ARJUNA NEET BATCH

Structure of Atom

LECTURE - 2

BY : DOLLY SHARMA

Objective of today's class

DISCOVERY OF FUNDAMENTAL PARTICLES, MILLIKAN'S OIL DROP EXPERIMENT, DISCOVERY OF PROTONS

Discovery of Protons

⇒ E. Goldstein.

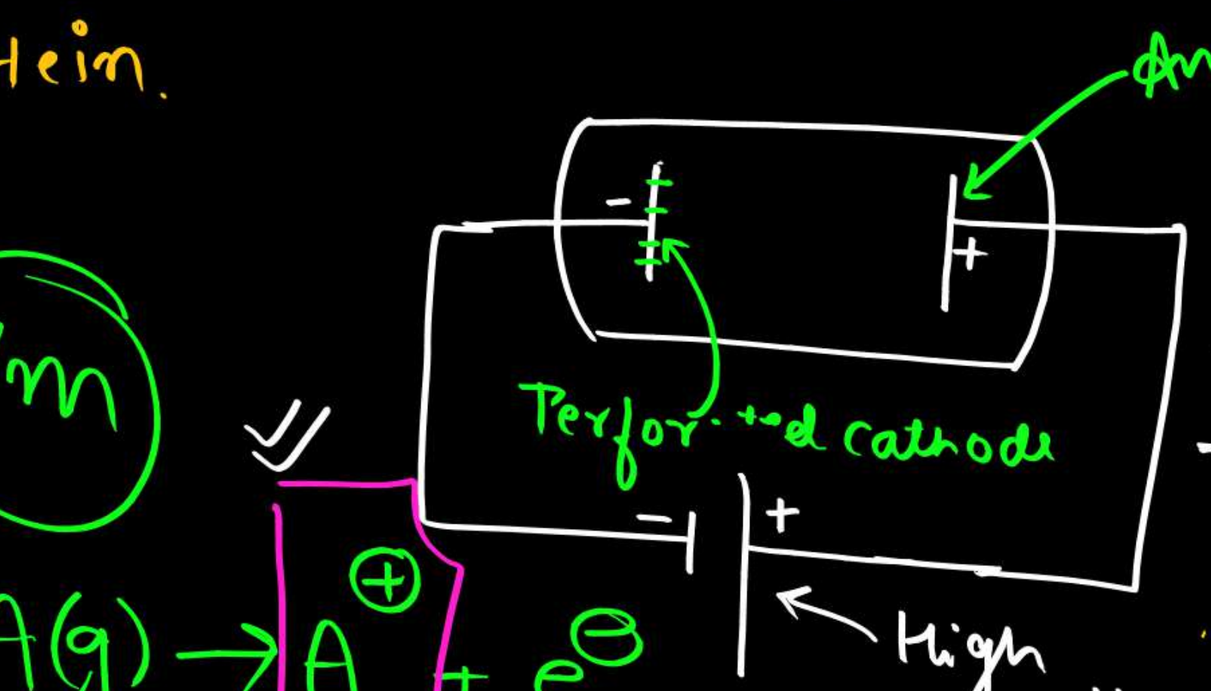
$Cl_2 \rightarrow Cl^+$

e/m

$A(g) \rightarrow A^+ + e^-$

Anode ray

Cathode ray



$H_2(g) \rightarrow H^+ + e^-$

Cathode ray

Anode ray

Canal Rays → Anode rays

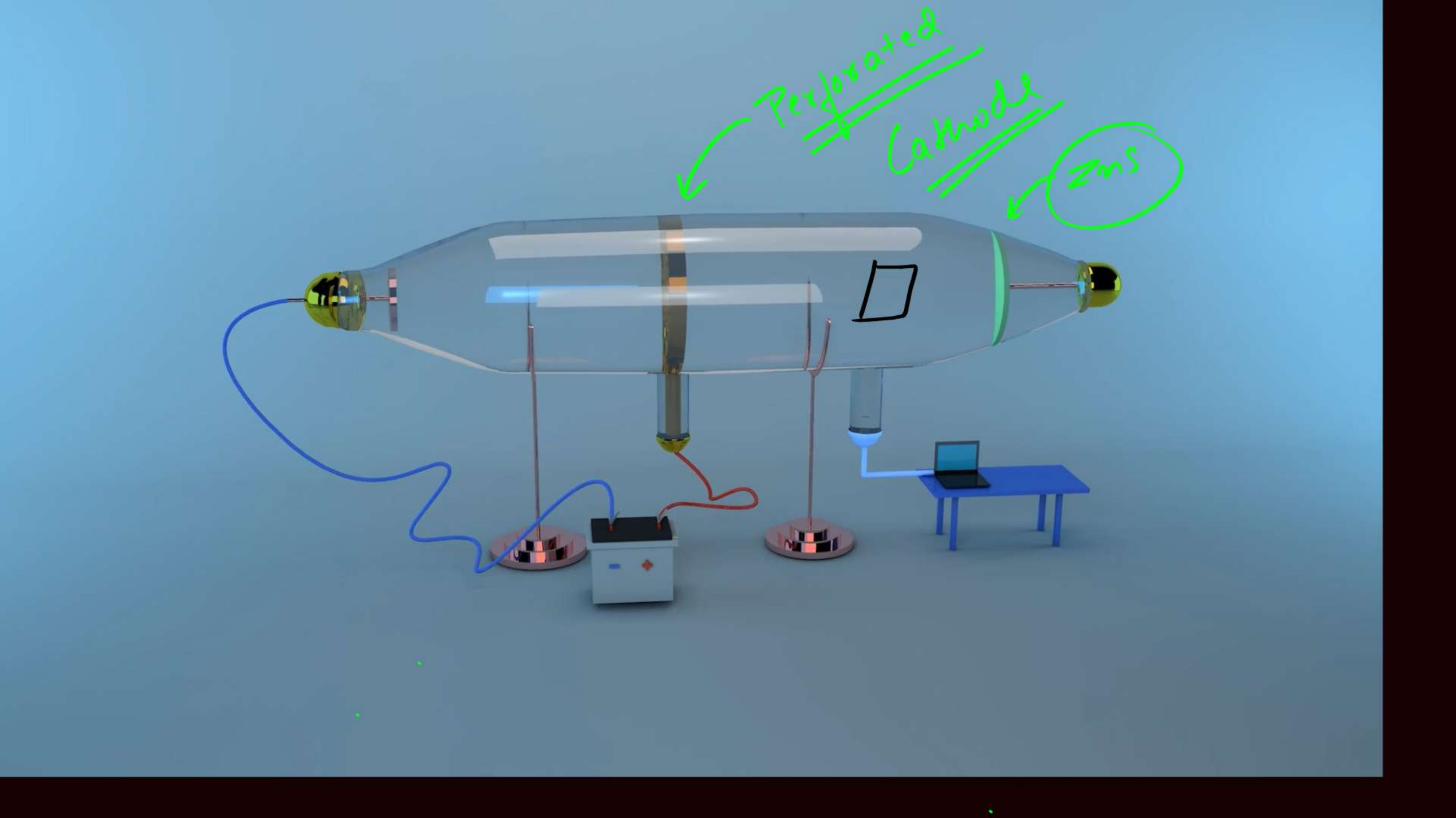
H^+

PROTONS

Anode → Anode ray

Atom (Neutral) gaseous —ionise→ Ion (gaseous) → positively charged +

Cathode ray ← Negatively charged $e^\ominus$


Perforated
Cathode
ZnS


ARJUN

CATHODE RAYS	ANODE RAYS
Cathode rays are firstly originated from material of electrode followed by ionization of gases.	Anode rays are originated by ionization of gas only in space between both the electrodes.
Cathode rays are always made up of negatively charged $e^{\ominus}$ in which mass, charge, specific charge (q/m) always remains same, irrespective of nature of gas taken in the discharge tube, so that cathode rays are regarded as universal in nature.	Anode rays are made up of positively charged cation in which charge mass, (q/m) is different for different gases hence not universal in nature, it depends upon natures of gas in discharge tube.
Cathode rays discovered by J. J. Thomson.	Anode rays are discovered by E. Goldstein.
Cathode rays are Negatively charged particles called negatrons & further Stoney gave them name electrons.	Anode rays are positively charged particles also known as CANAL RAYS.
	Anode rays of H_2 gas consist of protons.

