STOICHIOMETRY/LIMITING REAGENT PRACTICE

AP CHEMISTRY

(practice, practice, practice . . . show all work (including balanced equations) . . . the answers are on the back . . . the solutions are on the back wall . . .)

1. Determine the mass of lithium hydroxide produced when 0.38 g of lithium nitride reacts with water according to the following equation:

$Li_3N + 3H_2O$ -------> $NH_3 + 3LiOH$

2. What mass of sodium chloride is produced when chlorine reacts with 0.29 g of sodium iodide?

3. Determine the mass of carbon dioxide produced when 0.85 g of butane reacts with oxygen according to the following equation:

$2C_4H_{10} + 13O_2$ -------> $8CO_2 + 10H_2O$

4. Determine the mass of antimony produced when 0.46 g of antimony(III)oxide reacts with carbon according to the following equation:

$Sb_2O_3 + 3C$ --------> $2Sb + 3CO$

5. What mass of hydrogen peroxide (H_2O_2) must decompose to produce 0.77 g of water?

6. What mass of carbon monoxide must react with oxygen to produce 0.69 g of carbon dioxide?

7. Identify the limiting reagent when 65.14 g of $CaCl_2$ reacts with 74.68 g of Na_2CO_3 to produce $CaCO_3$ and NaCl (show work!)

8. Identify the limiting reactant when 4.687 g of SF_4 reacts with 6.281 g of I_2O_5 to produce IF_5 and SO_2.

9. If 4.1 g of Cr is heated with 9.3 g of Cl_2, what mass of $CrCl_3$ will be produced?

10. What mass of SO_2 is produced from the reaction between 31.5 g of S_8 and 8.65 g of O_2?

11. What mass of SO_3 is produced from the reaction of 12.4 g of SO_2 and 3.45 g of O_2?

12. What mass of H_2SO_4 is produced from the reaction of 6.58 g of SO_3 and 1.64 g of H_2O?

13. What mass of CdS is produced if 8.47 g of cadmium reacts with 2.51 g of sulfur?

Stoichiometry / Limiting Reagent Practice

1) $Li_3N + 3H_2O \rightarrow NH_3 + 3LiOH$

$$\frac{.38\,g\,Li_3N}{1} \times \frac{1\,mol\,Li_3N}{35\,g} \times \frac{3\,mol\,LiOH}{1\,mol\,Li_3N} \times \frac{24\,g}{1\,mol\,LiOH} = \boxed{.78\,g\,LiOH}$$

2) $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$

$$\frac{.29\,g\,NaI}{1} \times \frac{1\,mol\,NaI}{150\,g} \times \frac{2\,mol\,NaCl}{2\,mol\,NaI} \times \frac{58.5\,g}{1\,mol\,NaCl} = \boxed{.11\,g\,NaCl}$$

3) $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

$$\frac{.85\,g\,C_4H_{10}}{1} \times \frac{1\,mol\,C_4H_{10}}{58\,g} \times \frac{8\,mol\,CO_2}{2\,mol\,C_4H_{10}} \times \frac{44\,g}{1\,mol\,CO_2} = \boxed{2.6\,g\,CO_2}$$

4) $Sb_2O_3 + 3C \rightarrow 2Sb + 3CO$

$$\frac{.46\,g\,Sb_2O_3}{1} \times \frac{1\,mol\,Sb_2O_3}{291.5\,g} \times \frac{2\,mol\,Sb}{1\,mol\,Sb_2O_3} \times \frac{121.76\,g}{1\,mol\,Sb} = \boxed{.38\,g\,Sb}$$

5) $2H_2O_2 \rightarrow 2H_2O + O_2$

$$\frac{.77\,g\,H_2O}{1} \times \frac{1\,mol\,H_2O}{18.0\,g} \times \frac{2\,mol\,H_2O_2}{2\,mol\,H_2O} \times \frac{34.0\,g\,H_2O_2}{1\,mol\,H_2O_2} = \boxed{1.5\,g\,H_2O_2}$$

6) $2CO + O_2 \rightarrow 2CO_2$

$$.69\,g\,CO_2 \times \frac{1\,mol\,CO_2}{44\,g} \times \frac{2\,mol\,CO}{2\,mol\,CO_2} \times \frac{28\,g}{1\,mol\,CO} = \boxed{.44\,g\,CO}$$

