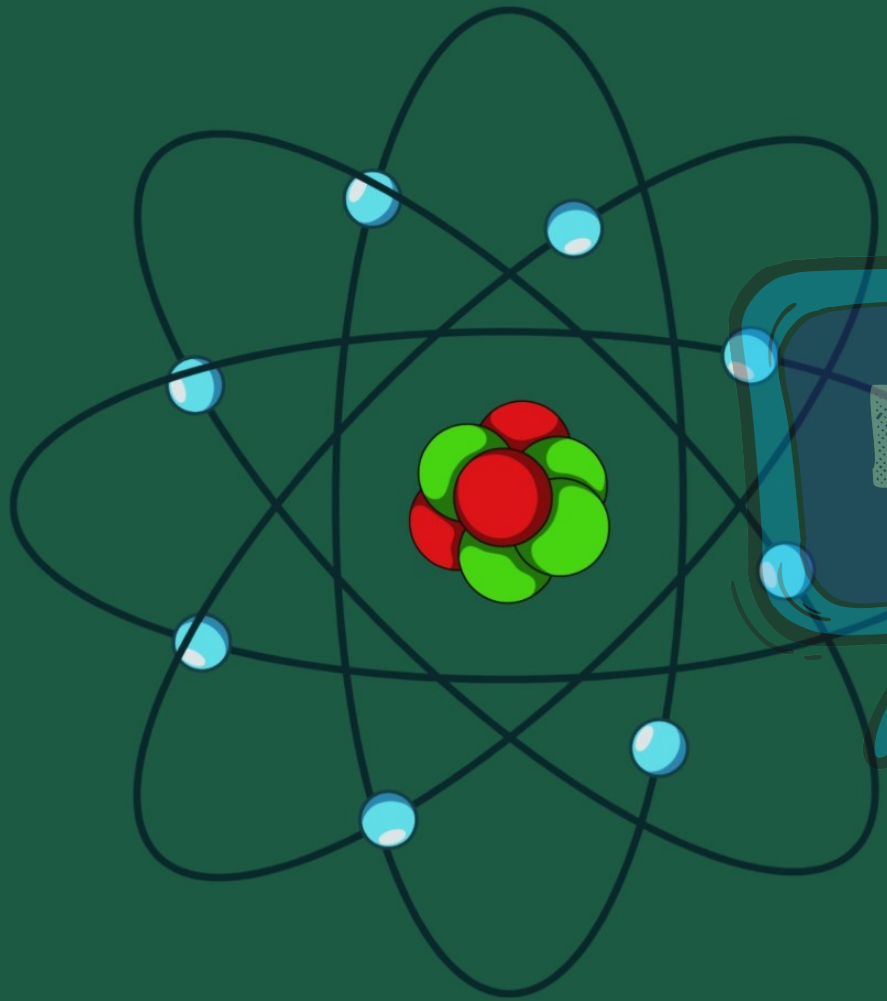
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Class–9

SCIENCE

Chapter – 4

Structure of the Atom

Part – 1

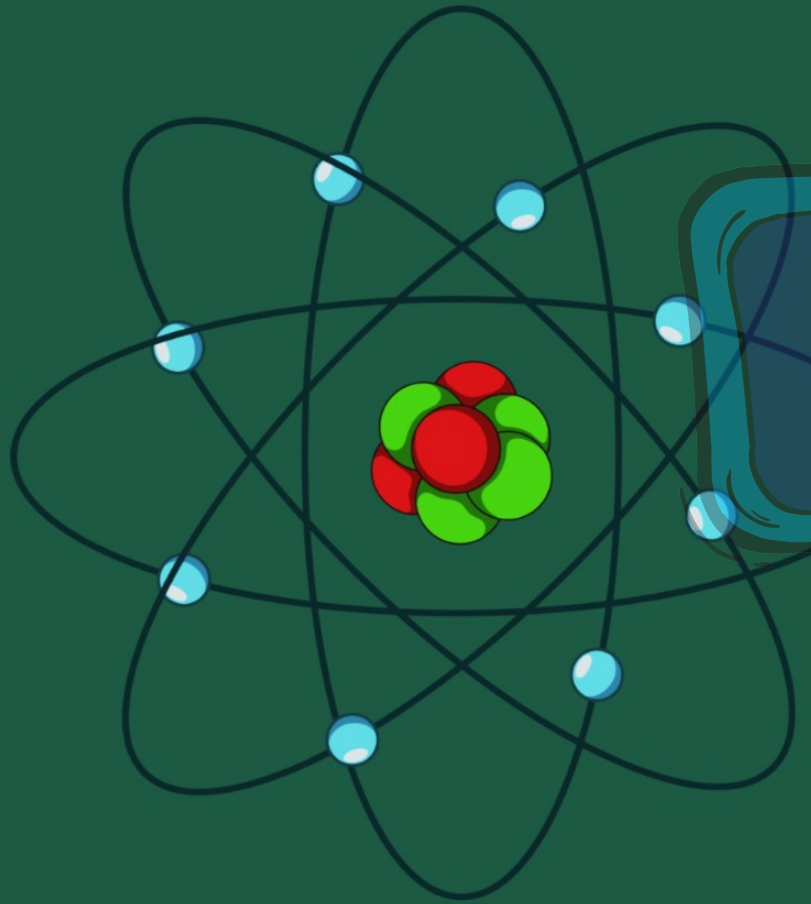
Models of an Atom

Deeksha Pahilajani

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OVERVIEW

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1. Models of an atom
2. Electron Distribution & Valency
3. Atomic Number & Mass Number

