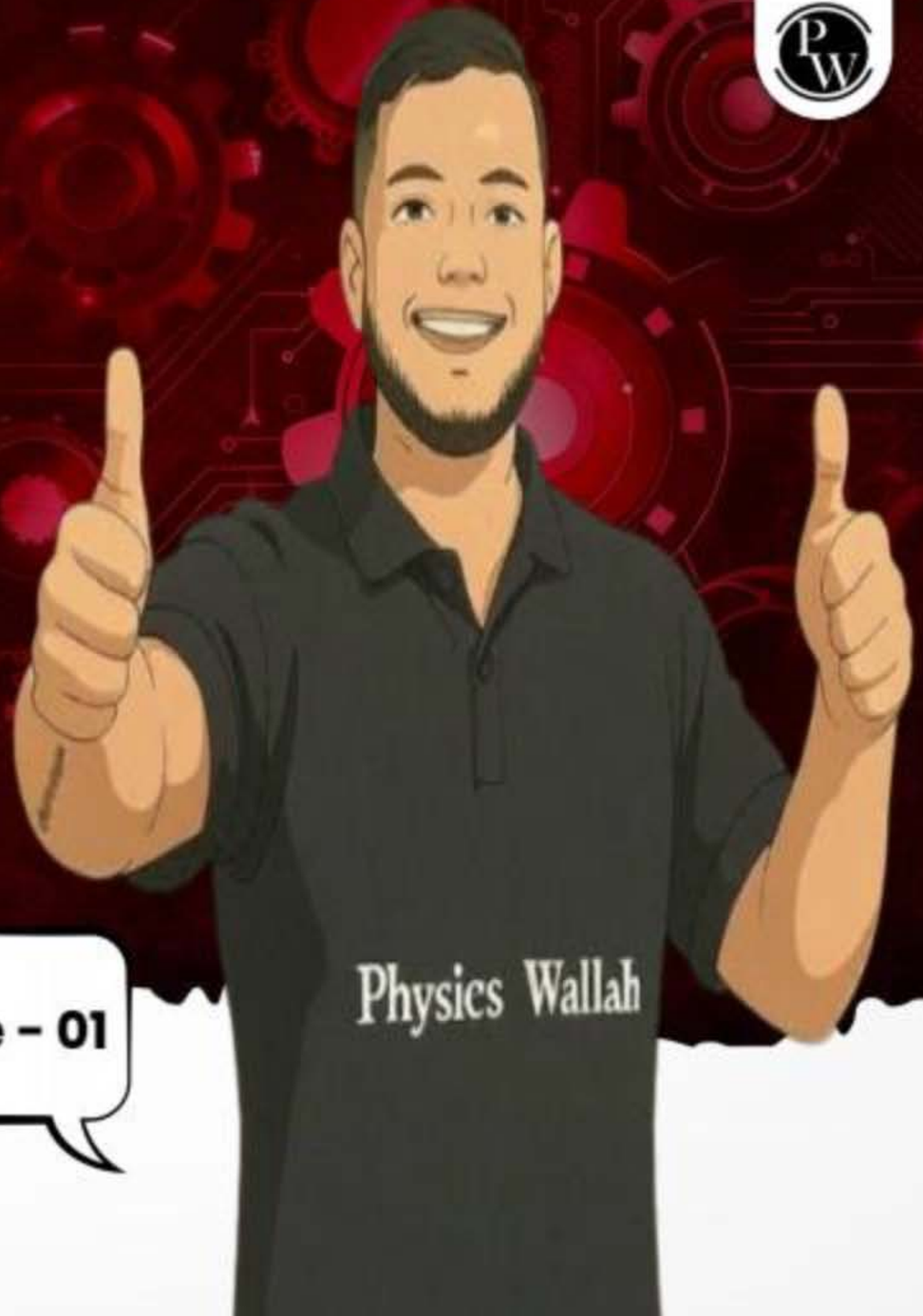
LAKSHYA

JEE 2026 BATCH

Physics

Electric charges and field



Lecture - 01

By – Rajwant Singh (RJ)

