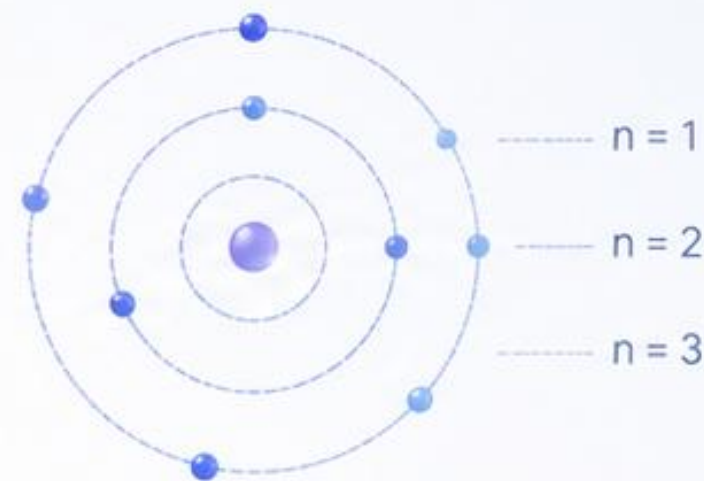
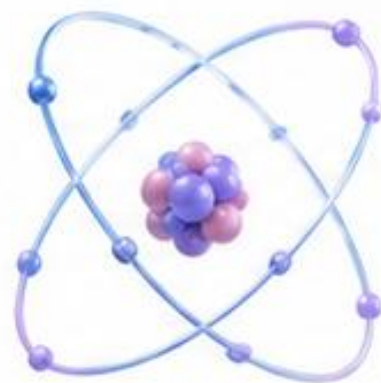