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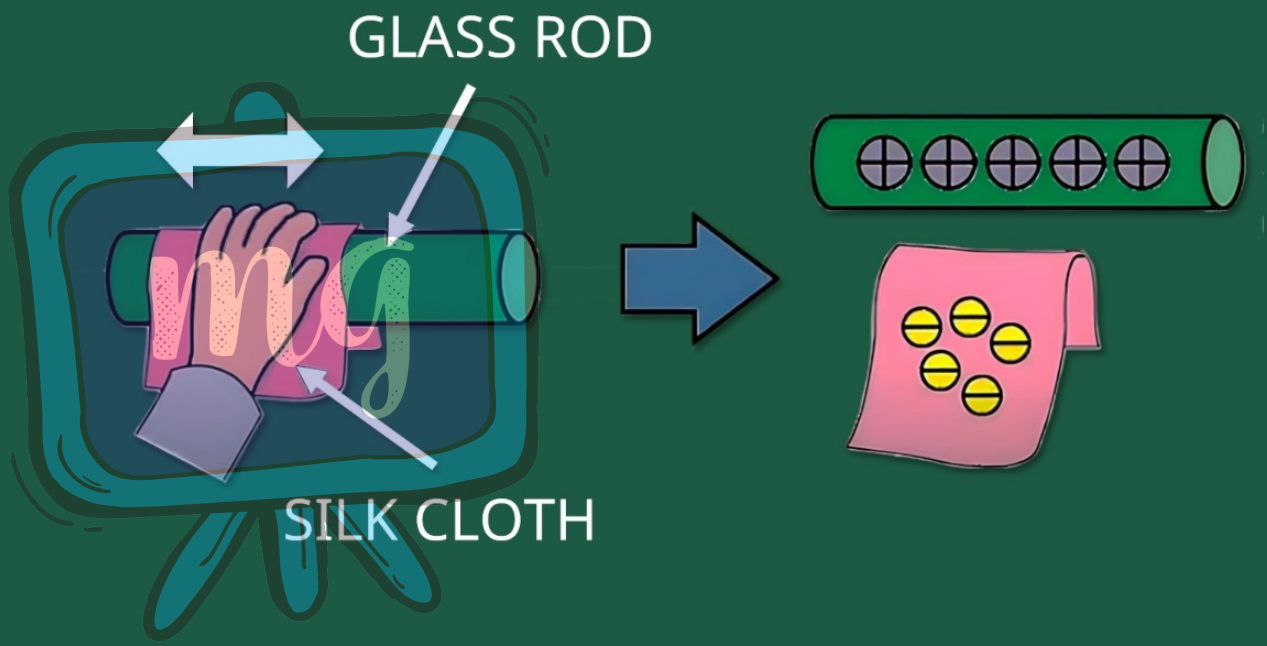
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CHARGED PARTICLES IN MATTER



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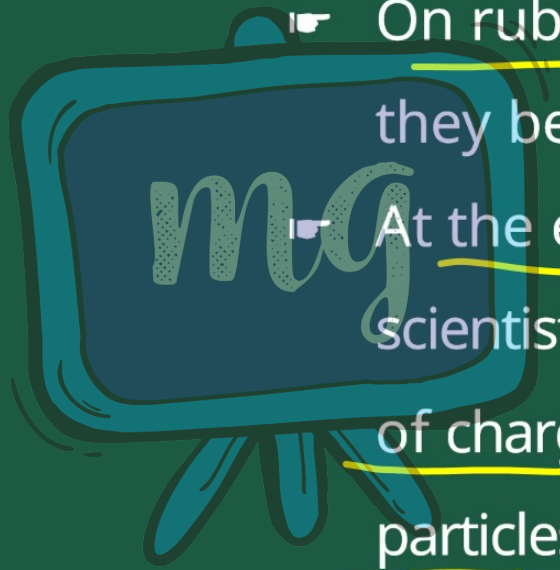
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Existence of charged particle in atom



- On rubbing two objects together, they become electrically charged.
- At the end of 19th century scientists were able to find existence of charged (e– & p+) and neutral particles (neutrons) in the atom.
- These particles were called the 'Sub- atomic Particles'.

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DISCOVERY OF ELECTRON



- Discovery by J. J. Thomson
- Cathode rays experiment
- Negatively charged particles
- Represented by e^-
- Charge on electron = -1.6×10^{-19} C
- Mass of electron = 9.1×10^{-31} kg

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DISCOVERY OF PROTON

- Discovery by E. Goldstein
- Anode rays/canal rays experiment
- Positively charged particles
- Represented by p^+
- Charge on proton = $+1.6 \times 10^{-19}$ C
- Mass of proton = 1.67×10^{-27} kg



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DISCOVERY OF NEUTRONS

- Discovery by J. Chadwick
- Neutral particles
- Represented by ‘n’
- Charge on neutron = 0
- Mass of neutron = 1.67×10^{-27} kg



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1.67×10^{-27} Kg

Subatomic Particle	Relative Charge	Relative Mass
Proton	1	1
Neutron	0	1
Electron	−1	Negligible (1/2000)