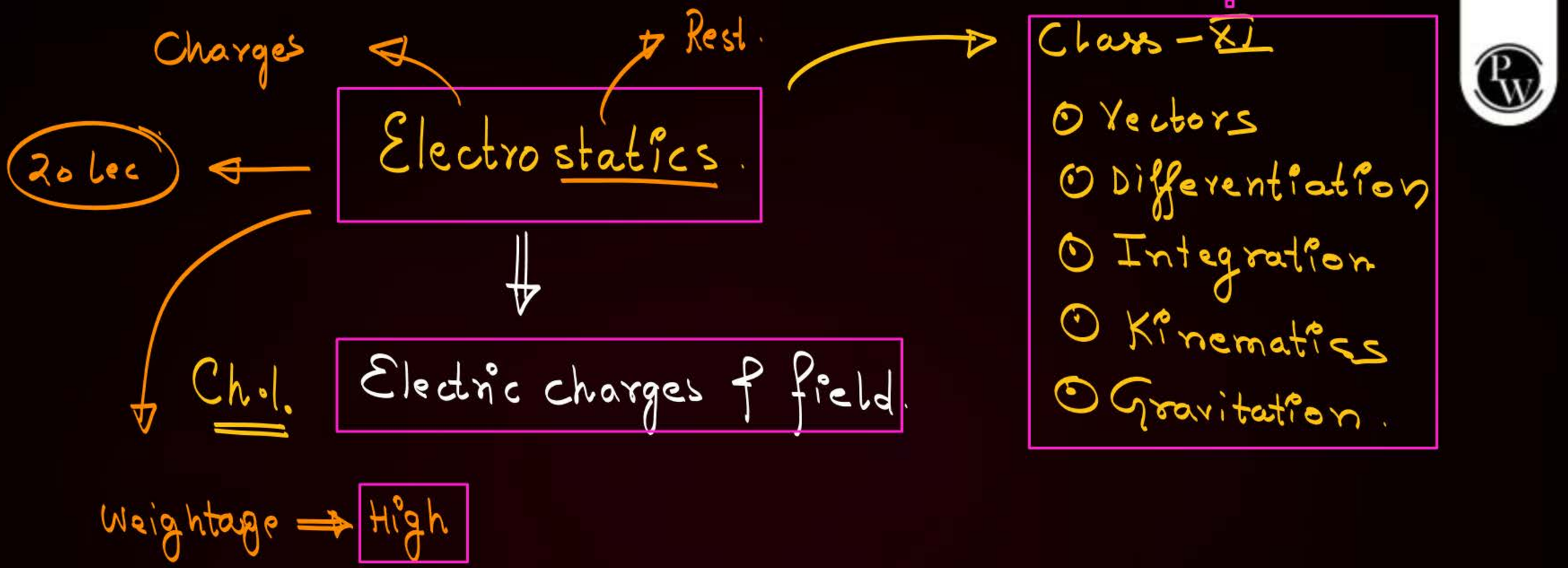
Topics *to be covered*

1. Electric charges
2. Properties of charges
3. Questions
4.
5.

Promise me.....

- You will fully focus on class and try to write down maximum things in class only.
- Only write question numbers
- Chat as minimum as possible and don't interact with each others or useless things.
- Jo bola wahi karoge, apna sara dimaag boli hui baton par lagaoge
- Har din meri class attend karoge, bhale kuch bhi ho jaye... (no excuses)
- Boards ko halke mein nahi lena hai.
- Class response should be high.
- Toh Shuru kare mere

"Antar Panter CULT"

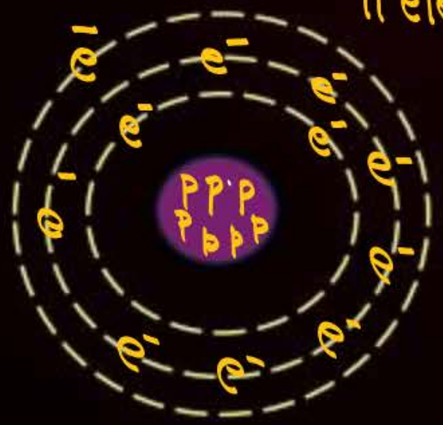

Charges
Rest
Class - XI
Electrostatics
20 lec
Vectors
Differentiation
Integration
Kinematics
Gravitation
Ch. 1.
Electric charges & field
Weightage ⇒ High

Charges

Electric Charges: Property of mass by which it experiences force in Electric field & Magnetic field.

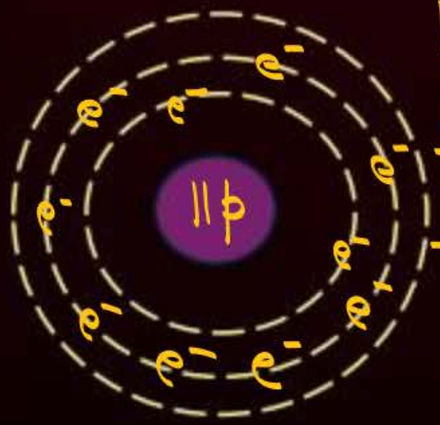
represent = Q

Atom (Na) → Atomic no = 11
11 protons (+)
11 electrons (−)



Neutral.

