Electrochemistry |

Below is a summary of important **formulae, terms, expressions, and units** in Electrochemistry:

Key Formulae and Expressions:

1. **Ohm's Law (Electricity Basics):**
   - $V = I \times R$
   - V: Voltage (Volts), I: Current (Amperes), R: Resistance (Ohms, Ω).
2. **Electrolysis (Faraday's Laws):**
   - $m = \frac{Z \cdot I \cdot t}{F}$
   - m: Mass of substance (grams), Z: Electrochemical equivalent, I: Current (Amperes), t: Time (seconds), F: Faraday's constant ($96485\,\mathrm{C/mol}$).
3. **Nernst Equation (Electrode Potential):**
   - $E = E^\circ - \frac{RT}{nF} \ln Q$
   - E: Electrode potential, E°: Standard electrode potential, R: Gas constant ($8.314\,\mathrm{J/mol\backslash\cdot}$ K), T: Temperature (Kelvin), n: Number of electrons, Q: Reaction quotient.
4. **Gibbs Free Energy and Cell Potential:**
   - $\Delta G = -nFE_{\mathrm{cell}}$
   - ΔG: Gibbs free energy (Joules), E_{cell}: Cell potential.
5. **Conductivity (κ) and Resistance (R):**
   - $R = \rho \frac{L}{A}, \kappa = \frac{1}{\rho}$
   - ρ: Resistivity ($\Omega \cdot \mathrm{m}$), κ: Conductivity ($\mathrm{S/m}$), L: Length (m), A: Cross-sectional area (m^2).
6. **Kohlrausch's Law:**
   - $\Lambda_m = \Lambda_m^\circ - Kc^{1/2}$
   - Λ_m: Molar conductivity, Λ_m°: Limiting molar conductivity, K: Constant, c: Concentration.
7. **Electrochemical Cell Potential:**
   - $E_{\mathrm{cell}} = E_{\mathrm{cathode}} - E_{\mathrm{anode}}$
8. **Debye-Hückel Limiting Law (Ionic Strength):**
   - $\log \gamma = -\frac{Az^2\sqrt{I}}{1 + aB\sqrt{I}}$
   - γ: Activity coefficient, I: Ionic strength.

Key Terms:

1. **Electrolyte:** Substance that conducts electricity in molten or aqueous state.
2. **Electrode Potential:** Tendency of an electrode to gain or lose electrons.
3. **Standard Electrode Potential (E°):** Potential of an electrode measured under standard conditions.
4. **Cell Potential (E_{cell}):** Potential difference between the two electrodes of a galvanic cell.

5. **Conductivity (κ):** Ability of a solution to conduct electricity.
6. **Resistance (R):** Opposition to the flow of electric current.
7. **Equivalent Conductivity (Λ):** Conductivity for one gram equivalent of electrolyte.
8. **Overpotential:** Additional voltage required beyond theoretical value for a reaction.

Important Units:

1. **Faraday's Constant (F):** $96485\,\mathrm{C/mol}$
2. **Gas Constant (R):** $8.314\,\mathrm{J/mol}\,\cdot\,\mathrm{K}$
3. **Voltage (V):** Volt (V)
4. **Current (I):** Ampere (A)
5. **Resistance (R):** Ohm (Ω)
6. **Conductivity (κ):** Siemens per meter ($\mathrm{S/m}$)
7. **Energy (ΔG):** Joule (J)
8. **Concentration:** Molarity ($\mathrm{mol/L}$)