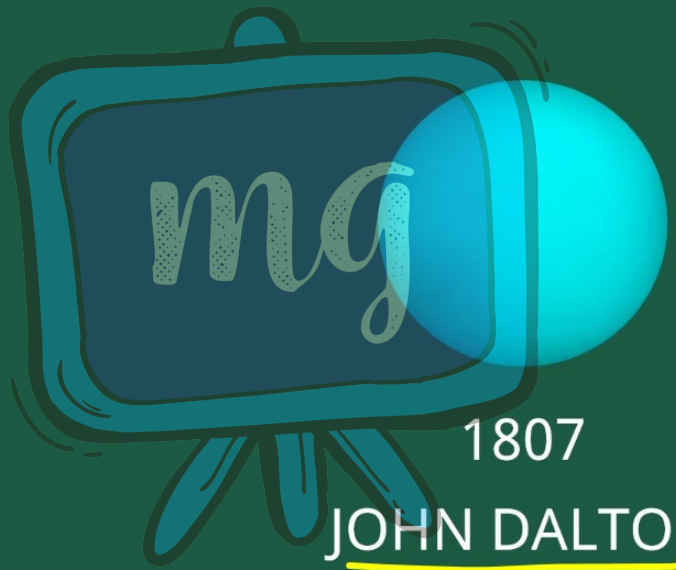
$+1.6 \times 10^{-19}$ C

-1.6×10^{-19} C

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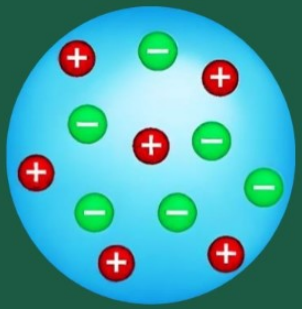
ATOMIC STRUCTURE



1807

JOHN DALTON

Solid sphere model



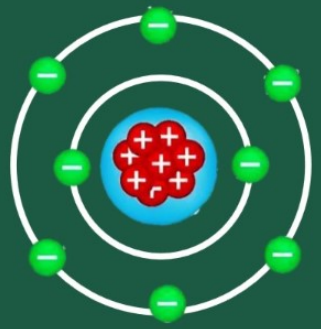
1897

J.J. THOMSON

Plum pudding model

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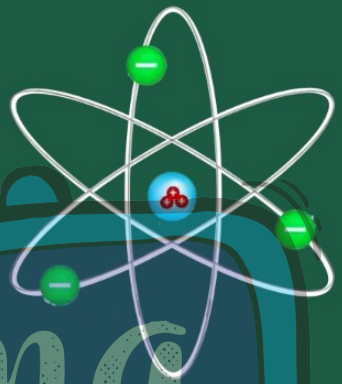
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1911

