Stoichiometry Worksheet C

Name KEY

1. $Na_2SiO_3 + 8HF \rightarrow H_2SiF_6 + 2NaF + 3H_2O$

   a. How many moles of HF are need to react with 0.600 mol of Na_2SiO_3?

$$0.600\ mol\ Na_2SiO_3 \times \frac{8\ mol\ HF}{1\ mol\ Na_2SiO_3} = \boxed{4.8\ moles\ HF}$$

   b. How many grams of NaF form when 0.800 mol of HF reacts with excess Na_2SiO_3?

$$0.800\ mol\ HF \times \frac{2\ mol\ NaF}{8\ mol\ HF} \times \frac{41.99\ g\ NaF}{1\ mol\ NaF} = \boxed{8.4\ g\ NaF}$$

   c. How many grams of Na_2SiO_3 can react with 0.900 g of HF?

$$0.900\ g\ HF \times \frac{1\ mol\ HF}{20\ g\ HF} \times \frac{1\ mol\ Na_2SiO_3}{8\ mol\ HF} \times \frac{122\ g\ Na_2SiO_3}{1\ mol\ Na_2SiO_3} = \boxed{0.686\ g\ Na_2SiO_3}$$

2. $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

   a. How many moles of CO_2 are produced when 0.200 mol of $C_6H_{12}O_6$ reacts in this fashion?

$$0.200\ mol\ C_6H_{12}O_6 \times \frac{2\ mol\ CO_2}{1\ mol\ C_6H_{12}O_6} = \boxed{0.400\ mol\ CO_2}$$

   b. How many grams of $C_6H_{12}O_6$ are need to form 8.50 g of C_2H_5OH?

$$8.5\ g\ C_2H_5OH \times \frac{1\ mol\ C_2H_5OH}{46\ g\ C_2H_5OH} \times \frac{1\ mol\ C_6H_{12}O_6}{2\ mol\ C_2H_5OH} \times \frac{180\ g\ C_6H_{12}O_6}{1\ mol\ C_6H_{12}O_6} = \boxed{16.6\ g\ C_6H_{12}O_6}$$

   c. How many grams of CO_2 form when 8.50 g of C_2H_5OH are produced?

$$8.5\ g\ C_2H_5OH \times \frac{1\ mol\ C_2H_5OH}{46\ g\ C_2H_5OH} \times \frac{2\ mol\ CO_2}{2\ mol\ C_2H_5OH} \times \frac{44\ g\ CO_2}{1\ mol\ CO_2} = \boxed{8.1\ g\ CO_2}$$

3. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

   a. Calculate the number of grams of CO that can react with 250 g of Fe_2O_3.

$$250\ g\ Fe_2O_3 \times \frac{1\ mol\ Fe_2O_3}{160\ g\ Fe_2O_3} \times \frac{3\ mol\ CO}{1\ mol\ Fe_2O_3} \times \frac{28\ g\ CO}{1\ mol\ CO} = \boxed{131\ g\ CO}$$

   b. Calculate the number of grams of Fe and the number of grams of CO_2 formed when 250 grams of Fe_2O_3 reacts.

$$250\ g\ Fe_2O_3 \times \frac{1\ mol\ Fe_2O_3}{160\ g\ Fe_2O_3} \times \frac{3\ mol\ CO_2}{1\ mol\ Fe_2O_3} \times \frac{44\ g\ CO_2}{1\ mol\ CO_2} = \boxed{59\ g\ CO_2}$$

$$250\ g\ Fe_2O_3 \times \frac{1\ mol\ Fe_2O_3}{160\ g\ Fe_2O_3} \times \frac{2\ mol\ Fe}{1\ mol\ Fe_2O_3} \times \frac{56\ g\ Fe}{1\ mol\ Fe} = \boxed{175\ g\ Fe}$$

4. $2\ NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

a. How many moles of Na_2CO_3 can be produced when 1.00 mole CO_2 reacts?

$$1.00\ mol\ CO_2 \times \frac{1\ mol\ Na_2CO_3}{1\ mol\ CO_2} = \boxed{1\ mol\ Na_2CO_3}$$

b. How many moles of Na_2CO_3 can be produced when 1.85 mol NaOH reacts?

$$1.85\ mol\ NaOH \times \frac{1\ mol\ Na_2CO_3}{2\ mol\ NaOH} = \boxed{0.925\ mol\ Na_2CO_3}$$

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 of Br_2?~~

$$30g\ C_6H_6 \times \frac{1\ mol\ C_6H_6}{78\ g\ C_6H_6} \times \frac{1\ mol\ C_6H_5Br}{1\ mol\ C_6H_6} \times \frac{157\ g\ C_6H_5Br}{1\ mol\ C_6H_5Br} = \boxed{60.4g\ C_6H_5Br}$$

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

$$\frac{56.7g}{60.4g} \times 100 = \boxed{93.9\%}$$

BONUS CHALLENGE QUESTION!!! (Combining almost every topic from this Unit)

$$\overset{+2\ -2}{CaCl_2} + \overset{+2\ -2}{K_2CO_3} \rightarrow \overset{+2\ -2}{CaCO_3} + 2\overset{+1\ -1}{KCl}$$

1- **Classify the reaction type:** double displacement
2- **Predict the products** (write them in above)
3- **Balance the reaction** (write the balanced equation above)
4- **Answer the question:** If you have 32 grams $CaCl_2$, how many grams of Potassium Chloride do you expect to produce?

$$32g\ CaCl_2 \times \frac{1\ mol\ CaCl_2}{111\ g\ CaCl_2} \times \frac{2\ mol\ KCl}{1\ mol\ CaCl_2} \times \frac{74\ g\ KCl}{1\ mol\ KCl} = \boxed{42.7g\ KCl}$$

5- If 55 grams of Potassium Chloride are produced when you perform the reaction, what is your percent yield?

$$\frac{55g}{42.7g} \times 100 = \boxed{129\%}$$

6- Translate your equation above into words

Calcium Chloride reacts with Potassium Carbonate to create Calcium Carbonate and Potassium Chloride