Name: KEY
Date: 1/5/09

Chemistry
Stoichiometry WS 2

I. *Complete the following stoichiometric calculations, balancing equations where necessary.*

1. Consider the combustion of octane (C_8H_{18}):

$$2\ C_8H_{18} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O$$

a. How many grams of CO_2 (wanted) are produced when 191.6 g of octane (given) are burned?

$$191.6\ g\ C_8H_{18} \left| \frac{1\ mol\ C_8H_{18}}{114.229\ g\ C_8H_{18}} \right| \frac{16\ mol\ CO_2}{2\ mol\ C_8H_{18}} \left| \frac{44.009\ g\ CO_2}{1\ mol\ CO_2} \right| = 590.6\ g\ CO_2$$

b. How many grams of oxygen gas are required to burn 47.03 g of octane?

$$47.03\ g\ C_8H_{18} \left| \frac{1\ mol\ C_8H_{18}}{114.229\ g\ C_8H_{18}} \right| \frac{25\ mol\ O_2}{2\ mol\ C_8H_{18}} \left| \frac{31.998\ g\ O_2}{1\ mol\ O_2} \right| = 164.7\ g\ O_2$$

c. How many grams of H_2O are produced when 91.2 g oxygen gas are consumed?

$$91.2\ g\ O_2 \left| \frac{1\ mol\ O_2}{31.998\ g\ O_2} \right| \frac{18\ mol\ H_2O}{25\ mol\ O_2} \left| \frac{18.015\ g\ H_2O}{1\ mol\ H_2O} \right| = 37.0\ g\ H_2O$$

d. How many liters of CO_2 are produced at STP (1 mol = 22.4 L) when the reaction yields 5.05 g H_2O?

$$5.05\ g\ H_2O \left| \frac{1\ mol\ H_2O}{18.015\ g\ H_2O} \right| \frac{16\ mol\ CO_2}{18\ mol\ H_2O} \left| \frac{22.4\ L\ CO_2}{1\ mol\ CO_2} \right| = 5.58\ L\ CO_2$$

2. ____ $Al_2(SO_4)_3$ + 6 NaOH → 2 $Al(OH)_3$ + 3 Na_2SO_4

a. How many grams of NaOH are needed to completely react with 2.33 g $Al_2(SO_4)_3$?

$$2.33\text{ g } Al_2(SO_4)_3 \left| \frac{1\text{ mol } Al_2(SO_4)_3}{342.151\text{ g } Al_2(SO_4)_3} \right| \frac{6\text{ mol NaOH}}{1\text{ mol } Al_2(SO_4)_3} \left| \frac{39.997\text{ g NaOH}}{1\text{ mol NaOH}} \right| = 1.63\text{ g NaOH}$$

b. If 87.3 g of $Al(OH)_3$ are formed, how many grams of Na_2SO_4 will be produced?

$$87.3\text{ g } Al(OH)_3 \left| \frac{1\text{ mol } Al(OH)_3}{78.004\text{ g } Al(OH)_3} \right| \frac{3\text{ mol } Na_2SO_4}{2\text{ mol } Al(OH)_3} \left| \frac{142.042\text{ g } Na_2SO_4}{1\text{ mol } Na_2SO_4} \right| = 238.456\text{ g } Na_2SO_4$$

3. ____ Ca_3P_2 + 6 H_2O → 3 $Ca(OH)_2$ + 2 PH_3

a. How many grams of water are needed to react with 33.9 g of Ca_3P_2?

$$33.9\text{ g } Ca_3P_2 \left| \frac{1\text{ mol } Ca_3P_2}{182.182\text{ g } Ca_3P_2} \right| \frac{6\text{ mol } H_2O}{1\text{ mol } Ca_3P_2} \left| \frac{18.015\text{ g } H_2O}{1\text{ mol } H_2O} \right| = 20.1\text{ g } H_2O$$

b. How many grams of PH_3 are produced when the above reaction takes place? (same given)

$$33.9\text{ g } Ca_3P_2 \left| \frac{1\text{ mol } Ca_3P_2}{182.182\text{ g } Ca_3P_2} \right| \frac{2\text{ mol } PH_3}{1\text{ mol } Ca_3P_2} \left| \frac{33.998\text{ g } PH_3}{1\text{ mol } PH_3} \right| = 12.7\text{ g } PH_3$$

c. How many grams of H_2O will be needed to produce 715 g $Ca(OH)_2$?

$$715\text{ g } Ca(OH)_2 \left| \frac{1\text{ mol } Ca(OH)_2}{74.093\text{ g } Ca(OH)_2} \right| \frac{6\text{ mol } H_2O}{3\text{ mol } Ca(OH)_2} \left| \frac{18.015\text{ g } H_2O}{1\text{ mol } H_2O} \right| = 348\text{ g } H_2O$$