ERNEST RUTHERFORD

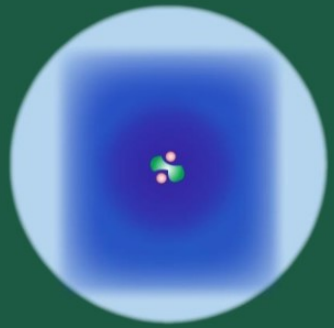
Nuclear model



1913

NIELS BOHR

Planetary model



1926

ERWIN SCHRODINGER

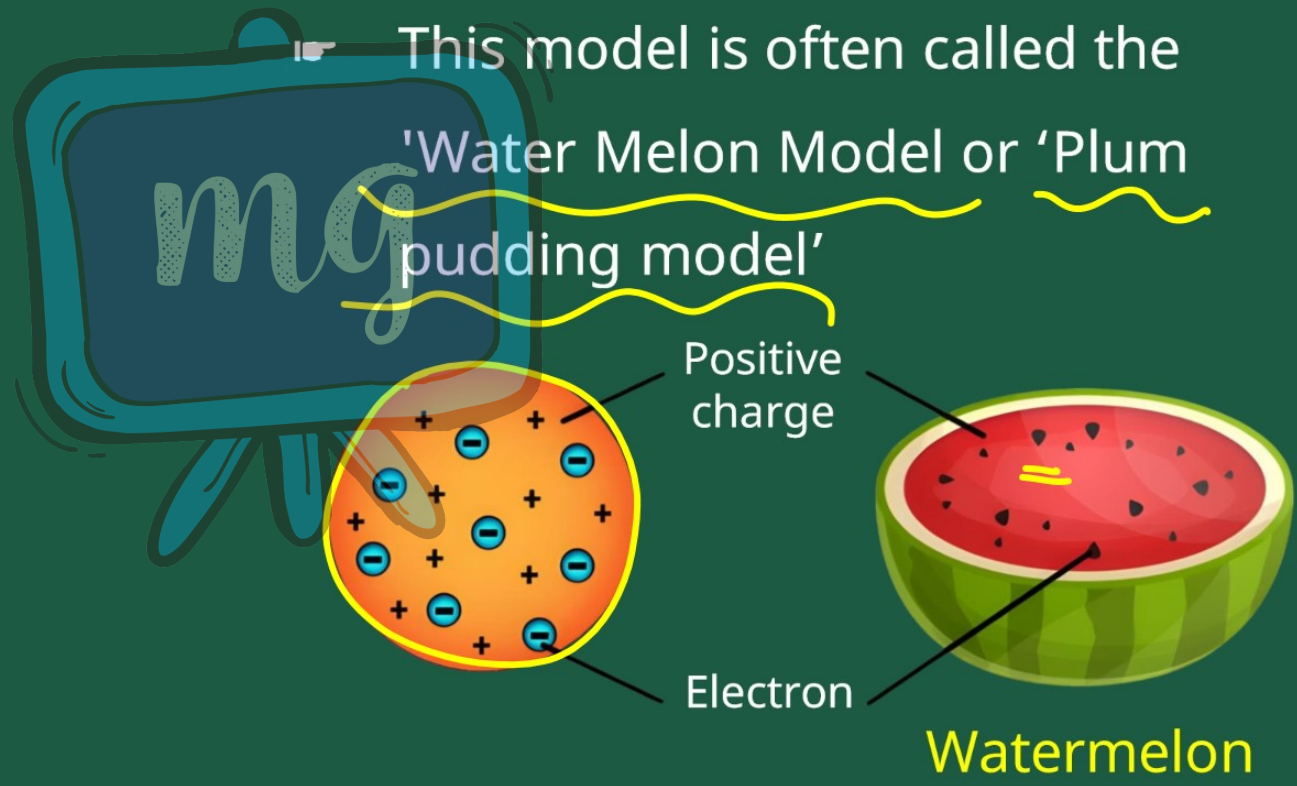
Quantum model

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THOMSON'S ATOMIC MODEL

This model is often called the 'Water Melon Model or 'Plum pudding model'



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Thomson Proposed that:-

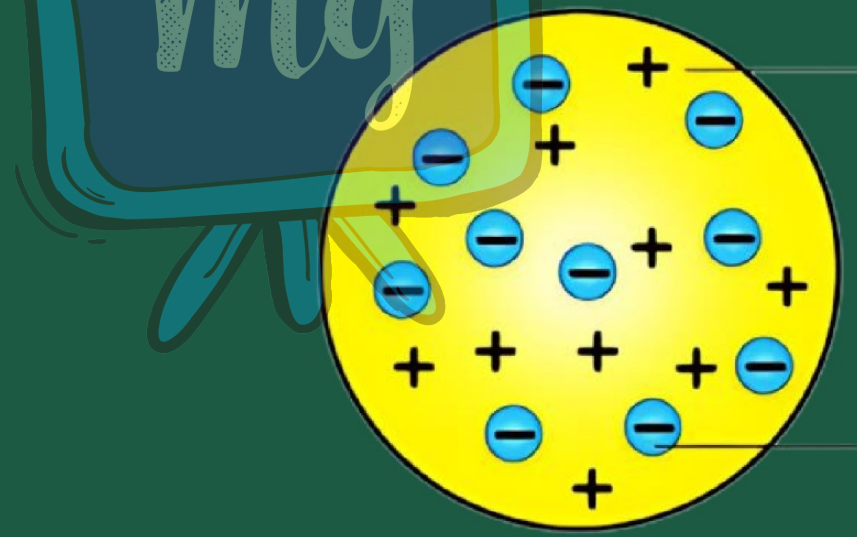
1. An atom consists of a positively charged sphere and the electrons are embedded in it.



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2. The negative and positive charges are equal in magnitude. So, the atom as a whole is electrically neutral.

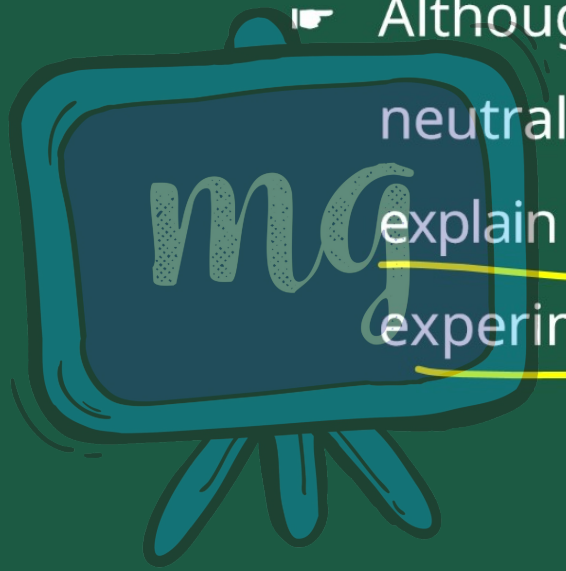


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Drawback of the model

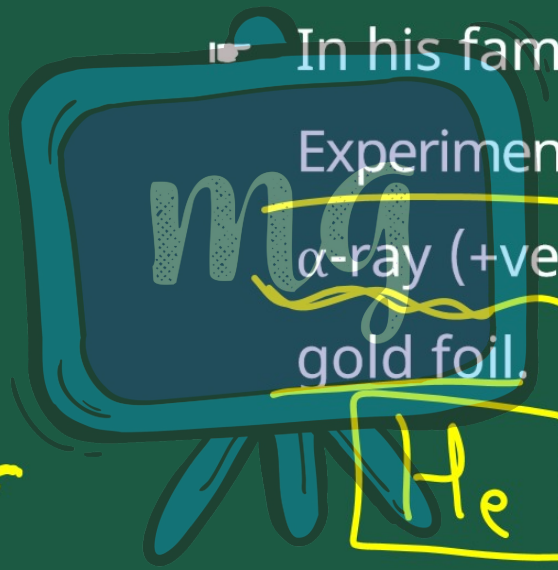
- Although this model explained neutrality of atom but it couldn't explain the results of other scientific experiments conducted on atom.