H^+

Cl^+

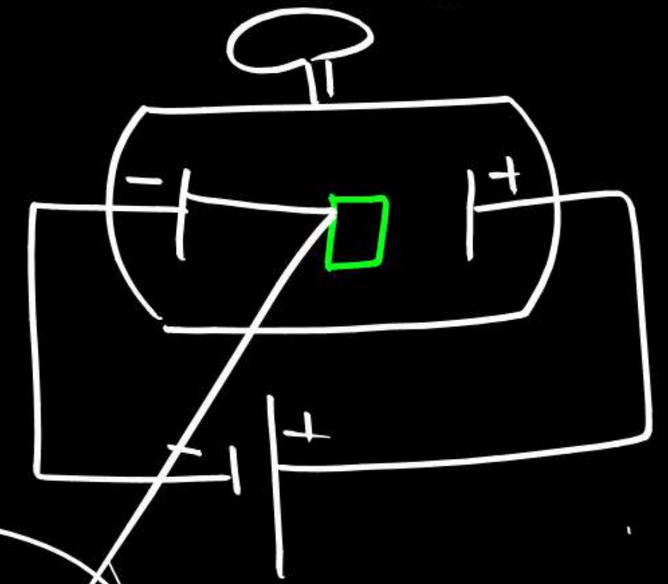
He^+

PROPERTIES OF CATHODE AND ANODE RAYS

- These rays travel in straight line, consist of material particles i.e. those particles which possess mass, speed & may Exert force of friction.
- These rays produce heating effect.
- These rays are deflected by External M.F. & E.F. (Magnetic field) (Electric field)

CATHODE RAYS

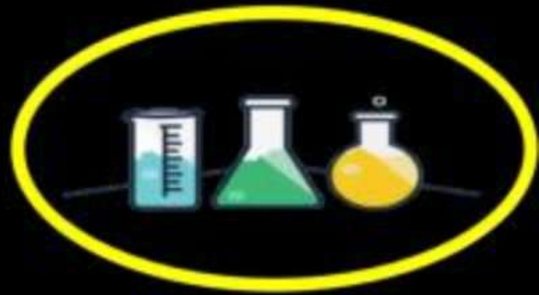
When this ray is made to collide on heavy metals Cu, Mo, W then some radiation called as X-Rays are produced.



