

## 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,  $K_{sp} = [Ca^{2+}]_f [Bz^-]_f^2$ .
- 3) Titration of this solution with EDTA gives  $[Ca^{2+}]_f$ . Reacts in a 1:1 manner  $\Rightarrow$  # of moles EDTA to get to equivalence point gives # of moles of ~~Ca<sup>2+</sup>~~  $Ca^{2+}$  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  $[Bz^-]_f$ .

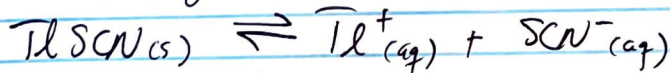
5) Calculate  $K_{sp}$  from  $[Ca^{2+}]_f$  ;  $[Bz^-]_f$ .

6) Repeat for the other solutions.

### § Additional Problem (Warm-up)

Q) Thallium Thiocyanate  $TlSCN$  is slightly soluble in water with a  $K_{sp}$  at  $25^\circ C$  of  $1.82 \times 10^{-4}$ . Estimate the solubility of Thallium Thiocyanate in units of grams per 100.0 mL of water.

A) The reaction is given by



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

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

We can convert this to the desired units as:

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