause damage and dangerous conditions in several ways. Hurricane winds can lift cars, uproot trees, and tear the roofs off buildings. Hurricanes may also produce tornadoes that cause even more damage. Heavy rains from hurricanes may make rivers overflow their banks and flood nearby areas. When a hurricane moves into a coastal area, it often pushes a huge mass of ocean water known as a **storm surge**. In a storm surge, the sea level rises several meters, backing up rivers and flooding the shore. A storm surge can be destructive and deadly. Large waves add to the destruction. A hurricane may affect an area for a few hours or a few days, but the damage may take weeks or even months to clean up.



### CHECK YOUR READING

What are the effects of hurricanes? Make a list for your answer.

The National Hurricane Center helps people know when to prepare for a hurricane. The center puts out a tropical-storm or hurricane watch when a storm is likely to strike within 36 hours. People may be evacuated, or moved away for safety, from areas where they may be in danger. As the danger gets closer—24 hours or less—the center issues a tropical-storm or hurricane warning. The warning stays in effect until the danger has passed.



**COMPARE AND CONTRAST** These pictures show a shoreline in North Carolina before and after Hurricane Fran in 1996. Compare the houses, road, and water in the two pictures.

## Winter storms produce snow and ice.

Most severe winter storms in the United States are part of low-pressure systems. Unlike hurricanes, the systems that cause winter storms form when two air masses collide. A continental polar air mass that forms over snow-covered ground is especially cold, dry, and dense. It can force moist air to rise very quickly, producing a stormy low-pressure system.

The National Weather Service (NWS) alerts people to dangerous weather. The NWS issues a winter storm watch up to 48 hours before a storm is expected. A winter storm warning means that dangerous conditions are already present or will affect an area shortly.

**Blizzards** Strong winds can blow so much snow into the air at once that it becomes difficult to see and dangerous to travel. **Blizzards** are blinding snowstorms with winds of at least 56 kilometers per hour (35 mi/h) and low temperatures—usually below  $-7^{\circ}\text{C}$  ( $20^{\circ}\text{F}$ ). Blizzards occur in many parts of the northern and central United States. Wind and snow can knock down trees and power lines. Without heat, buildings can become very cold, and water in pipes may freeze. Schools, hospitals, and businesses may have to close. Deep, heavy snow on top of a building may cause the roof to cave in.

**Lake-Effect Snowstorms** Some of the heaviest snows fall in the areas just east and south of the Great Lakes. Cold air from the northwest gains moisture and warmth as it passes over the Great Lakes. Over cold land, the air cools again and releases the moisture as snow. The lake effect can cover areas downwind of the Great Lakes with clouds and snow even when the rest of the region has clear weather.

### VOCABULARY

Remember to add a word triangle diagram for *blizzard*.



## INVESTIGATE Ice

### Why put salt on icy roads?

#### PROCEDURE

- 1 Place one ice cube in each cup.
- 2 Sprinkle salt onto the top of one of the ice cubes and observe the cubes for several minutes.

#### WHAT DO YOU THINK?

- Which ice cube melted more?
- Why do people put salt on roads in winter?