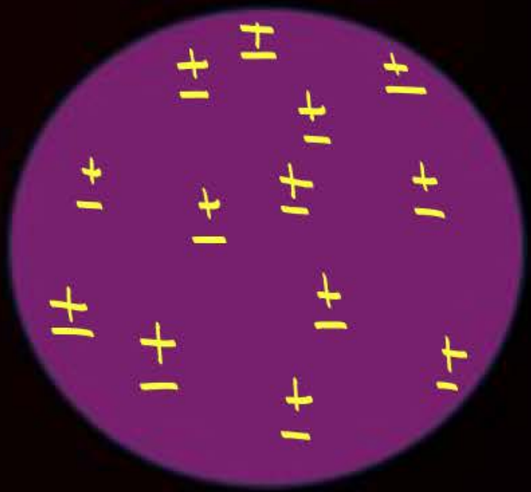
1 e^- Remove →



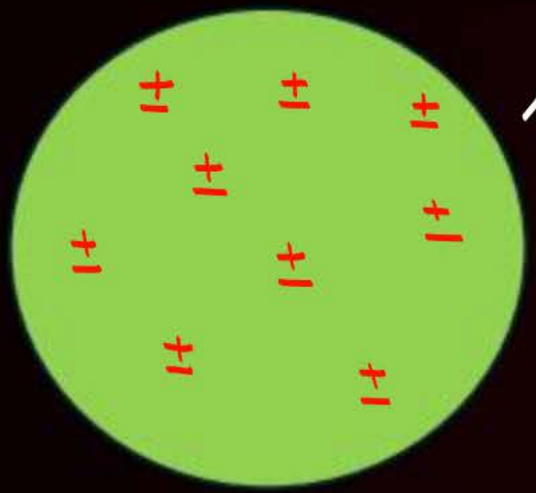
11 protons
10 electrons
Na^+

Neutral Body

Equal amount of (+) & (−) Charges.



- How can we change the neutrality of a body? "by adding & Removing electrons from neutral body".



"n" e^- Remove

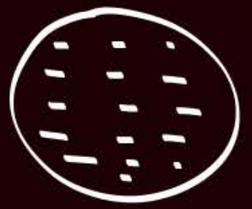
(e^- defficiency)

Positive charge body. $Q = +ne$

(Mass decrease)

"n" e^- are added

(e^- Excess)



Negative charge body $Q = -ne$

(Mass Increase).

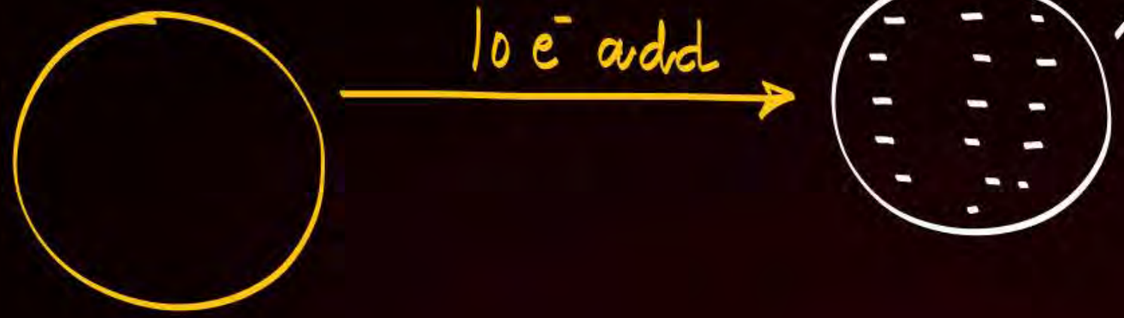
Let charge on $1e^-$ is $= e = -1.6 \times 10^{-19}$, $m_e = 9.11 \times 10^{-31}$ Kg

Charge on Proton $= +e = 1.6 \times 10^{-19}$ C, $m_p = 1.67 \times 10^{-27}$ Kg.

Note: Charge Can be Created by disturbing The neutrality of an Atom

"Charge Can neither be created or be destroyed"

Ex



10 e^- added

$Q_{body} = ?$

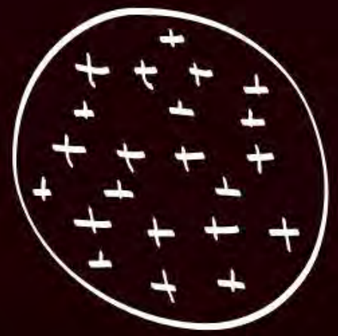
$1e^-$ charge $= 1.6 \times 10^{-19} C$.

