

UDAAN



FOR CLASS 10TH

ELECTRIC CHARGES AND CURRENT

Lecture – 01

ELECTRICITY



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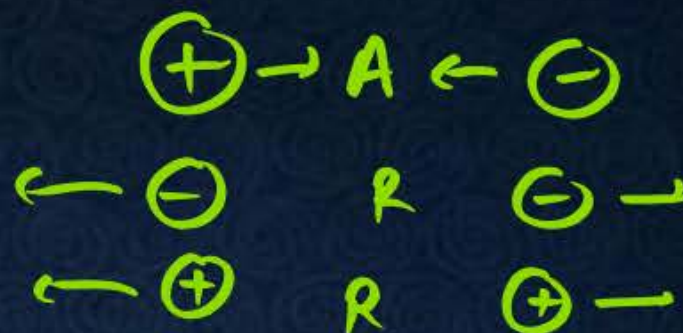




ELECTRIC CHARGE



'Q' or 'q'



Charge is the property associated with matter due to which it produces and Experience Electrical and Magnetic Effects.

SI Unit of charge : Coulomb (C)



$$1\text{mC} = 10^{-3}\text{C}$$

$$1\mu\text{C} = 10^{-6}\text{C}$$

Que. Where does the charge present in the universe?

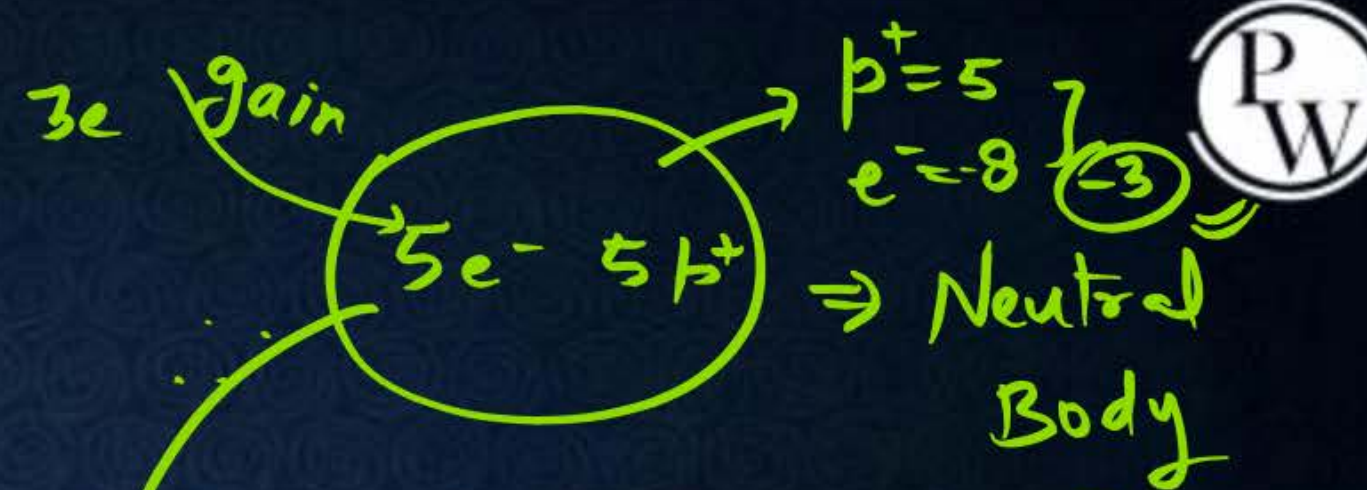
Ans. Charge is fundamentally present on the elementary particles, Electrons (-) and Protons (+) and Neutrons are Neutral in nature. All of them are present inside the Atom and Atoms constitute to become molecules, of which the substances of the universe are made.