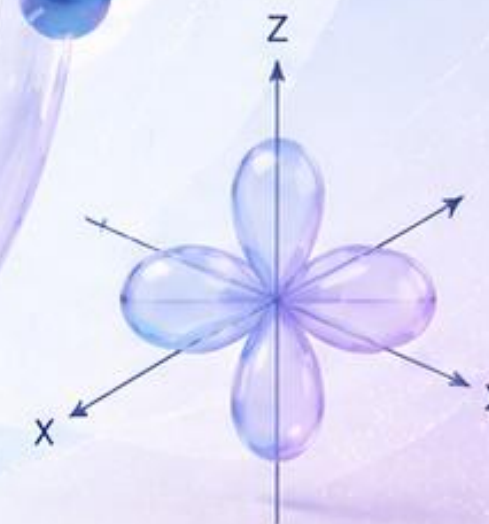
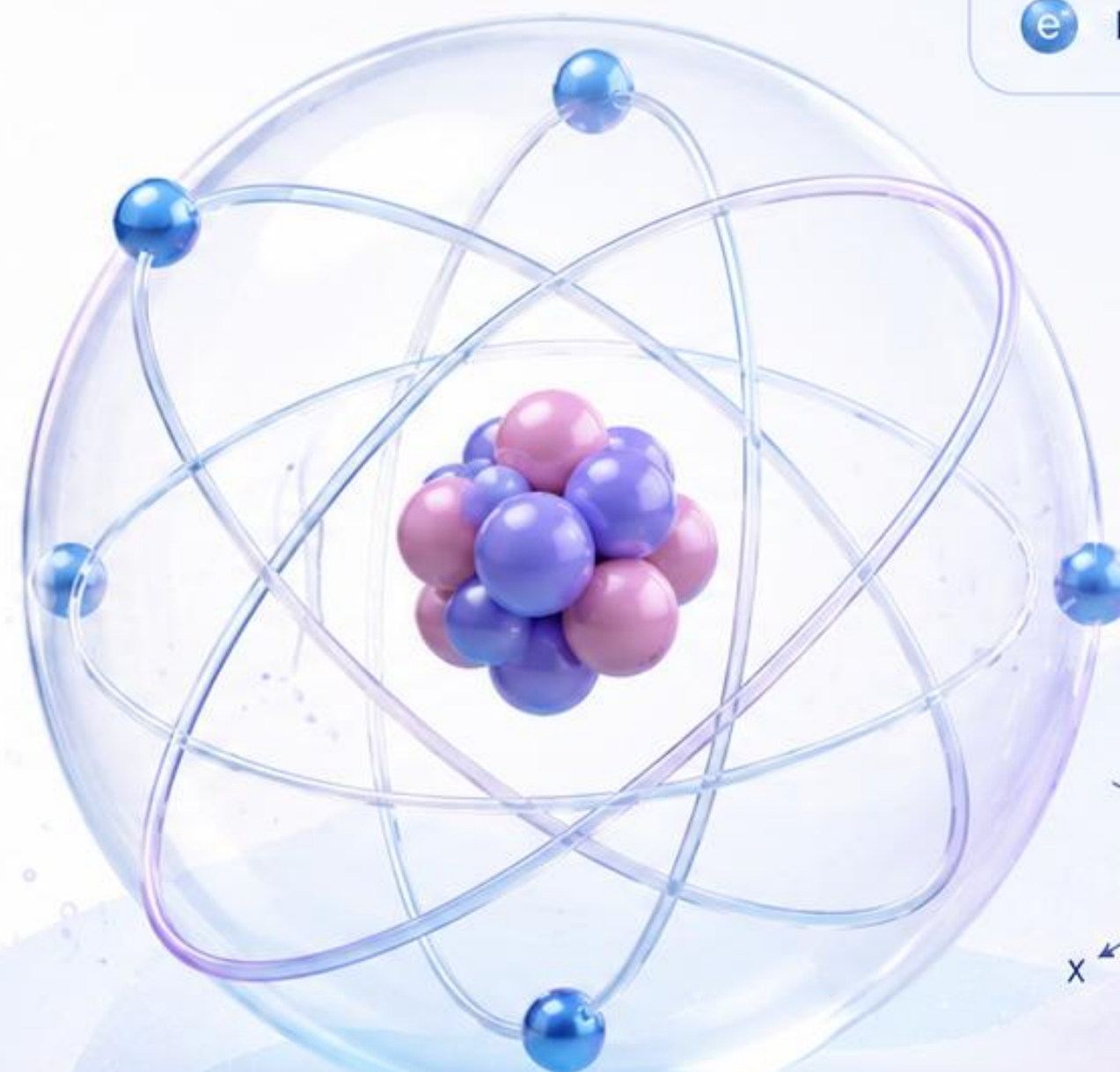
Unit 2

