

Chapter - 12 Atoms

- John Dalton $\rightarrow$ Atomic Theory (1805)
- J J Thomson $\rightarrow$ Proposed the structure of atom (1898)
- Ernst Rutherford $\rightarrow$ Atomic Model (1908)
- Neil Bohr $\rightarrow$ Atomic model (1912)
- Heisenberg $\rightarrow$ Uncertainty principle (1927)

Atom - is the basic unit of matter that consist of a ^{dense} ~~gas~~ central ~~nucleus~~ nucleus surrounded by a cloud of negatively charged e^{-} 's

* Dalton's Atomic theory :

- Matter consist of individual atoms
- All atoms of a given element have identical properties including identical mass. Atoms of different elements have different masses
- Compounds are formed when atoms of different elements combine in fix ratio
- Chemical reactions involve re organisation of atoms. These are neither created nor destroyed

• Dalton atomic theory explains:

- Law of conservation of mass
- Law of constant proportion
- Law of multiple proportion

• Limitations:

- 1) Fail to explain subatomic particles
- 2) Fail to explain static electricity

* Thomson model of atom:

• An atom is a sphere of positive charges having radius of the order 10^{-10} m in which entire mass and positive charge of atom is uniformly distributed

• Within the sphere the electrons are embedded in the sphere of positive charges just like seeds in the watermelon or plums in the pudding. So Thomson model of atom is called plum pudding model.

• The number of electrons in the atom are such that their total negative charge is equal to the total positive charge of the atom

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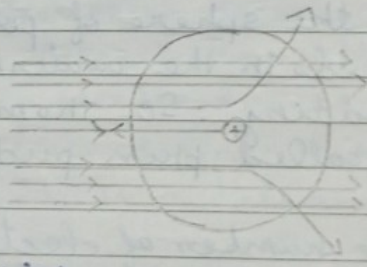
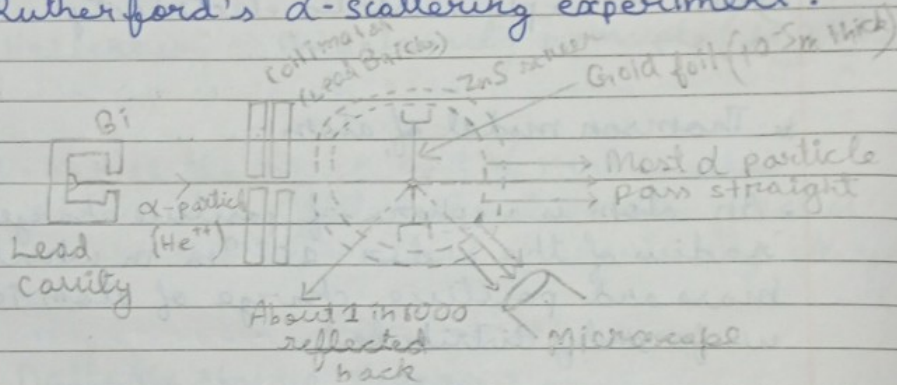
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. Limitations :

- 1) It could not explain the origin of spectral lines in the form of series as in the case of hydrogen atom
- 2) It could not account for the scattering of alpha particles

* Rutherford's α -scattering experiment :



Observation/Conclusion

- 1) Most of the part of atom is empty as 99.95% of α -particle pass undeviated

the origin of
form of series as in
atom

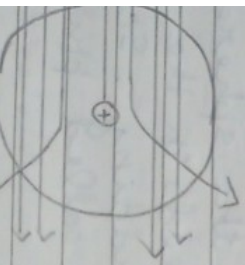
for the scattering of

ing experiment:

Gold foil (10 nm thick)

Most of particle
pass straight

Microscope



2) There is some positive charge inside atom
in a very small space as 0.14% of α -particle
deviated by 1° .

3) The positive charge inside the atom is
concentrated in an extremely small space called
nucleus (approx size 10^{-15}m) as one in
 10^{-6} α -particles deviated by 180°

4) The number of α -particles scattered at a
particular angle θ is different for
different particles
It is given by

$$N = \frac{K Z^2}{\sin^4(\theta/2)} \quad \left(\begin{array}{l} Z = \text{atomic no.} \\ K = 1/4\pi\epsilon_0 \end{array} \right)$$

5) The electrons are attracted by positive
nucleus but electrons do not move
towards the nucleus. It is due to
electrostatic force as centrifugal force
and revolves in a circular orbit around
the nucleus.

Distance of closest approach (r_0)