Friday worksheet 2a – concentrations in solutions with ionic substances.

Keep in mind - Square brackets [] denotes concentration (mol/L)
eg [NaCl] = concentration of NaCl in mol/L
eg [NaCl] = 0.12M = the concentration of NaCl in the solution is 0.12 mol/L

Exaple 1- What is the concentration of Lead(II) and nitrate ions in a 1.00M $Pb(NO_3)_2$ solution.
Since there is 1.00 mol of $Pb(NO_3)_2$ in every litre we also conclude that there is also 1.00 mol of Pb^{2+} and 2.0 mol of NO_3^- ions in every litre. We can see from the formula that the ratio of ions.

Valency of Some Simple and Polyatomic Ions

Valency	Simple (+ve) ions	Simple (-ve) ions	Polyatomic ions
1	Copper(I), Cu^+ Hydrogen, H^+ Potassium, K^+ Silver, Ag^+ Sodium, Na^+	Hydride, H^- Chloride, Cl^- Bromide, Br^- Iodide, I^-	Ammonium, NH_4^+ Hydrogencarbonate, HCO_3^- Hydroxide, OH^- Nitrate, NO_3^-
2	Calcium, Ca^{2+} Copper(II), Cu^{2+} Iron(II), Fe^{2+} Lead(II), Pb^{2+} Magnesium, Mg^{2+} Zinc, Zn^{2+}	Oxide, O^{2-} Sulfide, S^{2-}	Carbonate, CO_3^{2-} Sulfate, SO_4^{2-}
3	Aluminium, Al^{3+} Iron(III), Fe^{3+}	Nitride, N^{3-}	Phosphate, PO_4^{3-}

Example 2 - Find the $[NH_4^+]$ and $[PO_4^{-3}]$ in a 0.40M solution of ammonium phosphate.
Step 1 – write the formula of ammonium phosphate
=> $(NH_4)_3PO_4$
Step 2 – From the formula we see that for every mol of $(NH_4)_3PO_4$ we have one mol of PO_4^{-3} and three mol of NH_4^+ ions.
=> $[NH_4^+] = 3 \times 0.40 = 1.2M$, $[PO_4^{-3}] = 1 \times 0.40 = 0.40M$

1) Calculate the $[Fe^{3+}]$ and $[OH^-]$ in a 1.21 M Iron(III) hydroxide solution.

2) Calculate the concentration, in mol/L, of aluminium and nitrate ions in a 3.2 M solution of aluminium nitrate.

3) Calculate the concentration of ions, in mol/L, in a 0.500 M ammonium nitride solution.

4) A solution of aluminium nitrate is formed by dissolving 8.90 g of the substance in 300.0 mL of distilled water.
   a. Calculate the concentration of the aluminium nitrate solution.

   b. Calculate the:
      i. $[Al^{3+}]$
      ii. $[NO_3^-]$

5) A 1.00 L sample of 0.100 M NaCl was mixed with a 500.0 mL 0.200 M NH_4Cl . Given that no reaction takes place and assuming that both NaCl and ammonium chloride are soluble in water, find the concentration in mol/L of chloride ions in the final solution.

6) 4.52 grams of ammonium phosphate is dissolved in 2.00 L of pure water.
a. calculate the :

i. Concentration of ammonium phosphate in ppm

ii. Concentration of ammonium phosphate in mol/L

iii. $[NH_4^+]$

iv. $[PO_4^{-3}]$

7) 52.0 grams of aluminium nitrate is dissolved in 4.00 L of pure water and then mixed with 2.00 L of a 1.00 M sodium nitrate solution.
a. calculate the :

i. Concentration of aluminium in ppm in the final solution

ii. Concentration of nitrate ions, in mol/L, in the final solution.