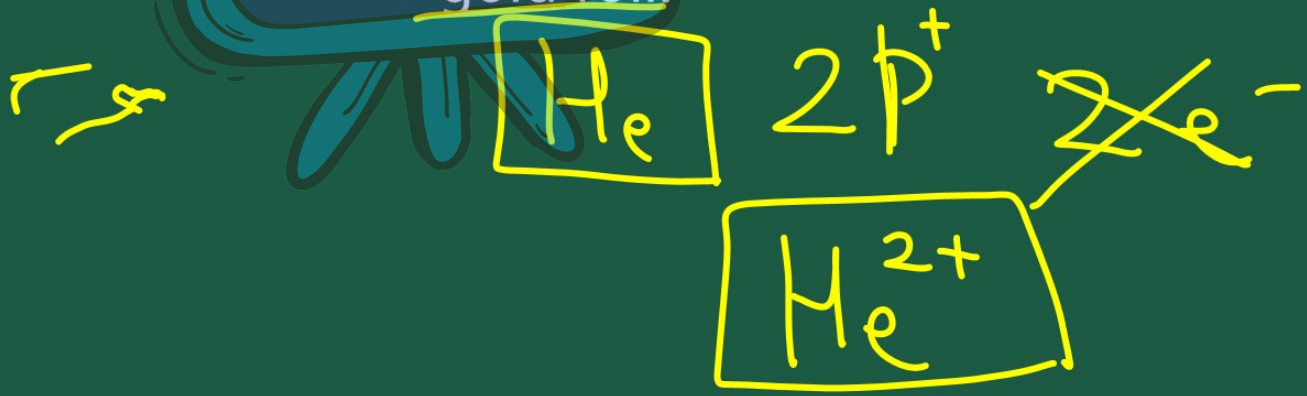
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RUTHERFORD'S ATOMIC MODEL

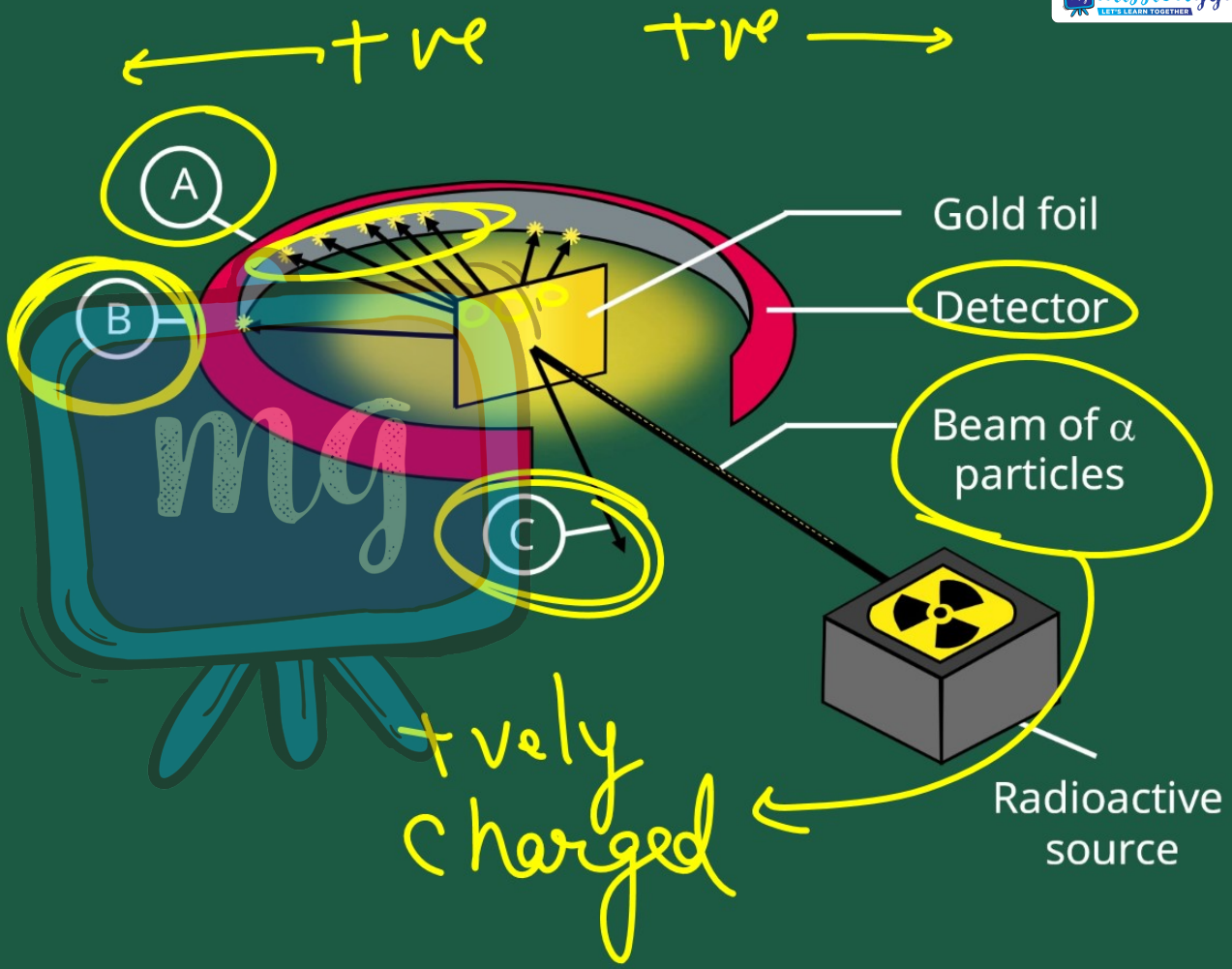


- In his famous 'α-ray Scattering Experiment', Rutherford bombarded α-ray (+ve Helium ion) upon thin gold foil.



