Week 2 Discussion Notes

§ Lab this week

We will be determining K_{sp} for Calcium Benzoate using titration. Basic idea:

1) Have an initial solution of $[Ca^{2+}]_i$; $[Bz^-]_i$. It will equilibrate to $[Ca^{2+}]_f$; $[Bz^-]_f$, and some precipitate formed (ICE Table).

2) If we filter the solution of the precipitate, we have a saturated solution ($Q = K_{sp}$). That is, $K_{sp} = [Ca^{2+}]_f [Bz^-]_i^2$.

3) Titration of this solution with EDTA gives $[Ca^{2+}]_f$. Reacts in a 1:1 manner ⇒ # of moles EDTA to get to equivalence point gives # of moles of Ca^{2+} in solution. Can then determine $[Ca^{2+}]_f$.

4) Using (1), or

$$Ca^{2+} + 2\,Bz^- \rightleftharpoons CaBz_2$$

and an ICE table, we can then determine $[Bz^-]_f$.

5) Calculate K_{sp} from $[Ca^{2+}]_f$; $[Bz^-]_f$.

6) Repeat for the other solutions.

§ Additional Problem (Warm-Up)

2) Thallium thiocyanate TlSCN is slightly soluble in water with a K_{sp} at 25°C of 1.82×10^{-4}. Estimate the solubility of Thallium thiocyanate in units of grams per 100.0 mL of water.

A) The reaction is given by

$$TlSCN_{(s)} \rightleftharpoons Tl^+_{(aq)} + SCN^-_{(aq)}$$

Hence $K_{sp} = [Tl^+][SCN^-] = 1.82 \times 10^{-4}$

If neither reacts with the solvent or each other to form other species, then we should have

$$[Tl^+] = [SCN^-] = \sqrt{1.82 \times 10^{-4}} = 1.35 \times 10^{-2} \frac{mol}{Litre}$$

We can convert this to the desired units as:

$$1.35 \times 10^{-2} \frac{mol}{litre} \times \frac{262.47 g}{mol} \times \frac{1 litre}{10\,(100.0 mL)} = \boxed{0.354 g \text{ per } 100.0 mL}$$