Stoichiometry Worksheet

1. Na_2SiO_3 (s) + 8 HF(aq) → H_2SiF_6 (aq) + 2 NaF(aq) + 3 H_2O (l)

a. How many moles of HF are needed to react with 0.300 mol of Na_2SiO_3?

$\frac{8 \text{ moles HF}}{1 \text{ mole } Na_2SiO_3} = \frac{X \text{ moles HF}}{0.300 \text{ mole } Na_2SiO_3}$

$8(0.300) = 1X$

$X = 2.4 \text{ moles HF}$

b. How many grams of NaF form when 0.500 mol of HF reacts with excess Na_2SiO_3?

$0.500 \text{ mol HF} \left| \frac{2 \text{ mol NaF}}{8 \text{ moles HF}} \right| \frac{41.988 \text{ g NaF}}{1 \text{ mol NaF}} = 5.25 \text{ g NaF}$

c. How many grams of Na_2SiO_3 can react with 0.800 g of HF?

$0.800 \text{ g HF} \left| \frac{1 \text{ mol HF}}{20 \text{ g HF}} \right| \frac{1 \text{ mol } Na_2SiO_3}{8 \text{ mol HF}} \left| \frac{122.06 \text{ g } Na_2SiO_3}{1 \text{ mol } Na_2SiO_3} \right. = 0.61 \text{ g } Na_2SiO_3$

2. $C_6H_{12}O_6$ (aq) → 2 C_2H_5OH (aq) + 2 CO_2 (g)

a. How many moles of CO_2 are produced when 0.400 mol of $C_6H_{12}O_6$ reacts in this fashion?

$0.400 \text{ mol } C_6H_{12}O_6 \left| \frac{2 \text{ mol } CO_2}{1 \text{ mol } C_6H_{12}O_6} \right. = 0.800 \text{ mol } CO_2$

b. How many grams of $C_6H_{12}O_6$ are needed to form 7.50 g of C_2H_5OH?

$7.50 \text{ g } C_2H_5OH \left| \frac{1 \text{ mol } C_2H_5OH}{46.02 \text{ g } C_2H_5OH} \right| \frac{1 \text{ mol } C_6H_{12}O_6}{2 \text{ mol } C_2H_5OH} \left| \frac{180.06 \text{ g } C_6H_{12}O_6}{1 \text{ mol } C_6H_{12}O_6} \right.$

c. How many grams of CO_2 form when 7.50 g of C_2H_5OH are produced?

$7.50 \text{ g } C_2H_5OH \left| \frac{1 \text{ mol } C_2H_5OH}{46.02 \text{ g } C_2H_5OH} \right| \frac{2 \text{ mol } CO_2}{2 \text{ mol } C_2H_5OH} \left| \frac{44.01 \text{ g } CO_2}{1 \text{ mol } CO_2} \right. = 7.17 \text{ g } CO_2$

$7.17 \text{ g } CO_2 \left| \frac{1 \text{ mol } CO_2}{44.01 \text{ g } CO_2} \right| \frac{2 \text{ mol } C_2H_5OH}{2 \text{ mol } CO_2} \left| \frac{46.02 \text{ g } C_2H_5OH}{1 \text{ mol } C_2H_5OH} \right| \frac{1 \text{ mol } C_6H_{12}O_6}{2 \text{ mol } C_2H_5OH} \left| \frac{180.06 \text{ g } C_6H_{12}O_6}{1 \text{ mol } C_6H_{12}O_6} \right. = 14.7 \text{ g } C_6H_{12}O_6$

3. Fe_2O_3 (s) 3CO (g) → 2Fe(s) 3CO_2 (g) (unbalanced!)

a. Calculate the number of grams of CO that can react with 0.150 kg of Fe_2O_3

$150 \text{ g } Fe_2O_3 \left| \frac{1 \text{ mol } Fe_2O_3}{159.7 \text{ g } Fe_2O_3} \right| \frac{3 \text{ mol CO}}{1 \text{ mol } Fe_2O_3} \left| \frac{28.01 \text{ g CO}}{1 \text{ mol CO}} \right. = 78.9 \text{ g CO}$

(150 g)

b. Calculate the number of grams of Fe and the number of grams of CO_2 formed when 0.150 kg of Fe_2O_3 reacts

$$150g\ Fe_2O_3 \left|\frac{1\ mol\ Fe_2O_3}{159.7g\ Fe_2O_3}\right|\frac{2\ mol\ Fe}{1\ mol\ Fe_2O_3}\left|\frac{55.85g\ Fe}{1\ mol\ Fe}\right| = 105g\ Fe$$

$$150g\ Fe_2O_3 \left|\frac{1\ mol\ Fe_2O_3}{159.7g\ Fe_2O_3}\right|\frac{3\ mol\ CO_2}{1\ mol\ Fe_2O_3}\left|\frac{44.01g\ CO_2}{1\ mol\ CO_2}\right| = 124g\ CO_2$$

Limiting Reagents

4. $2\ NaOH\ (s) + CO_2\ (g) \rightarrow Na_2CO_3\ (s) + H_2O\ (l)$

a. Which reagent is the limiting reactant when 1.85 mol NaOH and 1.00 mol CO_2 are allowed to react?

$$1.85\ mol\ NaOH \left|\frac{1\ mol\ Na_2CO_3}{2\ mol\ NaOH}\right| = 0.925\ mol\ Na_2CO_3$$

Limiting Reagent: NaOH

$$1.00\ mol\ CO_2 \left|\frac{1\ mol\ Na_2CO_3}{1\ mol\ CO_2}\right| = 1\ mol\ Na_2CO_3$$

b. How many moles of Na_2CO_3 can be produced?

0.925 mol Na_2CO_3

5. $C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr$

a. What is the theoretical yield of C_6H_5Br in this reaction when 30.0 g of C_6H_6 reacts with 65.0 g or Br_2?

L.R.

$$30.0g\ C_6H_6 \left|\frac{1\ mol\ C_6H_6}{78.06g\ C_6H_6}\right|\frac{1\ mol\ C_6H_5Br}{1\ mol\ C_6H_6}\left|\frac{156.97g\ C_6H_5Br}{1\ mol\ C_6H_5Br}\right| = 60.3g\ C_6H_5Br$$

$$65.0g\ Br_2 \left|\frac{1\ mol\ Br_2}{159.8g\ Br_2}\right|\frac{1\ mol\ C_6H_5Br}{1\ mol\ Br_2}\left|\frac{156.97g\ C_6H_5Br}{1\ mol\ C_6H_5Br}\right| = 63.8g\ C_6H_5Br$$

b. If the actual yield of C_6H_5Br was 56.7 g, what is the percent yield?

$$\left(\frac{56.7g}{60.3g}\right) \times 100 = 94.02\%$$