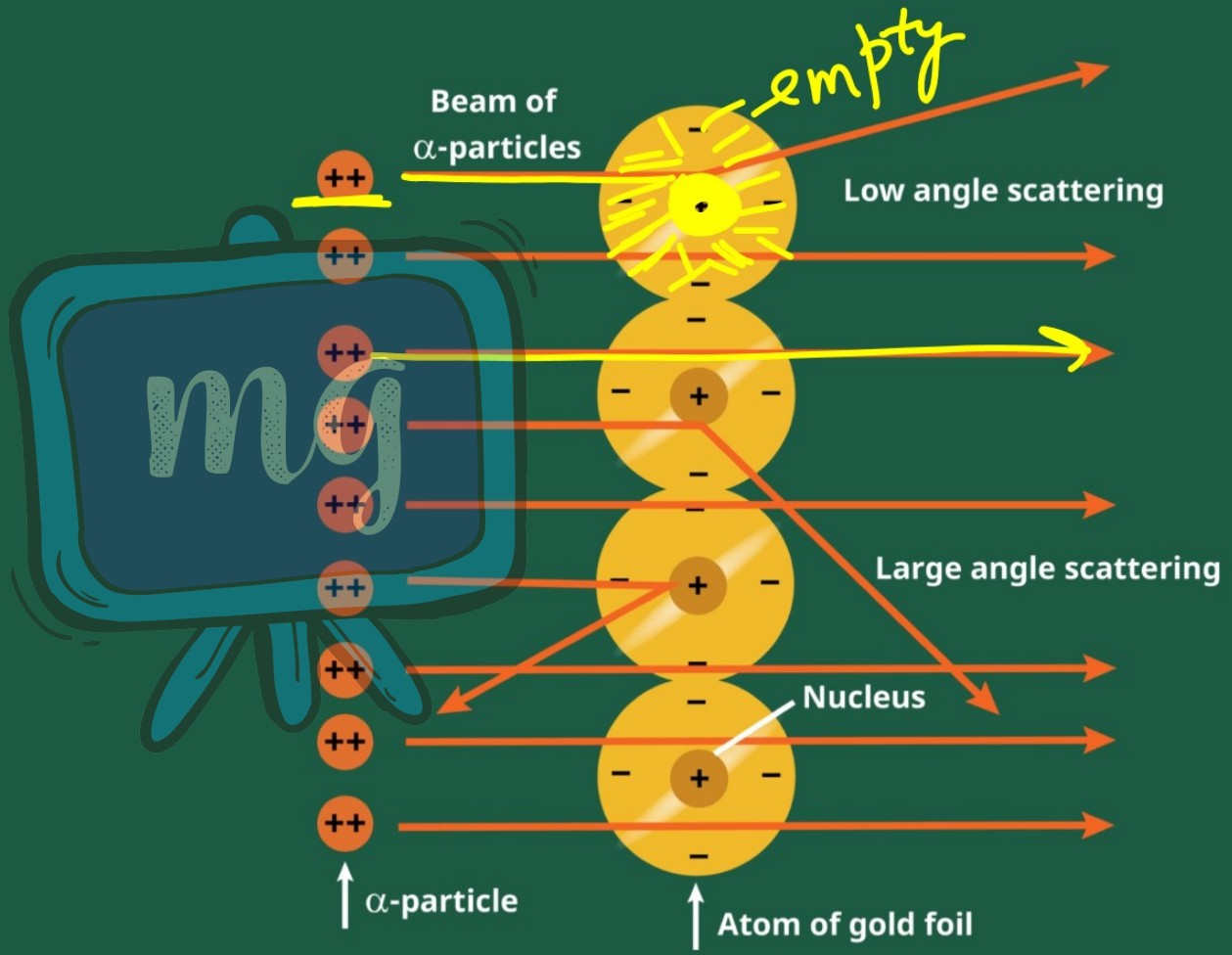
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Observations made by Rutherford in his experiment:-

(a) Most of α-particles passed through gold foil undeflected.

(b) Some of the α-particles deflected by foil by small angles.

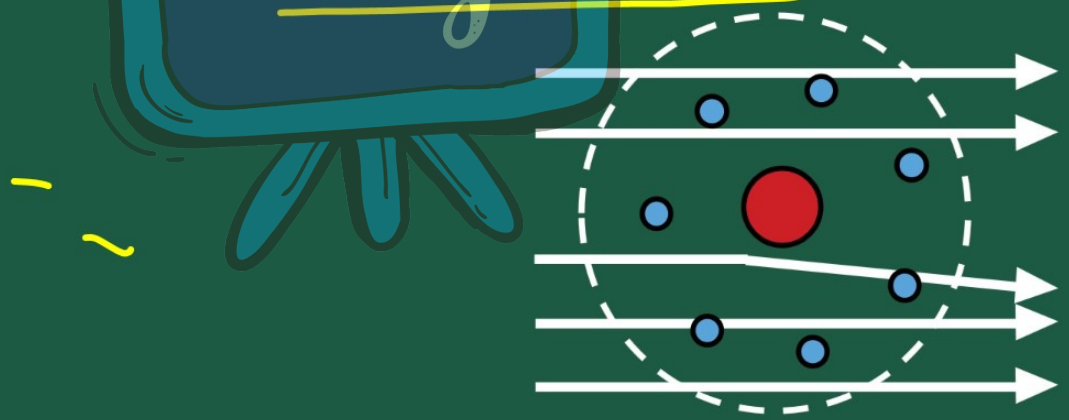
(c) One out of every 12000 particles appeared to rebound.

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Conclusions made by Rutherford:-

(a) Most of the space inside the atom is empty because most of the α-particles passed through the gold foil without getting deflected.

