10 CHEMICAL QUANTITIES

Practice Problems

In your notebook, solve the following problems.

SECTION 10.1 THE MOLE: A MEASUREMENT OF MATTER

1. What is the molar mass of sucrose ($C_{12}H_{22}O_{11}$)?

2. What is the molar mass of each of the following compounds?

   a. phosphorus pentachloride (PCl_5)

   b. uranium hexafluoride (UF_6)

3. Calculate the molar mass of each of the following ionic compounds:

   a. $KMnO_4$

   b. $Ca_3(PO_4)_2$

4. How many moles is 3.52×10^{24} molecules of water?

5. How many atoms of zinc are in 0.60 mol of zinc?

6. What is the mass of 1.00 mol of oxygen (O_2)?

SECTION 10.2 MOLE–MASS AND MOLE–VOLUME RELATIONSHIPS

1. What is the molar mass of each of the following compounds?

   a. $C_6H_{12}O_6$ b. $NaHCO_3$ c. C_7H_{12} d. KNH_4SO_4

2. Calculate the mass in grams of each of the following:

   a. 8.0 mol lead oxide (PbO)

   b. 0.75 mol hydrogen sulfide (H_2S)

   c. 0.00100 mol silicon tetrahydride (SiH_4)

   d. 1.50×10^{-2} mol molecular oxygen (O_2)

   e. 2.30 mol ethylene glycol ($C_2H_6O_2$)

3. How many grams are in 1.73 mol of dinitrogen pentoxide (N_2O_5)?

4. How many grams are in 0.658 mol of calcium phosphate [$Ca_3(PO_4)_2$]?

5. Calculate the number of moles in each of the following:

   a. 0.50 g sodium bromide (NaBr)

   b. 13.5 g magnesium nitrate [$Mg(NO_3)_2$]

   c. 1.02 g magnesium chloride ($MgCl_2$)

   d. 0.00100 g monochloromethane (CH_3Cl)

   e. 1.50×10^{-3} g propylene glycol [$C_3H_6(OH)_2$]

6. A chemist plans to use 435.0 grams of ammonium nitrate (NH_4NO_3) in a reaction. How many moles of the compound is this?

7. A solution is to be prepared in a laboratory. The solution requires 0.0465 mol of quinine ($C_{20}H_{24}N_2O_2$). What mass, in grams, should the laboratory technician obtain in order to make the solution?

8. What is the volume at STP of 2.66 mol of methane (CH_4) gas?

9. How many moles is 135 L of ammonia (NH_3) gas at STP?

10.3 PERCENT COMPOSITION AND CHEMICAL FORMULAS

1. A sample of a compound analyzed in a chemistry laboratory consists of 5.34 g of carbon, 0.42 g of hydrogen, and 47.08 g of chlorine. What is the percent composition of this compound?

2. Find the percent composition of a compound containing tin and chlorine if 18.35 g of the compound contains 5.74 g of tin.

3. If 3.907 g of carbon combines completely with 0.874 g of hydrogen to form a compound, what is the percent composition of this compound?

4. From the formula for calcium acetate, $Ca(C_2H_3O_2)_2$, calculate the mass of carbon that can be obtained from 65.3 g of the compound.

5. How many grams of aluminum are in 25.0 g of aluminum oxide (Al_2O_3)?

6. How many grams of iron are in 21.6 g of iron(III) oxide (Fe_2O_3)?

7. Determine the empirical formula of each of the following compounds from the percent composition:

  a. 7.8% carbon and 92.2% chlorine

  b. 10.0% C, 0.80% H, 89.1% Cl