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Day - I (H) Physical (Paper - II)

Chapter - Ionic Equilibrium

Topics - Solubility-product
& its qualitative analysis.

Solubility & Solubility-product

Solubility:- Solubility is defined as the amount of solute dissolved in 100 gm of solvent at given Temp. is called Solubility.

$$\text{Solubility} = \frac{\text{wt of solute}}{\text{wt of solvent}} \times 100$$

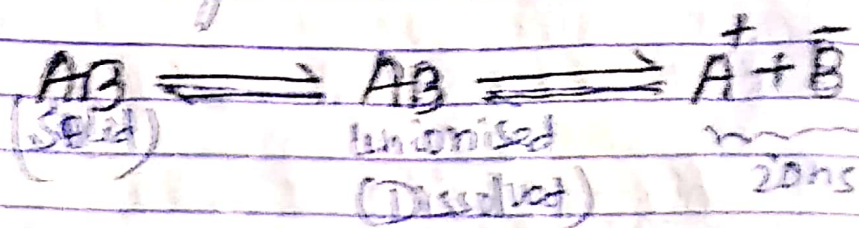
Solubility-product (K_{sp})

"The solubility-product of a sparingly soluble salt at a given temp may be defined as the product of concs of its ions in saturated solution with each concentration-term raised to the power equal to the number of times the ion occurs in the equation representing the dissociation of the electrolyte."

Quantity of
 ions. The solute dissolved is
 always const. for the given amount
 of particular solvent in saturated
 soln. at definite temp.

The ionisation of an electro-
 lyte occurs in solution & degree
 of dissociation depends upon concn.
 of dissolved electrolyte.

The equilibrium exists
 can be represented as



Applying the law of mass-action
 to the ionic equilibrium

$$K = \frac{[A^+][B^-]}{[AB]}$$

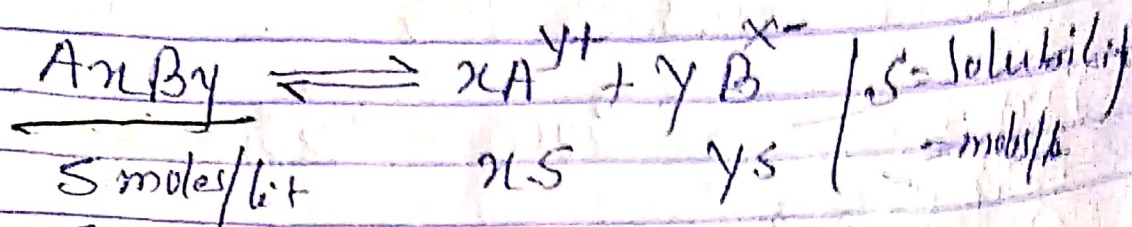
In saturated soln. the concn. of ionised
 molecules of the electrolyte is const.
 at particular temp.

$$[AB] = K' (\text{const})$$

$$\text{Thus } KK' = [A^+][B^-]$$

$$K_{sp} = [A^+][B^-]$$

Different Expression for Solubility-product
 & its relation with solubility.
 In general type of electrolyte, $A_x B_y$
 which dissociates as



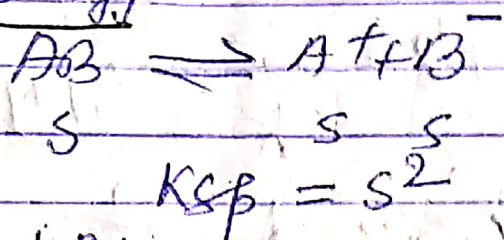
Thus

$$K_{sp} = [xS]^x [yS]^y$$

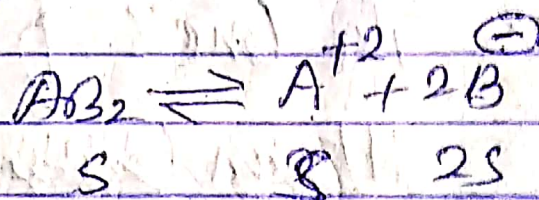
$$= x^x \cdot y^y \cdot S^{x+y}$$

Example:- Salt like AB , AB_2/A_2B , A_2B_3 etc.

① For AB -type.



② For AB_2/A_2B

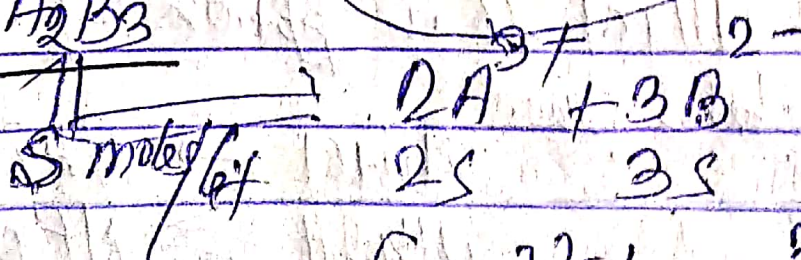


$$K_{sp} = S \times (2S)^2$$

$$= S \times 4S^2$$

$$K_{sp} = 4S^3$$

③ For A_2B_3

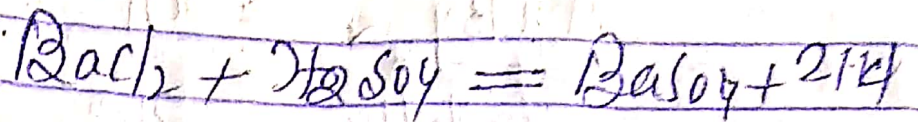


$$K_{sp} = [2S]^2 [3S]^3$$

$$= 4S^2 \times 27S^3 = 108S^5$$

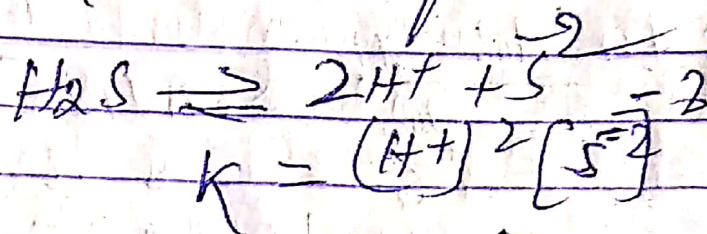
Application of Solubility-product in Qualitative analysis.

- ① Estimation of barium in barium sulphate.
Excess H_2SO_4 added to ppt. Barium is BaCl₂-soluble.



- ② Precipitation of the sulphates of gr II & IV.

H_2S is weak electrolyte & it is used to ppt of various sulphides of gr II & IV in qualitative analysis.

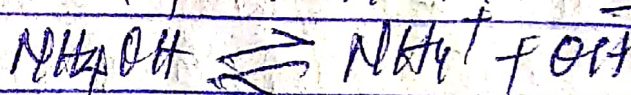
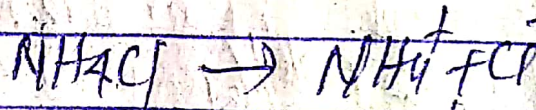


The concn of S^{2-} is depressed by adding

H^+ -ion concn.

- ③ Precipitation of gr-III hydroxide.

When NH_4OH is added in presence of NH_4Cl then pptn of gr-III hydroxide takes place.



NH_4^+ lowers the ionisation of NH_4OH , & hydroxide ppt.