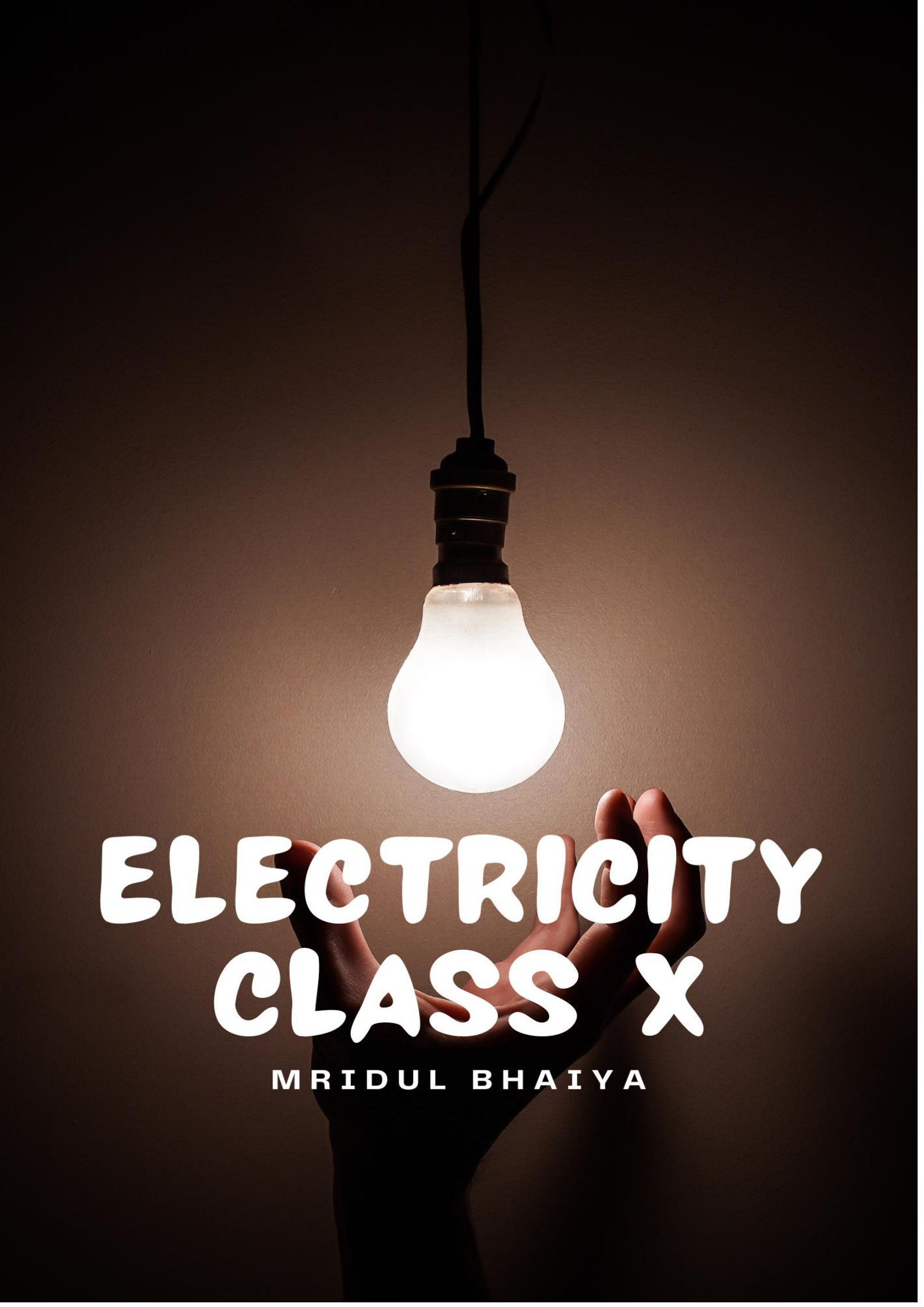


ELECTRICITY CLASS X

MRIDUL BHAIYA

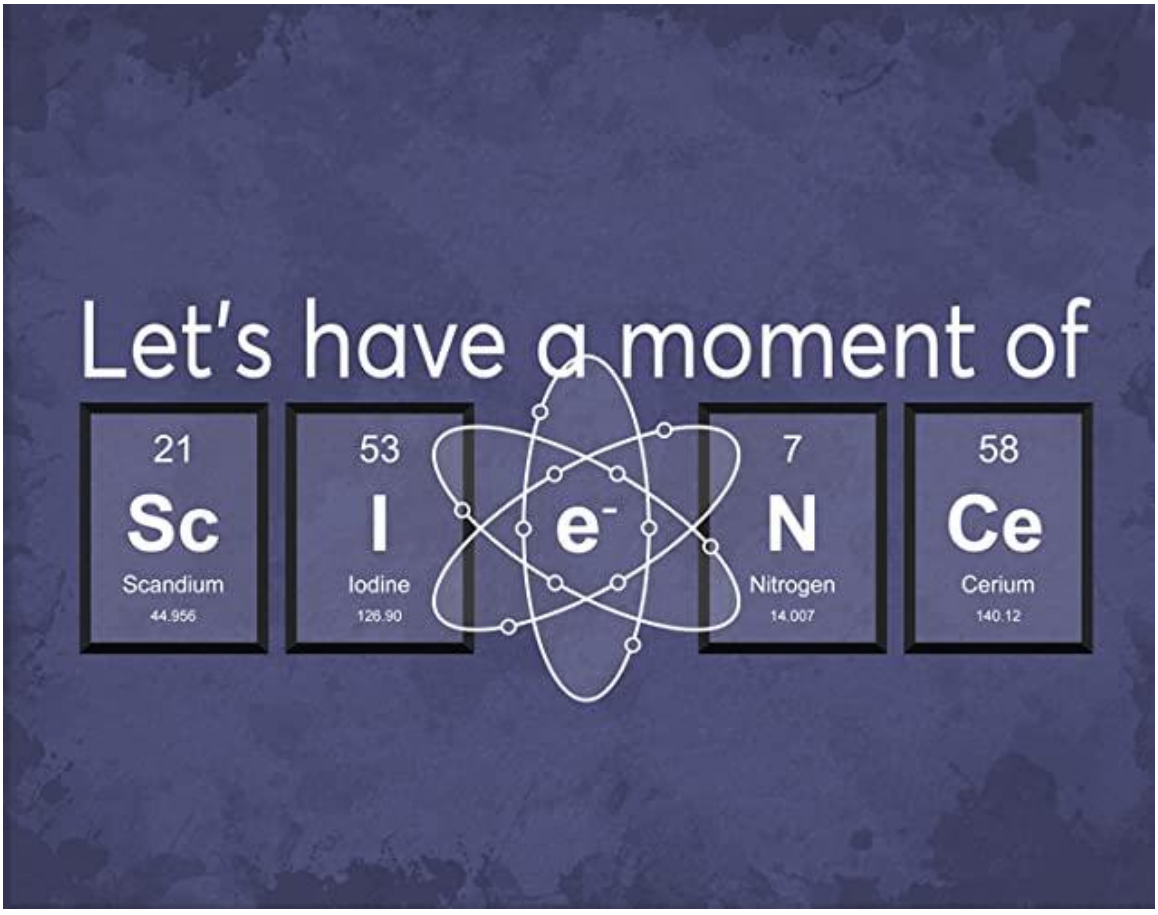
MBC – Mridul Bhaiya Classes

CLASS X

SCIENCE NOTES

ELECTRICITY

- ✓ Short notes
- ✓ PYQs with answers
- ✓ Graphics included



ELECTRICITY

Electricity is branch of Physics which deals with **study of charges**.

Electric charge

It is a property of matter to attract or repel other material, charge is a scalar quantity.

