

UPDAAN



2025

ELECTRICITY

Quantization of charge

$$Q = ne$$

PHYSICS

Lecture - 02

By - ER. RAKSHAK SIR



TOPICS to be covered

- 1 Electric Current
- 2 Voltage



QUESTION



$$n = ?$$

Find the Number of Electrons present in one coulomb of charge

$$Q = 1\text{C}$$

$$Q = ne$$

$$1 = n \times 1.6 \times 10^{-19}$$

$$\frac{1}{1.6 \times 10^{-19}} = n$$

$$\frac{10^0 \times 10^{19}}{16} = n$$

$$6.25 \times 10^{18} = n$$

$$\begin{array}{r} 6.25 \\ 12.5 \\ \hline 2.5 \\ 100 \times 10^{18} \\ \hline 16 \\ 4 \\ 2 \\ 1 \end{array}$$



ELECTRICAL SUBSTANCES



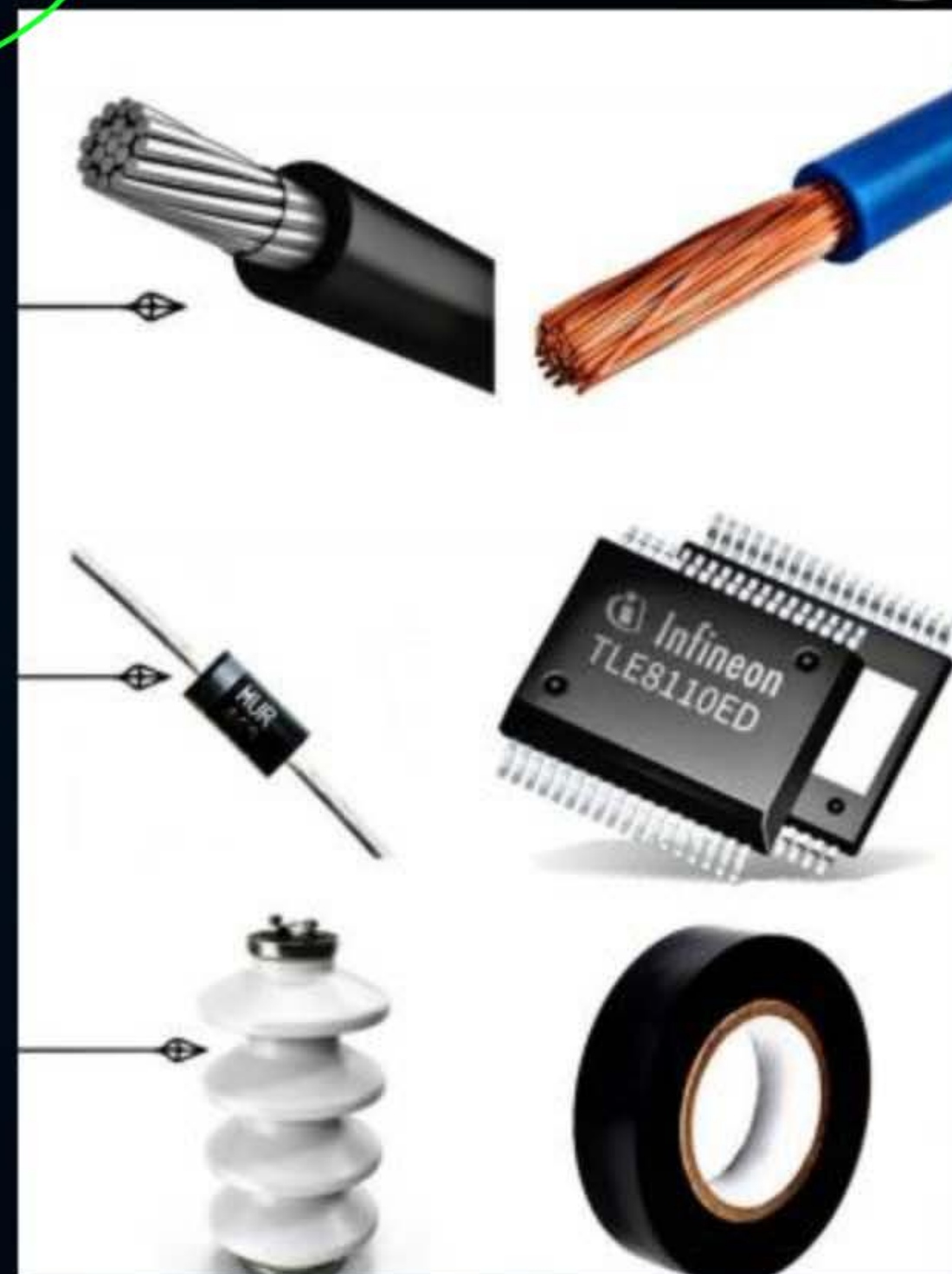
1. Conductors :

