Solubility is also temperature dependent. A general rule for solid/liquid solutions is that solubility increases with increasing temperature.

↑ solubility = ↑ temp.

Assignment 1: Read Hebden pages 73-76 (check out the comic on p.76) and do Questions #1-5

III) Calculating Solubility and Ion Concentrations

Use stoichiometry to calculate the concentration of ions given the concentration of solute.

Calculate $[Na^+]$ and $[SO_4^{2-}]$ in a 0.20M solution of $Na_2SO_{4(aq)}$

1 : 2 : 1

Dissoc eqn: $Na_2SO_{4(s)} \Rightarrow 2Na^+_{(aq)} + SO_4^{2-}{}_{(aq)}$

0.20M 0.40M 0.20M

2·(0.20M)

Calculate $[Fe^{3+}]$ and $[SO_4^{2-}]$ in a 0.50M solution of iron III sulphate:

$Fe_2(SO_4)_{3(s)} \longrightarrow 2Fe^{3+}_{(aq)} + 3SO_4^{2-}{}_{(aq)}$

0.50M 1.0M 1.5M

A saturated solution of $PbCl_2$ is found to contain 9.90g of $PbCl_2$ per litre of solution. Find $[Pb^{2+}]$.

$PbCl_{2(s)} \longrightarrow Pb^{2+}_{(aq)} + 2Cl^-_{(aq)}$

0.0355886M 0.0355886M

$$\frac{9.90\,g\ PbCl_2}{} \left| \frac{1\ mol\ PbCl_2}{278\,g\ PbCl_2} \right. = 0.0355886\ mol\ PbCl_2$$

$\therefore 0.0356\ M = [Pb^{2+}]$

$$[PbCl_2] = \frac{0.0355886\ mol}{1.00\,L} = 0.0355886\,M$$

Write an equation showing the equilibrium in a saturated solution of silver carbonate. The solubility of silver carbonate is 1.29×10^{-4} M. Find $[Ag^+]$ in grams per litre.

$Ag_2CO_{3(s)} \rightleftharpoons 2Ag^+_{(aq)} + CO_3^{-2}{}_{(aq)}$

1.29×10^{-4} M ×2 → 2.58×10^{-4} M = mol/L

$$\frac{2.58 \times 10^{-4}\ mol}{L} \left| \frac{107.9\,g\ Ag^+}{1\ mol} \right. = 0.0278\ g/L$$

A 558mL solution of $Al_2(SO_4)_3$ has a concentration of 0.0342M. You then add 325mL of water to it. What is the new concentration?

Dilution: $M_i V_i = M_f V_f$

$M_i = 0.0342M$

$V_i = 0.558L$

$V_f = 0.558L + 0.325L = 0.883L$

$M_f = ?$

$$\frac{(0.0342M)(0.558L)}{(0.883L)} = \frac{M_f (0.883L)}{0.883L}$$

$\therefore M_f = 0.0216M$

$[Al_2(SO_4)_3] = 0.0216M$

$M_f = 250mL + 250mL = 500mL = 0.500L$

250mL of 0.30M K_2SO_4 and 250mL of 0.80M $MgCl_2$ are mixed, and no precipitate forms. Calculate the concentration of each ion in the final solution. => dilution

dilution: $m_i V_i = m_f V_f$ ↳ M_f

$[K_2SO_4]_f = \frac{(0.30m)(0.250L)}{(0.500L)} = 0.15m$

$K_2SO_{4(s)} \rightarrow 2K^+_{(aq)} + SO_4^{2-}_{(aq)}$

0.15m 0.30m 0.15m

$[MgCl_2]_f = \frac{(0.80m)(0.250L)}{(0.500L)} = 0.40m$

$MgCl_{2(s)} \rightarrow Mg^{2+}_{(aq)} + 2Cl^-_{(aq)}$

0.40m 0.40m 0.80m

*Hint: if equal volumes ar mixed, the volume has been doubled. ∴ the concentrations have been halved.

$[K^+] = 0.30m$ $[Mg^{2+}] = 0.40m$

$[SO_4^{2-}] = 0.15m$ $[Cl^-] = 0.80m$

Assignment 2: Hebden p.77 # 8, 9 & p.78 #13 & p.81 #18a-d, 20abfg