Electric Charge (Q): Negative, Positive

S.I Unit → Coulomb (C)

Properties of Electric Charge

(i) Like charges repel each other and unlike charges attract each other.
(ii) Electric charges are added algebrically
(iii) Electric Charge is conserved
(iv) Electric charge is quantized

Electrical substances

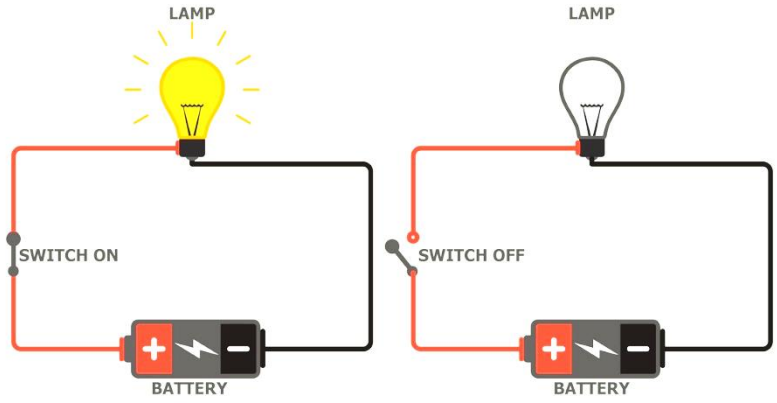
1. Conductors: The substances or materials that permit electrons to flow freely from particle to particle eg- copper, silver etc.

2. Insulators: The substances that resist the free flow of electrons. Eg- wood, glass, cloth etc. This is due to absence of loosely bound electrons.

Electricity: Static electricity, Current Electricity.

Electric Circuit

A continuous and closed path made up of wires on which an electric current run. An electric circuit consists of electric devices, a source of energy and wires that are connected with the help of a switch.



Open circuit

An open circuit is defined as an electric circuit in which current does not flow.

Closed circuit

A closed circuit allows electrical energy (electrons) to flow and move. There are no interruptions in a closed circuit to stop the flow of power. When a circuit is complete and the current can flow, it is called a closed circuit.

Charge in Motion : Electric Current (I)

The amount of charge passing per unit time through cross sectional area of conductor is called electric current.

$$I = \frac{Q}{t} \quad ; \text{ SI unit of current Ampere (A)}$$

Define 1 Ampere

1 A of current is defined as charge of 1 C is passing in 1 second.

Q. Calculate the number of electrons constituting one coulomb of charge. **[NCERT Exercise]**

Sol. Charge on one electron, $e = 1.6 \times 10^{-19}$ C

Total charge, $Q = 1$ C

Number of electrons, $n = \frac{Q}{e} = \frac{1C}{1.6 \times 10^{-19}} = 6.25 \times 10^{18}$

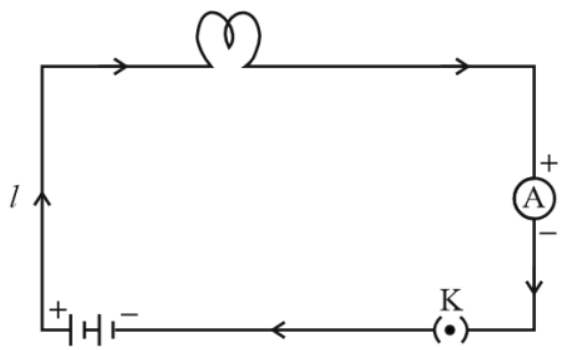
Q. Define the unit of current. **[NCERT Exercise]**

Sol. Unit of current is ampere. If one coulomb of charge flows through any section of a conductor in one second then the current through it is said to be one ampere.

$$I = \frac{Q}{t} \text{ or } 1A = 1Cs^{-1}$$

Direction of Electric Current

- Conventional current
- Flow of electrons.



Ammeter

- Used to measure electric current.
- Always connected in series with device.

Figure 1 : Ammeter

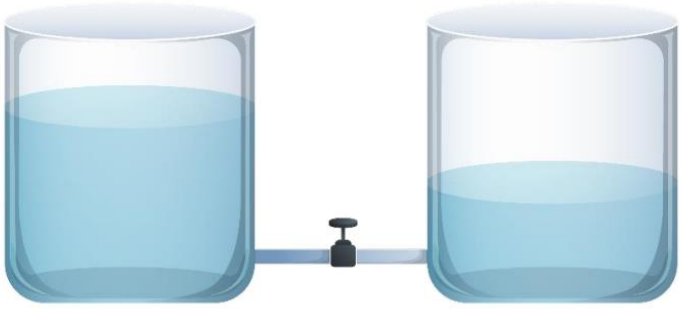
Galvanometer

- Used to measure smaller currents.
- Also shows direction of current flowing.

