

Introduction

- * we have learnt that atoms and molecules are the fundamental unit of matter. The existence of different kind of matter is due to different types of atoms and molecules present in them.
- * John Dalton consider atom to be an indivisible entity but his concept had to be discharged at the end of 19th century when scientist throw experiments where able to find ~~existence~~ of charged electrons and ~~protons~~ and neutral particle.

The atoms of different elements different in number of electrons, protons & neutrons.

charged particles in matter

- * The particles that carry an electrical charge are called charged particles generally on rubbing 2 objects together they become electrically charged it means that some charged particles are present with in the atoms or atom is made up of some charged particles are electron and proton.

Lorenz :- When you rub comb with hair it acquire electron and thus become negative charge and attract paper pins.

- * The charged acquired by the two objects are opposite in nature but the same in magnitude.

Discovery of electrons

J J. Thomson performed an experiment by passing electricity at a high voltage through a discharge tube containing a gas at a very low pressure. A green fluorescence was seen emitting out from the other end of the discharge tube.

- * The fluorescence is a result of ray emitting from the cathode (negative) towards the anode (positive) in the discharge tube. Hence, these rays are called cathode rays. From this his experiment Thomson arrived at the conclusion that cathode rays are nothing but a stream of negative charged particles. These negatively charged particles are called electrons.

Discovery of proton

- * A German scientist E. Goldstein in 1886 conducted the discharge tube and passed electric current through it. He found that the positively charged rays were emitted from the anode in the discharge tube and these rays are called canal rays.
- * When an electric field was applied these rays deflected toward the negative charge plate. Thus, Goldstein concluded that an atom contains positively charged particles along with electrons. These positively charged particle are named as proton by a British scientist Ernest Rutherford.

Discovery of Neutron

- * In 1932, James Chadwick observed that when Beryllium was exposed to α particles different kinds of particles were emitted. These particles have same mass as proton and carried no electrical charge. Hence Chadwick named this particle as Neutron.

- * These were present in the nucleus along with protons. Neutron Remark are present in nucleus of all atoms except f

except Hydrogen.

* As proton and Neutron are both present in the nucleus.
They are together known as nucleons.

Properties	Electron	Proton	Neutron
symbol	$-e^0$ (-ve)	p^+ , (+ve)	n^0 (Neutral)
location of the atom	outside the Nucleus	Inside the Nucleus	Inside the Nucleus
Relative charge	-1	+1	0
Absolute charge	$1.6 \times 10^{-19} C$	$1.67 \times 10^{-27} C$	0
Absolute Mass	$9.1 \times 10^{-31} kg$	$1.67 \times 10^{-27} kg$	$6.67 \times 10^{-27} kg$
Absolute mass	$9 \times 10^{-28} g$	$1.6 \times 10^{-24} g$	$6.6 \times 10^{-24} g$

STRUCTURE OF ATOM

According to the Dalton atomic theory atom was indivisible and indestructible.

Now the discovery of two fundamental particles electron and Proton inside the atom lead to the failure of this theory.

except of Dalton theory to know the arrangement of electron & proton with in atom many scientist proposed various atomic theory.

Thomson's model of an atom.

According to J.J Thomson the structure of an atom can be compared to ~~be~~ a water melon where electron are present inside of positive sphere the positive in the atom is spread all over like the ~~red part~~ edible part of the watermelon while the electron are spread in the positively charged sphere like the seeds in the water melons.

The mson model of an atom is popular known as Palam pudding or crissies pudding model of an atom. the negative charge of an electron & the positive charge of a sphere is equal in magnitude.

thus an atom as a whole is neutral

Limitation of Thomson's atomic model

- * This model couldn't explain the experiment of other scientist such as Rutherford as there is no nucleus in the atomic model propose by Thomson.

- * It couldn't explain the stability of an atom such that how positive & negative charge could remain so close together
- * Thomson's model couldn't explain why different elements have different properties.

Rutherford's Model of an atom

Introduction

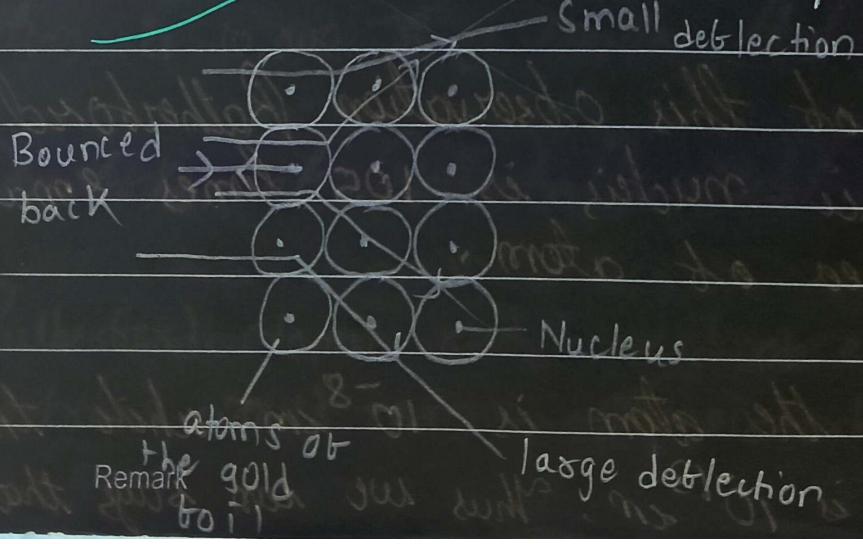
According to Rutherford the positively charged particle & the majority of the mass of an atom said to be confined in a small volume. He referred to this area is Nucleus another idea put forward by Rutherford nuclear model was that an atom nucleus should be surrounded by negatively charged particles of electron. Rutherford also suggested that the electron circle the nucleus. He called the electrical path orbit.

