# STOICHIOMETRY WORKSHEET #1

One mole of potassium permanganate reacts completely with excess hydrochloric acid according to the following reaction:

$16\ HCl + 2KMnO_4 \rightarrow 2KCl + 2MnCl_2 + 5Cl_2 + 8H_2O$

_____1. How many moles of water are produced?

_____2. How many grams of potassium chloride are produced?

_____3. How many moles of hydrochloric acid are reacted?

In the following reaction 10 moles of iron(III) oxide is reacted with 6 moles of carbon monoxide until reaction stops:

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

_____4. Which is the limiting reactant?

_____5. What is the theoretical yield of iron in moles, in this reaction?

_____6. What is the theoretical yield of iron in grams, in this reaction?

_____7. When this reaction was carried out by a student, the actual yield was found to be 200. grams Fe. What is the percent yield for this reaction?

_____8. How many moles of the excess reactant remain?

_____9. How many grams of excess reactant remain?

Some applications of stoichiometric calculations:

10. Element X reacts with oxygen gas to produce a compound of $X_2O_5$. In an experiment it is found that 2.0769 grams of pure X produces 3.7076 grams of pure $X_2O_5$.
    a. Write the balanced equation for this synthesis
    b. Calculate the number of moles of oxygen reacted.
    c. Calculate the number of moles of X reacted.
    d. Calculate the atomic weight of X

11. Two aqueous solutions were mixed together and a precipitate formed. One solution, nickel (III) acetate contained $6.35 \times 10^{23}$ ions of $Ni^{+3}$. The other solution, lithium oxalate, contained 3.15 g of the lithium oxalate solute. Determine a) the limiting reactant, b) excess reactant, c) the amount of excess reactant that remains after the reaction, d) the theoretical yield of precipitate that forms, e) the % yield if 3.00 g of precipitate does form and f) the actual yield if 92.4% yield is achieved.

Answers: 1) 4 moles water 2) 74.5 g KCl 3) 8 moles $HCl_{(aq)}$ 4) CO 5) 4 mol Fe 6) 223.4 g Fe 7) 89.5% 8) 8 moles of excess reactant 9) 1278 g $Fe_2O_3$ remain 10) a) $4X + 5O_2 \rightarrow 2X_2O_5$ b) 0.05095 mol $O_2$ c) 0.040768 mol X reacted d) 50.945 g/mol
11) balanced equation: $2Ni(C_2H_3O_2)_{3\,(aq)} + 3Li_2C_2O_{4\,(aq)} \rightarrow Ni_2(C_2O_4)_{3\,(s)} + 6LiC_2H_3O_{2\,(aq)}$
a) LR = $Li_2C_2O_4$ b) XS = $Ni(C_2H_3O_2)_3$ c) 244 g excess $Ni(C_2H_3O_2)_3$ unreacted d) 3.93 g $Ni_2(C_2O_4)_3$ precipitates out of solution, e) 76.3% yield f) 3.63 g actual yield