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Ionic equilibrium, pH and buffers

Formulas and units, JEE Main. Status: Reviewed on 2026-11-20.

Result	Formula	Units or note
Ionic product of water	Kw = [H+][OH-] = 1.0 x 10^-14 at 25 C Valid when: Dilute aqueous solution at 25 C only	(mol/L)^2
pH and pOH	pH = -log10 [H+]; pOH = -log10 [OH-]; pH + pOH = 14 Valid when: Dilute aqueous solution at 25 C for pH + pOH = 14	dimensionless
Weak acid	K_a = c alpha^2/(1 - alpha); [H+] = sqrt(K_a c) if alpha under 5 percent Valid when: Weak monoprotic acid; shortcut only if alpha is under 5 percent	K_a in mol/L; c in mol/L
Conjugate pair	K_a x K_b = Kw; pK_a + pK_b = 14 Valid when: Conjugate acid-base pair in water at 25 C	(mol/L)^2 for the product
Hydrolysis constant	K_h = Kw/K_a (anion) or Kw/K_b (cation); h = sqrt(K_h/c) Valid when: Salt of a weak acid or base in water; h small for the shortcut	mol/L
Henderson equation	pH = pK_a + log10 ([A-]/[HA]); pOH = pK_b + log10 ([BH+]/[B]) Valid when: Buffer of weak acid and its salt (or base and its salt), ratio about 0.1 to 10	dimensionless
Solubility product	K_sp = [A]^x [B]^y; AgCl: s = sqrt(K_sp); Mg(OH)2: s = (K_sp/4)^(1/3) Valid when: Sparingly soluble salt in water; ions in saturated solution	(mol/L)^(x+y)
Common ion	K_sp = s (s + c) for AgCl with c of Cl-; s about K_sp/c if s much less than c Valid when: Sparingly soluble 1:1 salt with a common ion; shortcut needs s much less than c	mol/L
Precipitation condition	ion product Q greater than K_sp: precipitate forms Valid when: Compare the ion product with K_sp at the same temperature	same as K_sp

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/chemistry/equilibrium/ionic-equilibrium-ph-and-buffers

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