APPEARANCE OF CHARGE

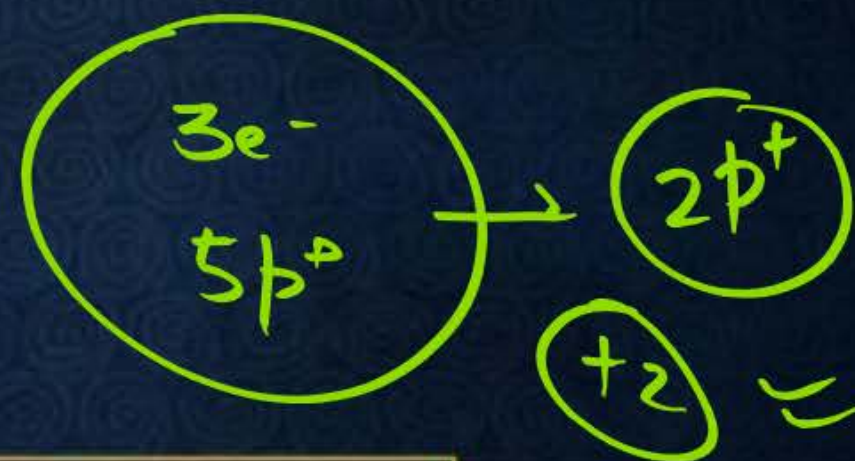
✓✓



Que. How does Charge appear on a body?

Ans. Charged Bodies/Particles can be created by disturbing the neutrality of an atom. Just like Ions are created out of Neutral Atoms)

Loss of 2e⁻



➡ Loss of electrons → Positive charge

➡ Gain of electron → Negative charge



PROPERTIES OF CHARGES (NTSE)



$$\begin{array}{cc} 5e^- & 2+ \\ 10+ & 4+ \\ & 3e^- \end{array} \Rightarrow (+8) =$$

1. **Additivity of charge** : Total charge on a body is the algebraic sum of all the charges located anywhere on the body.

NOTE: Charge is a scalar quantity

$$\begin{aligned} Q_{\text{net}} &= 10 + 4 + 2 \\ &\quad - 5 - 3 \\ &= 2 + 4 + 2 \\ &= (+8) \end{aligned}$$

2. **Charge is conserved** : Charge can neither be created nor be destroyed that means for an isolated system total charge is conserved/constant.

3. **Charge is ^{Constant} Invariant** : The numerical value of an elementary charge is independent of velocity.



QUANTIZATION OF CHARGE

Quantify \Rightarrow गणना

4. Quantization of Charge :

- The smallest charge that can exist in nature is the charge of an electron.
- If the charge of an electron ($= 1.6 \times 10^{-19} \text{ C}$) is taken as elementary unit, i.e. the quanta of charge, the charge on any body will be some integral multiple of e i.e. $Q = \pm ne$ with $n = 1, 2, 3, \dots$

$$Q = ne$$

$$e^- = -1.6 \times 10^{-19} \text{ C}$$

$$p^+ = +1.6 \times 10^{-19} \text{ C}$$

$$1e^- = 1.6 \times 10^{-19} \text{ C}$$

$$2e^- = 3.2 \times 10^{-19} \text{ C}$$

$$3e^- = 4.8 \times 10^{-19} \text{ C}$$

$$4e^- = 6.4 \times 10^{-19} \text{ C}$$

$$5e^- = 8.0 \times 10^{-19} \text{ C}$$

$$ne^- = n \times 1.6 \times 10^{-19} \text{ C}$$

$$Q_{\text{net}} = ne$$





In Text

Find the Number of Electrons present in one coulomb of charge

$$n = ?$$

$$Q = 1C$$

$$Q = ne$$

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

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

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

$$\begin{array}{r} n \\ 6.25 \\ 12.5 \\ 25 \end{array} = \frac{10 \times 10^{19}}{1.6}$$

$$\begin{array}{r} n \\ 100 \\ 10 \\ 4 \end{array} = \frac{100 \times 10^{18}}{16}$$

$$\begin{array}{r} 2 \\ n = 6.25 \times 10^{18} e^- \end{array}$$

Q011 (IIT Type)

Q. Which charge is not possible to occur?

A) $1.6 \times 10^{-19} \text{ C}$ $= 1e^-$

~~B) $3.6 \times 10^{-19} \text{ C}$ \Rightarrow Not possible~~

~~C) $3.6 \times 10^{-17} \text{ C}$ \Rightarrow Not possible~~

~~D) $3.6 \times 10^{-22} \text{ C}$ \Rightarrow Not possible~~

80% \Rightarrow





ELECTRICAL SUBSTANCES



1. Conductors : (Metal \Rightarrow Atom Size Big)

- 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.