Figure 2 : Galvanometer

Potential difference

- For the flow of electric current, we have to create potential difference.
- Battery is used to create potential difference in a circuit.



(A) **(B)**

"The work done on a charge by the battery to move it from higher potential to lower potential is called potential difference or voltage".

$$V = \frac{W}{Q}$$ S.I Unit of Potential difference is **Volt**.

Define 1 Volt

When 1 joule of work is done to move 1 C of charge is known as 1 Volt.

Voltmeter

- Used to measure potential difference.
- Voltmeter is always connected in parallel in a electric circuit.

Figure 3 : Voltmeter

OHM's Law

It states that current flowing in a conductor is directly proportional to the potential difference applied across the ends of the conductor, at a particular condition.

$$V \propto I$$

$$V = RI$$

R is a constant for the given metallic wire which is known as resistance.

Resistance

The opposition caused by atoms & other subatomic particles in the path of moving electrons is measured as resistance.

SI Unit → Ohm (Ω)

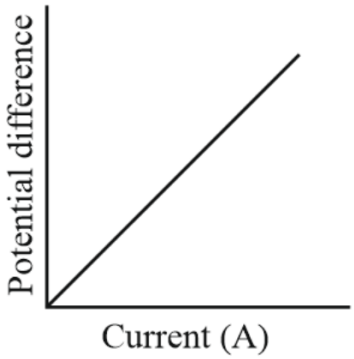
Define 1 Ohm (Ω)

1 Ohm is equal to the resistance of a conductor through which current of 1 ampere flows when a potential difference of 1 volt is applied to it.

$$V \propto I$$

$$V = RI$$

$$R = \frac{V}{I} = \frac{1V}{1A}$$



Factor Affecting Resistance

- Resistance is directly proportional to length of conductor.
- Resistance is inversely proportional to cross-sectional area of conductor.
- Material of conductor (□).
- Temperature of conductor.

Resistivity

- Ability of material to oppose the electric current.

$$R = \rho\frac{L}{A} \quad \rho = \text{Resistivity}$$

$$\rho = \frac{R \times A}{L} = \frac{\Omega \times m^2}{m}$$

- Unit of resistivity is **Ω m.**

Difference Between Resistance & Resistivity

Resistance	Resistivity
1. Opposition by the atoms & other sub-atomic, particles.	1. It is material dependant property by which it oppose flow of current.
2. It depends on resistivity.	2. It is constant valued property for particular material.
3. Unit – Ohm	3. Unit → Ohm meter

Resistance of Human Body & Electric Shock

The magnitude of current flowing through a person depends upon the resistance of the human body and the potential difference across him.

Current (mA)	Effect on human body
2	Mild shock
5	Painful shock
10	Contraction of involuntary muscles
15	Loss of control over muscles
70	Very severe shock. It can cause death if the current passes through the heart.

Superconductivity

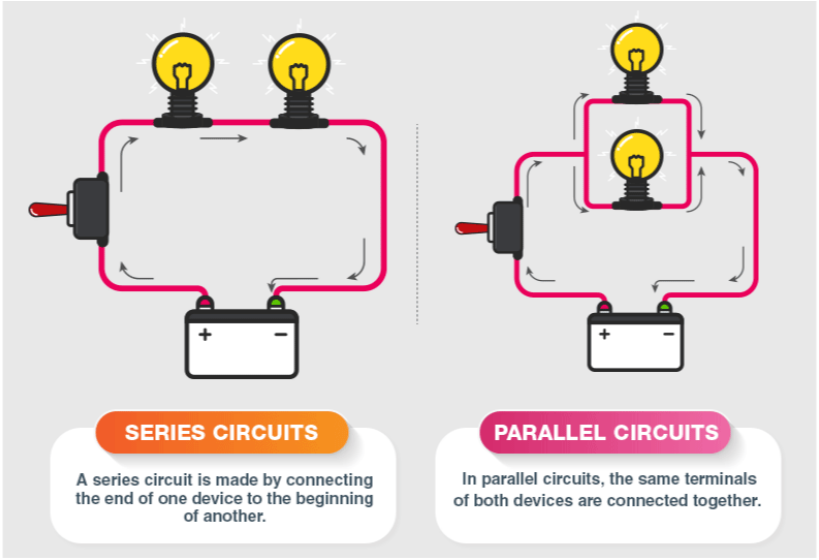
- The materials showing almost zero resistance at very very low temperature are called superconductors and this phenomenon is called superconductivity.
- For example: Mercury at 4.2 K behaves as a superconductor because it loses all electrical resistance at temperature below 4.2 K.

