

# States of Matter

1. Calculate the ratio of effusion rates of oxygen ( $O_2$ ) to hydrogen ( $H_2$ ).
2. Methane ( $CH_4$ ) effuses at a rate of 2.45 mol/s. What will be the effusion rate of argon (Ar) under the same conditions?
3. The effusion rate of hydrogen sulfide ( $H_2S$ ) is 1.50 mol/s. Another gas under similar conditions effuses at a rate of 1.25 mol/s. What is the molar mass of the second gas?
4. The pressure of a gas in a manometer is 12.9 mm Hg. Express this value in each of the following units.
  - a. torr
  - b. atmosphere
  - c. kilopascal
5. The vapor pressure of water is 2.3 kPa at  $23^\circ C$ . What is the vapor pressure of water at this temperature expressed in atmospheres?
6. What is the pressure of a mixture of nitrogen ( $N_2$ ) and oxygen ( $O_2$ ) if the partial pressure of  $N_2$  is 594 mm Hg and the partial pressure of  $O_2$  is 165 mm Hg?
7. A sample of air is collected at 101.1 kPa. If the partial pressure of water vapor in the sample is 2.8 kPa, what is the partial pressure of the dry air?
8. Suppose that 5-mL containers of helium (He), neon (Ne), and argon (Ar) are at pressures of 1 atm, 2 atm, and 3 atm, respectively. The He and Ne are then added to the container of Ar.
  - a. What is the partial pressure of He in the container after the three gases are mixed?
  - b. What is the total pressure in the container after the three gases are mixed?