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

$$Q = -1.6 \times 10^{-18} C$$

Neutral body

50 e^- are Removed



$Q_{body} = ?$

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

$50e^-$ charge $= 50 \times 1.6 \times 10^{-19}$.

$$Q_{body} = +8 \times 10^{-18} C$$

Type of charges and their properties

- Type of charges ⇒ There are two type of charges ⇒ (+) (−)

Ex:- proton
$q = +1.6 \times 10^{-19}\ C$
$m = 1.67 \times 10^{-27}\ Kg$

electron.
$q = -1.6 \times 10^{-19}\ C$
$m = 9.11 \times 10^{-31}\ Kg$.

- Unit of charge: Coulomb "C" "SI"

CGS = Stat Coulomb or franklin

$1C = 3 \times 10^{9}$ Stat Coloumb

- Dimension of charge: $I = \frac{Q}{t} \Rightarrow [Q] = [AT]$

- Scalar or Vector:

+5C +2C
−3C
System

$Q_{Total} = +5C - 3C + 2C$
$= +4C$..

Properties

1. ❖ Charge is transferable "we can add or Remove e^- to charge a body".

❖ Charge is always associated with mass "all charges will have mass" but mass may have Zero net charge

Ex:- neutron.

❖ Charge is Quantized:

Neutral body

2.5 e^- Remove. ✗

5e added ✓ $Q = -5e$

15 e^- Remove ✓ $Q = +15e$

Charge on any body is integral Multiple of electronic charge.

$$Q_{body} = \pm ne$$

$n = 1, 2, 3, 4, 5 \ldots$ (positive integer).

Quantisation of charge.

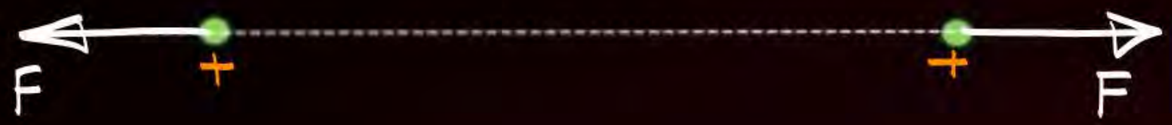
1. e^- se chota charge abhi Kelia (Class-12) possible nahi hai.

2. Quarks → aur bhi chote charges hai (Present inside Nucleus)

$$q_{Quarks} = \pm \frac{e}{3}, \pm \frac{2e}{3}$$

❖ Interaction of charges:

Like charges Repel Each other.



Unlike charges attract Each other.

Condition ⇒ Always applicable for point charges.

❖ Charge is Invariant:

Some physical Qty like mass, time, length Varies when body travels with very high speed (in Comparison to speed of light).

but charge never changes whatever may be the speed.

"Invarient".

+2C
Rest

+2C → Speed = 10^3 m/s

+2C → Speed = 2×10^6 m/s

+2C → Speed ≈ 3×10^8 m/s

In all cases charge will Remain **Same** "Invarient".

but Mass, length, time will Vary.

❖ Behavior of charges with motion

Charge at Rest

only Electric field will be produced.

Constant Velocity

Charge

(Electric field & Magnetic field)

accelerate.

Charge

(Electro Magnetic) Waves

❖ Charge is conserved:

For an Isolated System, charge is always Conserved.

Conductors ⟹ which has free e^- to Conduct electricity

"all valence e^- are free to Move"

which do not have free e^- for Conduction. ⟸ **Insulators**

"Valence e^- are bounded to atom"

Question 1

Which of the following charges is not possible?

A. 1.6×10^{-10} C

B. 1.6×10^{-18} C

C. 64×10^{-20} C

D. 4.5×10^{-19} C (Not possible).

Logic = "find the Value of n".

a) $Q = 1.6 \times 10^{-10} C$

$ne = 1.6 \times 10^{-10}$

$n = \frac{1.6 \times 10^{-10}}{1.6 \times 10^{-19}} = 10^9 e^-$

We have to Remove $10^9 e^-$ to get this charge. ✓

b) $1.6 \times 10^{-18} C$

$n = \frac{1.6 \times 10^{-18}}{1.6 \times 10^{-19}} = 10$

We have to Remove $10 e^-$ to get this charge. ✓

c) 64×10^{-20} C

$Q = ne$

$n = \frac{64 \times 10^{-20}}{1.6 \times 10^{-19}}$

$= 40 \times 10^{-1}$

$= 4$

We have to Remove $4e^-$ to get this charge.

✓

d) $Q = 4.5 \times 10^{-19}$ C

$n = \frac{Q}{e}$

$= \frac{4.5 \times 10^{-19}}{1.6 \times 10^{-19}}$

$= 2.81$

We have to Remove $2.81e^-$ to get this Charge.

