MICRO LAB

Mass and Density of Air at Different Pressures

OBJECTIVES

- *Measure* the pressure exerted by a gas.
- *Measure* the mass of a gas sample at different pressures.
- *Graph* the relationship between the mass and pressure of a gas sample.
- *Calculate* the mass of an evacuated bottle.
- *Calculate* the volume of a bottle.
- *Calculate* the density of air at different pressures.

MATERIALS

- automobile tire valve
- balance, centigram
- barometer
- cloth towel
- plastic soda bottle (2 or 3 L) or other heavy plastic bottle
- tire pressure gauge

BACKGROUND

You have learned that the amount of gas present, the volume of the gas, the temperature of the gas sample, and the gas pressure are related to one another. If the volume and temperature of a gas sample are held constant, the mass of the gas and the pressure that the gas exerts are related in a simple way.

In this investigation, you will use an automobile tire pressure gauge to measure the mass of a bottle and the air that the bottle contains for several air pressures. A tire pressure gauge measures "gauge pressure," meaning the added pressure in the tire in addition to normal atmospheric air pressure. Gauge pressure is often expressed in the units pounds per square inch, gauge (psig) to distinguish them from absolute pressures in pounds per square inch (psi). You will graph the mass of the bottle plus air against the gas pressure and observe what kind of plot results. Extrapolating this plot in the proper way will let you determine both the mass and the volume of the empty bottle. This information will also allow you to calculate the density of air at various pressures.

SAFETY

For review of safety, please see **Safety in the Chemistry Laboratory** in the front of your book.

PREPARATION

1. Make a data table with five columns labeled "Gauge pressure (psig)," "Mass of bottle + air (g)," "Corrected gas pressure (psi)," "Mass of air (g)," and "Density of air (g/cm^3)."