

## Molar Volume of a Gas

The volume of a mole of gas varies with a change in temperature or a change in pressure. Because of this variation, the volume of a gas is usually measured at a **standard temperature and pressure (STP)**. *Standard temperature is 0°C. Standard pressure is 101.3 kPa or 1 atmosphere.* At STP, 1 mole of any gas occupies a volume of 22.4 L. The number 22.4 L is called the molar volume of a gas at STP. Also recall that 1 mole of any substance contains Avogadro's number of particles. Thus, at STP, one mole of any gas occupies 22.4 L and contains  $6.02 \times 10^{23}$  representative particles of that gas.

Sample Problems:

1. Determine the volume, in liters, of 0.60 moles of  $\text{SO}_2$  gas at STP.
2. Determine the number of moles in 33.6 L of He gas at STP.
3. Determine the density of  $\text{CO}_2$  gas at STP.  
[D = mass/volume]
4. Determine the number of molecules in 5.0 L of  $\text{O}_2$  gas at STP.
5. A certain gas has a density of 2.5 g/L at STP. Determine the molar mass of this gas at STP.

## PRACTICE PROBLEMS

1. Calculate the volume of each of these gases at STP:
  - a) 7.6 mol Ar
  - b) 0.44 mol  $\text{C}_2\text{H}_6$
  - c) 1.20 mol  $\text{O}_2$
2. Determine the density of each of the following gases at STP:
  - a)  $\text{C}_3\text{H}_8$
  - b) Ne
  - c)  $\text{NO}_2$
3. Find each of the following quantities:
  - a) the volume in liters of 835 g of  $\text{SO}_3$  at STP
  - b) the volume in liters of  $3.24 \times 10^{23}$  molecules of  $\text{Cl}_2$  (STP)
  - c) the mass in grams of 18.0 L of  $\text{CH}_4$  [STP]