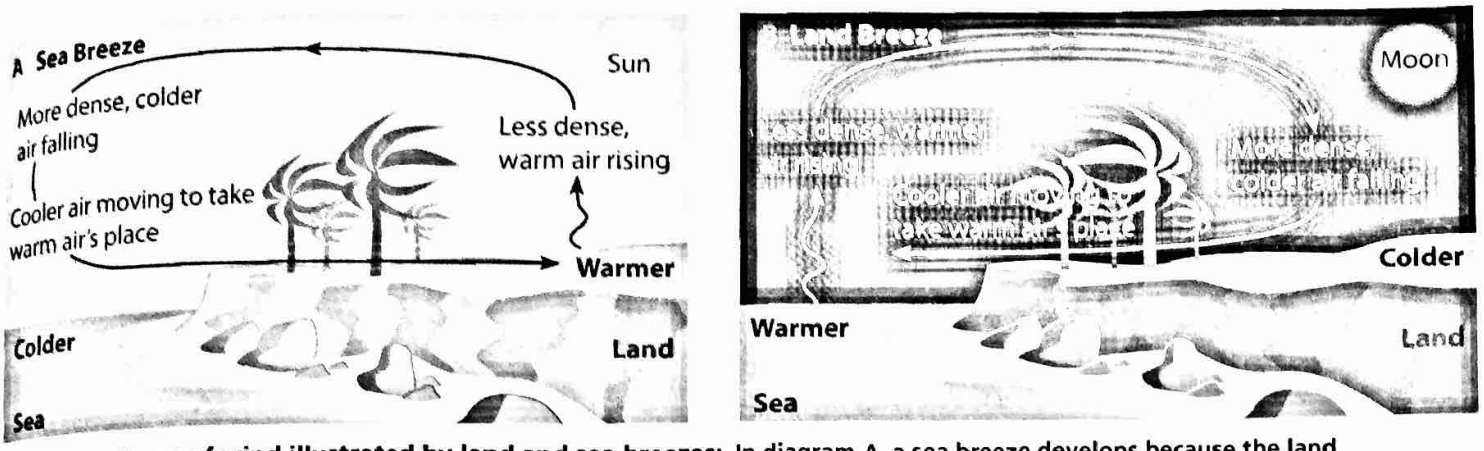


Figure 7-4. Cause of wind illustrated by land and sea breezes: In diagram A, a sea breeze develops because the land heats up faster than the water during the day—resulting in warm, less dense, low-pressure air that rises. Over the ocean cooler, denser, higher-pressure air forms. The cooler, denser, higher-pressure air from the sea replaces the rising warmer air over land—resulting in a sea breeze. In diagram B, at night, reverse conditions result in a land breeze. Note that land and sea breezes can be part of a convection cell.

Wind

Horizontal movement of air parallel to Earth's surface is called wind. Wind is a type of field called vector because it requires a magnitude and direction to totally describe it.

Wind Speed

Winds are caused by differences in air pressure, which are often caused by changing atmospheric conditions of temperature and water vapor content. Figure 7-4 illustrates the cause of wind using local land and sea breezes as an example. The difference in air pressure for a specific distance is called the **air pressure gradient.** The closer together the isobars on a weather map are, the greater (steeper) the pressure gradient. The greater the pressure gradient, the faster the wind speed. (See Figure 7-6.) An instrument called an **anemometer** (Figure 7-5) is used to measure wind speed. Wind speed is measured in miles per hour and knots—nautical miles per hour. One knot equals 1.15 miles per hour (mph); thus, 5 knots equals about 5.75 miles per hour.

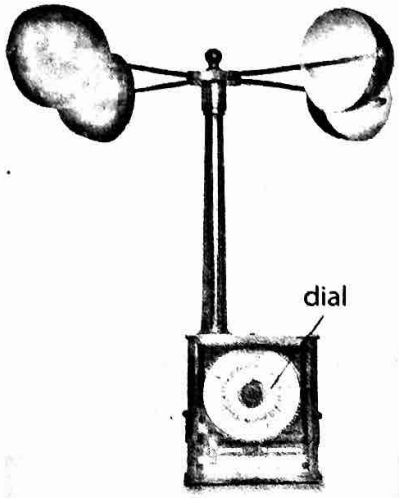


Figure 7-5. Anemometer: An Anemometer is an instrument for measuring wind speed. It usually consists of 3 or 4 cups to "catch" the wind attached to rods that are connected to a shaft that can spin. The faster the wind is blowing the greater the spinning of the anemometer. The spinning of the shaft is connected to a dial by mechanical or electronic means which can be read in units of wind speed.

