Stoichiometry Calculations

Part One: Mole to Mole Problems

1. How many moles of sodium will react with water to produce 4.0 mol of hydrogen in the following reaction?

$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

2. How many moles of lithium chloride will be formed by the reaction of chlorine with 0.046 mol of lithium bromide in the following reaction?

$2LiBr(aq) + Cl_2(g) \rightarrow 2LiCl(aq) + Br_2(l)$

3. Aluminum will react with sulfuric acid in the following reaction.

$2Al(s) + 3H_2SO_4(l) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

a. How many moles of H_2SO_4 will react with 18 mol Al?

b. How many moles of *each* product will be produced?

4. Propane burns in excess oxygen according to the following reaction.

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

a. How many moles *each* of CO_2 and H_2O are formed from 3.85 mol of propane?

b. If 0.647 mol of oxygen is used in the burning of propane, how many moles *each* of CO_2 and H_2O are produced? How many moles of C_3H_8 are consumed?

Part Two: Mole to mass problems

1. Phosphorus burns in air to produce a phosphorus oxide in the following reaction:

$4P(s) + 5O_2(g) \rightarrow P_4O_{10}(s)$

a. What mass of phosphorus will be needed to produce 3.25 mol of P_4O_{10}?

b. If 0.489 mol of phosphorus burns, what mass of oxygen is used? What mass of P_4O_{10} is produced?

2. Hydrogen peroxide breaks down, releasing oxygen, in the following reaction:

$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$

a. What mass of oxygen is produced when 1.840 mol of H_2O_2 decomposes?

b. What mass of water is produced when 5.0 mol O_2 is produced by this reaction?

Part Three: Mass to Mole Problems

1. Sodium carbonate reacts with nitric acid according to the following equation.

$Na_2CO_3(s) + 2HNO_3 \rightarrow 2NaNO_3 + CO_2 + H_2O$

a. How many moles of Na_2CO_3 are required to produce 100.0 g of $NaNO_3$?

b. If 7.50 g of Na_2CO_3 reacts, how many moles of CO_2 are produced?

2. Hydrogen is generated by passing hot steam over iron, which oxidizes to form Fe_3O_4, in the following equation.

$3Fe(s) + 4H_2O(g) \rightarrow 4H_2(g) + Fe_3O_4(s)$

a. If 625 g of Fe_3O_4 is produced in the reaction, how many moles of hydrogen are produced at the same time?

b. How many moles of iron would be needed to generate 27 g of hydrogen?

Part Four: Mass to Mass Problems

1. Calculate the mass of silver bromide produced from 22.5 g of silver nitrate in the following reaction:

$2AgNO_3(aq) + MgBr_2(aq) \rightarrow 2AgBr(s) + Mg(NO_3)_2(aq)$

2. What mass of acetylene, C_2H_2, will be produced from the reaction of 90. g of calcium carbide, CaC_2, with water in the following reaction?

$CaC_2(s) + 2H_2O(l) \rightarrow C_2H_2(g) + Ca(OH)_2(s)$

3. Chlorine gas can be produced in the laboratory by adding concentrated hydrochloric acid to manganese(IV) oxide in the following reaction:

$MnO_2(s) + 4HCl(aq) \rightarrow MnCl_2(aq) + 2H_2O$

a. Calculate the mass of MnO_2 needed to produce 25.0g of Cl_2

b. What mass of $MnCl_2$ is produced when 0.091g of Cl_2 is generated?