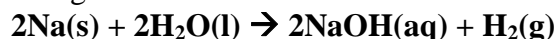# Stoichiometry Calculations

Write out the answers to the questions below on a separate sheet of notebook paper. Be sure to show all the conversion factors and calculations that you use. Please box in your final answer.

Part One

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?
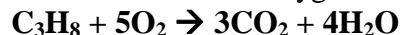
$$2LiBr(aq) + Cl_2(g) \rightarrow 2LiCl(aq) + Br_2(l)$$
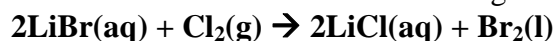
3. Aluminum will react with sulfuric acid in the following reaction.

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

   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?
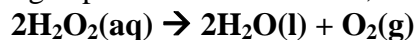
Part Two

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

$$4P(s) + 5O_2(g) \rightarrow P_4O_{10}(s)$$
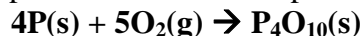
   a. What mass of phosphorus will be needed to produce 3.25 mol of P_4O_{10}?
   b. If 0.489 mol of phosphorus burns, what mass of oxygen is used? What mass of P_4O_{10} is produced?

2. Hydrogen peroxide breaks down, releasing oxygen, in the following reaction:
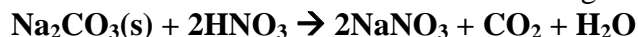
$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

   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

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

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

$$2AgNO_3(aq) + MgBr_2(aq) \rightarrow 2AgBr(s) + Mg(NO_3)_2(aq)$$
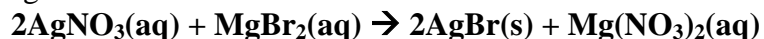
2. What mass of acetylene, C_2H_2, will be produced from the reaction of 90. g of calcium carbide, CaC_2, with water in the following reaction?

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

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

$$MnO_2(s) + 4HCl(aq) \rightarrow MnCl_2(aq) + 2H_2O$$
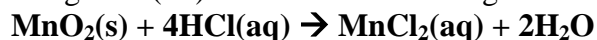
    a. Calculate the mass of MnO_2 needed to produce 25.0g of Cl_2

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