Wind Direction

Air (wind) moves from areas of high pressure to areas of low pressure. However, the Coriolis effect (caused by Earth's rotation) modifies that

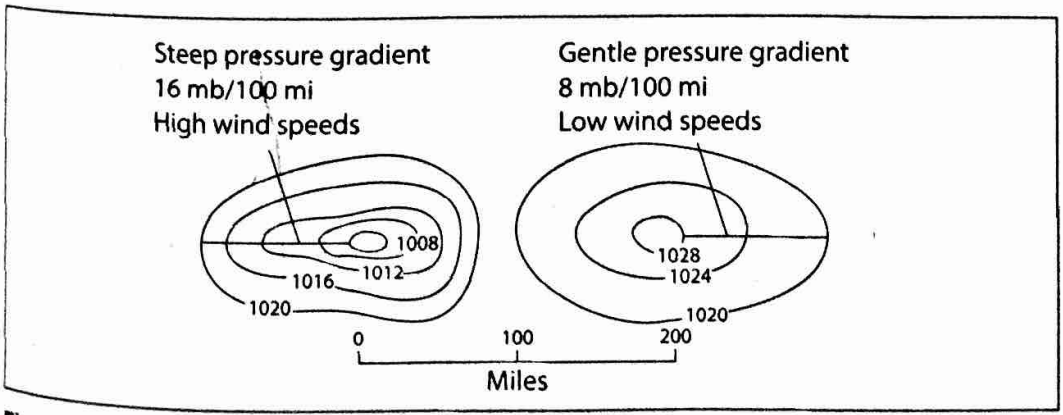


Figure 7-6. Pressure gradient as indicated by closeness of isobars on a weather map: The closer together the isobars, the greater the air pressure gradient. The greater the pressure gradient, the greater the wind speed.

MemoryJogger

You may recall seeing a wind vane or a picture of one. The arrowhead of a wind vane points into the wind—that is, it points in the direction that the wind is blowing from.

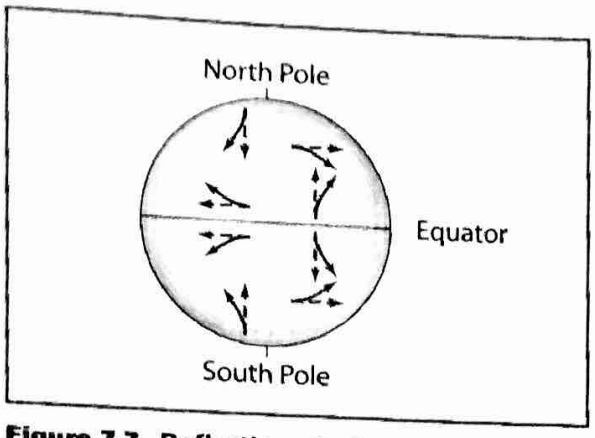


Figure 7-7. Deflection of winds by the Coriolis effect: The dashed arrow in each case shows the direction the wind would blow if there were no Coriolis effect. The solid arrow shows the actual path of the wind. If you face toward the direction the wind is blowing toward, it is always deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

pattern of movement, deflecting winds to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. Figure 7-7 illustrates how wind directions are modified by Earth's rotation.

A wind is named for the direction from which it comes; for example, a wind blowing from the south toward the north is a south wind. A wind blowing towards the southeast is a northwest wind—the direction the wind is coming from. An instrument called a wind vane, or weather vane, is often used to determine wind direction. The arrowhead of a wind vane points into the wind—that is, it points in the direction that the wind is blowing from.

