1. (b) Solubility of $Al_2(SO_4)_3$

$Al_2(SO_4)_3 \rightleftharpoons 2Al^{+++} + 3SO_4^{--}$

$\boldsymbol{K_{sp} = [Al^{3+}]^2[SO_4^{2-}]^3}$

2. (c) Due to common ion effect.

3. (b) $MX_2 \rightleftharpoons \underset{S}{M^{2+}} + \underset{2S}{2X^-}$

$K_{sp} = (2S)^2(S) = 4S^3$

$\Rightarrow S = 2\sqrt[3]{\frac{K_{sp}}{4}} = \sqrt[3]{\frac{4\times10^{-12}}{4}} = 1.0 \times 10^{-4}M.$

4. (b) Solubility product

EXPLANATION (easy to remember):
For sparingly soluble salts, in a *saturated solution*, the concentration of ions reaches equilibrium.
The product of concentrations of the ions in this state is constant → this is called the Solubility Product (Ksp).
Example:
For AgCl ⇌ $Ag^+ + Cl^-$
Ksp = $[Ag^+] \times [Cl^-]$

5. (b) $MX_2 \rightleftharpoons \underset{(S)}{M^+} + \underset{(2S)^2}{2X^-}$; $K_{sp} = 4S^3$

$\boldsymbol{S = \sqrt[3]{\frac{K_{sp}}{4}} = \sqrt[3]{\frac{1\times10^{-11}}{4}} = 1.35 \times 10^{-4}}$

6. (d) $mol^2\ L^{-2}$

Unit = $(mol\cdot L^{-1}) \times (mol\cdot L^{-1}) = mol^2\cdot L^{-2}$

7. (c) HgS

Lowest Ksp → Precipitates first

8. (a) $Mg(OH)_2 \rightleftharpoons \underset{(X)}{Mg^{++}} + \underset{(2X)^2}{2OH^-}$

$K_{sp} = 4X^3$

9. (c) $BaSO_4 \rightleftharpoons \underset{0.01}{\overset{(S)}{Ba^{++}}} + \underset{5}{\overset{(S)}{SO_4^{--}}}$

$K_{sp} = S^2 = S \times S = 0.01 \times S$

$S_{(SO_4^{2-})} = \frac{K_{sp}}{S_{(Ba^{++})}} = \frac{1\times10^{-9}}{0.01} = 10^{-7} mole/litre$

10. (a) $AB_2 \rightleftharpoons \underset{1\times10^{-5}}{A^+} + \underset{2\times10^{-5}}{2B^-}$

$K_{sp} = [1 \times 10^{-5}][2 \times 10^{-5}]^2 = 4 \times 10^{-15}$

11. (b) $CaF_2 \rightleftharpoons \underset{(S)}{Ca^{++}} + \underset{(2S)^2}{2F^-}; K_{sp} = 4S^3$

12. (b) Due to common ion effect.

13. (a) $Ag_2CrO_4 \rightleftharpoons [2Ag^+] + [CrO_4^{--}]$

Hence $K_{sp} = [Ag^+]^2[CrO_4^{--}]$

14. (d) K_{sp} for $CaF_2 = 4s^3 = 4 \times [2 \times 10^{-4}]^3 = 3.2 \times 10^{-11}$.

15. (d) The concentration of S^{2-} ions in group II is lowered by maintaining acidic medium in the presence of NH_4Cl. The ionization of H_2S is supressed due to common ion effect. So the ionic product is less than solubility product.

16. (b) NH_4Cl is hydrolysed and give $[H^+]$

$NH_4Cl + H.OH \rightleftharpoons NH_4OH + HCl$

$\boldsymbol{NH_4^+ + H.OH} \rightleftharpoons NH_4OH + H^+$

17. (c) $FeCl_3$is a salt of weak base $(Fe(OH)_3)$ and strong acid (HCl).

18. (c) For the precipitation of an electrolyte, it is necessary that the ionic product must exceed its solubility product.

19. (d) $K_{sp} = [Ag^+]^2[Cro_4^{--}] = [2S]^2[0.01]$

$=\boldsymbol{4S^2[0.01] = 4[2 \times 10^{-8}]^2 \times 0.01 = 16 \times 10^{-18}}$.

20. (c) Complex salts contain two different metallic elements but give test for only one of them. *e.g.* $K_4Fe(CN)_6$does not give test for Fe^{3+}ions.