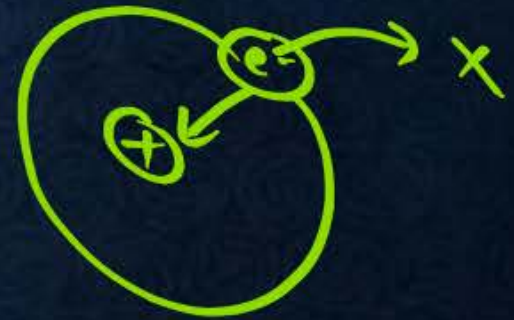
2. Semi Conductors :

- 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. TiO_2
- This is due to the presence of less free electrons which are tend to move to conduct electricity



3. **Insulators** : \rightarrow Non-Metals (Size \Rightarrow Small)

- 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)

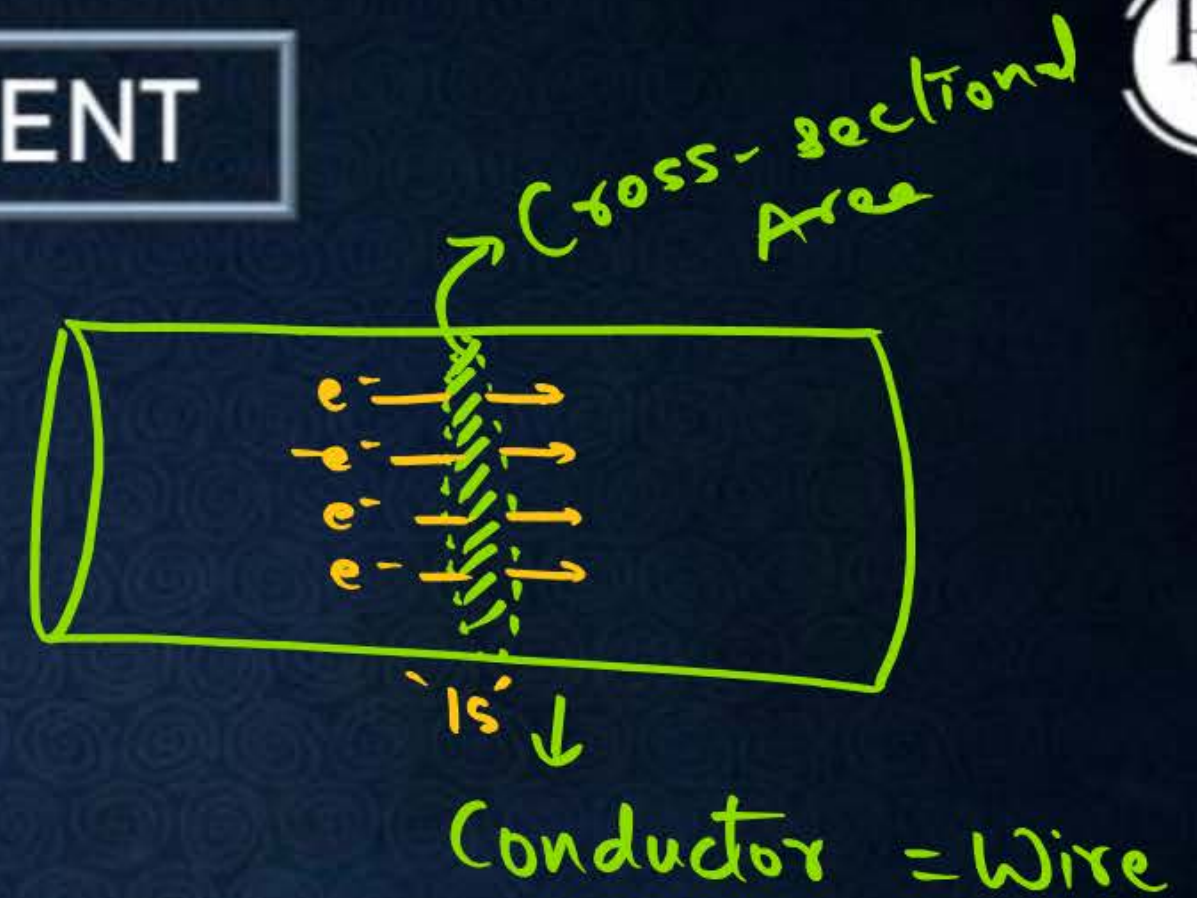




CHARGE IN MOTION: ELECTRIC CURRENT



Current = Rate of flow of charge



$$\text{Current} \uparrow = \frac{\text{Amount of charge} \uparrow}{\text{time} \downarrow}$$
$$\left\{ I = \frac{Q}{t} \right\}$$

