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

\[ \Delta \text{solubility} = \Delta \text{temp} \]

**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)

Dissoc eqn: \(Na_2SO_4(s) \rightarrow 2Na^+(aq) + SO_4^{2-}(aq)\)

\[
\begin{array}{ccc}
1 & : & 2 \\
0.20M & : & 0.40M \\
& \text{aq} & : 0.20M \\
\end{array}
\]

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

\[
Fe_2(SO_4)_3(s) \rightarrow 2Fe^{3+}(aq) + 3SO_4^{2-}(aq)
\]

\[
\begin{array}{ccc}
0.50M & : & 1.0M \\
& \text{aq} & : 1.5M \\
\end{array}
\]

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

\[
9.90g \text{ PbCl}_2 \rightarrow 1 \text{ mol PbCl}_2
\]

\[
[\text{PbCl}_2] = \frac{0.03588 \text{ mol}}{1.0L} = 0.03588 \text{M}
\]

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

\[
Ag_2CO_3(s) \rightleftharpoons 2Ag^{+}(aq) + CO_3^{2-}(aq)
\]

\[
[Ag^{+}](\text{aq}) = 2.58 \times 10^{-4} \text{ mol} \times \frac{2.58 \times 10^{-4} \text{ mol}}{1 \text{ mol}} = 0.0078 \text{ g/L}
\]

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:** \(\frac{M_i \cdot V_i}{V_f} = \frac{M_f \cdot V_f}{V_i}\)

\[
\begin{array}{ccc}
M_i & = & 0.0342 \text{M} \\
V_i & = & 0.558 \text{L} \\
V_f & = & 0.558 \text{L} + 0.325 \text{L} = 0.883 \text{L} \\
M_f & = & ?
\end{array}
\]

\[
[Al_2(SO_4)_3] = 0.0342 \text{M}
\]

\[
\frac{(0.0342 \text{ mol}) \times (0.883 \text{L})}{(0.883 \text{L})} = 0.0342 \text{M}
\]

\[
\therefore M_f = 0.0342 \text{M}
\]

\[
[Al_2(SO_4)_3] = 0.0342 \text{M}
\]
250mL of 0.30M K₂SO₄ and 250mL of 0.80M MgCl₂ are mixed, and no precipitate forms. Calculate the concentration of each ion in the final solution.

\[ m_i v_i = m_f v_f \]

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

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

K₂SO₄ → 2K⁺ + SO₄²⁻
0.15M 0.30M 0.15M

MgCl₂ → Mg⁺₂ + 2Cl⁻
0.40M 0.40M 0.80M

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

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