Structure of Atom

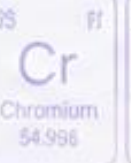
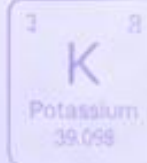
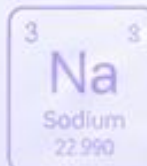
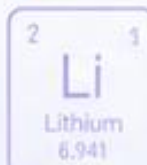


Subatomic Particles

p	Proton	(+)
n	Neutron	(0)
e ⁻	Electron	(-)

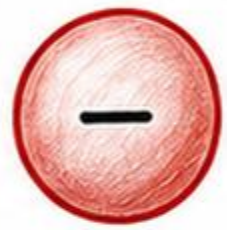


Chemistry Notes | Class 11



STRUCTURE OF ATOM — THE BIG JOURNEY

Dalton described atoms as indivisible building blocks. Later experiments showed that atoms contain smaller particles.



ELECTRON (e^-)

charge = $-1.602 \times 10^{-19} \text{ C}$
mass = $9.109 \times 10^{-31} \text{ kg}$



PROTON (p^+)

charge = $+1.602 \times 10^{-19} \text{ C}$
mass = $1.673 \times 10^{-27} \text{ kg}$



NEUTRON (n^0)

charge = 0
mass = $1.675 \times 10^{-27} \text{ kg}$

CATHODE RAYS

electron found



THOMSON MODEL

positive sphere



α -SCATTERING

tiny nucleus



BOHR MODEL

fixed energy levels

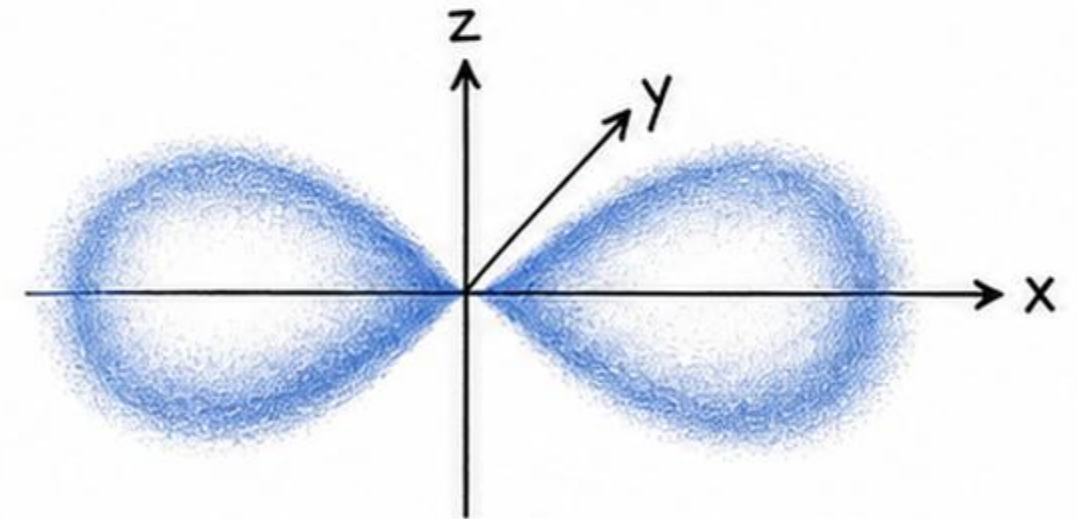
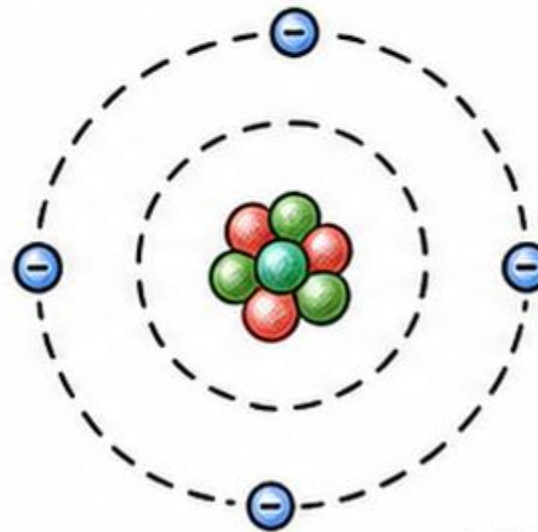


QUANTUM MODEL

probability orbitals

WHAT THIS CHAPTER EXPLAINS

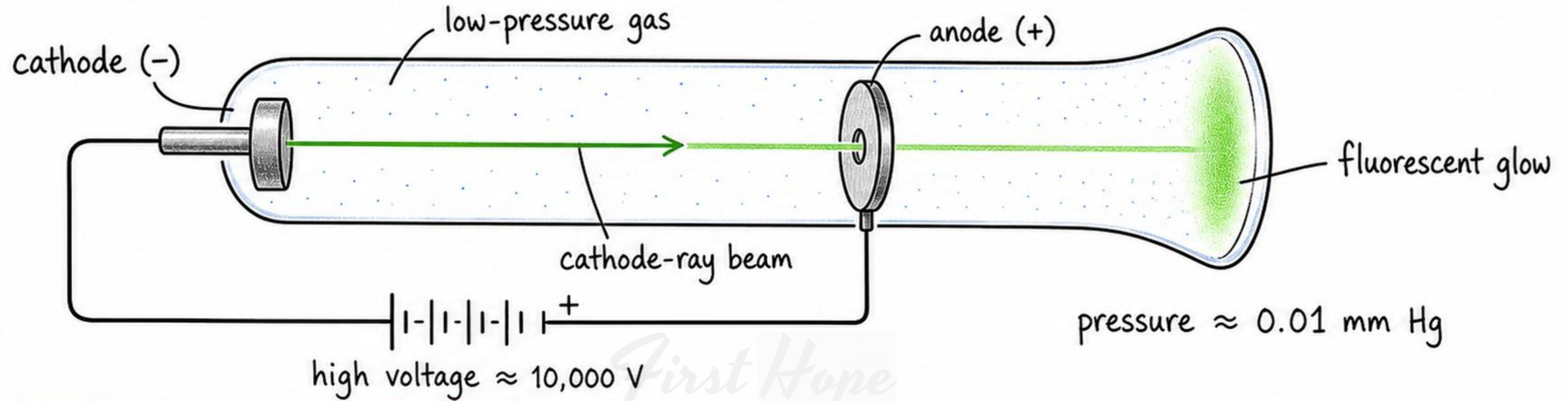
- how subatomic particles were discovered
- why atomic models changed
- how light and atoms exchange energy
- how electrons are described by quantum numbers
- how electronic configurations are written



orbit (fixed path) $\neq$ orbital (probability region)

Atomic models improve when new experimental evidence appears.