Cu
Mo
W

Electromagnetic radiation

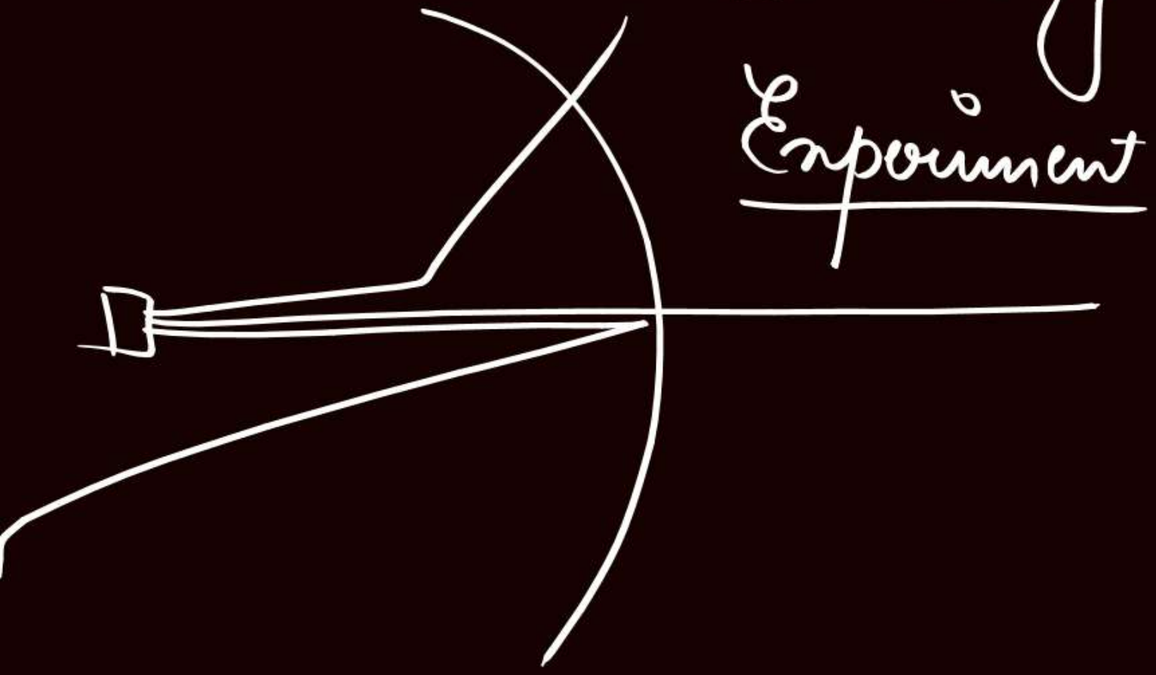
X-rays



J.J. Thomson

↓

Rutherford → Nucleus → α-Scattering Experiment

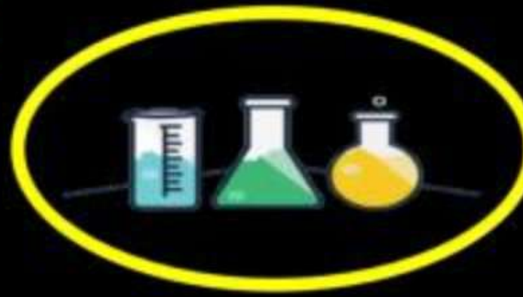


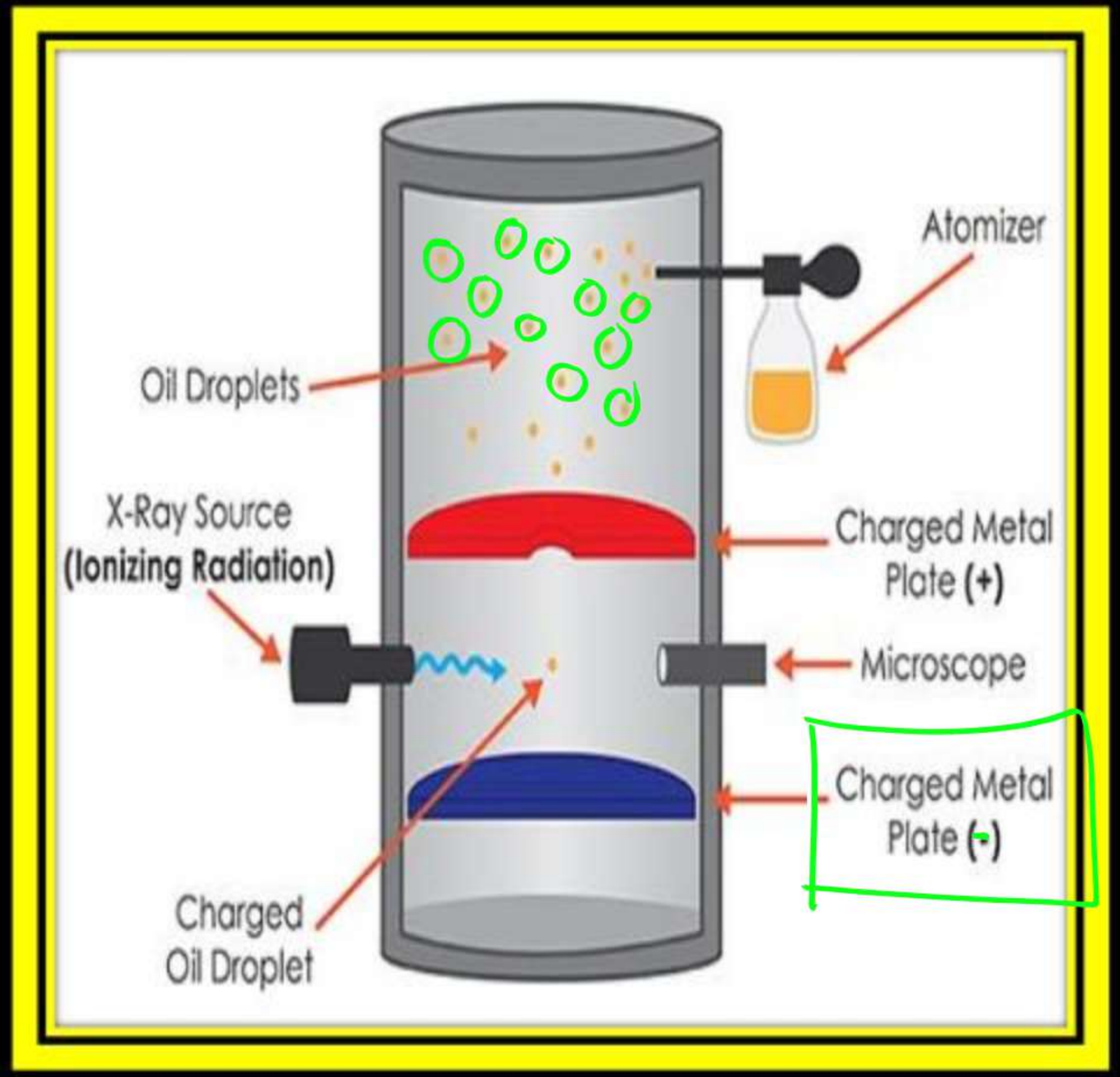
Rutherford → James Chadwik, Madam Curie

James Chadwik → Neutron → Nobel Prize

Millikan's Oil Drop Experiment

- Charge e$^{\ominus}$ was discovered by Millikan oil drop experiment by balancing of electro static force & gravitational force.
- Speed with which cathode rays move is not equal to speed of light, however it depends on external voltage applied.
- Speed of Negatively charged e$^{\ominus}$, when produced in discharge tube is known as cathode rays & when produced naturally called β - Rays





X-ray

Air → ionize

oil droplets ← e⊖

Explanation:-

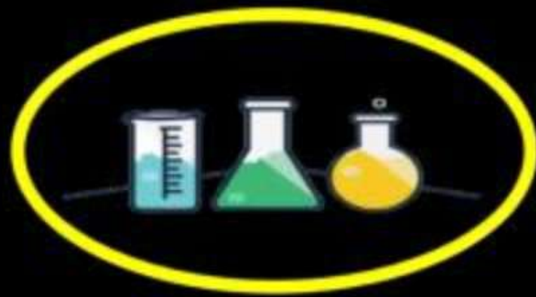
In this experiment, some fine oil droplets were allowed to enters through a tiny hole into the upper plate of electrical condenser. These oil droplets were produced by atomizer. The air in the chamber was subjected to the ionization by X-rays. The electrons produced by the ionization of air attach themselves to the oil drops.