7) $CaCl_2 + Na_2CO_3 \rightarrow 2NaCl + CaCO_3$

$$74.68\,g\,Na_2CO_3 \times \frac{1\,mol\,Na_2CO_3}{106\,g} \times \frac{2\,mol\,NaCl}{1\,mol\,Na_2CO_3} \times \frac{58.45\,g}{1\,mol} = 82.36\,g$$

$$65.14\,g\,CaCl_2 \times \frac{1\,mol\,CaCl_2}{111\,g} \times \frac{2\,mol\,NaCl}{1\,mol\,CaCl_2} \times \frac{58.45\,g}{1\,mol} = 67.54\,g$$

$CaCl_2$ is limiting reactant

8) $5SF_4 + 2I_2O_5 \rightarrow 4IF_5 + 5SO_2$

$$4.687\,g\,SF_4 \times \frac{1\,mol\,SF_4}{108\,g} \times \frac{5SO_2}{5SF_4} \times \frac{64\,g}{1\,mol\,SO_2} = 2.77\,g\,SO_2$$

$$6.281\,g\,I_2O_5 \times \frac{1\,mol\,I_2O_5}{333.8\,g} \times \frac{5\,mol\,SO_2}{2\,mol\,I_2O_5} \times \frac{64\,g}{1\,mol\,SO_2} = 3.011\,g\,SO_2$$

SF_4 is limiting.

9) $2Cr + 3Cl_2 \rightarrow 2CrCl_3$

$$\frac{4.1\,g\,Cr}{1} \times \frac{1\,mol\,Cr}{52\,g} \times \frac{2\,CrCl_3}{2\,mol\,Cr} \times \frac{158.5\,g}{1\,mol\,CrCl_3} = \boxed{13\,g\,CrCl_3}$$ ☆

$$\frac{9.3\,g\,Cl_2}{1} \times \frac{1\,mol\,Cl_2}{71\,g} \times \frac{2\,mol\,CrCl_3}{3\,mol\,Cl_2} \times \frac{158.5\,g}{1\,mol\,CrCl_3} = \boxed{14\,g\,CrCl_3}$$

Cr is the limiting reactant

10) $S_8 + 8O_2 \rightarrow 8SO_2$

$$\frac{31.5\,g\,S_8}{1} \times \frac{1\,mol\,S_8}{256\,g\,S_8} \times \frac{8\,mol\,SO_2}{1\,mol\,S_8} \times \frac{64\,g}{1\,mol\,SO_2} = 63.0\,g\,SO_2$$

$$\frac{8.65\,g\,O_2}{1} \times \frac{1\,mol\,O_2}{32\,g\,O_2} \times \frac{8\,mol\,SO_2}{8\,mol\,O_2} \times \frac{64\,g}{1\,mol\,SO_2} = \boxed{173\,g\,SO_2}$$

11) $2SO_2 + O_2 \rightarrow 2SO_3$

$$\frac{12.4\,g\,SO_2}{1} \times \frac{1\,mol\,SO_2}{64\,g} \times \frac{2\,mol\,SO_3}{2\,mol\,SO_2} \times \frac{80\,g\,SO_3}{1\,mol\,SO_3} = \boxed{15.5\,g\,SO_2}$$

$$\frac{3.45\,g\,O_2}{1} \times \frac{1\,mol\,O_2}{32\,g} \times \frac{2\,mol\,SO_3}{1\,mol\,O_2} \times \frac{80\,g\,SO_3}{1\,mol\,SO_3} = 17.3\,g\,SO_2$$

12. $SO_3 + H_2O \rightarrow H_2SO_4$

$$\frac{6.58\text{g } SO_3}{1} \times \frac{1\text{mol } SO_3}{80\text{g}} \times \frac{1\text{mol } H_2SO_4}{1\text{mol } SO_3} \times \frac{98\text{g}}{1\text{mol } H_2SO_4} = \boxed{8.06\text{g } H_2SO_4}$$

$$\frac{1.64\text{g } H_2O}{1} \times \frac{1\text{mol } H_2O}{18\text{g}} \times \frac{1\text{mol } H_2SO_4}{1\text{mol } H_2O} \times \frac{98\text{g}}{1\text{mol}} = 8.93\text{g } H_2SO_4$$

SO_3 is the limiting reactant.

13. $Cd + S \rightarrow CdS$

$$\frac{8.47\text{g Cd}}{1} \times \frac{1\text{mol Cd}}{112.4\text{g}} \times \frac{1\text{mol CdS}}{1\text{mol Cd}} \times \frac{144.4\text{g}}{1\text{mol CdS}} = \boxed{10.9\text{g CdS}}$$

$$\frac{2.51\text{g S}}{1} \times \frac{1\text{mol S}}{32\text{g}} \times \frac{1\text{mol CdS}}{1\text{mol S}} \times \frac{144.4\text{g}}{1\text{mol CdS}} = 11.3\text{g CdS}$$