SI unit \Rightarrow Ampere (A)

$$1 \text{ mA} = 10^{-3} \text{ A} \quad \checkmark$$

(milli)

$$1 \mu\text{A} = 10^{-6} \text{ A} \quad \checkmark$$

(Micro)

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

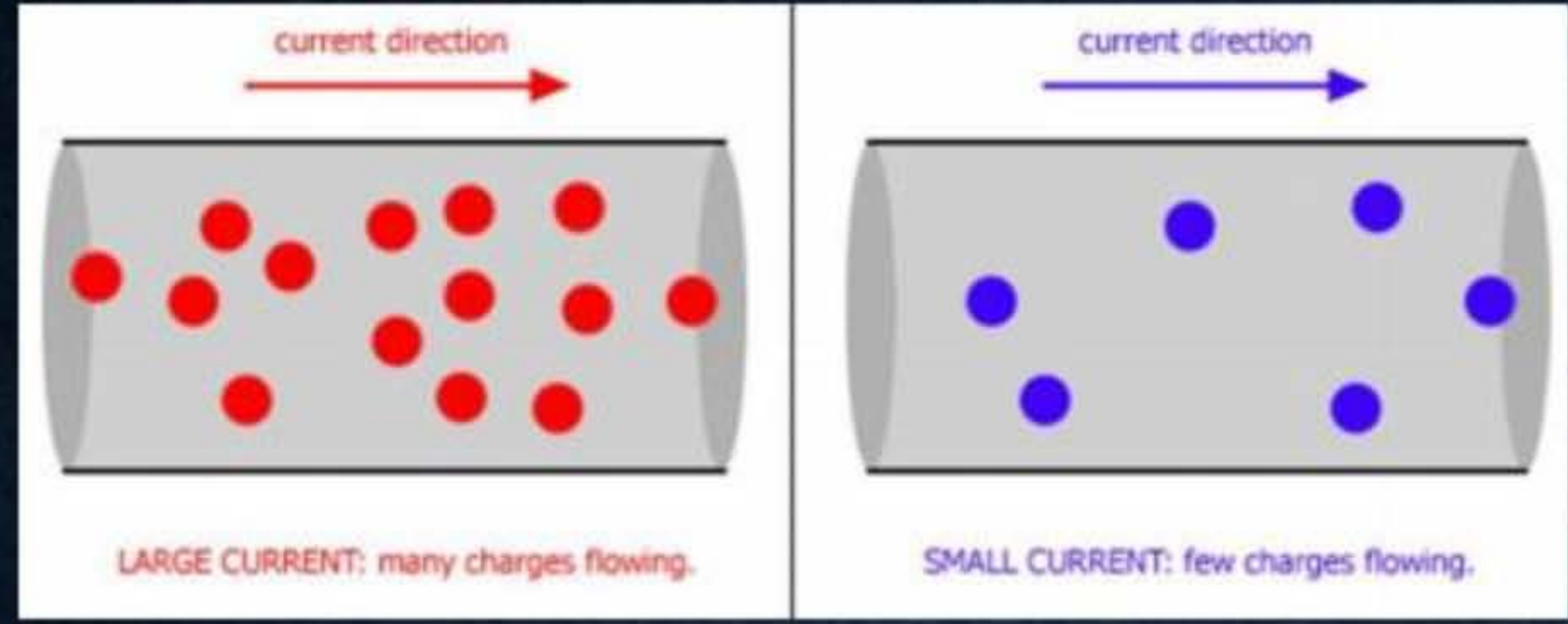
Def: 1 A \rightarrow When a charge of 1 C is passed in 1 s