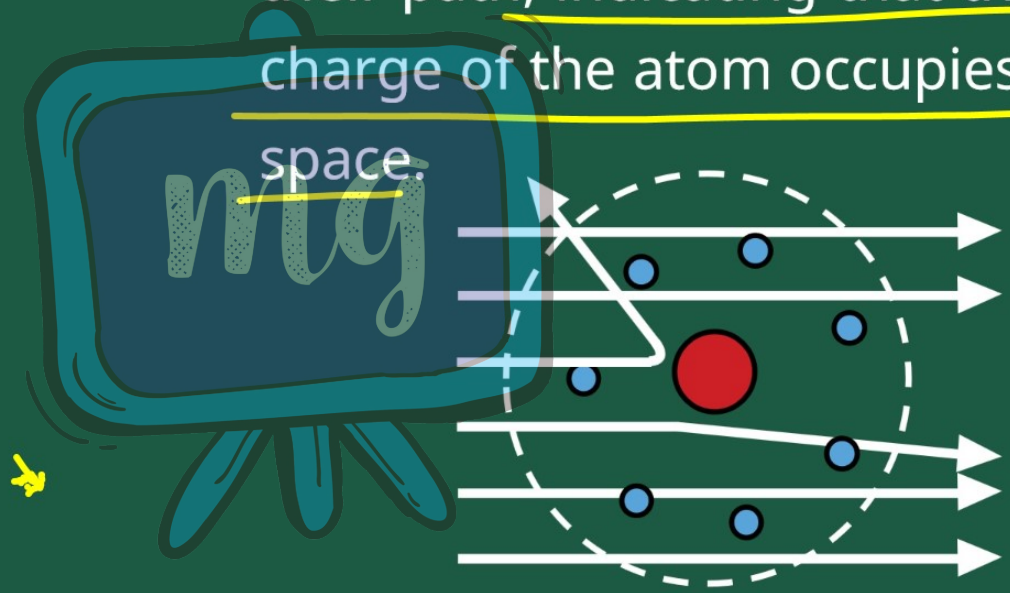


Deflected α-particle

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(b) Very few particles were deflected from their path, indicating that the positive charge of the atom occupies very little space.

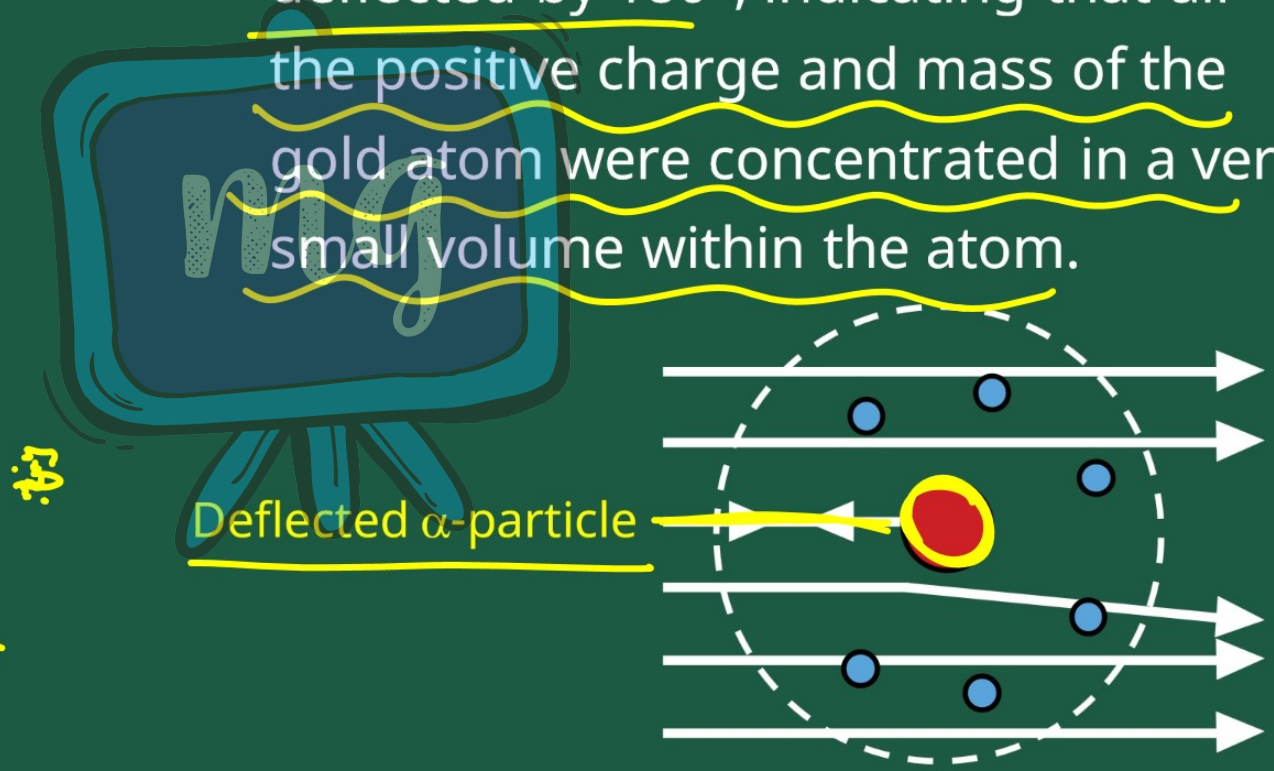


Deflected α-particle

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(c) A very small fraction of particles were deflected by 180°, indicating that all the positive charge and mass of the gold atom were concentrated in a very small volume within the atom.