Rutherford scattering experiment

- * Rutherford selected a gold foil as he wanted thin.
- * The gold foil used by rutherford was 0.004 mm in thickness that the foil was about 1000 atoms.

- * In his experiment fast moving α particle was made to fall a thin gold foil
- * The α particles are helium ion +2 charge then atomic mass is $4u$. Hence a high velocity beam of α particle has a lot of energy.
- * This particle was study by flashes of light they produced on striking zinc sulfide screen.
- * The α particle are much harder than the sub atomic particles present in gold
- * Hence he expected the α particles to pass through with little deflection and struck the zinc sulfide screen but the observation he made were quite unspectable

Result of Rutherford Gold experiment



- * Rutherford postulated that the atoms must contain large empty space as most the α particles pass without getting deflection.
- * Some α particles are deflected by the boil through small angles while some are deflected through large angle. Thus Rutherford concluded that the +vely charge particles in an atom ~~is~~ must be constructed in a very small space.
- * ~~Out~~ One out of every 12,000 particles was deflected through 180° showing a bubblecount. Thus, Rutherford came to the conclusion that all the '+' charge of the atom and most of the mass of the atom is constructed in a very small volume within the atom.
- * Rutherford name the small space inside the atom as the nucleus of the atom or the atomic nucleus.
- * On the basic of this observation Rutherford calculated that the atomic nucleus is 105 times smaller then the total area of atom.
- * The radius of the atom is 10^{-8} cm while the radius of the nucleus is 10^{-13} cm. Thus we can say that the atom

is relatively large with a heavy atom at its centre
the electrons are arranged around the nucleus ~~per~~
processes negligible mass.

Rutherford's Atomic Model

- * Based on the result of α particles scattering experiment Rutherford put forth his atomic model.
- * An atom contains positive charge centre called the nucleus of the atom almost all the mass of atom is contained in the nucleus.
- * The electrons of the atom revolves around the nucleus in a fixed orbit.
- * The size of the nucleus is mainly the smaller than the smallest size of the atom the nucleus of the atom is 10,000 times smaller than the atom.

