TURBO

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Ionic Equilibrium

Class 11 Chemistry • Complete Formula Sheet

Sr.	Concept	Formulas	Other Information
		Electrolytes & Dissociation	
1	Electrolytes	**Strong:** 100% ionization (HCl, NaOH) **Weak:** Partial ionization (CH_3COOH, NH_4OH)	**Note:** Non-electrolytes (Urea, Sugar) do not conduct electricity in solution.
2	Degree of Dissociation (α)	$\alpha = \frac{\text{No. of moles dissociated}}{\text{Total no. of moles dissolved}}$	**Range:** $0 < \alpha < 1$. For strong electrolytes, $\alpha \approx 1$.
3	Ostwald Dilution Law	For weak electrolytes: $K_a = \frac{C\alpha^2}{1-\alpha}$ If $\alpha < 0.05$, then $\alpha = \sqrt{\frac{K_a}{C}}$	**Concept:** As dilution increases (C decreases), α increases.
		Acids, Bases, and pH	
4	Ionic Product of Water	$K_w = [H^+][OH^-] = 10^{-14}$ at 298 K $pK_w = pH + pOH = 14$	**Temp dependence:** As Temp ↑, K_w ↑ and pH of neutral water ↓.
5	pH and pOH	$pH = -\log[H^+]$ $pOH = -\log[OH^-]$	**Relation:** Higher $[H^+]$ means lower pH.
6	Conjugate Acid-Base Pair	$K_a \times K_b = K_w$ $pK_a + pK_b = 14$	**Rule:** Strong acid has a weak conjugate base and vice versa.
		Salt Hydrolysis	
7	Strong Acid + Weak Base	$pH = 7 - \frac{1}{2}(pK_b + \log C)$ Example: NH_4Cl	**Nature:** Solution is acidic ($pH < 7$).
8	Weak Acid + Strong Base	$pH = 7 + \frac{1}{2}(pK_a + \log C)$ Example: CH_3COONa	**Nature:** Solution is basic ($pH > 7$).
9	Weak Acid + Weak Base	$pH = 7 + \frac{1}{2}(pK_a - pK_b)$ Example: CH_3COONH_4	**Note:** pH is independent of concentration C.
		Buffer Solutions	
10	Acidic Buffer	$pH = pK_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$	**Henderson-Hasselbalch Equation.**
11	Basic Buffer	$pOH = pK_b + \log \frac{[\text{Salt}]}{[\text{Base}]}$	**Example:** NH_4OH + NH_4Cl.
		Solubility Product (K_{sp})	
12	K_{sp} Definition	For salt $A_xB_y \rightleftharpoons xA^{y+} + yB^{x-}$ $K_{sp} = [A^{y+}]^x[B^{x-}]^y$	**Saturation:** Valid only for saturated solutions.
13	AB Type Salt	$K_{sp} = S^2 \Rightarrow S = \sqrt{K_{sp}}$ Example: $AgCl$	**Where:** S = Solubility in mol/L.
14	AB_2 or A_2B Type	$K_{sp} = 4S^3 \Rightarrow S = \left(\frac{K_{sp}}{4}\right)^{1/3}$ Example: PbI_2, Ag_2CrO_4	**Careful:** Unit of S must be Molarity.
15	AB_3 Type	$K_{sp} = 27S^4 \Rightarrow S = \left(\frac{K_{sp}}{27}\right)^{1/4}$ Example: $Al(OH)_3$	**Common ion:** Solubility decreases in presence of a common ion.

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16	Precipitation Condition	$Q_{sp} > K_{sp} \rightarrow$ Precipitation $Q_{sp} = K_{sp} \rightarrow$ Saturated $Q_{sp} < K_{sp} \rightarrow$ Unsaturated	**Key:** Q_{sp} is the Ionic Product at any concentration.