Gases and Pressure

SECTION 1

Objectives

- Define *pressure*, give units of pressure, and describe how pressure is measured.
- State the standard conditions of temperature and pressure and convert units of pressure.
- Use Dalton's law of partial pressures to calculate partial pressures and total pressures.

In the chapter "States of Matter," you read about the kinetic-molecular theory, which is based on the idea that particles of matter are always in motion. In this section, you will study the implications of the kinetic-molecular theory of gases.

You have learned that the temperature of a gas is related to the kinetic energy of the gas molecules. In this chapter, you will learn about other properties of gases, including pressure, volume, and amount of gas present, and the relationship between these properties.

Pressure and Force

If you pump air into an automobile tire, the pressure in the tire will increase. The pressure increase is caused by the increase in the number of collisions of molecules of air with the inside walls of the tire. The collisions cause an outward push, or force, against the inside walls. Gas molecules exert pressure on any surface with which they collide. The pressure exerted by a gas depends on volume, temperature, and the number of molecules present. **Pressure** *(P) is defined as the force per unit area on a surface.* The equation defining pressure is shown in **Figure 1.**

FIGURE 1 The pressure the ballet dancer exerts against the floor depends on the area of contact. The smaller the area of contact, the greater the pressure.

(a) Area of contact = 325 cm²

$$\text{Pressure} = \frac{\text{force}}{\text{area}} = \frac{500\ \text{N}}{325\ \text{cm}^2} = 1.5\ \text{N/cm}^2$$

(b) Area of contact = 13 cm²

$$\text{Pressure} = \frac{\text{force}}{\text{area}} = \frac{500\ \text{N}}{13\ \text{cm}^2} = 38\ \text{N/cm}^2$$

(c) Area of contact = 6.5 cm²

$$\text{Pressure} = \frac{\text{force}}{\text{area}} = \frac{500\ \text{N}}{6.5\ \text{cm}^2} = 77\ \text{N/cm}^2$$