CHEM 100 Review Quiz

(remember: always give answers to correct number of significant figures)

1. An object has mass 14.45 g and volume 10.0 cm3. Calculate the object’s density.

D = mass/volume = 14.45 g/10.0 cm3 = 1.45 g/cm3

2. Name the following compounds

a. FeO iron(II) oxide b. Mg3N2  magnesium nitride

c. CCl4 carbon tetrachloride d. CoPO4 cobalt phosphate

3. Calculate the number of moles of AgNO3 in 15.0 g of AgNO3

Moles = mass in grams/molar mass

Molar mass AgNO3 = 169.87 g/mol (use periodic table)

Moles = 15.0 g /169.87 g/mol = 0.883 mol

4. Calculate the mass in grams of 2.00 moles of N2O3

Moles = mass in grams/molar mass

Rearranging: mass in grams = moles x molar mass

Molar mass N2O3 = 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:

BaCl2 (aq) + Na2SO4 (aq) → 2 NaCl (aq) + BaSO4 (s)

Convert 10.0 g BaCl2 to moles (as in Q3)

Molar mass BaCl2 = 208.23 g/mol

Moles BaCl2 = 10 g/208.23 g/mol = 0.0480 mol BaCl2

Since 1 mole BaCl2 yields 1 mole BaSO4 from equation:

Moles BaSO4 formed = 0.0480 mol

Convert moles BaSO4 to grams (as in Q4)

Molar mass BaSO4 = 233.38 g/mol

Mass BaSO4 formed = 0.048 mol x 233.38 g/mol = 11.2 g BaSO4

6. 15.0 g of Fe(NO3)3 reacts with 15.0 g KOH according to the following equation:

Fe(NO3)3 (aq) + 3 KOH (aq) → Fe(OH)3 (s) + 3 KNO3 (aq)

a. Calculate the limiting reactant

Convert masses to moles as in above questions.

Molar masses: Fe(NO3)3  = 241.86 g/mol KOH = 56.11 g/mol

Moles Fe(NO3)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(NO3)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(NO3)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(NO3)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(NO3)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 M1V1 = M2V2

Where M1 and V1 refer to initial molarity and volumes (the more concentrated solution)

and M2 and V2 refer to final molarity and volumes (the diluted solution)

M1 = 12.1 M

V1 = 100 mL

M2 = unknown

V2 = 250 mL

Therefore, M2 = 4.84 M

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