THE PREPARATION OF STANDARD SOLUTIONS

STANDARD SOLUTION

Any solution containing a known concentration of a solute in a solvent concentration may be expressed in several ways;

i MOLAR CONCENTRATION

A solution containing a simple fraction of the Avagadro No. of particles in 1dm^3 of pure solvent.

Ii MASS CONCENTRATION

A solution whose concentration of solute is expressed as a mass dm^{-3} for example a solution of Barium Chloride, 100g dm^{-3}.

Solutions whose concentration is expressed in moles per decimeter cube (mol.dm^{-3}) are known as Primary Standards. Solutions which contain a known mass dm^3 are known as Secondary Standards. The Primary Standards are most important.

THE MOLE

The mole is a measure of NUMBERS OF PARTICLES, where one mole = 6.029 x 10^{23} particles:- The Avagadro Number (L or N). The concept of molarity is possibly the most important in chemistry:- it enables us to write down simple equations of reactions and appears in many studies for example volume ratios in which gases react at the same pressure, calculation of density for pure crystals, and calculation of molecular mass of compounds.

MOLECULAR MASS AND ATOMIC MASS

The Molecular mass of a substance is the mass of that substance in grams which contains L molecules, ion pairs etc. The atomic mass of an element's is the mass of grams for one mole of that elements atoms.

The atomic mass equals the molecular mass divided by the atomicity (no of atoms per molecule) of the given element for example;

I Argon, Ar approx = 40 (molecular mass)

Ar approx = 40 (atomic mass)

The atomicity of Argon is 1, Argon is monatomic.

Ii Chlorine, Cl_2 = 70.906

The 2 in the chemical formula for Chlorine denotes an atomicity of 2 - Chlorine is diatomic.

Therefore Cl = 35.453

ie. one mole of Chlorine molecules has a mass of 70.906g

one mole of Chlorine atoms has a mass of 35.453g.

Therefore one mole of Chlorine molecules contains 2 moles of Chlorine atoms combined chemically into a single entity.

It must be understood completely that the mole is a measure not of the number of atoms in a molecule but is the measure of the number of molecules themselves.

Therefore one mole of $CaCO_3$ is 6.029×10^{23} $CaCO_3$ "units" and not 1 mole Ca, 1 mole C & 3 moles of O all added together.

When ionic substances dissolve however, the reverse of above is sometimes true: if one mole of Calcium Chloride is dissolved in 1 litre of pure water;

CaCl2(s) = Ca ++ (aq) + 2Cl(-)(aq)

The equation shows the crystals lattice to break down into separate ions, the ratio of Ca2+ : Cl(-) being 1:2.

Therefore in one molar solution of CaCl2 is 1 molar with respect to Ca2+ ions, but 2 molar with respect to $Cl^{(-)}$(aq) ions.

On any sample of pure chemical purchased, there will be found printed "formula" = some mass.

eg NaOH = 40.00

This means that if 40.00g of NaOH are taken and dissolved in 1 litre of pure water, the resulting solution is 1 molar w.r.t. NaOH since the equation of solution for NaOH is;

NaOH(s) + x H_2O(l) -> $Na^{(+)}$(aq) + $OH^{(-)}$(aq)

the solution is also 1 molar w.r.t. both $Na^{(+)}$ & $OH^{(-)}$ ions

The x denotes a large unknown but determinable No. of moles of water being present. It is often omitted but strictly speaking, to write

NaOH(s) + H_2O(l) -> Na^{+}(aq) + $OH^{(-)}$(aq)

means 1 mole of NaOH dissolved in 1 mole of water and hence is not a molar solution it is a 1000 molar solution (in theory)