CATHODE RAYS AND DISCOVERY OF THE ELECTRON

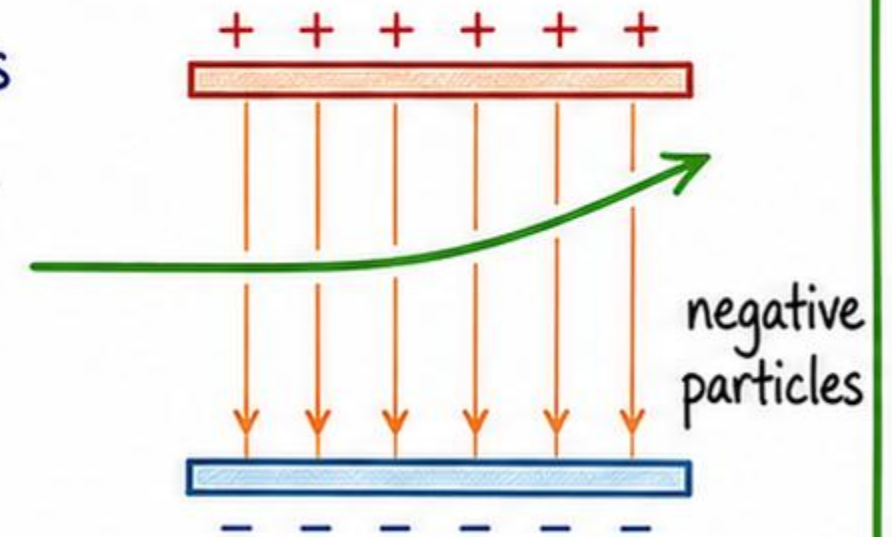


WHAT WAS OBSERVED

- rays start at the cathode and move towards the anode
- they travel in straight lines and cast sharp shadows
- they make a light paddle wheel move — so they carry momentum
- they produce fluorescence and heating

WHAT THE TESTS SHOWED

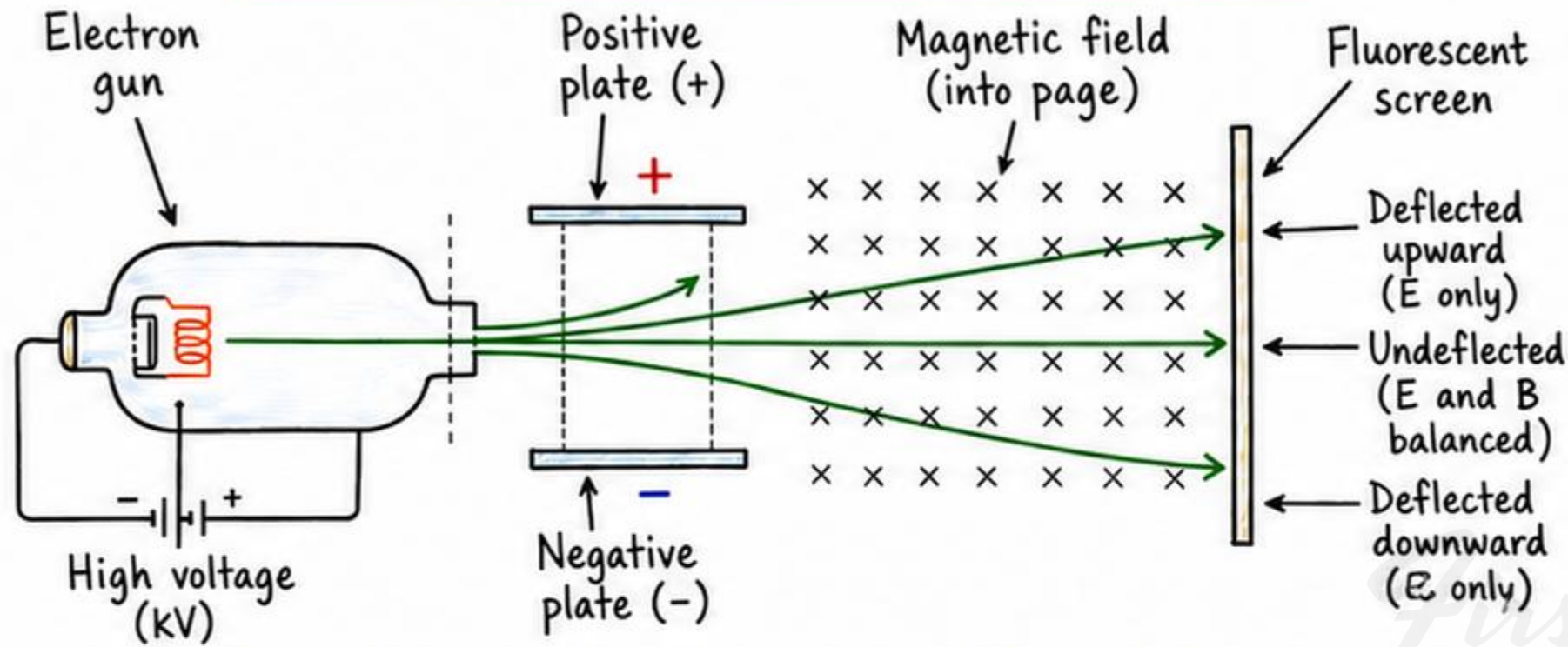
- electric and magnetic fields deflect the rays
- the beam bends towards the positive plate
- behaviour is independent of the gas and electrode material
- cathode rays are streams of negatively charged particles: electrons