(Metals)

Bigger
Atomic
Size



- The substances or materials that permit electrons to flow freely from particle to particle. eg- Copper, Iron, Silver, Aluminium etc.
- This is due to presence of more loosely bound electrons (Free Electrons). See Electron Sea Model.



Conductor > S.C. > Insulator



2. Semi Conductors : (Metalloids)

- A material that has an electrical conductivity value falling between that of a conductor, such as metallic copper, and an insulator, such as glass. eg- SiAs, GaAs, Titanium Dioxide etc.
- This is due to the presence of less free electrons which are tend to move to conduct electricity

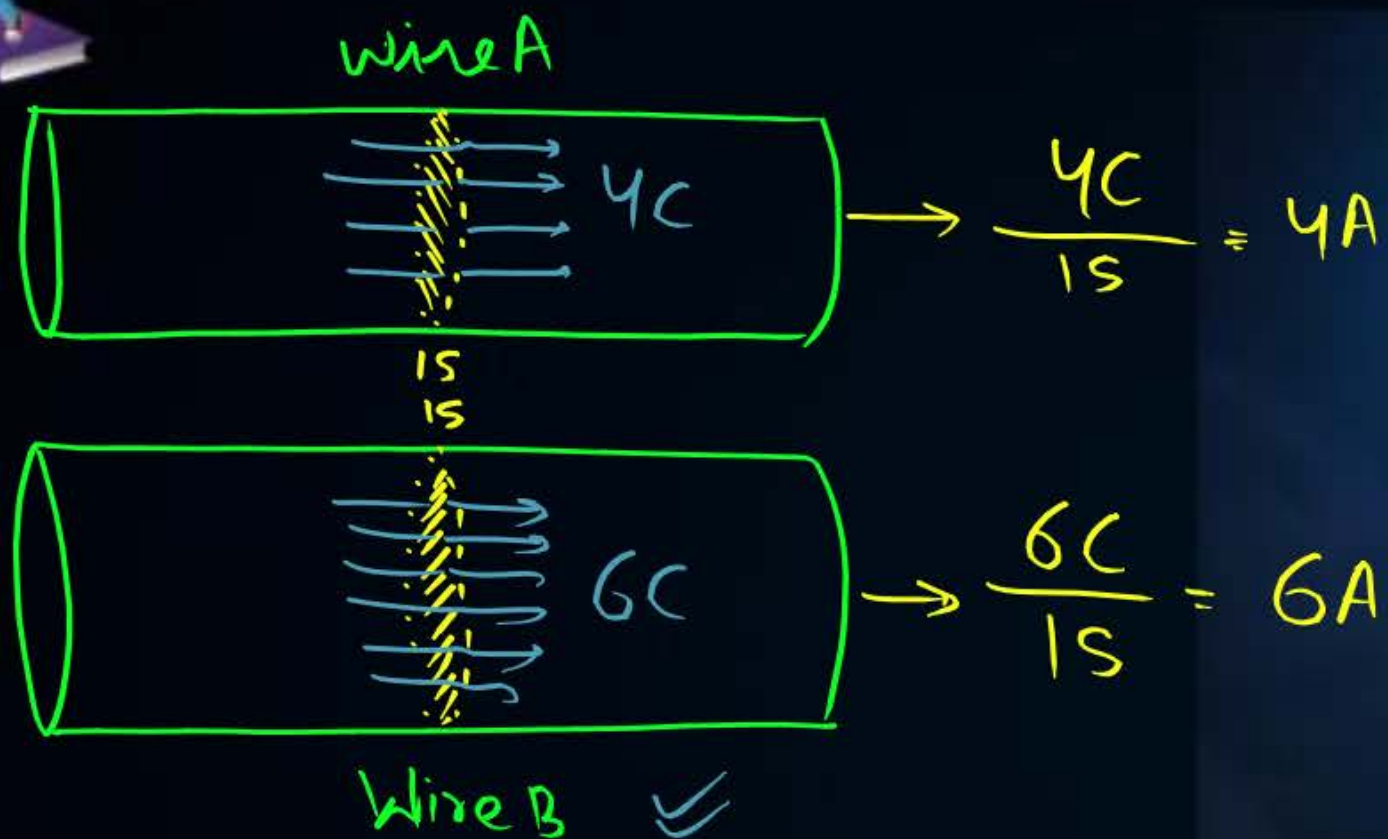
3. Insulators : (Non-Metals) \Rightarrow Small sized Atoms \rightarrow e^- tightly Bound.

