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Structure of atom

John Dalton assumed that atom is indivisible.

- In 1866 E. Goldstein discovered the presence of new radiations in a gas discharge tube and called them canal rays. These rays were positively charged radiations which led to the discovery of sub-atomic particle called proton.

In 1900 J.J. Thomson discovered the sub-atomic particle—the electron with a negative charge.

Structure of an Atom

2.Rutherford’s model of an atom

A-Particles: (+ 2 charge and 4 mass) when fast-moving a-particles are bombarded on very thin gold foil, following observations were made:

- Most of the α-particles passed straight through the gold foil.
- Some of the α-particles were deflected by the foil by small angles.
- One out of 12000 particles appeared to rebound.

Conclusions made by Rutherford based on his observations:

- Most of the space inside the atom is empty because a-particles passed through the gold foil.

- Very few particles were deflected from their path because +ve charge of the atom occupies a very little space.

- A very small fraction of a-particles were rebounded back, shows all + ve charge and mass of the gold atom is concentrated in a very small volume within an atom.

- The radius of the nucleus calculated was 105 times less than the radius of the atom.

Nuclear Model of an Atom

- Centre → +ve charge → called nucleus. All mass resides in nucleus.

- Electrons → revolve around the nucleus in orbits.

- Size of the nucleus is very small as compared to the size of the atoms.

Drawbacks of Rutherford's model of the atom: When an electron undergoes acceleration, it radiates energy. Thus revolving electron would lose energy and finally fall into the nucleus. Due to this atom should be highly unstable and hence matter would not exist in the form that we know.

But we know that atoms are quite stable.

Bohr's Model of Atom

Postulates of Neil Bohr

- Only special orbits known as discrete orbits of electrons are allowed inside the atom.

- While revolving in discrete orbits the electrons do not radiate energy. These orbits are called energy levels.

Orbits or shells are represented by K, L, M, N or the numbers, n = 1, 2, 3, 4

Neutrons

Distribution of electrons in different orbits (Shells) given by Bohr and Bury: Rules:

- Maximum number of electrons present in a shell is given by $2n^2$ (n = shell number)

E.g., n = 1 (K shell) $2(1)^2 = 2$ electron

- The maximum number of electrons that can be accommodated in the outermost orbit is 8.

- Electrons are not accommodated in a given shell unless the inner shells are completely filled.

Definitions

- Valency: The combining capacity of an atom is called its valency,
- Atomic number: It is equal to a number of protons.
- Mass number: It is equal to the sum of protons and neutrons.

Isotopes: Atoms of the same element with same atomic number but a different mass number, are called isotopes.

Chemical properties → same but Physical properties → different

Applications of isotopes:

- An isotope of Uranium used as fuel.
- An isotope of Cobalt is used in the treatment of cancer
- An isotope of Iodine is used in the treatment of goitre.

Isobars: Atoms of different elements with same mass number but different atomic numbers are called isobars.

Soni kumari (chemistry)