J. J. Thomson showed that the electron is a constituent of every atom.

MEASURING THE ELECTRON: THOMSON AND MILLIKAN

THOMSON'S e/m EXPERIMENT

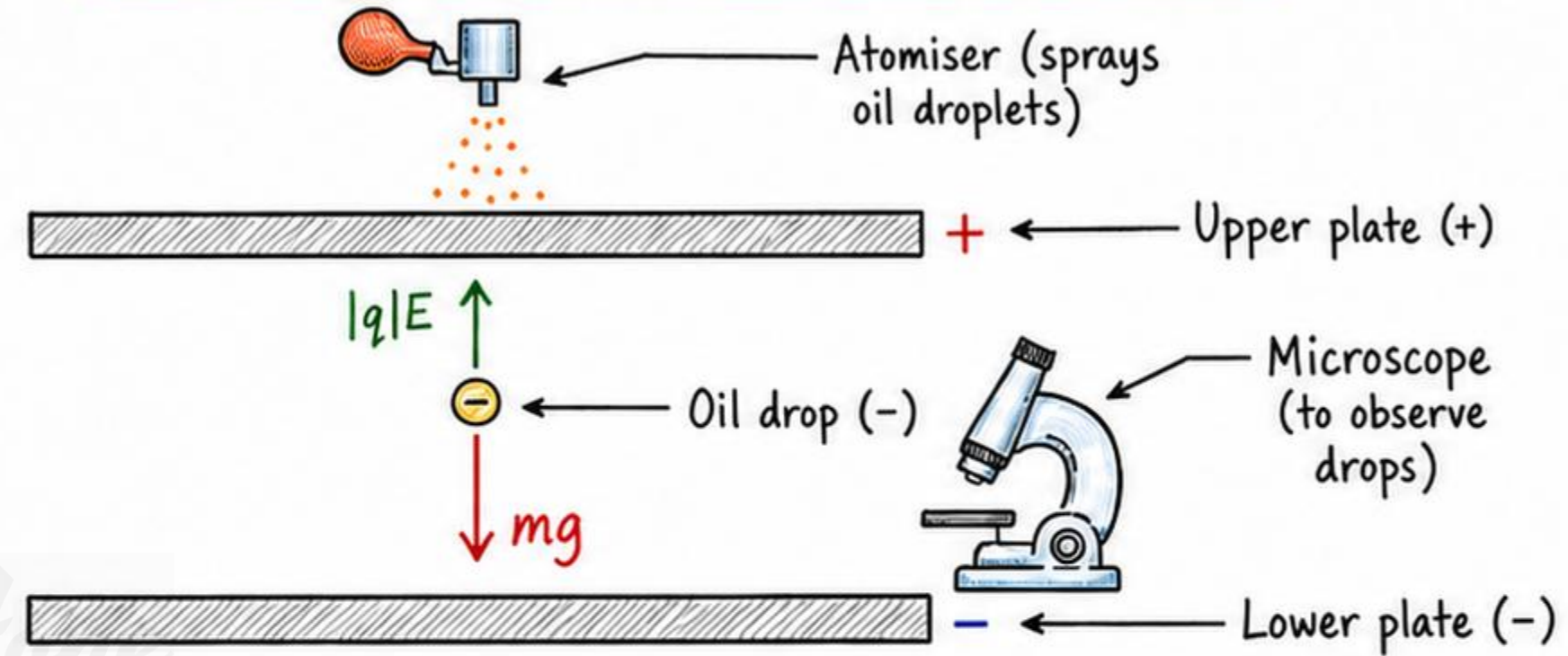


- electric and magnetic fields deflect the electron beam
- the deflection depends on electron charge/mass and field strengths
- balancing the two fields gives the charge-to-mass ratio

$$e/m_e = 1.758820 \times 10^{11} \text{ C kg}^{-1}$$

This value was the same for different gases and cathode materials.

MILLIKAN OIL-DROP EXPERIMENT



- tiny charged oil drops were observed between two plates
- voltage was adjusted until electric force balanced weight
- every measured drop charge was an integral multiple of one basic charge

$$q = ne, \quad n = 1, 2, 3, \dots$$

$$\text{electron charge: } e = -1.602176 \times 10^{-19} \text{ C}$$

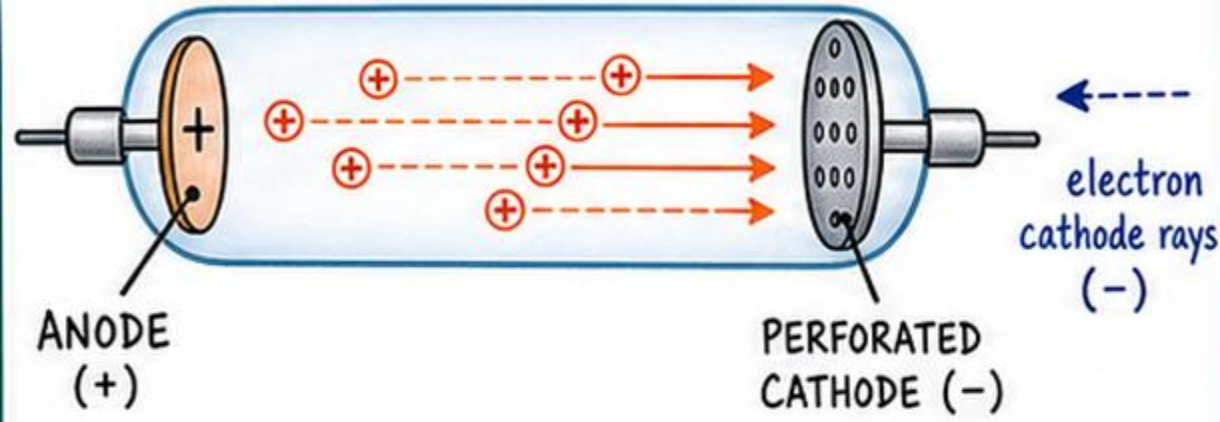
$$\text{electron mass: } m_e = 9.1094 \times 10^{-31} \text{ kg}$$

$$m_e = |e| \div (|e|/m_e)$$

Thomson found e/m_e ; Millikan found e . Together they gave the electron's mass.

