

Basics of Electricity

Basics of Electricity – Quick Reference Notes

1. What Is Electricity?

- **Definition:** A form of energy resulting from the movement of electric charge (usually electrons) through a material.
 - **Key Concepts:**
 - **Charge** – property of particles; comes in positive (+) and negative (–) forms.
 - **Current** – flow of charge, measured in amperes (A).
 - **Voltage (Potential Difference)** – the “push” that drives charge, measured in volts (V).
 - **Resistance** – opposition to current flow, measured in ohms (?).
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2. Fundamental Units (SI System)

Quantity	Symbol	Unit	What It Measures
Electric charge Q		coulomb (C)	Amount of charge
Current	I	ampere (A)	Rate of charge flow (C/s)
Voltage	V	volt (V)	Energy per unit charge (J/C)
Resistance	R	ohm (?)	Opposition to current
Power	P	watt (W)	Rate of energy use (J/s)
Energy	E	joule (J)	Work done by electricity

3. Ohm’s Law

- **Formula:** ($V = I \times R$)
 - Voltage = Current × Resistance
 - **Rearrangements:**
 - ($I = \frac{V}{R}$)
 - ($R = \frac{V}{I}$)
 - **Use:** Predict how voltage, current, and resistance relate in a simple circuit.
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4. Types of Current

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Type	Symbol	Description	Typical Use
Direct Current (DC)	—	Flows in one direction only	Batteries, electronics
Alternating Current (AC)	—	Changes direction periodically (usually sinusoidal)	Household power, grid

5. Simple Circuit Elements

Component	Symbol	Function
Battery / Power Supply	—	Provides voltage (EMF)
Resistor	R	Limits current, creates voltage drop
Switch	—	Opens/closes circuit
Lamp / Load	—	Converts electrical energy to light/heat/mechanical work
Capacitor	C	Stores electric charge (energy)
Inductor	L	Stores magnetic energy; opposes changes in current

6. Series vs. Parallel Circuits

Feature	Series	Parallel
Current	Same through all components	Splits; each branch gets its own current
Voltage	Divides among components	Same across all branches
Total Resistance	$(R_{\text{total}} = R_1 + R_2 + \dots)$	$(\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots)$
Failure Mode	One open break stops whole circuit	Other branches keep working if one fails

7. Power in Electrical Circuits

- **Basic Formula:** $(P = V \times I)$ (watts)
- Using Ohm's Law, power can also be expressed as:
 - $(P = I^2 \times R)$
 - $(P = \frac{V^2}{R})$