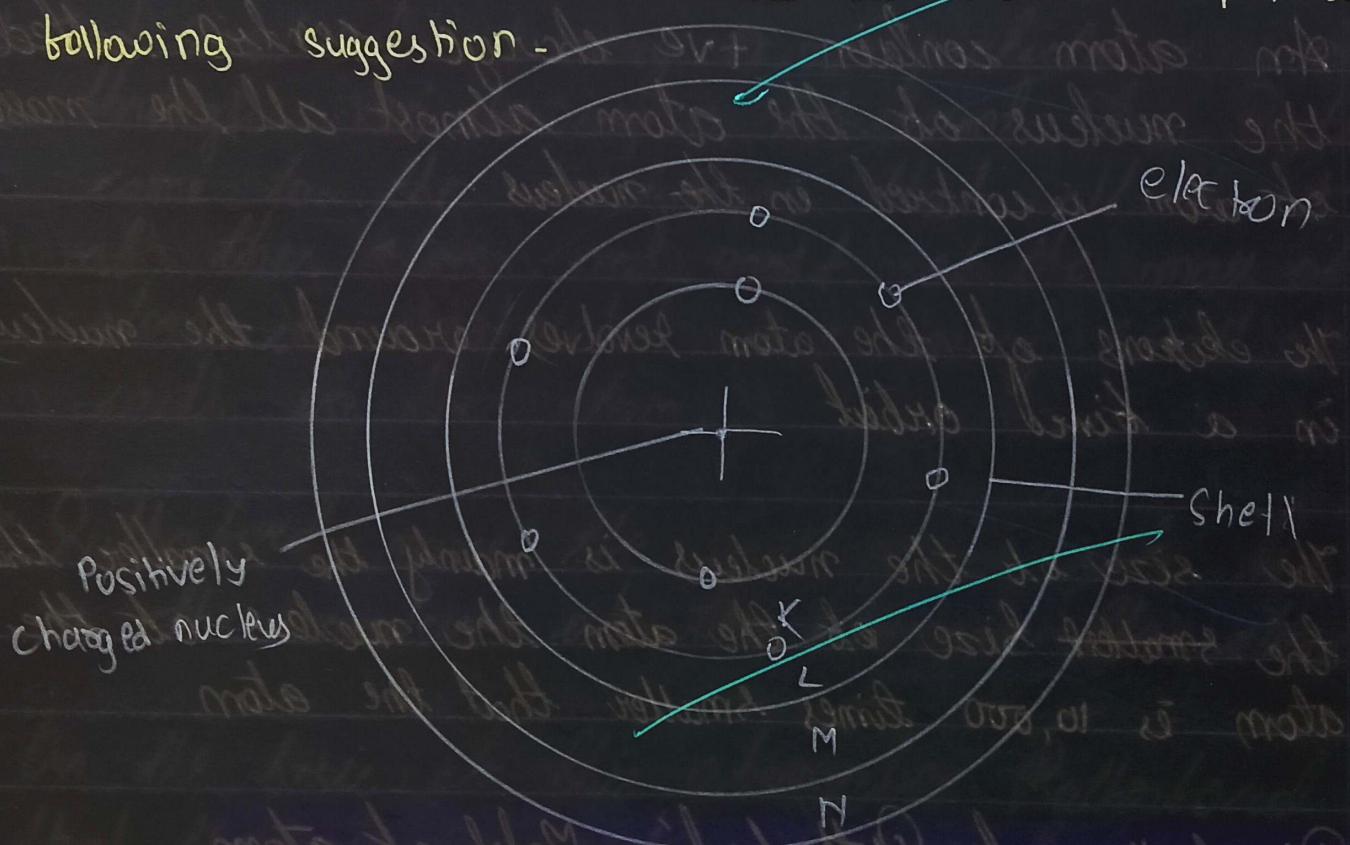
Drawbacks of Rutherford's Model of atom

- * Rutherford atomic model could not explain how moving electrons would remain on their orbit.

- * Any charge particles during acceleration would radiate energy while revolving. It could loss its energy and eventually fall into the nucleus.
- * This means the atom would be highly unstable that the matter is composed of stable atoms. Thus, the major drawback of Rutherford's atomic model was that it could not explain the stability of an atom.

Bohr's Model of Atom

- * Neil Bohr devised the Rutherford's atom model and put forth the following suggestion -



- * Neil Bohr proposed that the electron posses a specific amount of energy which allows them revolve around the nucleus.

- * The electrons are confined to this energy level while revolving in this discrete orbit the electrons do not radiate energy. hence, this orbit are also known as stationary orbit. Smaller the size of the orbit smaller is its energy.
- * As we move away from the nucleus the energy of the orbit is increases progressively.
- * The transition of an electron from one orbit to another orbit is always accompanied with absorption or emission of energy.
- * When an electron jumps from a lower energy level to higher energy level it absorbs energy.
- * When an electron returns from a higher energy level to lower energy level it emits energy.

Distribution of electrons in orbits

- * According to Bohr's model electrons occupied certain stable orbit or shell each shell has a definite energy.
- * This orbits or shell are represented by the letters K, L, M, N or the numbers 1, 2, 3, 4.
- * The maximum number of electrons present in a shell is given by the formula $2n^2$, where 'n' is the orbit number or shell number.

- * The maximum number of electrons in different shells are as follows
 - 1st orbit or K-shell will have $= 2 \times 1^2 = 2$
 - 2nd Orbit or L-shell will have $= 2 \times 2^2 = 8$
 - 3rd Orbit or M-shell will have $= 2 \times 3^2 = 18$
 - 4th Orbit or N-shell will have $= 4 \times 4^2 = 32$ electrons
- * The maximum number of electrons which can be accommodated in the outer-most orbit is 8.
- * The orbits and shell are filled in a step wise manner.
- * Electrons are not accommodated in a given shell, unless the inner shells are filled.

Octet Rule

- * The Octet rule states that the maximum number of electrons that the outermost shell of an electrically neutral and chemically stable atom can have is 8.

Electron Configurations of Elements

- * The energy of every electron depends on the shell it occupies.
- * Electrons in the K shell have ~~maximum~~ ^{minimum} energy, electrons in subsequent shell have higher energy.
- * The arrangement of electrons of each element is called electronic configurations of element.

For Ex - $N_7 - 2, 5$

K	L	M	N
2	5	-	-

Valency

- * The valency of an element represents the combining capacity of the element.
- * It can also be defined as the no. of electrons lost, gain or share by its atom during a chemical combination.

Valency shell

- * The outermost shell or orbit of an atom is known as the valence shell or valence orbit.
- * The number of valence electron varies from 1 to 8 for the atom of different elements.
- * The electrons present in the outermost valence shell of an atom are called valence electrons.
- * The valency electron of an atom determine the valency of that element.

Ions

- * Ions are electrically charged species ions is formed by loss or gain of electrons by an atom. So, it contains any unequal numbers of electrons and protons these are two types ions :-

- (i) Cation
- (ii) Anions

Cations

* cations are the positively charged ion formed by loss of one or more electrons by an atom. for ex - sodium ~~after~~ loss one electron to form sodium ion. hence no ring

Formation of cations

* if an element has one, two and three electrons in the outer most cell of its atom then it losses these electrons to achieve the noble gas electronic arrangement of 8 balanced electrons and formed positively charged ion or cation.