✗

Question 2

How many Electron are there in 1 Coulomb of charge?

A 6.25×10^{18} electrons

B 1.6×10^{18} electrons

C No, because of Quantization of charge

D None of these

Question 3

CHCV

One metallic sphere A is given positive charge whereas another identical metallic sphere B of exactly same mass as of A is given equal amount of negative charge. Then.

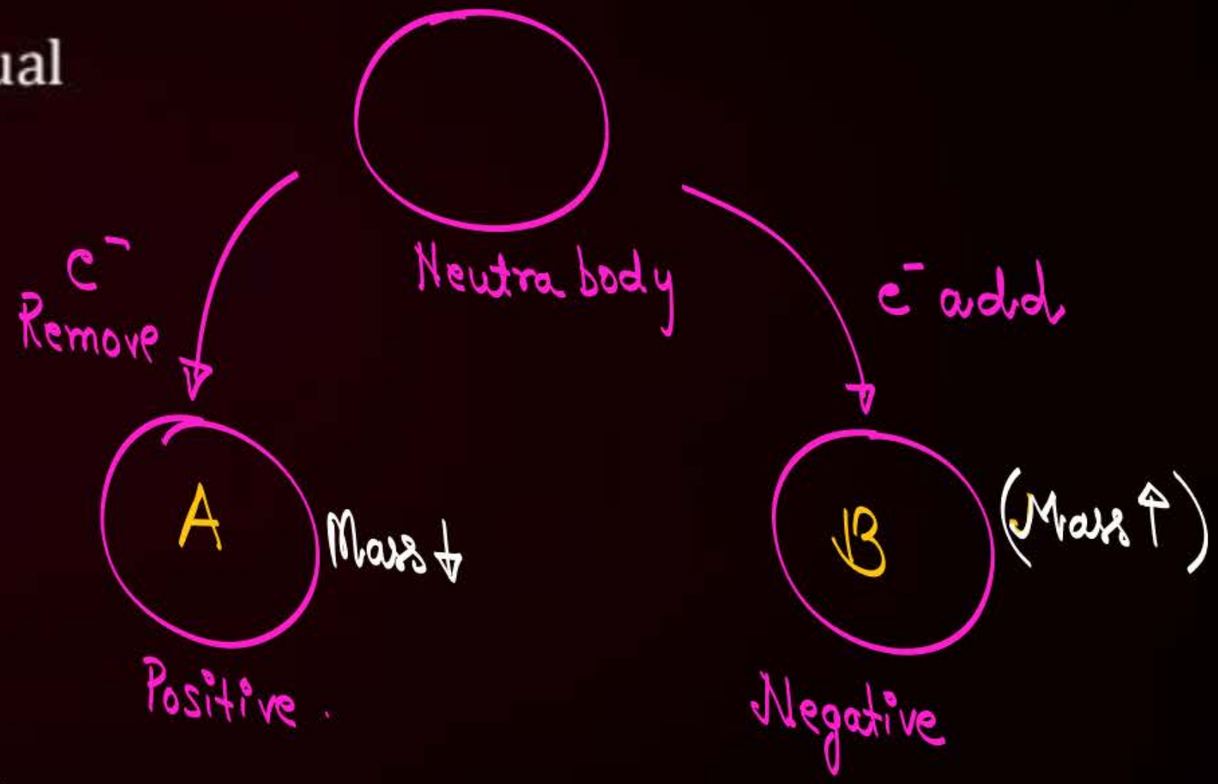
(A) Mass of A and mass of B still remain equal

(B) Mass of A increases

(C) Mass of B decreases

(D) Mass of B increases

Ans



Concept :- we change neutrality of body by adding / Removing e^-. ($m_e = 9.11 \times 10^{-31}$ kg).

Question 4

HW

When 10^{14} electrons are removed from a neutral metal sphere, then the charge on the sphere becomes

A. 16 μC

B. –16 μC

C. 32 μC

D. –32 μC

Question 5

HW

Calculate total number of electrons in 18gm of H_2O?

Question 8

HW

A soap bubble is given a negative charge that is distributed uniformly over its surface then the radius of bubble

A. Increases

B. Decreases

C. Remains unchanged

D. Nothing can be said.

Question 10

HW

If 10^5 electrons are being emitted by plate per seconds in photoelectric Experiment, find the value of photo current.

Homework

(Summary in Next class)

Class theory revise

Class questions : Self try

Module 1 : Chapter : Electric charge and Field
Topic wise: 1,2,


THANK
You