**Limiting Reagent Worksheet**

1) When copper (II) chloride reacts with sodium nitrate, copper (II) nitrate and sodium chloride are formed.
   a) Write the balanced equation for the reaction given above:

   \[ \text{CuCl}_2 + \text{NaNO}_3 \rightarrow \text{Cu(NO}_3\text{)}_2 + \text{NaCl} \]

   b) If 15 grams of copper (II) chloride react with 20 grams of sodium nitrate, how much sodium chloride can be formed?

   c) What is the limiting reagent for the reaction in #2? ________________

   d) How many grams of copper(II) nitrate is formed?

   e) How much of the excess reagent is left over in this reaction?

   f) If 11.3 grams of sodium chloride are formed in the reaction described in problem #2, what is the percent yield of this reaction?

2) When lead (II) nitrate reacts with sodium iodide, sodium nitrate and lead (II) iodide are formed.
   a) Balance the following equation:

   \[ \text{Pb(NO}_3\text{)}_2 \text{(aq)} + \text{NaI (aq)} \rightarrow \text{PbI}_2 \text{(s)} + \text{NaNO}_3 \text{(aq)} \]

   b) If I start with 25.0 grams of lead (II) nitrate and 15.0 grams of sodium iodide, how many grams of sodium nitrate can be formed?

   c) What is the limiting reagent in the reaction described in problem 2?

   d) How many grams of lead(II) iodide is formed?

   e) How much of the nonlimiting reagent will be left over from the reaction in problem #2?

   f) If 6 grams of sodium nitrate are formed in the reaction described in problem #2, what is the percent yield of this reaction?

3) 1000 grams of sodium chloride is combined with 2000 grams of barium phosphate.
   a) Balance the following equation:

   \[ 6 \text{NaCl} + \text{Ba}_3\text{(PO}_4\text{)}_2 \rightarrow \text{Na}_3\text{PO}_4 + \text{BaCl}_2 \]

   b) What is the limiting reactant?

   c) How many grams of excess reactant are left?

4) A chemist burns 160.0 g of Al in excess air to produce aluminum oxide, Al$_2$O$_3$. She produces 260.0 g of solid aluminum oxide.
Write a balanced equation for the reaction.

\[ \text{Al} + \text{O}_2 \rightarrow \text{Al}_2\text{O}_3 \]

a) Determine the theoretical yield.

b) Determine the percent yield.

5) 4000 grams of heptane is combusted with 7000 grams of oxygen.

\[ \text{C}_7\text{H}_{16} + 11 \text{O}_2 \rightarrow 7 \text{CO}_2 + 8 \text{H}_2\text{O} \]

a) What is the limiting reactant?

b) How many grams of carbon dioxide is produced?

c) How many grams of excess reactant are left?

6) In the reaction of Zn with HCl, 140.15 g of ZnCl₂ was actually formed, although the theoretical yield was 143 g. What was the percent yield?

7) 12.5 g of copper are reacted with an excess of chlorine gas, and 25.4 g of copper(II) chloride are obtained. Calculate the theoretical yield and the percent yield.

\[ \text{Cu} + \text{Cl}_2 \rightarrow \text{CuCl}_2 \]

8) In the reaction of Zn with HCl, 140.15 g of ZnCl₂ was actually formed, although the theoretical yield was 143 g. What was the percent yield?

\[ \text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 \]
Limiting Reagent Worksheet -KEY

1) Write the balanced equation for the reaction given above:
   \[ \text{CuCl}_2 + 2 \text{NaNO}_3 \rightarrow \text{Cu(NO}_3)_2 + 2 \text{NaCl} \]

2) If 15 grams of copper (II) chloride react with 20 grams of sodium nitrate, how much sodium chloride can be formed?
   To solve this problem determine how much sodium chloride can be made from each of the reagents by themselves. When you work out how much sodium chloride can be made with 15 grams of copper (II) chloride, you find that 13.0 grams will be formed. When starting with 20 grams of sodium nitrate, 13.6 grams will be formed. Since 13.0 grams is the smaller number, that’s our answer. Please note that rounding differences may cause your answers to be slightly different, so if they are, don’t panic.

3) What is the limiting reagent for the reaction in #2? copper (II) chloride

4) How much of the nonlimiting reagent is left over in this reaction?
   Nonlimiting reagent remaining = 20 grams – 20 grams (13.0 / 13.6) = 0.88 grams

5) If 11.3 grams of sodium chloride are formed in the reaction described in problem #2, what is the percent yield of this reaction?
   \[ \frac{11.3}{13.0} \times 100\% = 86.9\% \]

1) Write the balanced equation for the reaction of lead (II) nitrate with sodium iodide to form sodium nitrate and lead (II) iodide:
   \[ \text{Pb(NO}_3)_2 (\text{aq}) + 2 \text{NaI (aq)} \rightarrow \text{PbI}_2 (\text{s}) + 2 \text{NaNO}_3 (\text{aq}) \]

2) If I start with 25.0 grams of lead (II) nitrate and 15.0 grams of sodium iodide, how many grams of sodium nitrate can be formed?
   To solve, the students should do two calculations. In the first, they’ll determine the quantity of sodium nitrate that can be formed with 25 grams of lead (II) nitrate, assuming that there’s plenty of sodium iodide present to react with it – their calculation should indicate that 12.8 grams of sodium nitrate can be formed. Likewise, they should do a calculation in which they determine the quantity of sodium nitrate that can be formed with 15 grams of sodium iodide. Their calculation should find that 8.51 grams of sodium nitrate can be formed. Since the smallest of the two answers is 8.51 grams, this is the quantity of sodium nitrate that will actually be formed in this reaction.

3) What is the limiting reagent in the reaction described in problem 2?
   Because sodium iodide is the reagent that causes 8.51 grams of sodium nitrate to be formed, it is the limiting reagent.

4) How much of the nonlimiting reagent will be left over from the reaction in problem #2?
   By doing a stoichiometry calculation to determine the amount of lead (II) nitrate required to form 8.51 grams of sodium nitrate, students should determine that there are 8.38 grams of lead (II) nitrate remaining.