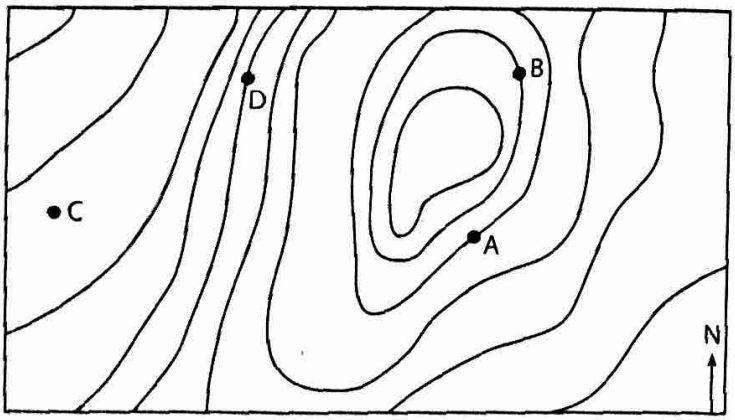
Formation of Waves on Surface Water

Wind blowing over bodies of water creates friction where the air and liquid water meet. The friction transfers energy from the wind to the body of water and produces waves. The stronger the wind, the higher the waves. These energy waves move out from the area where they are produced and toward land where the energy results in wave erosion at shorelines.

Review Questions

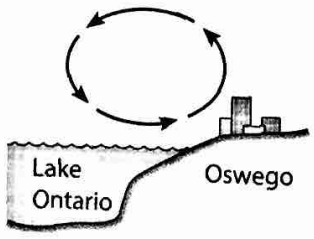
18. As the pressure gradient increases, wind velocity
(1) decreases
(2) increases
(3) remains the same

19. The following map represents a portion of an air-pressure field at Earth's surface. At which position is wind speed lowest?
(1) A (2) B (3) C (4) D

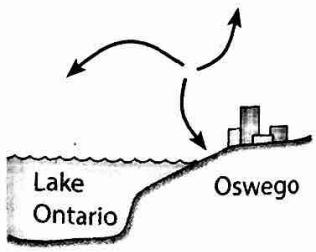


20. In the Northern Hemisphere, a wind blowing from the south will be deflected towards the
(1) northwest
(2) northeast
(3) southwest
(4) southeast

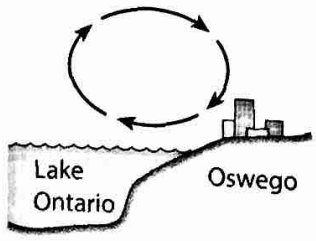
21. Which cross-section best shows the normal movement of the air over Oswego, New York, on a very hot summer afternoon?



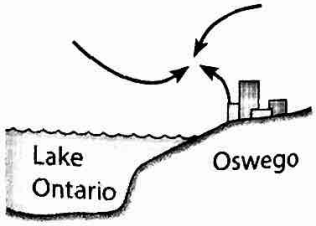
(1)



(3)



(2)



(4)

22. The weather element determined by an anemometer is
(1) pressure
(2) humidity
(3) visibility
(4) wind velocity

23. Winds blow from regions of
(1) high temperature to regions of low air temperature
(2) high air pressure to regions of low air pressure
(3) low temperature to regions of high temperature
(4) low air pressure to regions of high air pressure

24. Which is NOT true about wind?
(1) Wind direction is named for the direction toward which the wind blows.
(2) Wind moves from regions of higher pressure to lower pressure.
(3) The steeper the gradient, the greater the wind speed.
(4) Wind is horizontal movement of air.

General Circulation of the Air in the Troposphere

Differences in air temperature and pressure in various portions of the troposphere cause air to be in constant motion. This circulation of air produces convection cells throughout the troposphere.

Convection Cells

The unequal distribution of insolation on Earth results in unequal heating and differences in air pressure. Cooler air, being denser, sinks toward Earth under the influence of gravity, causing the less dense, warmer air to rise. The result is a series of convection cells around Earth at various latitudes, as shown in Figure 7-8. As indicated by the solid arrows, there are upward currents in the vicinity of 0° latitude (the equator) and 60° North and South latitudes. Downward currents exist near 30° and 90° North and South latitudes. Regions where air comes together to form vertical currents are regions of convergence. Regions where air spreads out from the vertical currents are regions of divergence.

As part of these tropospheric convection cells, there are bands of easterly moving air at the top of the troposphere, called **jet streams.** The winds of the jet stream can blow 200 miles an hour or more. Commercial airplanes flying with the jet stream can save a half hour of flight time traveling from the west to east coasts of the

Polar