UDAAN

2025

ELECTRICITY

PHYSICS | Lecture - 01

By - ER. RAKSHAK SIR

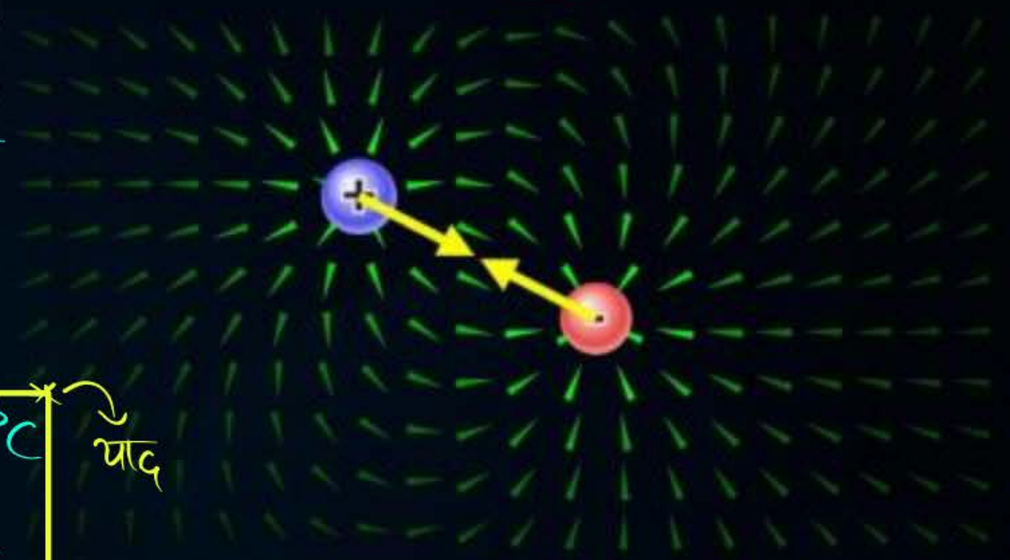
Topics to be covered

1. ELECTRIC CHARGE
2. APPEARANCE OF CHARGE
3. PROPERTIES OF CHARGES
4. ELECTRICAL SUBSTANCES
5. CHARGE IN MOTION : ELECTRIC CURRENT

ELECTRIC CHARGE

Matter → Mass → Inertia
Matter → Volume → Space occupy
Matter → Charge → Attract/repel
Matter → Atoms → e^- p^+ n^0

