Stoichiometry Review Name KEY

1. **25.0 g of methane (CH_4) burns. How many grams of water should be produced?**

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

$$\frac{25.0\text{ g}}{1} \times \frac{1\text{ mol } CH_4}{16.0\text{ g}} \times \frac{2\text{ mol } H_2O}{1\text{ mol } CH_4} \times \frac{18.0\text{ g}}{1\text{ mol } H_2O} = \boxed{56.3\text{ g}}$$

2. **Hydrogen is produced when methane reacts with water. The other product is carbon dioxide. Using 80.0 g of methane and 16.3 g of water, how many grams of hydrogen can be produced?**

$CH_4 + 2H_2O \rightarrow 4H_2 + CO_2$

$$\frac{80.0\text{ g}}{1} \times \frac{1\text{ mol } CH_4}{16.0\text{ g}} = \frac{5.00\text{ mol}}{1} = 5.00$$

$$\frac{16.3\text{ g}}{1} \times \frac{1\text{ mol } H_2O}{18.0\text{ g}} = \frac{0.9055\ldots\text{ mol}}{2} = 0.45\ldots \quad \text{LR}$$

$$\frac{0.9055\ldots\text{ mol } H_2O}{1} \times \frac{4\text{ mol } H_2}{2\text{ mol } H_2O} \times \frac{2.0\text{ g}}{1\text{ mol } H_2} =$$

$\boxed{3.6\text{ g}}$

3. **Methanol is made by reacting carbon monoxide with hydrogen gas. Starting with 2.5 g of hydrogen and 30.0 grams of CO, what mass of methanol could be produced?**

$CO + 2H_2 \rightarrow CH_3OH$

$$\frac{2.5\text{ g}}{1} \times \frac{1\text{ mol } H_2}{2.0\text{ g}} = \frac{1.25\ldots\text{ mol}}{2} = 0.625\ldots \quad \text{LR}$$

$$\frac{30.0\text{ g}}{1} \times \frac{1\text{ mol } CO}{28.0\text{ g}} = \frac{1.07\ldots\text{ mol}}{1} = 1.07\ldots$$

$$\frac{1.25\text{ mol } H_2}{1} \times \frac{1\text{ mol } CH_3OH}{2\text{ mol } H_2} \times \frac{32.0\text{ g}}{1\text{ mol } CH_3OH} =$$

$\boxed{20.\text{ g}}$

4. **In a reaction of 15.3 g of NaCl with excess lead(II) nitrate, how many grams of lead(II) chloride will be produced?** $2NaCl + Pb(NO_3)_2 \rightarrow 2NaNO_3 + PbCl_2$

$$\frac{15.3\text{ g}}{1} \times \frac{1\text{ mol NaCl}}{58.5\text{ g}} = 0.26153\ldots\text{ mol NaCl}$$

$$\frac{0.26153\ldots\text{ mol NaCl}}{1} \times \frac{1\text{ mol } PbCl_2}{2\text{ mol NaCl}} \times \frac{278.2\text{ g}}{1\text{ mol}} =$$

$\boxed{36.4\text{ g}}$

5. **Refer to the following equation to answer these questions:** $2NaBH_4 + I_2 \rightarrow B_2H_6 + 2NaI + H_2$

If 6.3 g of $NaBH_4$ are reacted with excess iodine, what is the percent yield if 1.9 g if B_2H_6 is actually produced?