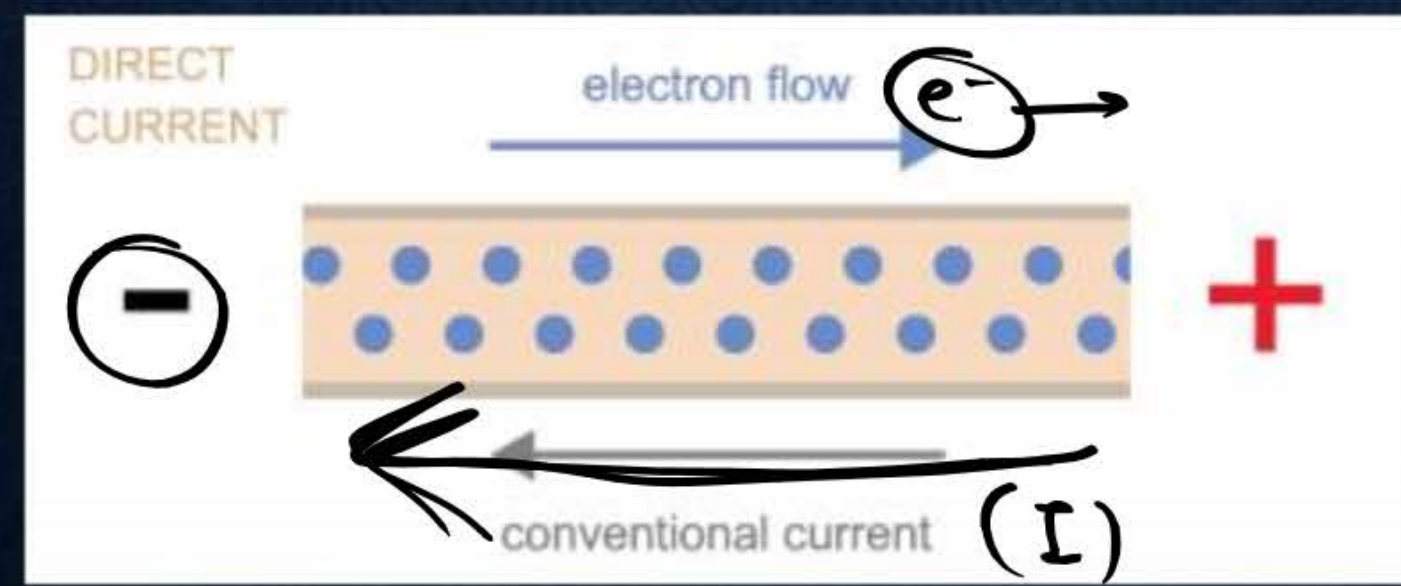


FLOW OF ELECTRIC CURRENT IN A CONDUCTOR

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



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



xxx electronic current
 $e^- e^- e^- e^-$
 ~~~~  $I \rightarrow$  (conventional current)  
 (~~~~~)





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.

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

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

$$Q = ?$$

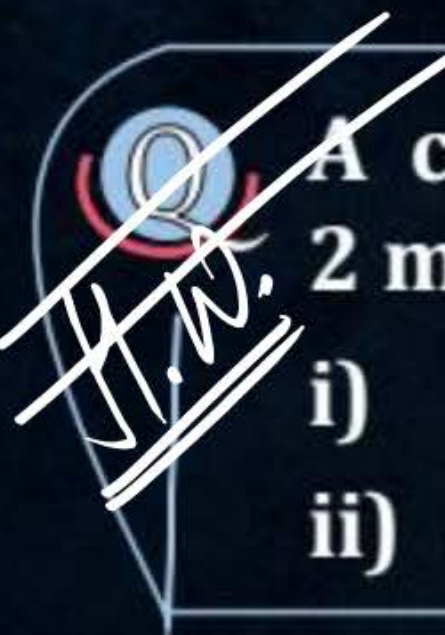
$$I = \frac{Q}{t}$$

$$Q = It$$

$$= \frac{0.5}{1} \times 600$$

$$Q = 300 \text{ C}$$



 A current of  $0.4\text{ A}$  is drawn by a motor of an electric fan for 2 minutes. Find

- i) the amount of electric charge that flows through the circuit.
- ii) the amount of electrons passed through the wire



A white outline of a house with a chimney, positioned to the left of the word 'HOMEWORK'.

# HOMEWORK





**Page Number- 84**

**NCERT Corner**

**Questions number – 2, 3**



Naya hai, [Be Familiar]  
Tough Nahi hai !!!

# THANK YOU