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Features of Rutherford proposed model of atom:-

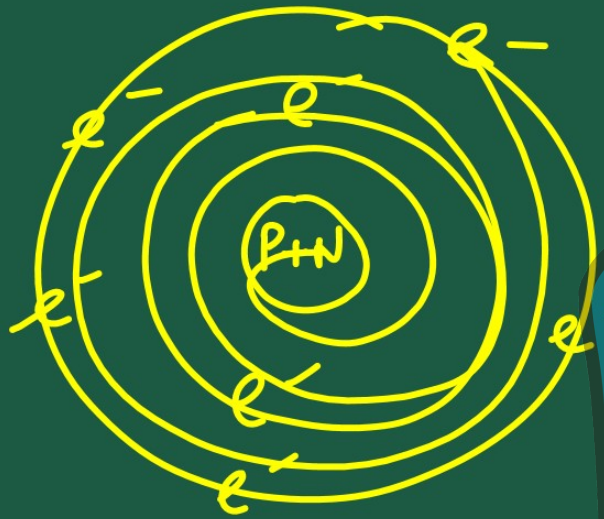
(i) There is positively placed nucleus in an atom. Nearly all the mass resides in nucleus (Proton + Neutron).

(ii) Electrons revolve round the nucleus in well defined orbits.

(iii) Size of nucleus (10^{-15} m) is very small compared to the size of atom.

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Drawbacks of Rutherford's Model (Unstability of Atom):-

- According to Rutherford, electrons revolve round the nucleus in well-defined orbits, but electrons being charged particles will lose their energy and finally will fall into the nucleus.

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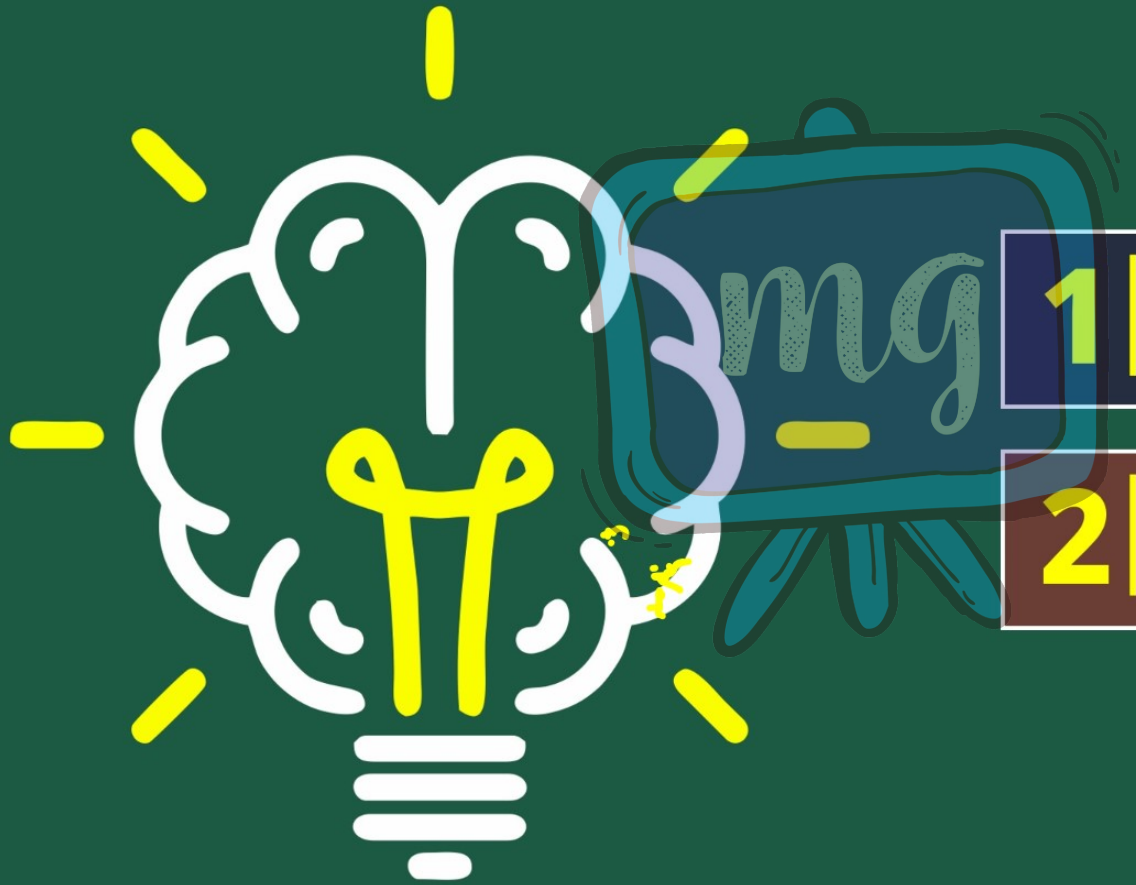
- This will make atom highly unstable.
- This was unexplained by him.



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LEARNING OUTCOMES

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1. Introduction to sub-atomic particles
2. Models of an atom

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ASSESSMENT

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1 Which subatomic particle carries a negative charge?

A Proton

B Nucleons

C Electron

D Neutron

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ASSESSMENT

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2 Who proposed the model of the atom known as the "Plum Pudding" model?

A J.J. Thomson

B Ernest Rutherford

C Niels Bohr

D Erwin Schrödinger

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ASSESSMENT

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3 Rutherford's alpha-particle scattering experiment was responsible for the discovery of

A Atomic Nucleus

B Electron

C Proton

D Neutron