Stoichiometry Worksheet Week 2

1. If 2.45×10^2 molecules of oxygen gas are available, how many moles of H_2 would react with it? $2\ H_2 + O_2 \rightarrow 2\ H_2O$

$2.45\times10^{2}\ \text{molec}\ O_2 \times \frac{1\ \text{mol}\ O_2}{(6.02\times10^{23})\ \text{molec}\ O_2} \times \frac{2\ \text{mol}\ H_2}{1\ \text{mol}\ H_2} = 8.14\times10^{-22}\ \text{mol}\ H_2$

2. What would the final volume be of water when a 5.5 M solution is needed to react with 12 g of HCl? The equation that represents the reaction follows.

$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$

$12\ g\ HCl \times \frac{1\ \text{mol}\ HCl}{36.46\ g\ HCl} \times \frac{1\ \text{mol}\ H_2O}{1\ \text{mol}\ HCl} = 0.329127811\ \text{mol} = \frac{5.5\ \text{mol}}{L}$

$= 0.060\ L$

3. Kim uses 50 mL of $Pb(NO_3)_2$ at a concentration of 4.5 mol/L, what is the mass produced of sodium iodide (NaI)? Using the following equation:

$2\ NaI + Pb(NO_3)_2 \rightarrow PbI_2 + 2\ Na(NO_3)$

$\frac{4.5\ \text{mol}}{2} = \frac{x}{.050\ L}$

$= .225\ \text{mol}$ ← given

$.225\ \text{mol}\ Pb(NO_3)_2 \times \frac{2\ \text{mol}\ NaI}{1\ \text{mol}\ Pb(NO_3)_2} \times \frac{149.98\ g\ NaI}{1\ \text{mol}\ NaI} = 70\ g\ NaI$

4. 120 mL of CH_3COONa is used to produce H_2O . If 9.81g of H_2O is made, what is the concentration of CH_3COONa used? The following equation represents the reaction:

$NaHCO_3\ (s) + CH_3COOH\ (aq) \rightarrow CH_3COONa\ (aq) + CO_2\ (g) + H_2O\ (l)$

$9.81\ g\ H_2O \times \frac{1\ \text{mol}\ H_2O}{18.02\ g\ H_2O} \times \frac{1\ \text{mol}\ CH_3COONa}{1\ \text{mol}\ H_2O} = \frac{0.544395117\ \text{mol}}{.12\ L}$

$= 4.5\ M$

5. How many L of a 7.0M solution of HCl are needed to react with 9.85g of H_2O? The equation that represents the reaction follows.

$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$

$9.85\ g\ H_2O \times \frac{1\ \text{mol}\ H_2O}{18.02\ g\ H_2O} \times \frac{1\ \text{mol}\ HCl}{1\ \text{mol}\ H_2O} = \frac{0.546614872\ \text{mol}\ HCl}{x} = \frac{7.0\ \text{mol}}{L}$

$0.078\ L$

6. 150mL of $BaCl_2$ is used to produce $BaCrO_4$. If 25.0 g of $BaCrO_4$ is made, what is the concentration of the $BaCl_2$ used? The following equation represents the reaction:

$$K_2CrO_{4\,(aq)} + BaCl_{2(aq)} \rightarrow BaCrO_{4(s)} + 2KCl_{(aq)}$$

$25.0\,g\,BaCrO_4 \times \frac{1\,mol\,BaCrO_4}{253.33\,g\,BaCrO_4} \times \frac{1\,mol\,BaCl_2}{1\,mol\,BaCrO_4} = \frac{0.098685509\,mol}{.15\,L}$

$0.66\,mol/L$

7. Use the equation below to answer questions a and b.

$$Cu + 2\,AgNO_3 \rightarrow Cu(NO_3)_2 + 2\,Ag$$

a- If 4.33×10^7 molecules of Ag are available, how many moles of silver nitrate $AgNO_3$ would react with it?

$4.33\times10^{7}\,molec\,Ag \times \frac{1\,mol\,Ag}{(6.02\times10^{23}\,molec\,Ag)} \times \frac{2\,mol\,AgNO_3}{2\,mol\,Ag} = 7.19\times10^{-17}\,mol\,AgNO_3$

b- If 450.0 g of copper nitrate $Cu(NO_3)_2$ was produced, how many Ag atoms must have reacted with the copper nitrate?

$450.0\,g\,Cu(NO_3)_2 \times \frac{1\,mol\,Cu(NO_3)_2}{187.50\,g\,Cu(NO_3)_2} \times \frac{2\,mol\,Ag}{1\,mol\,Cu(NO_3)_2} \times \frac{6.02\times10^{23}\,atoms\,Ag}{1\,mol\,Ag} = 2.890\times10^{24}\,Ag\,atoms$

8. Fred neutralizes 250 mL of HCL at a concentration of 4.5mol/L using $Ca(OH)_2$ according to the following equation:

$2HCl + Ca(OH)_2 \rightarrow CaCl_2 + 2\,H_2O$

What is the mass of the $CaCl_2$ that will be left in the beaker?

$n = C \times V \quad \frac{4.5\,mol}{2} \times .25\,L = 1.125\,mol$ given

$1.125\,mol\,HCl \times \frac{1\,mol\,CaCl_2}{2\,mol\,HCl} \times \frac{110.97\,g\,CaCl_2}{1\,mol\,CaCl_2} = 62\,g\,CaCl_2$