<u>REVIEW QUESTIONS</u>
Chapter 6

1. Determine the molar mass for each compound shown below:

    a) $(NH_4)_2CO_3$

       Molar mass = [2(14.01)+8(1.01)+12.01+3(16.00)] = 96.11 g/mol

    b) $Fe_3(PO_4)_2$

       Molar mass = [3(55.85)+2(30.97)+8(16.00)] = 357.49 g/mol

2. How many chlorine atoms are present in 45 g of chlorine gas (Cl_2)?

    $$45 \text{ g Cl}_2 \text{ x } \frac{1 \text{ mol}}{70.90 \text{ g}} \text{ x } \frac{2 \text{ mol Cl}}{1 \text{ mol Cl}_2} \text{ x } \frac{6.02 \text{x} 10^{23} \text{ atoms}}{1 \text{ mol}} = 7.6 \text{x} 10^{23} \text{ atoms of Cl}$$

3. How many moles are in 3.4×10^{23} molecules of H_2SO_4?

    $$3.4 \text{x} 10^{23} \text{ molecules x } \frac{1 \text{ mol}}{6.02 \text{x} 10^{23} \text{ molecules}} = 0.56 \text{ mol}$$

4. How many grams does 5.60×10^{22} molecules of SiO_2 weigh?

    $$5.60 \text{x} 10^{22} \text{ molecules x } \frac{1 \text{ mol}}{6.02 \text{x} 10^{23} \text{ molecules}} \text{ x } \frac{60.09 \text{ g}}{1 \text{ mol}} = 5.59 \text{ g}$$

5. What mass of chlorine is present in 12.2 g of $PbCl_2$?

    $$12.2 \text{ g PbCl}_2 \text{ x } \frac{1 \text{ mol}}{278.1 \text{ g}} \text{ x } \frac{2 \text{ mol Cl}}{1 \text{ mol PbCl}_2} \text{ x } \frac{35.45 \text{ g}}{1 \text{ mol}} = 3.11 \text{ of Cl}$$

6. How many atoms of oxygen are present in 2.15 g of $Ca_3(PO_4)_2$?

$$2.15 \text{ g } Ca_3(PO_4)_2 \text{ x } \frac{1 \text{ mol}}{310.18 \text{ g}} \text{ x } \frac{8 \text{ mol O}}{1 \text{ mol } Ca_3(PO_4)_2} \text{ x } \frac{6.02x10^{23} \text{ atoms}}{1 \text{ mol}} = 3.34x10^{22} \text{ atoms of O}$$

7. Calculate the mass percent composition of each element in C_3H_9N.

   Molar mass = [3(12.01)+9(1.01)+14.01] = 59.13

$$\% \text{ C} = \frac{36.03 \text{ g}}{59.13 \text{ g}} x100 = 60.93\%$$

$$\% \text{ H} = \frac{9.09 \text{ g}}{59.13 \text{ g}} x100 = 15.4\%$$

$$\% \text{ N} = \frac{14.01 \text{ g}}{59.13 \text{ g}} x100 = 23.69\%$$

8. Silver chloride, used in silver plating, contains 75.27% silver. Calculate the mass of silver chloride required to make 4.8 g of silver plating.

$$4.8 \text{ g Ag x } \frac{100 \text{ g AgCl}}{75.27 \text{ g Ag}} = 6.4 \text{ g}$$

9. The recommended daily allowance (RDA) for iodine is 150 µg/day. How many grams of KI must one consume in order to meet this guideline?

$$\% \text{ I in KI} = \frac{126.90 \text{ g}}{166.00 \text{ g}} x100 = 76.\underline{4}5\%$$

$$150 \text{ µg I x } \frac{1 \text{ g}}{10 \text{ µg}} \text{ x } \frac{100 \text{ g KI}}{76.\underline{4}5 \text{ g I}} = 2.0x10^{-4} \text{ g KI}$$

