Class 12 Electrochemistry Formula Sheet

CBSE 2026-27 · Unit 2 · 9 of 70 theory marks · Based on the NCERT Class 12 Chemistry textbook

1. Core formulas

Quantity	Formula	Units / notes
Standard cell potential	$E°_{cell} = E°_{cathode} - E°_{anode}$	V · use reduction potentials for both
Nernst (cell, 298 K)	$E_{cell} = E°_{cell} - (0.059/n) \log Q$	Q = [products]/[reactants]; solids omitted
Nernst (electrode)	$E = E° - (0.059/n) \log (1/[M^{n+}])$	for $M^{n+} + ne^- \rightarrow M$
2.303RT/F at 298 K	≈ 0.059 V	$R = 8.314\ J\ K^{-1}\ mol^{-1}$
Gibbs energy	$\Delta_r G° = -nFE°_{cell}$	$J\ mol^{-1} \cdot F = 96487\ C\ mol^{-1}$ (≈ 96500)
Equilibrium constant	$\log K_c = nE°_{cell} / 0.059$	also $\Delta_r G° = -2.303\ RT \log K_c$
Resistance	$R = \rho (l/A)$	Ω · ρ = resistivity
Conductivity	$\kappa = 1/\rho = G^*/R$	$S\ cm^{-1}$
Cell constant	$G^* = l/A = \kappa R$	cm^{-1}
Molar conductivity	$\Lambda_m = \kappa \times 1000 / c$	$S\ cm^2\ mol^{-1}$ (κ in $S\ cm^{-1}$, c in $mol\ L^{-1}$)
Strong electrolyte	$\Lambda_m = \Lambda°_m - A\sqrt{c}$	$\Lambda°_m$ by extrapolating Λ_m vs $\sqrt{c}$ to c = 0
Kohlrausch's law	$\Lambda°_m = \nu_+\lambda°_+ + \nu_-\lambda°_-$	e.g. $\Lambda°_m(CaCl_2) = \lambda°(Ca^{2+}) + 2\lambda°(Cl^-)$
Weak electrolyte	$\alpha = \Lambda_m/\Lambda°_m$; $K_a = c\alpha^2/(1-\alpha)$	α = degree of dissociation
Faraday's first law	$w = ZIt$; $Q = It$	moles of $e^- = Q/F$
Faraday's second law	$w_1/w_2 = E_1/E_2$	same charge, cells in series (E = equivalent weight)

2. Selected standard reduction potentials at 298 K

Half-reaction	E° (V)	Half-reaction	E° (V)
$Li^+ + e^- \rightarrow Li$	−3.05	$2H^+ + 2e^- \rightarrow H_2$	0.00
$Mg^{2+} + 2e^- \rightarrow Mg$	−2.36	$Cu^{2+} + 2e^- \rightarrow Cu$	+0.34
$Zn^{2+} + 2e^- \rightarrow Zn$	−0.76	$Ag^+ + e^- \rightarrow Ag$	+0.80
$Fe^{2+} + 2e^- \rightarrow Fe$	−0.44	$Cl_2 + 2e^- \rightarrow 2Cl^-$	+1.36
$Ni^{2+} + 2e^- \rightarrow Ni$	−0.25	$F_2 + 2e^- \rightarrow 2F^-$	+2.87

Values as in NCERT Table 2.1. Use the values given in the question in the exam.

3. Limiting molar ionic conductivities λ° at 298 K ($S\ cm^2\ mol^{-1}$)

H^+	Na^+	K^+	Ca^{2+}	Mg^{2+}	Cl^-	Br^-	CH_3COO^-	SO_4^{2-}
349.6	50.1	73.5	119.0	106.0	76.3	78.1	40.9	160.0

4. Batteries, fuel cells and corrosion

Device	Anode	Cathode	Remember
Dry (Leclanché) cell	$Zn \rightarrow Zn^{2+} + 2e^-$	$MnO_2 + NH_4^+ + e^- \rightarrow MnO(OH) + NH_3$	Primary; about 1.5 V
Mercury cell	$Zn(Hg) + 2OH^- \rightarrow ZnO + H_2O + 2e^-$	$HgO + H_2O + 2e^- \rightarrow Hg + 2OH^-$	Constant ~1.35 V: no ion whose concentration changes in the overall reaction
Lead storage battery (discharge)	$Pb + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$	$PbO_2 + SO_4^{2-} + 4H^+ + 2e^- \rightarrow PbSO_4 + 2H_2O$	Secondary; overall $Pb + PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O$
H_2–O_2 fuel cell	$2H_2 + 4OH^- \rightarrow 4H_2O + 4e^-$	$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$	Overall $2H_2 + O_2 \rightarrow 2H_2O$
Rusting of iron	$2Fe \rightarrow 2Fe^{2+} + 4e^-$	$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$	Fe^{2+} oxidised further to rust, $Fe_2O_3 \cdot xH_2O$

5. Step-by-step method for any numerical

☐ Write the balanced cell or electrode reaction. Read n from it.
☐ Write the formula before substituting — CBSE marks it.
☐ Substitute with units; keep concentrations as given (solids and pure liquids = 1).
☐ Calculate; sense-check sign and size (e.g. ΔrG° negative when $E^\circ cell$ is positive).
☐ Box the answer with units: V, kJ mol^{-1}, S cm^{-1}, S cm^2 mol^{-1}, g, C or s.

6. Graph to know

Λm vs $\sqrt{c}$: a strong electrolyte (KCl) gives a nearly straight line with a small negative slope (extrapolate to find $\Lambda^\circ m$); a weak electrolyte (CH_3COOH) shows a steep rise at low concentration and cannot be extrapolated — use Kohlrausch's law.

Source: CBSE Chemistry curriculum 2026-27 (unit marks); NCERT Class 12 Chemistry, Unit 2 Electrochemistry.