Electricity

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Electric Charge

physical property of matter that causes it to experience a force when placed in an electromagnetic field. S.I. Unit: Coulomb (C)

- Positive charge : Loss of electron
- Negative charge : Gain of electron

$Q = ne.$

Properties:

1. Additivity of Charge :Total charge=sum of all charges on the body.
2. Charge is Conserved : Charge cannot be created or destroyed.
3. Charge is Invariant : Charge value remains the same, regardless of speed.
4. Quantization of Charge : Charge is a multiple of electron charge:

Conductors	Semiconductors	Insulators
Allow Current to pass	Medium Conductivity	Don't allow Current to pass

Electric Current

Flow of electric charge through a conductor.

Unit: Ampere (A) → 1 A = 1 C/s.

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

I = current, Q = charge, t = time.

1 Ampere: When 1C of charge flows in 1 second then current is said to be 1A.

Potential Difference

The work done to move a unit positive charge between two points.

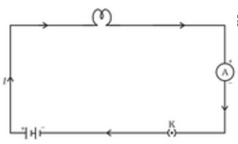
Unit: Volt (V) → 1 V = 1 J/C.

1 Volt :1 Joule of work done to move 1 unit positive charge between two points

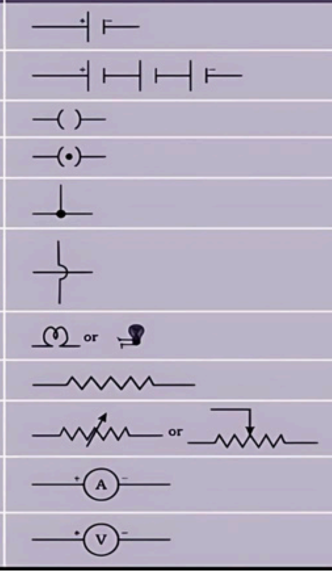
$V = W/Q$

Electric Circuit

A continuous path for current flow, consisting of a er source, conductor, and load.

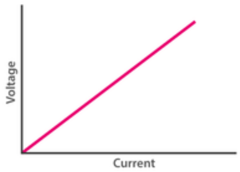


Sl. No.	Components	Symbols
1	An electric cell	
2	A battery or a combination of cells	
3	Plug key or switch (open)	
4	Plug key or switch (closed)	
5	A wire joint	
6	Wires crossing without joining	
7	Electric bulb	or
8	A resistor of resistance R	
9	Variable resistance or rheostat	or
10	Ammeter	
11	Voltmeter	



Ohm's Law

Current through a conductor is directly proportional to the potential difference across its ends, at a constant temperature



$V \propto I$

$V = IR$

$R = \rho L/A$

$\rho = RA/L$

$\rho = \Omega m$

Resistance:

Property of a conductor that resists the flow of charges. Unit: Ohm (Ω).

Factors Affecting Resistance:

- Length (l): R∝l
- Area (A): R∝1/A
- Material: Different materials have different resistivities (ρ)

Question Asked

***Step 1** : Firstly check what question is asking and write given, to find from question . Out of V,I,R two quantities will be given and you'll have to find third one. Other information might also be provided to find other two values.*

Step 2 : Then finally use Ohm's Law:
V = IR

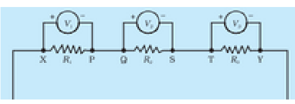
Don't forget to write units

Resistance and Resistivity ka diffrence yaad rkhna

Resistance	Resistivity
Opposition to the flow of electric current in a substance. Depends on length and size of the conductor. Unit: ohm (Ω).	Resistance of a material with unit length and unit cross-sectional area. Independent of length or size of the conductor.Unit: ohm-meter (Ω·m).

Series circuit

In a series circuit, components (like resistors, bulbs, or batteries) are connected end to end in a single path for the electric current to flow.



Series Circuit

Voltage: Total voltage (V) is the sum of the voltages across each resistor:

$V = V_1 + V_2 + V_3$

Current: Current (I) is the same through each resistor.

Ohm's Law for Each Resistor:

$V_1 = IR_1, V_2 = IR_2, V_3 = IR_3$

Equivalent Resistance:

$V = IR$

Substituting:

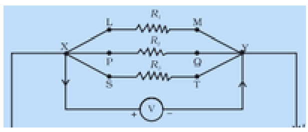
$IR = IR_1 + IR_2 + IR_3$

Cancelling I:

$R_s = R_1 + R_2 + R_3$

Parallel Circuit

In a parallel circuit, components are connected in separate branches, and each component gets its own direct path to the power source



Parallel Circuit

Current: Total current (I) is the sum of the currents through each resistor:

$I = I_1 + I_2 + I_3$

Voltage: Voltage (V) is the same across each resistor.

Ohm's Law for Each Resistor:

$I_1 = \frac{V}{R_1}, I_2 = \frac{V}{R_2}, I_3 = \frac{V}{R_3}$

Equivalent Resistance:

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

Substituting:

$\frac{V}{R_p} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$

Cancelling V:

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

question practice kro

Heating effect of electric current

Joules Law oh Heating ; Heat is proportional to the square of the current, resistance, and time.

For a current I flowing through a resistor of resistance R with a potential difference V, the work done to move a charge Q across the resistor is VQ. The power input to the circuit is:

$$P = \frac{VQ}{t} = VI$$

The energy supplied by the source in time t is VIt. This energy is dissipated as heat in the resistor, so the heat produced is:

$$H = VIt$$

Using Ohm's law, V=IR, the heat can also be expressed as:

$$H = I^2Rt$$

Applications:

- Electric Bulb-has a tungsten filament inside a neutral gas or vaccum. When current passes through, the filament heats up and emits light, with most energy lost as heat.
- Electric fuse- is a low melting point wire in a circuit. If current rises suddenly, the wire melts, breaking the circuit and preventing damages.
- Electric heater- Use a nichrome coil with high resistance to generate heat when current flows

Electric Power :

$$P = VI$$
$$P = I^2R = V^2/R$$

Power (P): Rate of energy consumption.
Unit: Watt (W) → 1 W = 1 J/s.

1 **watt** is the power consumed by a device carrying 1A of current at 1V. In practice, a larger unit, the kilowatt (1000 watts), is used.

Electric Energy : energy used by a circuit to allow current flow. It is the product of power and time, measured in watt-hours (Wh).

Commercial Unit of Energy:

One watt-hour is the energy used when 1 watt of power is consumed for 1 hour. The commercial unit of electric energy is the kilowatt-hour (kWh), also called a "unit."

1 kWh = 1000 watts × 3600 seconds
= 3.6×10^6 watt-seconds
= 3.6×10^6 joules (J)

Question Based

Step 1: Read the question carefully. Identify the given values (V, I, R) and determine what needs to be found.

- Out of voltage (V), current (I), and resistance (R), two values will be given, and you'll have to find the third.
- Other information might be provided to calculate remaining values like power or heat.

Step 2: Use Ohm's Law: V=IR

- Ensure all units are correct before proceeding.

Step 3: For heat produced:

$$H = I^2Rt \quad \text{or} \quad H = VIt$$

Step 4:

- For power calculation:

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

Step 5:

- Substitute the values into the appropriate formulas and calculate the required quantity. Always check your units at the end.

Chapter ka KAZAANA:

- **Numerical**
- **Series and Parallel Resistance**
- **R =ρ (l/A)**
- **Power/ Heating effect**
- **Ohm's Law Graph**
- **Calculating cost of Electricity of Appliance**