$$\frac{6.3\text{ g}}{1} \times \frac{1\text{ mol } NaBH_4}{37.8\text{ g}} \times \frac{1\text{ mol } B_2H_6}{2\text{ mol } NaBH_4} \times \frac{27.6\text{ g}}{1\text{ mol } B_2H_6} = 2.3\text{ g} \leftarrow \text{theor.}$$

$$\frac{1.9\text{ g}}{2.3\text{ g}} \times 100 = \boxed{83\%}$$

6. **When 36.8 g of C_6H_6 reacts with an excess of chlorine gas, C_6H_5Cl and HCl are produced. If 38.8 g of C_6H_5Cl is actually produced, what is the percent yield?** $C_6H_6 + Cl_2 \rightarrow C_6H_5Cl + HCl$

$$\frac{36.8\text{ g } C_6H_6}{1} \times \frac{1\text{ mol}}{78.0\text{ g}} \times \frac{1\text{ mol } C_6H_5Cl}{1\text{ mol } C_6H_6} \times \frac{112.5\text{ g}}{1\text{ mol } C_6H_5Cl} = 53.1\text{ g}$$

$$\frac{38.8\text{ g}}{53.1\text{ g}} \times 100 = \boxed{73.1\%}$$

* 7. **Ammonia gas can be produced by reacting calcium oxide with ammonium chloride. Water and calcium chloride are produced in addition to ammonia. If 23.0 g of calcium oxide and 50.0 g of ammonium chloride are mixed, what is the percent yield if 14.5 g of ammonia are actually produced?**

$CaO + 2NH_4Cl \rightarrow H_2O + CaCl_2 + 2NH_3$

$$\frac{23.0\text{ g}}{1} \times \frac{1\text{ mol } CaO}{56.1\text{ g}} = \frac{0.4099\ldots\text{ mol}}{1} = 0.4099\ldots \quad \text{LR}$$

$$\frac{50.0\text{ g}}{1} \times \frac{1\text{ mol } NH_4Cl}{53.3\text{ g}} = \frac{0.9345\ldots\text{ mol}}{2} = 0.4672\ldots$$

$$\frac{0.4099\ldots\text{ mol } CaO}{1} \times \frac{2\text{ mol } NH_3}{1\text{ mol } CaO} \times \frac{17.0\text{ g}}{1\text{ mol } NH_3} = 13.9\text{ g}$$

$$\frac{14.5\text{ g}}{13.9\text{ g}} \times 100 = \boxed{104\%}$$

8. **If 30.0 g of sodium chloride reacts with sulfuric acid, and 14.6 g of hydrochloric acid is produce, what is the percent yield?** $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$

$$\frac{30.0\text{ g } NaCl}{1} \times \frac{1\text{ mol } NaCl}{58.5\text{ g}} \times \frac{2\text{ mol } HCl}{2\text{ mol } NaCl} \times \frac{36.5\text{ g}}{1\text{ mol}} = 18.7\text{ g}$$

$$\frac{14.6\text{ g}}{18.7\text{ g}} \times 100 = \boxed{78.1\%}$$

9. **In testing a respirator, 2.00 g of carbon monoxide gas is passed through diiodine pentoxide. Upon analyzing the results, it is found that 3.17 g of I_2 was produced. Calculate the percent yield of the reaction.**

$$I_2O_5 + 5CO \rightarrow I_2 + 5CO_2$$

$$\frac{2.00\text{ g } CO}{1} \times \frac{1\text{ mol } CO}{28.0\text{ g}} \times \frac{1\text{ mol } I_2}{5\text{ mol } CO} \times \frac{253.8\text{ g}}{1\text{ mol } I_2} = 3.63\text{ g}$$

$$\frac{3.17\text{ g}}{3.63\text{ g}} \times 100 = \boxed{87.3\%}$$

10. **Bauxite, which contains aluminum oxide, can be decomposed using electricity to obtain aluminum. If 1554.7 grams of aluminum oxide is decomposed, and 795.3 grams of aluminum is produced, what is the percent yield?** $2Al_2O_3 \rightarrow 4Al + 3O_2$

$$\frac{1554.7\text{ g } Al_2O_3}{1} \times \frac{1\text{ mol } Al_2O_3}{102.0\text{ g}} \times \frac{4\text{ mol } Al}{2\text{ mol } Al_2O_3} \times \frac{27.0\text{ g}}{1\text{ mol } Al} = 823.08\text{ g}$$

$$\frac{795.3\text{ g}}{823.08\text{ g}} \times 100 = \boxed{96.6\%}$$