Limiting Reactant Practice Problems

1) The more reactive halogen elements are able to replace the less reactive halogens from their compounds.

$Cl_{2(g)} + NaI_{(aq)} \rightarrow NaCl_{(aq)} + I_{2(s)}$

Suppose that a solution containing 25.0 g NaI reacts with 5.00 g of Cl_2. What mass of iodine will be produced from the reaction above?

2) For the following ***unbalanced*** chemical reaction, suppose that exactly 15.0g of each reactant is used. What is the limiting reactant?

$Al_{(s)} + HCl_{(aq)} \rightarrow AlCl_{3(aq)} + H_{2(g)}$

3) For the following ***unbalanced*** chemical reaction, suppose that exactly 15.0g of each reactant is used. What is the limiting reactant?

$Pb(NO_3)_{2(aq)} + HCl_{(aq)} \rightarrow PbCl_{2(s)} + HNO_{3(aq)}$

4) How much excess reactant (from question #3) will be left when the reaction is complete?

Limiting Reactant Practice Problems

1) The more reactive halogen elements are able to replace the less reactive halogens from their compounds.

$Cl_{2(g)} + 2NaI_{(aq)} \rightarrow 2NaCl_{(aq)} + I_{2(s)}$

Suppose that a solution containing 25.0 g NaI reacts with 5.00 g of Cl_2. What mass of iodine will be produced from the reaction above?

First, determine limiting reactant;

$$\frac{5.00 g Cl_2}{1} x \frac{1 mol Cl_2}{71 g Cl_2} x \frac{2 mol NaI}{1 mol Cl_2} x \frac{150 g NaI}{1 mol NaI} = 21.1 g NaI$$, we have excess NaI available, so the Cl_2 is the limiting reactant and should be used to calculate the amount of I_2 produced in this reaction.

$$\frac{5.00 g Cl_2}{1} x \frac{1 mol Cl_2}{71 g Cl_2} x \frac{1 mol I_2}{1 mol Cl_2} x \frac{254 g I_2}{1 mol I_2} = 17.9 g I_2$$

2) For the following ***unbalanced*** chemical reaction, suppose that exactly 15.0g of each reactant is used. What is the limiting reactant?

$2Al_{(s)} + 6HCl_{(aq)} \rightarrow 2AlCl_{3(aq)} + 3H_{2(g)}$

Start with either reactant and solve for the mass of the other reactant;

$$\frac{15.0 g Al}{1} x \frac{1 mol Al}{27 g Al} x \frac{6 mol HCl}{2 mol Al} x \frac{36 g HCl}{1 mol HCl} = 60.0 g HCl$$, we do not have 60.0g of HCl available (only 15 g HCl) to react with all of the Al, so HCl is the limiting reactant.

3) For the following ***unbalanced*** chemical reaction, suppose that exactly 15.0g of each reactant is used. What is the limiting reactant?

$Pb(NO_3)_{2(aq)} + 2HCl_{(aq)} \rightarrow PbCl_{2(s)} + 2HNO_{3(aq)}$

$$\frac{15.0 g Pb(NO_3)_2}{1} x \frac{1 mol Pb(NO_3)_2}{331 g Pb(NO_3)_2} x \frac{2 mol HCl}{1 mol Pb(NO_3)_2} x \frac{36 g HCl}{1 mol HCl} = 3.26 g HCl$$, we have plenty of HCl to react with all 15g of the $Pb(NO_3)_2$, so $Pb(NO_3)_2$ is the limiting reactant.

4) How much excess reactant (from question #3) will be left when the reaction is complete?

Subtract the amount of HCl that would react (3.26g HCl) and subtract it from the starting amount of HCl (15.0g);

15.0g – 3.26g = 11.74g HCl excess