- The substances or materials that resist the free flow of electrons from atom to atom and molecule to molecule. eg- Wood, Glass, Cloth etc.
- This is due to the absence of more loosely bound electrons (Free Electrons)



CHARGE IN MOTION : ELECTRIC CURRENT

→ flow



$$\text{Current} = \frac{\text{Amount of charge} \rightarrow \text{Coulomb}(C)}{\text{time} \rightarrow \text{Seconds}(s)}$$

↓
Ampere (A)



* $\text{Current} = \frac{\text{Amount of charge}}{\text{time}}$

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

Define 1A of Current :-

1 C of charge is passed through a cross-section of a conductor in 1 sec.

* Define current.

- Current is a quantity which measures the Amount of charge passing through a cross-section in a unit time

SI unit \rightarrow Ampere (A)

denote \rightarrow 'I'

$$1A = \frac{1C}{1s}$$

QUESTION



A current of 0.5 A is drawn by a filament of an electric bulb for 10 minutes. Find the amount of electric charge that flows through the circuit.

a) 200 C

b) 100 C

☒ c) 300 C

d) 600 C

$$I = 0.5 \text{ A}$$

$$t = 10 \text{ min} \times 60 = 600 \text{ sec}$$

$$Q = ?$$

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

$$0.5 = \frac{Q}{600}$$

$$\rightarrow Q = \frac{300}{\cancel{600} \times \cancel{1}} = 300 \text{ C}$$



ELECTRIC CURRENT



Electric Current is defined as the rate of flow of Charge through a cross-section of a conductor per unit time.

divide by
time

SI Unit of Current : ampere (A)

Que. What constitutes the electric current flowing in a conductor?

Ans. Due to some external agency (Potential Difference), free electrons present in the conductor, flow through the wire, which constitutes the flow of charge as electric current

