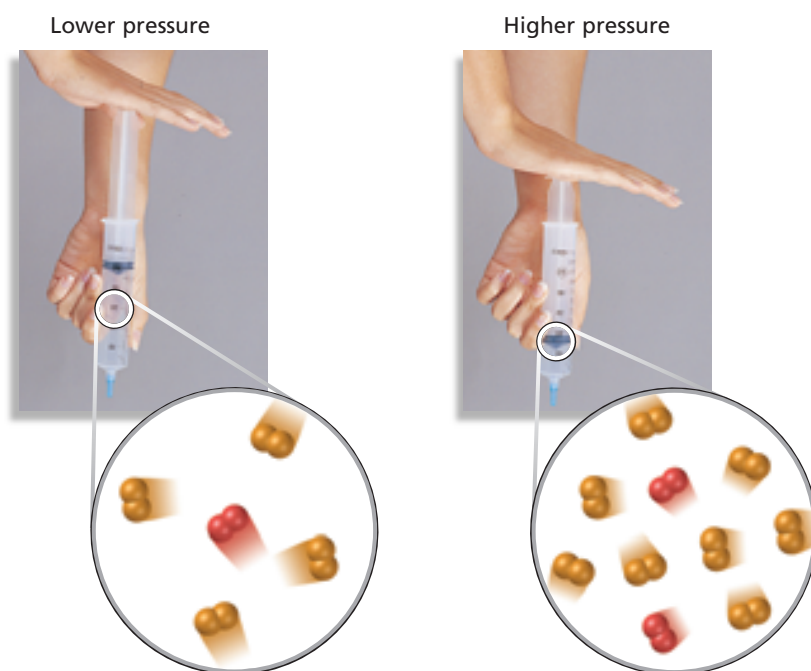# *The Gas Laws*

OBJECTIVES

- Use the kinetic-molecular the-
  ory to explain the relation-
  ships between gas volume,
  temperature, and pressure.

- Use Boyle's law to calculate
  volume-pressure changes at
  constant temperature.

- Use Charles's law to calculate
  volume-temperature changes
  at constant pressure.

- Use Gay-Lussac's law to cal-
  culate pressure-temperature
  changes at constant volume.

- Use the combined gas law to
  calculate volume-tempera-
  ture-pressure changes.

Scientists have been studying physical properties of gases for hundreds of years. In 1662, Robert Boyle discovered that gas pressure and volume are related mathematically. The observations of Boyle and others led to the development of the gas laws. The *gas laws* are simple mathematical rela-tionships between the volume, temperature, pressure, and amount of a gas.

Boyle's Law: Pressure-Volume Relationship

Robert Boyle discovered that doubling the pressure on a sample of gas at constant temperature reduces its volume by one-half. Reducing the pressure on a gas by one-half allows the volume of the gas to double. As one variable increases, the other decreases. **Figure 6** shows that as the volume of gas in the syringe decreases, the pressure of the gas increases.

You can use the kinetic-molecular theory to understand why this pressure-volume relationship holds. The pressure of a gas is caused by moving molecules hitting the container walls. Suppose the volume of a container is decreased but the same number of gas molecules is present at the same temperature. There will be more molecules per unit volume. The number of collisions with a given unit of wall area per unit time will increase as a result. Therefore, pressure will also increase.

CHEMISTRY INTERACTIVE TUTOR

Module 6: Gas Laws

Lower pressure   Higher pressure

FIGURE 6 The volume of gas in the syringe shown in the photo is reduced when the plunger is pushed down. The gas pressure increases as the volume is reduced because the molecules collide more frequently with the walls of the container in a smaller volume.