11-7 How do winds form?

Objective

Explain how winds form.

Key Terms

wind: horizontal movement of air

air current: up-and-down movement of air

Winds and Air Pressure Earth's atmosphere is nearly always in motion. Some air movements are weak and end quickly. Others are strong and last a long time.

Air is free to move in any direction. Its actual movements are determined by many factors. The horizontal movement of air along Earth's surface is called **wind.** Wind has often been described as "air in a hurry."

Air can also move vertically. Instead of being called wind, small vertical movements are usually called updrafts or downdrafts. Vertical movements are also important in the atmosphere. However, a much greater volume of air moves horizontally.

Winds form as cool, heavy air moves toward warm, light air. Cool air moves in under warm air. The cool air moves along the surface of Earth toward warmer air.

Winds are caused by differences in air pressure. Regions of cold, heavy air have high air pressure. These regions are called highs. Regions of warm, light air have low air pressure. These regions are called lows.

Air moves from regions of high pressure to regions of low pressure. Winds form when air moves. The speed of the wind depends on the differences in air pressure.

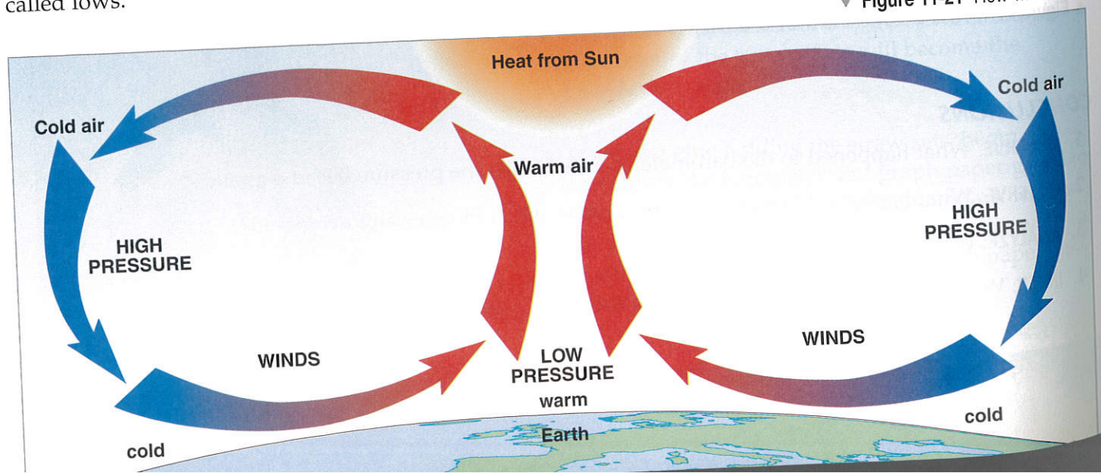
▲ **Figure 11-20** The winds that move these sailboards are produced by differences in air pressure.

1 **PREDICT:** Will the speed of a wind be greater if the difference in air pressure is large or small?

Air Currents Up-and-down movements of air are called **air currents.** Air currents are formed because the Sun does not heat all parts of Earth equally. Some areas of Earth are warmed more than other areas. As air over the warmer regions is heated, it expands and becomes less dense. As air over cooler regions is cooled, it becomes heavier, or denser. The cool air moves in under the warm air. It pushes the warm air upward. As the warm air mixes with the cool air, it becomes heavier and moves downward.

2 **DEFINE:** What is an air current?

▼ **Figure 11-21** How winds form



CHECKING CONCEPTS

1. An air current is an _____ movement of air.
2. Cool air is more _____ than warm air.
3. As cool air moves in under warm air, it pushes the warm air _____.
4. Wind is the _____ movement of air along Earth's surface.
5. Wind speed depends on differences in _____.

THINKING CRITICALLY

6. **INFER:** The Sun does not heat the surface of Earth equally. What effect does this have on weather patterns?
7. **CONTRAST:** What are the differences between highs and lows?
8. **EXPLAIN:** Why does cold air push warm air upward?
9. **INFER:** **a.** Where on Earth would you expect to find the warmest and least dense air? Why? **b.** Where would you expect to find the coldest and densest air? Why?

Web InfoSearch

El Niño Changes in the temperatures of surface ocean water may be responsible for some global weather patterns. Such changes have been linked to El Niño events. El Niño is a warm ocean current that appears off the coast of Peru in December each year and may spread south. El Niño affects Earth's wind patterns and can cause extreme weather far from where it occurs.

SEARCH: Use the Internet to find out more about this. What happens during an El Niño event? Start your search at www.conceptsandchallenges.com. Some key search words are **El Niño, trade winds,** and **climate change.**

Hands-On Activity

OBSERVING AIR PRESSURE

You will need safety goggles, a plastic foam cup, hot water, a funnel, and a small plastic bottle with a screw-on cap.

1. Your teacher will provide you with some hot water in a plastic foam cup. Carefully pour the water into the plastic bottle using a funnel.
   ⚠ **CAUTION:** Use an oven mitt to hold the bottle. Also, be careful when handling the cup of hot water.
2. Quickly pour the hot water out of the plastic bottle back into the plastic foam cup.
3. Immediately screw the cap on the plastic bottle.

▲ **STEP 2** Pour the hot water quickly into the cup.

Practicing Your Skills

4. **OBSERVE:** What happened to the plastic bottle after you screwed on the cap?
5. **INFER:** What can you say about the pressure of the warm air compared to the pressure of the cold air?
6. **CONCLUDE:** Based on your observations, should wind move from cold areas to warm or from warm areas to cold?
7. **RELATE:** How does this activity relate to the way winds form?