Thus oil droplets acquire negative charge. When sufficient amount of electric field is applied, the motion of the droplets can be accelerated, retarded or made stationery. Millikan observed that the smallest charge found on them was -1.6×10^{-19} coulomb and the magnitude of electrical charge, q on the droplets is always an integral multiple of the electrical charge 'e' i.e., $q = ne$

Charge $\leftarrow q = ne$

$n \rightarrow$ no. of $e^{\ominus}$

$e \rightarrow$ Charge on $1\ e^{\ominus}$



Electron ($e^{\ominus}$)

Charge on $1e^{\ominus}$ = one unit (- ive) charge

$= -1.6 \times 10^{-19}\ C = 4.8 \times 10^{-10}$ esu

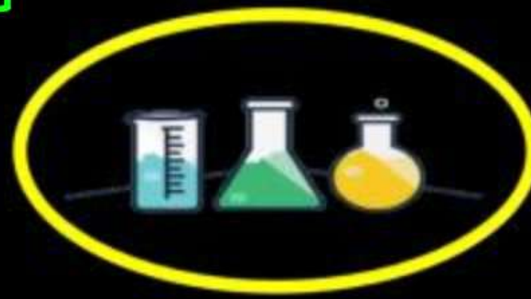
C → Coulumb

esu → Electro static Unit

Charge on 1 mole $e^{\ominus}$ =

$= -1.6 \times 10^{-19} \times 6.022 \times 10^{23} =$ **– 96500 C**

= – 1 Farraday



Mass of one $e^{\ominus}$ = almost negligible

$= 0.00055 \text{ amu} = 9.1 \times 10^{-28} \text{ gm} = 9.1 \times 10^{-31} \text{ kg}$

