Friday worksheet 2b – concentration calculations to find amount of solute

To find the amount of a substance present in a given volume of a solution we need to know its concentration.

In this worksheet we will be manipulating formulae and converting units.

Concentration = C
Volume = V
Amount = A

$$A = C \times V$$

Example 1. What is the amount, in mol, of lead in 30.0 mL of a 0.101M solution of $Pb(NO_3)_2$.

Step 1 find the amount($Pb(NO_3)_2$) of substance using the formula

=> A = C X V

=> make sure all units are correct. C = mol/L, V = L

=> $Pb(NO_3)_{2\,(mol)}$ = 0.101ol/L X 0.0300 L = 3.03 X 10^{-3} mol.

Step 2 Find the mol of Pb.

Since there is one mol of Pb for every mol of $Pb(NO_3)_2$

=> n_{Pb} = 3.03 X 10^{-3} mol.

Example 2 What is the mass of nitrate in 60.0 mL of a 1.32M $Al(NO_3)_3$?

Step 1 Find the mol of aluminium nitrate present in 60.0 mL.

=> amount = C X V = 1.32 mol/L X 0.0600 L = 0.0792 mol

Step 2 Find the mol of NO_3^-

=> Since for every mol of $Al(NO_3)_3$ there are three mol of NO_3^-.

=> 3 X 0.0792 = 0.2376 mol of nitrate

Step 3 find the mass of nitrate

=> mass = 0.2376 X 62.0 = 14.7g

Example 3 What is the volume, in mL, of a 0.2 M $AgNO_3$ solution that contains exactly 8.5 grams of $AgNO_3$?

Step 1 Transform the formula to make it equal to volume.

=> A/C =V

=> amount is 8.5 grams but the concentration is given in mol/L so convert the units.

Step 2 Convert from grams to mol of $AgNO_3$

=> 8.5g of $AgNO_3$ = 8.5/170 = 0.050 mol

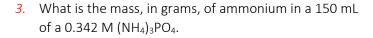*Step 3 Find the volume in mL*

=> 0.050 mol/ 0.2mol/L = 0.25L = 250mL

1. A brand of wine has the alcohol (ethanol) content clearly labelled as 13.5%v/v. Given that the density of ethanol, at room temperature, is 0.7892 g/mL calculate the mass of ethanol in 75 mL of wine

2. Calculate the mass, in grams, of $Ca(NO_3)_2$ found in 135.0 mL of a 0.12M $Ca(NO_3)_2$.

3. What is the mass, in grams, of ammonium in a 150 mL of a 0.342 M $(NH_4)_3PO_4$.

4. A sample of seawater taken from the Bay has an NaCl concentration of 0.600 M.
   a. Calculate the volume, in litres, of sea water that would contain exactly 35.6 grams of NaCl.

   b. What mass, in kilograms, of Cl^- ions is present in 345 mL of seawater?
   Step 1 Find the mol of NaCl in 345 mL
   => mol = C X V = 0.600 mol/L X 0.345 L = 0.207 mol
   Step 2 Find the mol of Cl^-
   => For every mol of NaCl there is one mol of Cl^- ions also present.
   => mol of Cl^- = 0.207
   Step 3 find the mass of Cl^-
   => mass = 0.207 X formula mass of Cl = 0.207 X 35.5 = 7.35 g or 7.35 X 10^{-3} kg