

Physics — Electricity

Chapter: Electricity

Key Definitions

- **Electric Charge:** A property of matter that causes it to experience a force when placed in an electromagnetic field. It is measured in coulombs (C).
- **Current (I):** The rate of flow of electric charge. It is measured in amperes (A).
- Formula:

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

- Where (Q) is the charge in coulombs and (t) is the time in seconds.
- **Voltage (V):** The electric potential difference between two points. It is measured in volts (V).
- Formula:

$$V = \frac{W}{Q}$$

- Where (W) is the work done in joules and (Q) is the charge in coulombs.
- **Resistance (R):** The opposition to the flow of electric current. It is measured in ohms (Ω).
- Formula:

$$R = \frac{V}{I}$$

- **Ohm's Law:** The relationship between voltage, current, and resistance in a circuit.
- Formula:

$$V = I \cdot R$$

Important Formulas

- **Power (P):** The rate at which electrical energy is consumed or converted. It is measured in watts (W).
- Formula:

$$P = V \cdot I$$

- Alternative forms:

- $$P = I^2 \cdot R$$

- $$P = \frac{V^2}{R}$$

- **Energy (E):** The total work done by an electric current over time.
- Formula:

$$E = P \cdot t$$

Circuit Diagrams

1. **Series Circuit:** - In a series circuit, components are connected end-to-end, so the same current flows through all components. - Total Resistance:

$$R_{total} = R_1 + R_2 + R_3 + \dots$$

2. **Parallel Circuit:** - In a parallel circuit, components are connected across the same voltage source, and the total current is the sum of the currents through each component. - Total Resistance:

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

Summary Table

| Quantity | Symbol | Unit | Formula |
|------------------|--------|----------|-------------------|
| Charge | (Q) | Coulombs | - |
| Current | (I) | Amperes | $I = \frac{Q}{t}$ |
| Voltage | (V) | Volts | $V = \frac{W}{Q}$ |
| Resistance (R) | | Ohms | $R = \frac{V}{I}$ |
| Power | (P) | Watts | $P = V \cdot I$ |
| Energy | (E) | Joules | $E = P \cdot t$ |

Key Takeaways

- Electric current is the flow of charge, and it requires a closed circuit to flow.
- Ohm's Law is fundamental in understanding the relationship between voltage, current, and resistance.
- Power and energy calculations are essential for understanding electrical consumption in circuits.
- Series and parallel circuits behave differently in terms of current and voltage distribution.