Limiting Reactant and Percent Yield Practice

1) Consider the following reaction:

$3NH_4NO_3 + Na_3PO_4 \rightarrow (NH_4)_3PO_4 + 3NaNO_3$

a) Which reactant is limiting, assuming we started with 30.0 grams of ammonium nitrate and 50.0 grams of sodium phosphate.

b) What is the mass of **each product** that can be formed?

2) Consider the following unbalanced reaction:

$\_\_\_\_CaCO_3 + \_\_\_\_FePO_4 \rightarrow \_\_\_\_Ca_3(PO_4)_2 + \_\_\_\_Fe_2(CO_3)_3$

a) Which reactant is limiting, assuming we start with 100. grams of calcium carbonate and 45.0 grams of iron (III) phosphate.

b) What is the mass of each product that can be formed?

3) Write the balanced equation for the reaction given below:

_____$CuCl_2$ + _____$NaNO_3$ → _____$Cu(NO_3)_2$ + _____NaCl

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

b) What is the limiting reagent? _____

4. For the combustion of sucrose:

$C_{12}H_{22}O_{11} + 12O_2 \text{ ---> } 12CO_2 + 11H_2O$

a. There are 10.0 g of sucrose and 10.0 g of oxygen reacting. Which is the limiting reagent?

b. How many grams of CO_2 can form?

c. How many grams of H_2O can form?

1/20/16

Limiting Reactant and Percent Yield Practice

1) Consider the following reaction:

$3NH_4NO_3 + Na_3PO_4 \rightarrow (NH_4)_3PO_4 + 3NaNO_3$

a) Which reactant is limiting, assuming we started with 30.0 grams of ammonium nitrate and 50.0 grams of sodium phosphate.

$30\text{ g } NH_4NO_3 \left| \frac{\text{mol}}{80\text{ g}} \right. = .375 \text{ mol } NH_4NO_3 \div 3 = .125$ ★ NH_4NO_3 Limiting

$50\text{ g } Na_3PO_4 \left| \frac{\text{mol}}{164\text{ g}} \right. = .30 \text{ mol } Na_3PO_4 \div 1 = .3$

b) What is the mass of **each product** that can be formed?

$.375 \text{ mol } NH_4NO_3 \left| \frac{1 (NH_4)_3PO_4}{3} \right. = .125 \text{ mol } (NH_4)_3PO_4 \left| \frac{149\text{ g}}{1 \text{ mol}} \right. = 18.63\text{ g } (NH_4)_3PO_4$

$.375 \text{ mol } NH_4NO_3 \left| \frac{3 NaNO_3}{3 NH_4NO_3} \right. = .375 \text{ mol } NaNO_3 \left| \frac{85\text{ g}}{1 \text{ mol}} \right. = 31.88\text{ g } NaNO_3$

2) Consider the following unbalanced reaction:

$3\ CaCO_3 + 2\ FePO_4 \rightarrow 1\ Ca_3(PO_4)_2 + 1\ Fe_2(CO_3)_3$

a) Which reactant is limiting, assuming we start with 100. grams of calcium carbonate and 45.0 grams of iron (III) phosphate.

$100\text{ g } CaCO_3 \left| \frac{\text{mol}}{52\text{ g}} \right. = 1.9 \text{ mol } CaCO_3 \div 3 = .63$

$45\text{ g } FePO_4 \left| \frac{\text{mol}}{151\text{ g}} \right. = .29 \text{ mol } FePO_4 \div 2 = .145$ ★ $FePO_4$ limiting

b) What is the mass of each product that can be formed?

$.29 \text{ mol } FePO_4 \left| \frac{1 Ca_3(PO_4)_2}{2 FePO_4} \right. = .145 \text{ mol } Ca_3(PO_4)_2 \left| \frac{310\text{ g}}{\text{mol}} \right. = 44.95\text{ g } Ca_3(PO_4)_2$

$.29 \text{ mol } FePO_4 \left| \frac{1 Fe_2(CO_3)_3}{2 FePO_4} \right. = .145 \text{ mol } Fe_2(CO_3)_3 \left| \frac{292\text{ g}}{\text{mol}} \right. = 42.34\text{ g } Fe_2(CO_3)_3$

3) Write the balanced equation for the reaction given below:

$1\ CuCl_2 + 2\ NaNO_3 \rightarrow 1\ Cu(NO_3)_2 + 2\ NaCl$

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

$15\ g\ CuCl_2 \left| \frac{mol}{134\ g} \right. = .11\ mol\ CuCl_2 \left| \frac{2\ NaCl}{1\ CuCl_2} \right. = .22\ mol\ NaCl \left| \frac{58\ g}{mol} \right. = 12.76\ g\ NaCl$

b) What is the limiting reagent? $CuCl_2$

$20\ g\ NaNO_3 \left| \frac{mol}{85\ g} \right. = .24\ mol\ NaNO_3 \left| \frac{2\ NaCl}{2\ NaNO_3} \right. = .24\ mol\ NaCl \left| \frac{58\ g}{mol} \right. = 13.92\ g\ NaCl$

★ Run both quantities given to find mass of product → lowest mass = limiting ★

4. For the combustion of sucrose:

$$C_{12}H_{22}O_{11} + 12O_2 \text{ ---> } 12CO_2 + 11H_2O$$

a. There are 10.0 g of sucrose and 10.0 g of oxygen reacting. Which is the limiting reagent?

$10\ g\ C_{12}H_{22}O_{11} \left| \frac{mol}{342\ g} \right. = .029 \div 1 = .029$

$10\ g\ O_2 \left| \frac{mol}{32\ g} \right. = .31\ mol\ O_2 \div 12 = .026$ Oxygen limiting

b. How many grams of CO_2 can form?

$.31\ mol\ O_2 \left| \frac{12\ CO_2}{12\ O_2} \right. = .31\ mol\ CO_2 \left| \frac{44\ g\ CO_2}{mol} \right. = 13.64\ g\ CO_2$

c. How many grams of H_2O can form?

$.31\ mol\ O_2 \left| \frac{11\ H_2O}{12\ O_2} \right. = .28\ mol\ H_2O \left| \frac{18\ g}{mol} \right. = 5.04\ g\ H_2O$