

41. (a) The ionic product of an electrolyte in its saturated solution

Explanation (Word-Friendly):

Solubility product (K_{sp}) applies to **sparingly soluble salts only**.

In a **saturated solution**, the electrolyte dissociates into ions.

At equilibrium, the **product of concentrations of ions** remains **constant**.

This constant is called **solubility product (K_{sp})**.

Example:

For the salt:



Solubility product:

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

42. (d) K_w increases with increase in temperature.

43. (b) It contains two cations and one anion.

44. (a) $HgSO_4$ of $K_{sp} = S^2$

$$S = \sqrt{K_{sp}}; S = \sqrt{6.4 \times 10^{-5}}; S = 8 \times 10^{-3} \text{ m/l.}$$

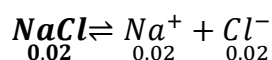
45. (b) The solubility of $BaSO_4$ in g/litre is given 2.33×10^{-3}

$$\therefore \text{in mole/litre } n = \frac{w}{m.wt} = 1 \times 10^{-5} = \frac{2.33 \times 10^{-3}}{233}$$

Because $BaSO_4$ is a compound

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

46. (d) $AgCl \rightleftharpoons Ag^+ + Cl^-$



$$K_{sp} AgCl = 1.20 \times 10^{-10}$$

$$K_{sp} AgCl = [Ag^+][Cl^-] = a \times [a + 0.2] = a^2 + 0.2a$$



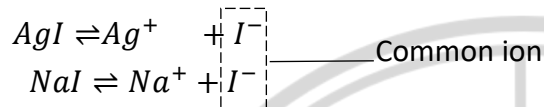
a^2 is a very small so it is neglected.

$$K_{sp}AgCl = 0.2a$$

$$1.20 \times 10^{-10} = 0.2a$$

$$a = \frac{1.20 \times 10^{-10}}{0.20} = 6 \times 10^{-10} \text{ mole}$$

47. (b) Solubility is decreased due to common ion effect.



48. (c) K_{sp} of $BaSO_4 = 1.5 \times 10^{-9}$; $Ba^{++} = 0.01M$

$$SO_4^{--} = \frac{1.5 \times 10^{-9}}{0.01} = 1.5 \times 10^{-7}$$

49. (c) $AgCrO_4 \rightleftharpoons 2Ag^+ + CrO_4^{2-}$
(2s)² s

$$K_{sp} = 4S^3 \text{ given } 2S = 1.5 \times 10^{-4}$$

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

$$= (1.5 \times 10^{-4})^2 \times \left(\frac{1.5 \times 10^{-4}}{2}\right) = 1.6875 \times 10^{-12}$$

50. (c) $PbCl_2 \rightleftharpoons \underset{S}{Pb^{2+}} + 2\underset{S}{Cl^-}$

$$K_{sp} \text{ of } PbCl_2 = [Pb^{2+}] \times [Cl^-]^2 ; K_{sp} = S \times (2S)^2$$

$$K_{sp} = S \times 4S^2 = 4S^3; S^3 = \frac{K_{sp}}{4}; S = \sqrt[3]{\frac{K_{sp}}{4}}$$

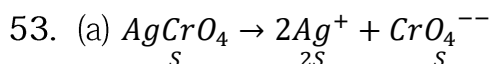
51. (b) $AgCl \rightleftharpoons [Ag^+][Cl^-] ; K_{sp} = S \times S ; K_{sp} = S^2$

$$S = \sqrt{K_{sp}} = \sqrt{1.44 \times 10^{-4}} = 1.20 \times 10^{-2} M.$$

52. (d) By formula $BA_2 \rightarrow B^+ + 2A^-$

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



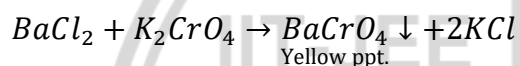


$$K_{sp} = (2S)^2 S = 4S^3$$

$$S = \left(\frac{K_{sp}}{4}\right)^{\frac{1}{3}} = \left(\frac{32 \times 10^{-12}}{4}\right)^{\frac{1}{3}} = 2 \times 10^{-4} M.$$

54. (d) Common ion effect is noticed only for weak electrolyte dissociation. H_2SO_4 is strong electrolyte.

55. (c) When we added barium ion in chromate ion solution we obtained yellow ppt of $BaCrO_4$.



56. (d) AB is a binary electrolyte.

$$S = \sqrt{K_{sp}} = \sqrt{1.21 \times 10^{-6}} = 1.1 \times 10^{-3} M$$

57. (b) Precipitation occurs when ionic product > solubility.

58. (c) For a binary electrolyte, so that

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

$$S = \sqrt{K_{sp}}.$$

59. **(d) The value of ionic product is greater than the value of solubility product**

Explanation (Word-Friendly):

Ionic Product (IP): Actual concentration of ions in a solution

Solubility Product (K_{sp}): Maximum concentration of ions that can exist without forming a precipitate

Condition Result

$IP < K_{sp}$ No precipitate (solution is unsaturated)



Condition Result

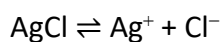
$IP = K_{sp}$ Saturated solution (equilibrium) – no precipitate

$IP > K_{sp}$ Precipitate forms

Therefore, precipitation occurs only when:

Ionic Product $>$ Solubility Product (K_{sp})

60. (c) Let solubility of $AgCl = S$



$K_{sp} = (\text{concentration of } Ag^+) \times (\text{concentration of } Cl^-)$

$$K_{sp} = S \times 0.08$$

So,

$$S = K_{sp} / 0.08$$

$$S = (4.0 \times 10^{-10}) / 0.08$$

$$S = 5.0 \times 10^{-9} \text{ M}$$