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



* Denoted by 'Q' or 'q'
* **SI Unit of charge : Coulomb (C)**

$Q_1 = 3C$, $Q_2 = 5.3C$, $Q_3 = 1mC = 10^{-3}C$ यात्रा

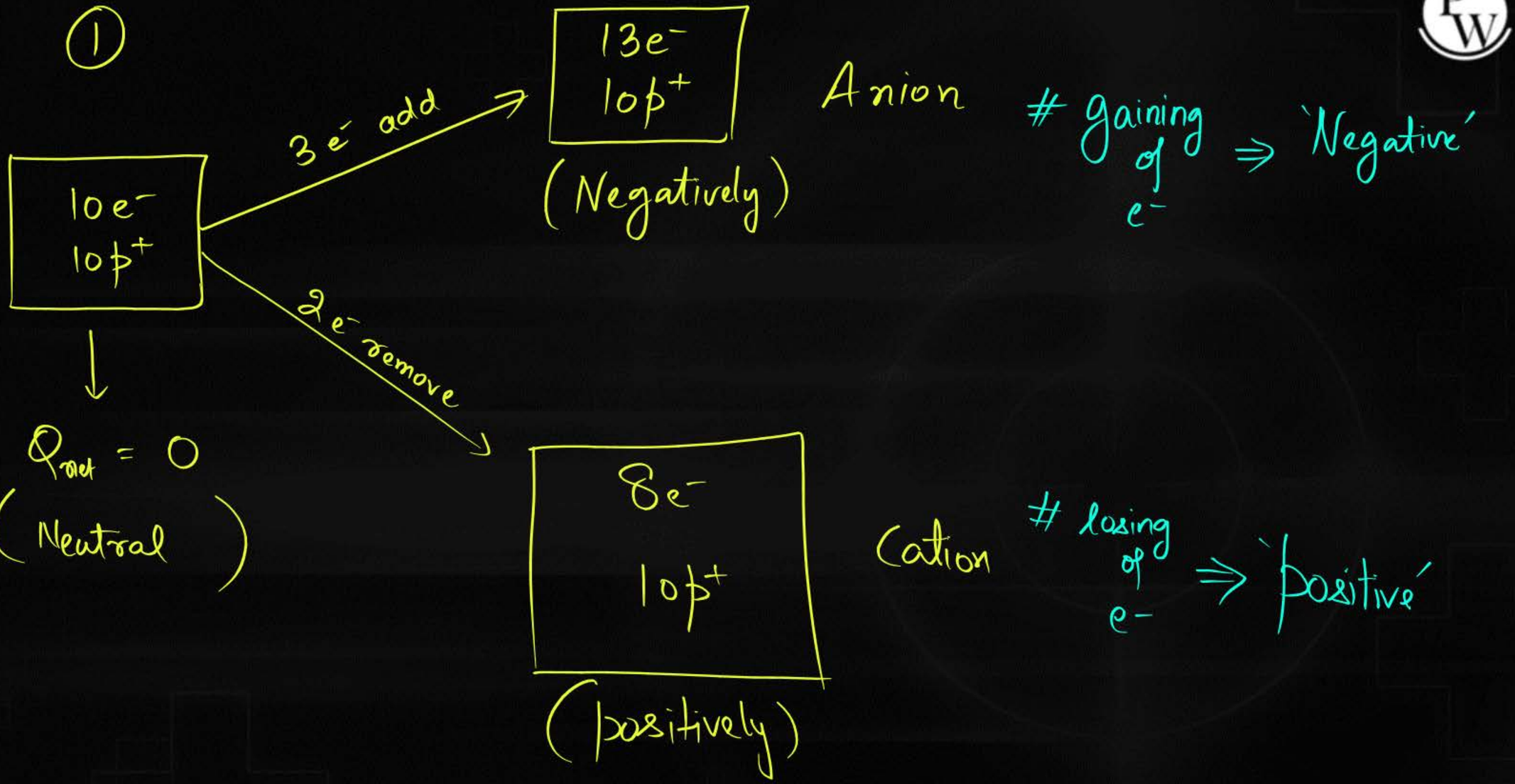
$Q_4 = 1\mu C = 10^{-6}C$

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

①



APPEARANCE OF CHARGE

Neutron (n°) → Chargeless X
→ Neutral (+ = −)

Proton (p⁺) → (+ > −)

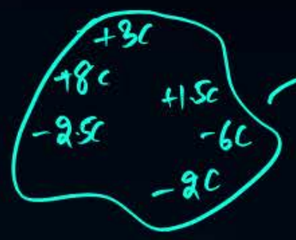
electron → (− > +)

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 electrons → Positive charge**
- **Gain of electron → Negative charge**

PROPERTIES OF CHARGES



$Q_{net} = +3 + 8 + 1.5 - 2.5 - 6 - 2$

$= +0.5 + 1.5 = +2C$

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

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

out of Syllabus

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

Vary Nahi Karta, Change Nahi hota

(q) → 3×10^8 m/s No Change

(m) → $C = 3\times10^8$ m/s

Mass changes
length change

Quanta → Charge ke Packets Banane ki Prakriya

→ packet = one electron

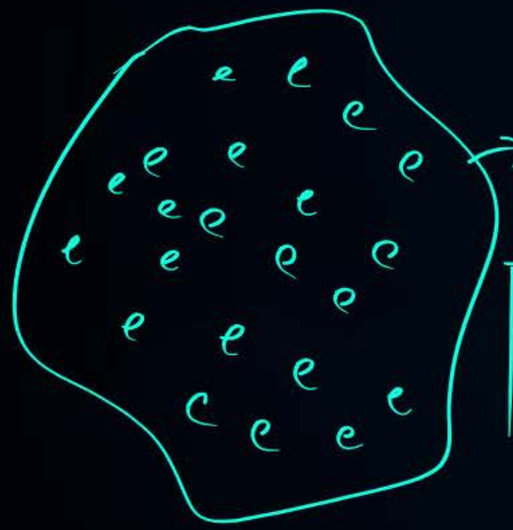
Imp!

4. Quantization of Charge :

- The smallest charge that can exist in nature is the charge of an electron.
- If the charge of an electron (= 1.6×10^{-19} 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 $n = 1, 2, 3, \ldots$

net charge, no. of electrons, one e⁻ ka charge

$$Q = ne$$



$Q_{net} = 22e$

$Q_{net} = 22 \times 1.6 \times 10^{-19}$ C

$Q_{net} = ne$

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

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

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

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

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

⋮

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

THANK YOU