Mass of 1 mole $e^{\ominus} = 0.00055 \text{ gm} = 0.55 \text{ mg}$

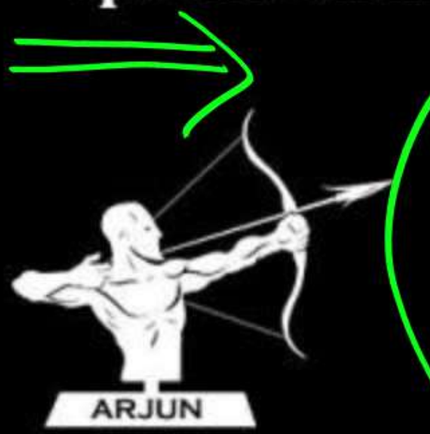
mg → milli gram.

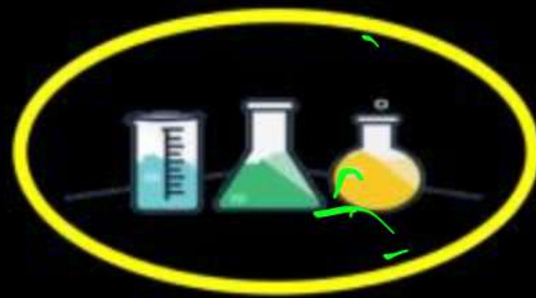
Mass of $e^{\ominus}$ = 1/1837 mass of protons » $\frac{1(\text{H-atom})}{1837}$

$m_e = \frac{1}{1837}$ mass of 1 H atom.

Specific charge on $e^{\ominus}$ $(q/m) = 1.76 \times 10^{8} \text{ C/gm} = 1.76 \times 10^{11} \text{ C/kg}$

$\left(\frac{\text{Charge}}{\text{mass}}\right)$





Protons

Charge on one protons = one unit (+ ive) charge

$= + 1.6 \times 10^{-19}\ C = + 4.8 \times 10^{-10}$ esu

$N_A \rightarrow 6.02 \times 10^{23}$

Charge on 1 mole protons $= + 1.6 \times 10^{-19} \times N_A = + 96500\ C$

= (+) 1 Farraday

N_A

ARJUN

Mass of one proton = one unit mass (~ 1 amu)

= 1.00727 amu = 1.66×10^{-24} » 1.66×10^{-27} kg

Mass of 1 mole proton = 1.00727 gm

mp » mass of H - atom

Specific charge on proton » $(q_p/m_p) = 9.58 \times 10^4$ C/gm

» 9.58×10^7 C/kg

$\frac{q_p}{m_p}$ ($\frac{\text{charge of Proton}}{\text{mass of proton}}$)

$\frac{qp}{mp} < \frac{qe}{me}$

1837 : 1

$\frac{qe}{me} : \frac{qp}{mp}$

Neutron

→ was discovered by James Chadwick.

Charge on one neutron = Zero = neutral

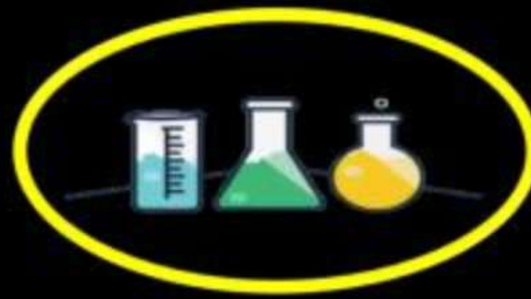
Mass of 1 neutron = 1 unit mass (~ 1 amu) = 1.00867 amu

$= 1.67 \times 10^{-24}$ gm

$= 1.67 \times 10^{-27}$ kg

Mass of 1 mole of neutron = 1.00867 gm

Specific charge = 0



Subatomic Particles	Scientist	charge in C	mass (in Kg)	q/m
$e^{\ominus}$				
Proton				
neutron				

thanks
for watching