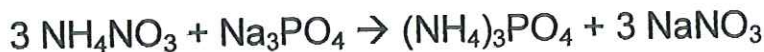


Limiting Reagent Worksheet

For the following reactions, find the following:

- Which of the reagents is the limiting reagent?
- What is the maximum amount of each product that can be formed?
- How much of the other reagent is left over after the reaction is complete?

1) Consider the following reaction:



Answer the questions above, assuming we started with 30 grams of ammonium nitrate and 50 grams of sodium phosphate.

$$30 \text{g } \text{NH}_4\text{NO}_3 \times \frac{1 \text{ mol } \text{NH}_4\text{NO}_3}{80.05 \text{ g } \text{NH}_4\text{NO}_3} = .37 \text{ mol } \text{NH}_4\text{NO}_3 \text{ available}$$

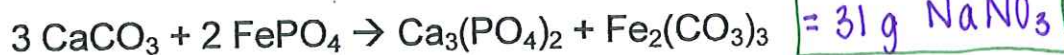
$$50 \text{g } \text{Na}_3\text{PO}_4 \times \frac{1 \text{ mol } \text{Na}_3\text{PO}_4}{163.94 \text{ g } \text{Na}_3\text{PO}_4} = .30 \text{ mol } \text{Na}_3\text{PO}_4 \text{ available}$$

more Na_3PO_4 is available than is required. therefore, NH_4NO_3 is the limiting reactant.

$$.37 \text{ mol } \text{NH}_4\text{NO}_3 \times \frac{1 \text{ mol } \text{Na}_3\text{PO}_4}{3 \text{ mol } \text{NH}_4\text{NO}_3} = .12 \text{ mol } \text{Na}_3\text{PO}_4 \text{ required}$$

$$.37 \text{ mol } \text{NH}_4\text{NO}_3 \times \frac{1 \text{ mol } (\text{NH}_4)_3\text{PO}_4}{3 \text{ mol } \text{NH}_4\text{NO}_3} \times \frac{141.03 \text{ g } (\text{NH}_4)_3\text{PO}_4}{1 \text{ mol } (\text{NH}_4)_3\text{PO}_4} = 17 \text{ g } (\text{NH}_4)_3\text{PO}_4$$

2) Consider the following reaction:



Answer the questions at the top of this sheet, assuming we start with 100 grams of calcium carbonate and 45 grams of iron (III) phosphate.

$$100 \text{g } \text{CaCO}_3 \times \frac{1 \text{ mol } \text{CaCO}_3}{100.09 \text{ g } \text{CaCO}_3} = .999 \text{ mol } \text{CaCO}_3 \text{ available}$$

$$45 \text{g } \text{FePO}_4 \times \frac{1 \text{ mol } \text{FePO}_4}{150.82 \text{ g } \text{FePO}_4} = .30 \text{ mol } \text{FePO}_4 \text{ available}$$

less FePO_4 is available than is required. therefore, FePO_4 is the limiting reactant.

$$.999 \text{ mol } \text{CaCO}_3 \times \frac{2 \text{ mol } \text{FePO}_4}{3 \text{ mol } \text{CaCO}_3} = .666 \text{ mol } \text{FePO}_4 \text{ required}$$

$$.30 \text{ mol } \text{FePO}_4 \times \frac{1 \text{ mol } \text{Ca}_3(\text{PO}_4)_2}{2 \text{ mol } \text{FePO}_4} \times \frac{310.18 \text{ g } \text{Ca}_3(\text{PO}_4)_2}{1 \text{ mol } \text{Ca}_3(\text{PO}_4)_2} = 47 \text{ g } \text{Ca}_3(\text{PO}_4)_2$$

$$= 44 \text{ g } \text{Fe}_2(\text{CO}_3)_3$$

Limiting Reagent Worksheet

All of the questions on this worksheet involve the following reaction: When copper (II) chloride reacts with sodium nitrate, copper (II) nitrate and sodium chloride are formed.

- 1) Write the balanced equation for the reaction given above:



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

$$15\text{g CuCl}_2 \times \frac{1\text{ mol CuCl}_2}{134.45\text{g CuCl}_2} = .11\text{ mol CuCl}_2 \text{ available}$$

$$20\text{g NaNO}_3 \times \frac{1\text{ mol NaNO}_3}{85.00\text{g NaNO}_3} = .24\text{ mol NaNO}_3 \text{ available}$$

$$.11\text{ mol CuCl}_2 \times \frac{2\text{ mol NaNO}_3}{1\text{ mol CuCl}_2} = .22\text{ mol NaNO}_3 \text{ required}$$

$$.11\text{ mol CuCl}_2 \times \frac{2\text{ mol NaCl}}{1\text{ mol CuCl}_2} \times \frac{58.44\text{g NaCl}}{1\text{ mol NaCl}} = 13\text{g NaCl}$$

NaNO₃ available > NaNO₃ required
 so, CuCl₂ is limiting reactant.

- 3) What is the limiting reagent for the reaction in #2? CuCl₂

- ~~4)~~ How much of the nonlimiting reagent is left over in this reaction?

DO LATER

- 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?