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Electrochemical cells, Nernst equation and Gibbs energy

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

Result	Formula	Units or note
Cell emf	E cell = E(cathode) - E(anode) (reduction potentials) Valid when: reduction potentials of both electrodes; cathode minus anode	V
Gibbs energy	delta G0 = -n F E0; delta G = -n F E Valid when: n = electrons transferred per mole of reaction as written	J mol^-1 (F = 96500 C mol^-1)
Equilibrium constant	delta G0 = -RT ln K; log K = n E0 / 0.059 at 298 K Valid when: 298 K; standard state for the log form	dimensionless
Nernst equation	E = E0 - (0.059/n) log Q at 298 K Valid when: 298 K; concentrations used in place of activities	V
Concentration cell	E = (0.059/n) log(c cathode / c anode); E0 = 0 Valid when: same electrode on both sides, 298 K	V
Faraday's law	m = I t M / (n F) Valid when: constant current; 100 percent current efficiency; M of species deposited	g (I in A, t in s)
Combining half-reactions	n3 E3 = n1 E1 + n2 E2 (add delta G0) Valid when: half-reactions share a species; add delta G0, not E0 values	V
Lead accumulator	Pb + PbO2 + 2H2SO4 giving 2PbSO4 + 2H2O (discharge) Valid when: discharge only; the reverse occurs on charging	not applicable
Fuel cell (acidic)	anode H2 giving 2H+ + 2e-; cathode O2 + 4H+ + 4e- giving 2H2O Valid when: acidic electrolyte	not applicable

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/chemistry/redox-reactions-and-electrochemistry/electrochemical-cells-nernst-eq

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