Superconductors have very important applications:

(i) Power transmission on superconductor means virtually **no loss** in transmission.

(ii) Superconductors can be used in making supermagnets.

Combination of Resistance



Series

1. Current remains same.

2. Voltage divides.

Parallel

1. Current divides.

2. Voltage remains same.

Resistors in Series

$V = V_1 + V_2 + V_3$

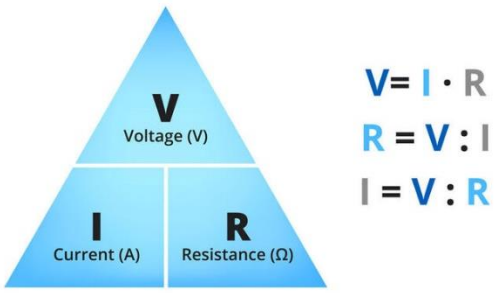
$V = IR$ (By Ohm's law)

On applying Ohm's law to the three resistors separately, we further have

$V_1 = IR_1$

$V_2 = IR_2$

$V_3 = IR_3$



From above equation

$IR = IR_1 + IR_2 + IR_3$

$\boxed{R_S = R_1 + R_2 + R_3}$

Resistors in Parallel

$I = I_1 + I_2 + I_3$

Let R_p be the equivalent resistance of the parallel combination.

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

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

From above equation

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

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

Heating effect of Electric current

Electrons when flow through conductors it collides with other atoms due to friction the electron loses kinetic energy to heat energy.

Joule's law of Electric current

It states that, Heat produced in a conductor is directly proportional to the square the amount of current flowing (I), Resistance (R) of conductors, Time period (T) of the flow of current.

$$\text{Heat} \propto (\text{Current})^2$$
$$\propto \text{Resistance}$$
$$\propto \text{Time}$$
$$H \propto I^2 RT$$

Application of Heating effects

1. Electric bulb

Electric bulb is made up of tungsten because of its higher melting point and glowing effect. Bulb have argon gas which protect filament from Decaying.

2. Electric fuse

It is made up of Cu-Ni Alloy. It has low melting point therefore it melts down when high amount of current exceeds.

3. Heating elements

It is made up of Nichrome. It is used to produce heat because of its high resistance.

Nichrome Ni (60%)

Cr (12%)

Fe (26%)

Mn (2%)

A heating element should have the following properties:

(i) It should have high resistance.

(ii) It should have high melting point.

(iii) It should not oxides at the high temperature.

(iv) Thermal expansion of heating element should not be very high.

Electric Power

The amount of electric charge consumed in a circuit per unit time.

$P = \frac{W}{t}$

Since W = Vit

P = VI

Other Formulas of Power

$V = IR$

$P = IV$

$P = I^2R$

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

$P = IV$

$P = \frac{V}{R}(V)$

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

S.I unit of power is **watt (W).**

Define 1 watt ?

It is the power consumed by a device that carries 1 A of current when operated at a potential difference of 1 volt.

P = VI

1W = 1 volt × 1 Ampere

- Watt is very small unit for power.
- In actual practice we use a larger unit "kilo-watt".

1 KW = 1000 watts

Commercial unit of Electrical Energy

1 KWh = 1000 watt × 3600 sec

= 3.6×10^6 watt sec.

= 3.6×10^6 J

NOTE THIS IS JUST THE SHORT NOTES FOR REVISING THE CHAPTER

PLEASE PREFER THE DETAILED NOTES PROVIDED FIRST !!

This Chapter Ends here !! But not your work

Go to Practice Questions, Solve Dpps attend MCQs and revise the notes after some 2nd 4th and 7th day

To get 95+ you have to keep on revising what you studied.

[Remember Consistency and HardWork Gives Great Result]

NOTES MADE BY

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