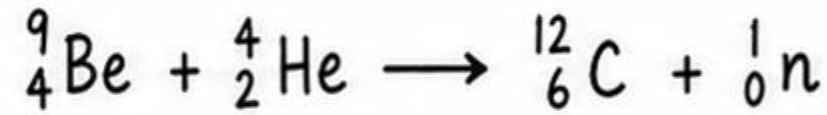
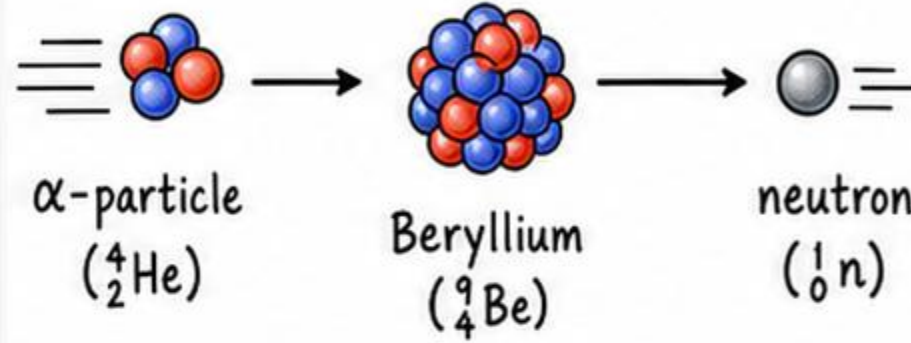
PROTON, NEUTRON AND FUNDAMENTAL PARTICLES

CANAL (ANODE) RAYS



- positive rays move in the direction opposite to cathode rays
- their charge-to-mass ratio depends on the gas in the tube
- the lightest positive particle comes from hydrogen
 H^+ = proton, charge = $+1.602 \times 10^{-19} \text{ C}$

NEUTRON: CHADWICK, 1932

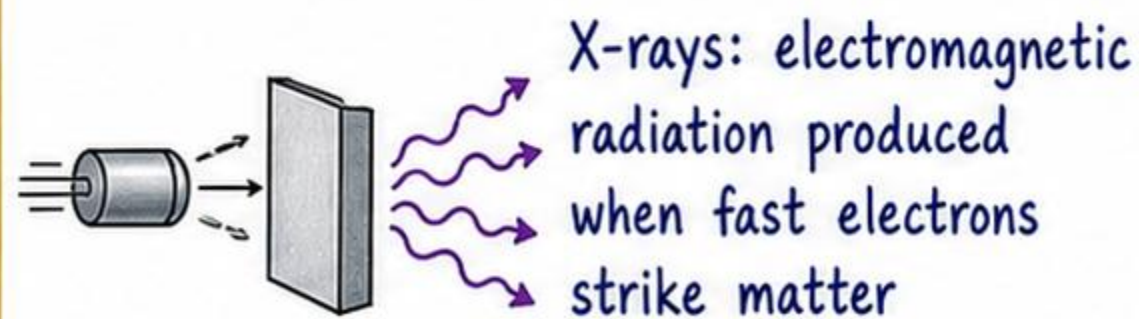


- neutron has no electrical charge
- its mass is nearly the same as a proton

THE THREE FUNDAMENTAL PARTICLES

particle	symbol	relative charge	charge / C	mass / kg
electron	e^-	-1	-1.602×10^{-19}	9.109×10^{-31}
proton	p^+	+1	$+1.602 \times 10^{-19}$	1.673×10^{-27}
neutron	n^0	0	0	1.675×10^{-27}

RELATED DISCOVERIES



α , β and γ radiations arise in radioactive decay



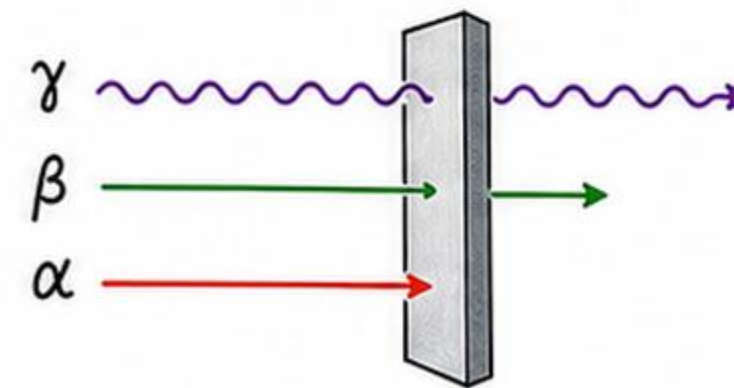
α : positive helium nuclei (${}^4_2\text{He}$)



β : electrons (e^-)



γ : neutral electromagnetic radiation



penetrating power:
 $\gamma > \beta > \alpha$

Electrons surround the nucleus; protons and neutrons are called nucleons.



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