10. Determine the empirical formula for a compound with the following composition:

$$41.1\% \text{ N} \qquad 11.8\% \text{ H} \qquad 47.1\% \text{ S}$$

$$41.1 \text{ g N} \times \frac{1 \text{ mol}}{14.01 \text{ g}} = 2.934 \text{ mol N (2)}$$

$$11.8 \text{ g H} \times \frac{1 \text{ mol}}{1.01 \text{ g}} = 11.68 \text{ mol H (8)} \qquad \text{Formula is } N_2H_8S$$

$$47.1 \text{ g S} \times \frac{1 \text{ mol}}{32.06 \text{ g}} = 1.469 \text{ mol S (1)}$$

11. A leak in the air conditioning system of an older car releases 55 g of CF_2Cl_2 each month. How much Cl is emitted into the atmosphere by this car in a year?

$$12 \text{ months} \times \frac{55 \text{ g } CF_2Cl_2}{1 \text{ month}} \times \frac{1 \text{ mol}}{120.91 \text{ g}} \times \frac{2 \text{ Cl}}{1 \text{ } CF_2Cl_2} \times \frac{35.45 \text{ g}}{1 \text{ mol}} = 390 \text{ g (2 sig figs)}$$

12. Seawater contains 3.5% NaCl by mass and has a density of 1.02 g/mL. What volume of seawater contains 1.0 g of sodium?

$$1.0 \text{ g Na} \times \frac{1 \text{ mol}}{22.99 \text{ g}} \times \frac{1 \text{ mol NaCl}}{1 \text{ mol Na}} \times \frac{58.44 \text{ g}}{1 \text{ mol}} \times \frac{100 \text{ g seawater}}{3.5 \text{ g NaCl}} \times \frac{1 \text{ mL}}{1.02 \text{ g}} = 71 \text{ mL seawater}$$

Alternate solution:

$$1.0 \text{ g Na} \times \frac{58.44 \text{ g NaCl}}{22.99 \text{ g Na}} \times \frac{100 \text{ g seawater}}{3.5 \text{ g NaCl}} \times \frac{1 \text{ mL}}{1.02 \text{ g}} = 71 \text{ mL seawater}$$

13. A compound whose empirical formula is C_3H_3O has a molar mass of 110.0 g/mol. What is the molecular formula for the compound?

$$\text{mass of empirical formula} = [3(12.01)+3(1.01)+16.00] = 55.06 \text{ g}$$

$$n = \frac{\text{molar mass}}{\text{mass of empirical formula}} = \frac{110.0 \text{ g}}{55.06 \text{ g}} = 2$$

$$\text{molecular formula} = (C_3H_3O)_2 = C_6H_6O_2$$

14. What is the mass percent of each element in $C_3H_4O_3$?

molar mass = [3(12.01)+4(1.01)+3(16.00)] = 88.07 g/mol

$$\% \text{ C} = \frac{36.03 \text{ g}}{88.07 \text{ g}} \times 100 = 40.92\%$$

$$\% \text{ H} = \frac{4.04 \text{ g}}{88.07 \text{ g}} \times 100 = 4.59\%$$

$$\% \text{ O} = \frac{48.00 \text{ g}}{88.07 \text{ g}} \times 100 = 54.50\%$$

15. A 45.2-mg sample of phosphorous reacts with selenium to form 131.6 mg of the selenide. What is the empirical formula of the phosphorous selenide?

mass of selenium = 131.6 mg - 45.2 mg = 86.4 mg

$$\text{mole P} = 45.2 \text{ mg} \times \frac{1 \text{ g}}{10^3 \text{ mg}} \times \frac{1 \text{ mol}}{30.97 \text{ g}} = 1.46 \times 10^{-3} \text{ mol} \qquad (1.33) \times 3 = 4$$

$$\text{mole Se} = 86.4 \text{ mg} \times \frac{1 \text{ g}}{10^3 \text{ mg}} \times \frac{1 \text{ mol}}{78.96 \text{ g}} = 1.094 \times 10^{-3} \text{ mol} \qquad (1) \times 3 = 3$$

empirical formula = P_4Se_3