Important Formulas and Terms

🔹 Important Terms & Concepts

- **Electric current (I)**: Flow of electric charge.
- **Steady current**: Constant flow of charge.
- **Conductors**: Materials allowing free movement of electrons (e.g., metals).
- **Electrolytes**: Solutions where positive and negative ions move.
- **Drift velocity**: Average velocity of electrons under an electric field.
- **Resistivity (ρ)**: Property of material that resists current.
- **Ohmic and non-ohmic materials**: Follow/violate Ohm's law.

🔹 Key Expressions / Equations

1. **Current (I)**:

$$I = \frac{q}{t}$$

(where q is the net charge, t is the time)

2. **Instantaneous current**:

$$I(t) = \lim_{\Delta t \to 0} \frac{\Delta Q}{\Delta t}$$

3. **Ohm's Law**:

$$V = IR$$

4. **Resistance of a conductor**:

$$R = \rho \frac{l}{A}$$

(where ρ is resistivity, l is length, A is cross-sectional area)

5. **Drift velocity relation**:

$$I = nAv_d e$$

(where n is number density, A is cross-sectional area, v_d is drift velocity, e is charge of electron)

6. **Power**:

$$P = VI = I^2R = \frac{V^2}{R}$$

7. **Resistors in series**:

$$R_{eq} = R_1 + R_2 + \cdots + R_n$$

8. **Resistors in parallel**:

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$$

9. **Kirchhoff's First Law (Current Law)**:

$$\sum I_{\text{in}} = \sum I_{\text{out}}$$

10. **Kirchhoff's Second Law (Voltage Law)**:

$$\sum \text{EMF} = \sum IR \quad \text{(in a closed loop)}$$

Fundamental Constants

- **Charge of an electron (e)** = $1.6 \times 10^{-19}\ \text{C}$
- **Avogadro's number** $N_A = 6.022 \times 10^{23}$
- **Permittivity of free space** $\varepsilon_0 = 8.85 \times 10^{-12}\ \text{C}^2/\text{N}\backslash\text{cdotp}\text{m}^2$

SI Units

Quantity	Symbol	SI Unit
Electric Current	I	Ampere (A)
Electric Charge	Q	Coulomb (C)
Voltage (Potential)	V	Volt (V)
Resistance	R	Ohm (Ω)
Power	P	Watt (W)
Energy (Work)	W	Joule (J)
Electric Field	E	V/m
Current Density	J	A/m²
Resistivity	ρ	Ω·m
