DPP–14 (Selective Precipitation)-Solution

Chapter: Ionic Equilibrium

"Someone else is training while you're overthinking. Guess who wins?"

GROUP–A : Ionic Product vs K_{sp}

Q1. In which case solution of AgSCN will be unsaturated :-

Compare **ionic product (IP)** with K_{sp}.

Unsaturated condition:

$$[Ag^+][SCN^-] < K_{sp}$$

Correct option: (2)

Q2. Precipitate of CaF_2 is obtained when equal volumes are mixed :-

After mixing equal volumes, concentrations become **half**. Check ionic product vs K_{sp}.

Option (3): Final $[Ca^{2+}] = 5 \times 10^{-5}$, Final $[F^-] = 5 \times 10^{-4}$

$$IP = (5 \times 10^{-5})(5 \times 10^{-4})^2 = 1.25 \times 10^{-11} > K_{sp}$$

Hence precipitation occurs.

Correct option: (3)

Q3. When HCl gas is passed through saturated NaCl solution, pure NaCl precipitates because :-

Addition of common ion increases ionic product.

HCl increases $[Cl^-]$

$$[Na^+][Cl^-] > K_{sp} \Rightarrow \text{NaCl precipitates}$$

Correct option: (3)

Q4. Which precipitates when H_2S is passed :-

Check ionic product for both sulfides.

CuS:

$$IP = 0.01 \times 8.1 \times 10^{-21} = 8.1 \times 10^{-23} > K_{sp}(8 \times 10^{-36})$$

ZnS:

$$IP = 8.1 \times 10^{-23} < 3 \times 10^{-22}$$

Correct option: (2) CuS

Q5. CuS precipitates first because :-

Lower K_{sp} precipitates first.

Correct option: (3)

Q6. Why As^{3+} precipitates but Zn^{2+} does not in acidic medium :-

Acidic medium suppresses $[S^{2-}]$.

Only salt with **very low** K_{sp} can precipitate at low $[S^{2-}]$. As_2S_3 has much smaller K_{sp} than ZnS.

Correct option: (3)

Q7. Will precipitation occur if pH of 0.001 M $Mg(NO_3)_2$ is adjusted to 9?

Find $[OH^-]$ from pH and compare IP.

$pH = 9 \Rightarrow pOH = 5 \Rightarrow [OH^-] = 10^{-5}$

$$IP = (10^{-3})(10^{-5})^2 = 10^{-13} < K_{sp}$$

Correct option: (2)

Q8. Maximum $[OH^-]$ without precipitation :-

Use $K_{sp} = [Mg^{2+}][OH^-]^2$.

$$9 \times 10^{-12} = 0.01 \times [OH^-]^2 \Rightarrow [OH^-] = 3 \times 10^{-5}$$

Correct option: (4)

GROUP–B : First / Last Precipitation

Q9. Order of precipitation of hydroxides :-

Smaller K_{sp} precipitates first.

Correct option: (1) $Fe(OH)_3$, $Zn(OH)_2$, $Mg(OH)_2$

Q10. Which salt precipitates last on adding $AgNO_3$?

Largest K_{sp} precipitates last.

Correct option: (1) AgCl

GROUP–C : Precipitation Requirement

Q11. Concentration of H_2SO_4 required to precipitate $BaSO_4$:-

Use $K_{sp} = [Ba^{2+}][SO_4^{2-}]$.

$$1 \times 10^{-9} = 0.01 \times [SO_4^{2-}] \Rightarrow [SO_4^{2-}] = 10^{-7}$$

Correct option: (3)

Q12. Concentration of iodide when AgCl just starts precipitating :-

Find $[Ag^+]$ at AgCl precipitation, then apply AgI equilibrium.

AgCl starts when

$$[Ag^+] = \frac{K_{sp}(AgCl)}{[Cl^-]} = \frac{10^{-10}}{0.06} = 1.67 \times 10^{-9}$$

Now for AgI:

$$[I^-] = \frac{4 \times 10^{-16}}{1.67 \times 10^{-9}} \approx 2.4 \times 10^{-7}$$

Correct option: (2)

Weird Chemist Rule: Jiska K_{sp} sabse chhota — wahi sabse pehle girta.