PRACTICE PROBLEMS

40. Suppose a 5.00 L sample of O_2 at a given temperature and pressure contains 1.08×10^{23} molecules. How many molecules would be contained in each of the following at the same temperature and pressure?
a. 5.0 L H_2
b. 5.0 L CO_2
c. 10.0 L NH_3

41. How many moles are contained in each of the following at STP?
a. 22.4 L N_2
b. 5.60 L Cl_2
c. 0.125 L Ne
d. 70.0 mL NH_3

42. Find the mass, in grams, of each of the following at STP.
a. 11.2 L H_2
b. 2.80 L CO_2
c. 15.0 mL SO_2
d. 3.40 cm^3 F_2

43. Find the volume, in liters, of each of the following at STP.
a. 8.00 g O_2
b. 3.50 g CO
c. 0.0170 g H_2S
d. 2.25×10^5 kg NH_3

44. Acetylene gas, C_2H_2, undergoes combustion to produce carbon dioxide and water vapor. If 75.0 L CO_2 is produced,
a. how many liters of C_2H_2 are required?
b. what volume of H_2O vapor is produced?
c. what volume of O_2 is required?

45. Assume that 5.60 L H_2 at STP reacts with excess CuO according to the following equation:

$$CuO(s) + H_2(g) \longrightarrow Cu(s) + H_2O(g)$$

Make sure the equation is balanced before beginning your calculations.
a. How many moles of H_2 react?
b. How many moles of Cu are produced?
c. How many grams of Cu are produced?

46. If 29.0 L of methane, CH_4, undergoes complete combustion at 0.961 atm and 140°C, how many liters of each product would be present at the same temperature and pressure?

47. If air is 20.9% oxygen by volume,
a. how many liters of air are needed for complete combustion of 25.0 L of octane vapor, C_8H_{18}?
b. what volume of each product is produced?

48. Methanol, CH_3OH, is made by causing carbon monoxide and hydrogen gases to react at high temperature and pressure. If 4.50×10^2 mL CO and 8.25×10^2 mL H_2 are mixed,
a. which reactant is present in excess?
b. how much of that reactant remains after the reaction?
c. what volume of CH_3OH is produced, assuming the same pressure?

49. Calculate the pressure, in atmospheres, exerted by each of the following:
a. 2.50 L HF containing 1.35 mol at 320.0 K
b. 4.75 L NO_2 containing 0.86 mol at 300.0 K
c. 5.50×10^4 mL CO_2 containing 2.15 mol at 57°C

50. Calculate the volume, in liters, occupied by each of the following:
a. 2.00 mol H_2 at 300.0 K and 1.25 atm
b. 0.425 mol NH_3 at 37°C and 0.724 atm
c. 4.00 g O_2 at 57°C and 0.888 atm

51. Determine the number of moles of gas contained in each of the following:
a. 1.25 L at 250.0 K and 1.06 atm
b. 0.80 L at 27°C and 0.925 atm
c. 7.50×10^2 mL at –50.0°C and 0.921 atm

52. Find the mass of each of the following.
a. 5.60 L O_2 at 1.75 atm and 250.0 K
b. 3.50 L NH_3 at 0.921 atm and 27°C
c. 125 mL SO_2 at 0.822 atm and –5°C

Diffusion and Effusion

SECTION 4 REVIEW

53. Describe in your own words the process of diffusion.

54. At a given temperature, what factor determines the rates at which different molecules undergo diffusion and effusion?

55. Ammonia, NH_3, and alcohol, C_2H_6O, are released together across a room. Which will you smell first?