Exercise 9.3a

Limiting Reactants

Name: _____

Date:_____ Per:_____

DIRECTIONS: Solve the following problems in the space provided.

1. Given the equation $NH_3 + HCl \rightarrow NH_4Cl$, find the number of particles of NH_4Cl formed if 30.0 g of NH_3 reacts with 10.0 g of HCl.

Analyze, rewrite, balance equation

$1NH_3$	+	$1HCl$	→	$1NH_4Cl$
30.0 g		*10.0 g*		*?part.*

Solve for 1st reactant $\frac{30.0\text{ g } NH_3}{} \times \frac{1\text{ mol } NH_3}{17.031\text{g } NH_3} \times \frac{1\text{ mol } NH_4Cl}{1\text{ mol } NH_3} \times \frac{6.022 \times 10^{23}\text{ part. } NH_4Cl}{1\text{ mol } NH_4Cl} = 1.06 \times 10^{24}\text{ part. } NH_4Cl$

Solve for 2nd reactant $\frac{10.0\text{ g HCl}}{} \times \frac{1\text{ mol HCl}}{36.461\text{g HCl}} \times \frac{1\text{ mol } NH_4Cl}{1\text{ mol HCl}} \times \frac{6.022 \times 10^{23}\text{ part. } NH_4Cl}{1\text{ mol } NH_4Cl} = \boxed{1.65 \times 10^{23}\text{ part. } NH_4Cl}$

2. Given the equation $WO_3 + H_2 \rightarrow W + H_2O$, find the mass of W formed if 2.40×10^{22} particles of WO_3 reacts with 1.30 g of H_2.

Analyze, rewrite, balance equation

$1WO_3$	+	$3H_2$	→	$1W$	+	$3H_2O$
2.40×10^{22} part.		*1.30 g*		*?g*		

Solve for 1st reactant $\frac{2.40 \times 10^{22}\text{ part. } WO_3}{} \times \frac{1\text{ mol } WO_3}{6.022 \times 10^{23}\text{ part. } WO_3} \times \frac{1\text{ mol W}}{1\text{ mol } WO_3} \times \frac{183.84\text{g W}}{1\text{ mol W}} = \boxed{7.33\text{ g W}}$

Solve for 2nd reactant $\frac{1.30\text{ g } H_2}{} \times \frac{1\text{ mol } H_2}{2.016\text{g } H_2} \times \frac{1\text{ mol W}}{3\text{ mol } H_2} \times \frac{183.84\text{g W}}{1\text{ mol W}} = 39.6\text{ g W}$

3. Given the equation $Zn + CrCl_3 \rightarrow CrCl_2 + ZnCl_2$, find the mass of $CrCl_2$ formed if 3.20×10^{19} particles of $CrCl_3$ reacts with 10.0 g Zn.

Analyze, rewrite, balance equation

$1Zn$	+	$2CrCl_3$	→	$2CrCl_2$	+	$1ZnCl_2$
10.0 g		3.20×10^{19} part.		*?g*		

Solve for 1st reactant $\frac{10.0\text{ g Zn}}{} \times \frac{1\text{ mol Zn}}{65.38\text{g Zn}} \times \frac{2\text{ mol } CrCl_2}{1\text{ mol Zn}} \times \frac{122.902\text{g } CrCl_2}{1\text{ mol } CrCl_2} = 37.6\text{g } CrCl_2$

Solve for 2nd reactant $\frac{3.20 \times 10^{19}\text{ part. } CrCl_3}{6.022 \times 10^{23}\text{ part. } CrCl_3} \times \frac{1\text{ mol } CrCl_3}{2\text{ mol } CrCl_3} \times \frac{2\text{ mol } CrCl_2}{1\text{ mol } CrCl_2} \times \frac{122.902\text{g } CrCl_2}{} = \boxed{0.00653\text{g } CrCl_2}$

4. Given the equation $RbCl + O_2 \rightarrow RbClO_4$, find the mass of $RbClO_4$ formed if 2.70 g of O_2 reacts with 135 g RbCl.

Analyze, rewrite, balance equation

$1RbCl$	+	$2O_2$	→	$1RbClO_4$
135g		*2.70g*		*?g*

Solve for 1st reactant $\frac{135\text{ g RbCl}}{} \times \frac{1\text{ mol RbCl}}{120.921\text{g RbCl}} \times \frac{1\text{ mol } RbClO_4}{1\text{ mol RbCl}} \times \frac{184.917\text{g } RbClO_4}{1\text{ mol } RbClO_4} = 206\text{ g } RbClO_4$

Solve for 2nd reactant $\frac{2.70\text{ g } O_2}{} \times \frac{1\text{ mol } O_2}{31.998\text{g } O_2} \times \frac{1\text{ mol } RbClO_4}{2\text{ mol } O_2} \times \frac{184.917\text{g } RbClO_4}{1\text{ mol } RbClO_4} = \boxed{7.80\text{ g } RbClO_4}$