220 Volts → domestic Power Supply

Potential difference = Voltage

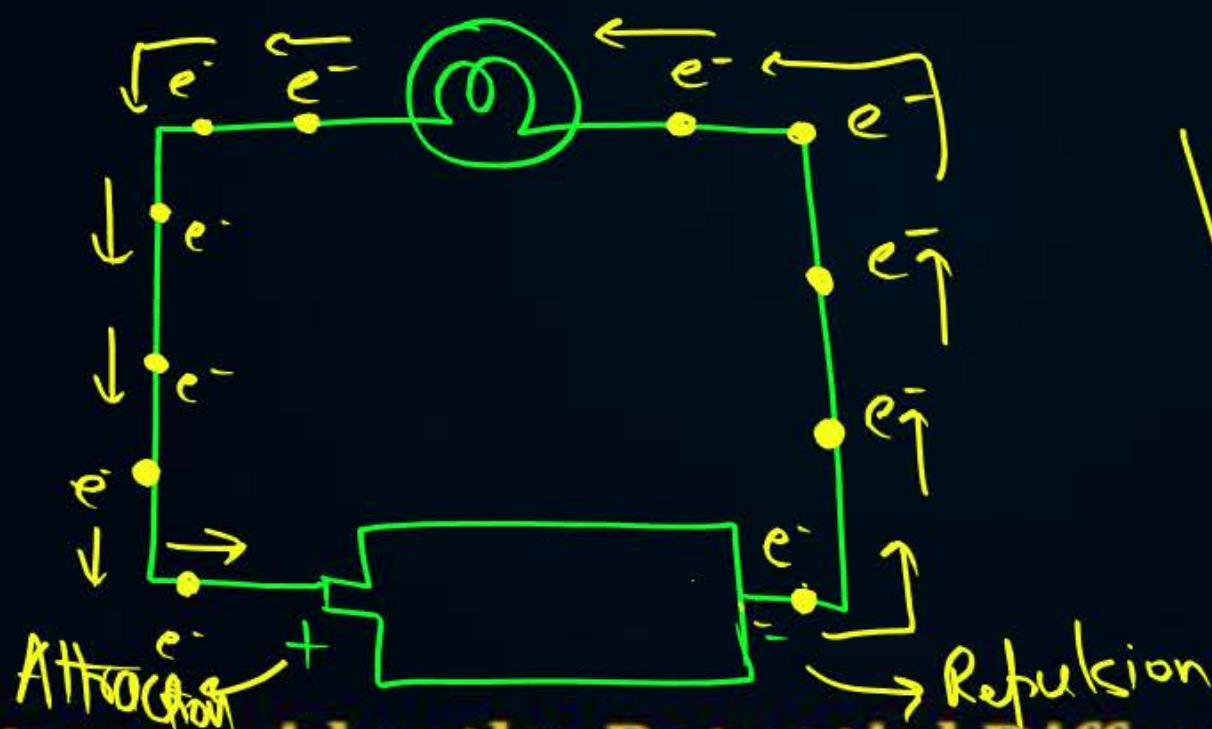


THE CONCEPT OF VOLTAGE



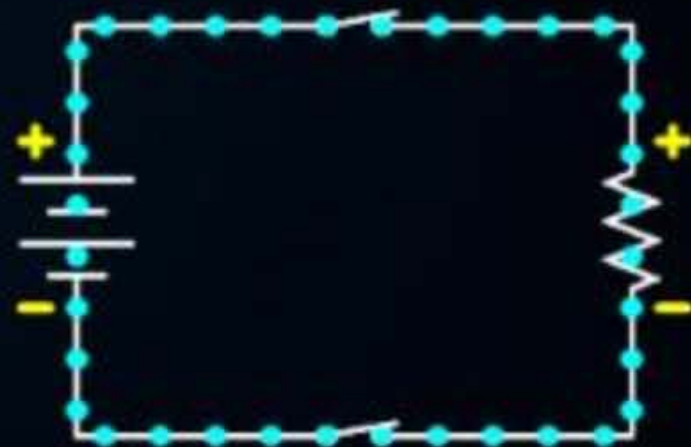
Que. Why does the electric charge flow?

Ans. Electric Charges in a conductor flow due to presence of potential difference across the ends of the conductor, Potential difference, in other words, called Voltage.



$V \uparrow$ $I \uparrow$

Direction of electron motion



Que. Which entity provides the Potential Difference?

Ans. Cathode and Anode present at the ends of the Battery provides electric energy for the charge to flow in the wire.

Provider of Voltage

* Potential Difference or Voltage

$$\text{Voltage} = \frac{\text{Workdone}}{\text{Charge}}$$

219

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

Define :- Voltage is defined as workdone per unit charge. (1C)

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

Volts = $\frac{\text{Joule}}{\text{Coulomb}}$

Define 1 Volt \Rightarrow When 1J of Work is done on 1C of Charge.

$$10V = \frac{10J}{1C} \quad , \quad 220V = \frac{220J}{1C}$$



DEFINE ONE VOLT



Define 1 Volt:

When 1 Joule of Work is done on a unit positive charge to move it from one point to another point, then potential difference is said to be 1 volt

QUESTION



What is the work done required to move a charge of 2 C through a potential difference of 12 V?

a) 12 J

b) 2 J

☒ c) 24 J

d) 48 J

Voltage

$V = 12 \text{ V}$

$Q = 2 \text{ C}$

$W = ?$

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

$12 = \frac{W}{2} \rightarrow W = 24 \text{ J}$



THANK
YOU

