Quantitative Analysis ----- Practice Review Quiz

(always give answers to correct number of significant figures)

1. An object has mass 14.45 g and volume 10.0 cm^3. Calculate the object's density.

D = mass/volume = 14.45 g/10.0 cm^3 = 1.45 g/cm^3

2. Name the following compounds

a. FeO iron(II) oxide

b. Mg_3N_2 magnesium nitride

c. CCl_4 carbon tetrachloride

d. $CoPO_4$ cobalt phosphate

3. Calculate the number of moles of $AgNO_3$ in 15.0 g of $AgNO_3$

Moles = mass in grams/molar mass

Molar mass $AgNO_3$ = 169.87 g/mol (use periodic table)

Moles = 15.0 g /169.87 g/mol = 0.0883 g

4. Calculate the mass in grams of 2.00 moles of N_2O_3

Moles = mass in grams/molar mass

Rearranging: mass in grams = moles x molar mass

Molar mass N_2O_3 = 76.01 g/mol

Mass in grams = 2.00 mol x 76.01 g/mol = 152 g

5. Calculate the mass of barium sulfate that will form when 10.0 g of barium chloride reacts completely according to the following reaction:

$$BaCl_2\ (aq) + Na_2SO_4\ (aq) \rightarrow 2\ NaCl\ (aq) + BaSO_4\ (s)$$

Convert 10.0 g $BaCl_2$ to moles (as in Q3)

Molar mass $BaCl_2$ = 208.23 g/mol

Moles $BaCl_2$ = 10 g/208.23 g/mol = 0.0480 mol $BaCl_2$

Since 1 mole $BaCl_2$ yields 1 mole $BaSO_4$ from equation:

Moles $BaSO_4$ formed = 0.0480 mol

Convert moles $BaSO_4$ to grams (as in Q4)

Molar mass $BaSO_4$ = 233.38 g/mol

Mass $BaSO_4$ formed = 0.048 mol x 233.38 g/mol = 11.2 g $BaSO_4$

6. 15.0 g of $Fe(NO_3)_3$ reacts with 15.0 g KOH according to the following equation:

$$Fe(NO_3)_3\ (aq) + 3\ KOH\ (aq) \rightarrow Fe(OH)_3\ (s) + 3\ KNO_3\ (aq)$$

a. Calculate the limiting reactant

Convert masses to moles as in above questions.

Molar masses: $Fe(NO_3)_3$ = 241.86 g/mol KOH = 56.11 g/mol

Moles $Fe(NO_3)_3$ = 0.0620 mol Moles KOH = 0.257 mol

So which is limiting (will be all used up) and which is in excess?

From equations, reactant ratio is 1:3

This means 0.0620 mol of $Fe(NO_3)_3$ would require 3 x 0.0620 mol (= 0.186 mol) KOH to react completely

Since there are 0.257 mol of KOH (in the 15 g), the KOH is in excess and all the $Fe(NO_3)_3$ will be used up – it is the limiting reactant since it will determine the mass of products that form, not the KOH

b. Calculate the theoretical yield of $Fe(OH)_3$

Use the 15 g (0.0620 mol) of $Fe(NO_3)_3$ (the limiting reactant) to calculate the mass of $Fe(OH)_3$ that forms (which is the theoretical yield)

Mole ratio is 1:1

That is, 0.0620 mol of $Fe(NO_3)_3$ will form 0.0620 mol of $Fe(OH)_3$

Convert 0.0620 mol of $Fe(OH)_3$ to mass (as in above questions)

Molar mass of $Fe(OH)_3$ = 106.866 g/mol

Recall: mass in grams = moles x molar mass

Mass of $Fe(OH)_3$ = 0.062 mol x 106.866 g/mol = 6.66 g $Fe(OH)_3$

7. Calculate the molarity of 31.35 g of NaCl in 1.50 L of aqueous solution

Molarity = moles of solute (NaCl)/volume of solution

Convert 31.35 g NaCl to mol as in above questions - gives 0.536 mol NaCl

Molarity = 0.536 mol/1.50 L = 0.357 M NaCl

8. Calculate the final concentration of a HCl solution prepared by diluting 100.0 mL of 12.1 M HCl to 250.0 mL.

For dilutions use $M_1V_1 = M_2V_2$

Where M_1 and V_1 refer to initial molarity and volumes (the more concentrated solution)

and M_2 and V_2 refer to final molarity and volumes (the diluted solution)

$M_1 = 12.1$ M

$V_1 = 100$ mL

M_2 = unknown

$V_2 = 250$ mL

Therefore, $M_2 = 4.84$ M

(You can leave volumes in mL since those units will cancel)