Name: Key

Date: 3/26/19

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 are produced when 191.6 g of octane are burned?

$$\frac{191.6\text{ g } C_8H_{18}}{1} \times \frac{1\text{ mol } C_8H_{18}}{114.232\text{ g } C_8H_{18}} \times \frac{16\text{ mol } CO_2}{2\text{ mol } C_8H_{18}} \times \frac{44.01\text{ g } CO_2}{1\text{ mol } CO_2} = 591.1\text{ g } CO_2$$

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

$$\frac{47.03\text{ g } C_8H_{18}}{1} \times \frac{1\text{ mol } C_8H_{18}}{114.232\text{ g } C_8H_{18}} \times \frac{25\text{ mol } O_2}{2\text{ mol } C_8H_{18}} \times \frac{31.998\text{ g } O_2}{1\text{ mol } O_2} = 164.7\text{ g } O_2$$

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

$$\frac{91.2\text{ g } O_2}{1} \times \frac{1\text{ mol } O_2}{31.998\text{ g } O_2} \times \frac{18\text{ mol } H_2O}{25\text{ mol } O_2} \times \frac{18.015\text{ g } H_2O}{1\text{ mol } H_2O} = 37.0\text{ g } H_2O$$

d. How many liters of CO_2 are produced at STP when the reaction yields 5.05 g H_2O?

$$\frac{5.05\text{ g } H_2O}{1} \times \frac{1\text{ mol } H_2O}{18.015\text{ g } H_2O} \times \frac{16\text{ mol } CO_2}{18\text{ mol } H_2O} \times \frac{22.4\text{ L } CO_2}{1\text{ mol } CO_2} = 5.58\text{ L } CO_2$$

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 $Al_2(SO_4)_3$?

$$\frac{2.33\text{ g } Al_2(SO_4)_3}{1} \times \frac{1\text{ mol } Al_2(SO_4)_3}{342.15\text{ g } Al_2(SO_4)_3} \times \frac{6\text{ mol NaOH}}{1\text{ mol } Al_2(SO_4)_3} \times \frac{39.97\text{ g NaOH}}{1\text{ mol NaOH}} = 1.63\text{ g NaOH}$$

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

$$\frac{87.3\text{ g } Al(OH)_3}{1} \times \frac{1\text{ mol } Al(OH)_3}{78.003\text{ g } Al(OH)_3} \times \frac{3\text{ mol } Na_2SO_4}{2\text{ mol } Al(OH)_3} \times \frac{142.04\text{ g } Na_2SO_4}{1\text{ mol } Na_2SO_4} = 238.5\text{ g } Na_2SO_4$$

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?

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

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

$$\frac{33.9\text{ g } Ca_3P_2}{1} \times \frac{1\text{ mol } Ca_3P_2}{182.182\text{ g } Ca_3P_2} \times \frac{2\text{ mol } PH_3}{1\text{ mol } Ca_3P_2} \times \frac{33.998\text{ g } PH_3}{1\text{ mol } PH_3} = 12.65\text{ g } PH_3$$

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

$$\frac{715\text{ g } Ca(OH)_2}{1} \times \frac{1\text{ mol } Ca(OH)_2}{74.092\text{ g } Ca(OH)_2} \times \frac{6\text{ mol } H_2O}{3\text{ mol } Ca(OH)_2} \times \frac{18.015\text{ g } H_2O}{1\text{ mol } H_2O} = 347.7\text{ g } H_2O$$