**CHALLENGE** Why do people put sand or cinders on icy roads? Design an experiment to test your ideas.

#### SKILL FOCUS

Observing

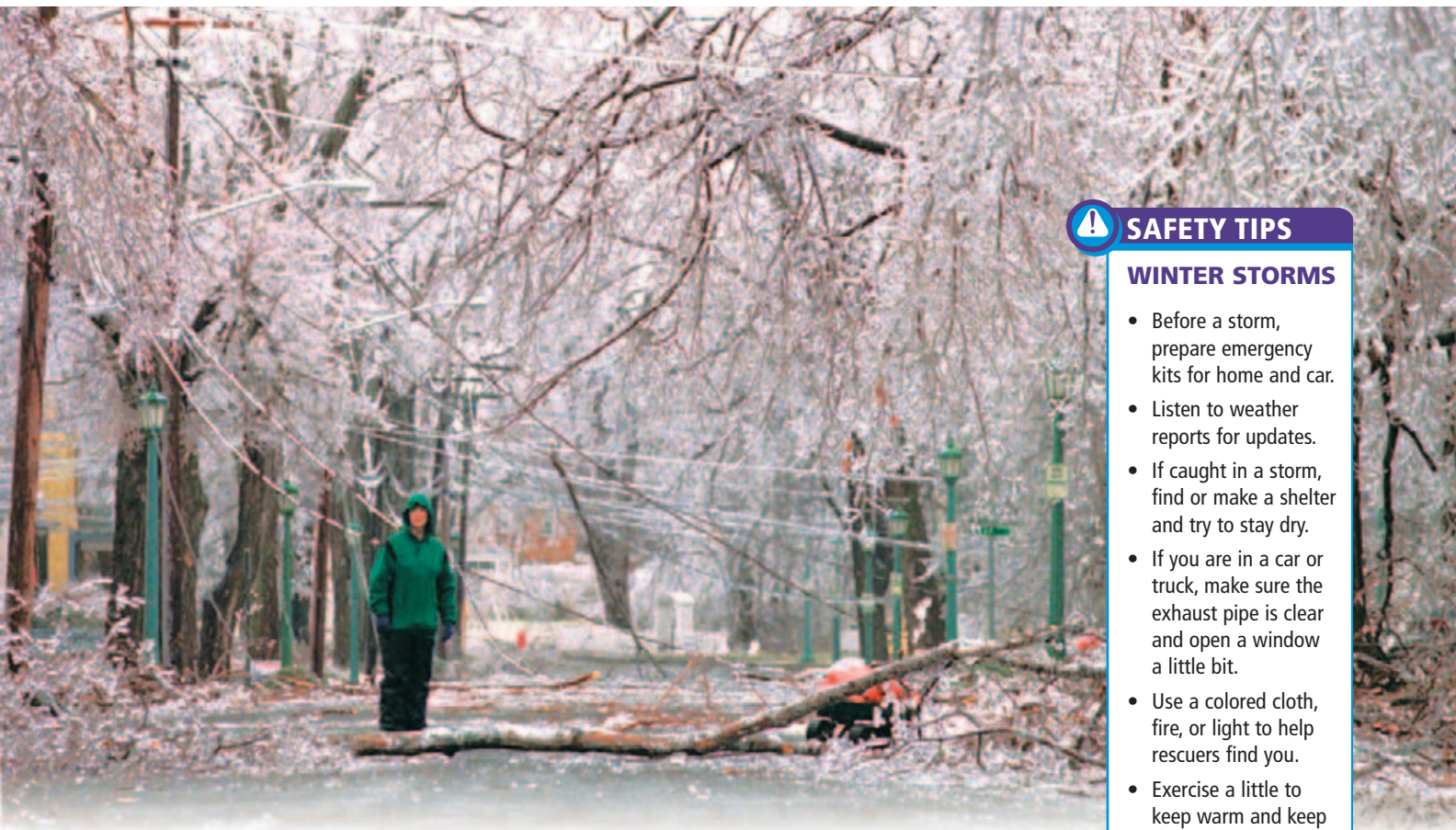
#### MATERIALS

- 2 ice cubes
- 2 cups
- table salt

#### TIME

10 minutes





## SAFETY TIPS

### WINTER STORMS

- Before a storm, prepare emergency kits for home and car.
- Listen to weather reports for updates.
- If caught in a storm, find or make a shelter and try to stay dry.
- If you are in a car or truck, make sure the exhaust pipe is clear and open a window a little bit.
- Use a colored cloth, fire, or light to help rescuers find you.
- Exercise a little to keep warm and keep blood flowing to your fingers and toes.
- If at home, stay inside even if there is no heat or power. Wear layers of clothing.

**Ice Storms** When rain falls onto freezing-cold ground, conditions can become dangerous. The cold rain freezes as it touches the ground and other surfaces. This freezing rain covers everything with heavy, smooth ice. The ice-covered roads become slippery and dangerous. Drivers may find it hard to steer and to stop their cars. Branches or even whole trees may break from the weight of ice. Falling branches can block roads, tear down power and telephone lines, and cause other damage. Damage from ice storms can sometimes shut down entire cities.

#### CHECK YOUR READING

What type of precipitation occurs in each type of winter storm?

## 3.2 Review

### KEY CONCEPTS

1. Where and when do hurricanes form?
2. In what two ways can hurricanes cause floods?
3. List three of the possible dangers from winter storms.

### CRITICAL THINKING

4. **Compare and Contrast** What are the differences between the eye and the eye wall of a hurricane?
5. **Compare** What do hurricanes and winter storms have in common?

### CHALLENGE

6. **Apply** If the wind is blowing from the west and the conditions are right for lake-effect snow, will the snow fall to the north, south, east, or west of a lake? Drawing a diagram may help you work out an answer.