CHAPTER NO 03

ATOMIC STRUCTURE

Q1. Write down the main postulates of Dalton's Atomic Theory.

DALTON'S ATOMIC THEORY:

In 1808 Dalton presented his theory, the main postulates of this theory are as follows:

POSTULATES:

i. All elements are made up of small indivisible, indestructible particles called atoms.

ii. All atoms of a given element are identical in all respects, having same size, mass and chemical properties, but the atom of one element is differ from the atom of other element.

iii. Compounds are formed when atoms of more than one element combine in a simple whole number ratio.

iv. A chemical reaction is a rearrangement of atoms but atoms themselves are not changed this means that atom are neither created nor destroyed during chemical reaction.

Q2. Define Modern Atomic Theory.

MODERN ATOMIC THEORY:

"Atom is a complex organization composed of even smaller particles called sub-atomic particles (fundamental particles). These are electron, proton and neutron."

Q3. Explain discovery of electrons by discharge tube experiment? Also discuss its structure.

DISCOVERY OF ELECTRONS BY DISCHARGE TUBE:
INTRODUCTION:

In 1897, a British physicist J.J Thomson discovered electrons by discharge tube experiment.

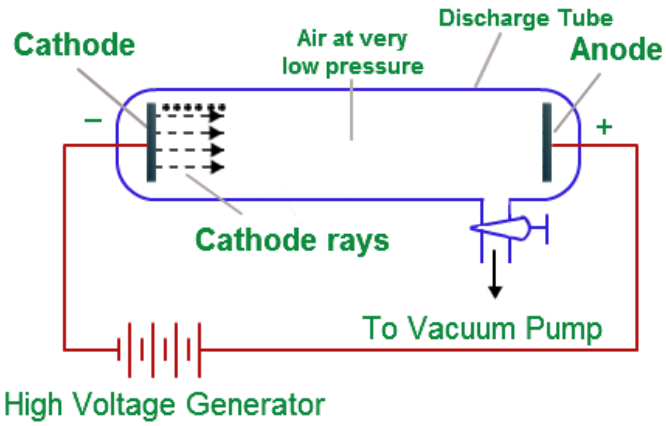
STRUCTURE OF DISCHARGE TUBE:

i. A discharge tube is a glass with cylindrical shape. It is sealed at both ends.

ii. Two metallic electrodes anode and cathode are present inside the tube.

iii. A vaccum pump is present with the wall of discharge tube to decrease internal pressure.

iv. It is connected to a high voltage battery (10,000) volts.



EXPERIMENT:

When the tube is evacuated and a current of high potential is passed between the electrodes streaks of bluish light extending from negative electrodes (cathode) towards positive electrodes (anode). The rays appear to travel in straight line from cathode to anode, cause the wall at the opposite end of the tube glow where they strike. These rays were called cathode rays after called electrons.

Q4. Write down the properties of cathode rays.

PROPERTIES OF CATHODE RAYS:

i. They are deflected towards positive plate of electric field proving that they carry negative charge.

ii. These particles are emitted from cathode surface and move in straight line.

iii. They produce shadow of opaque object placed in their path

iv. They can produce mechanical pressure indicating that they possess kinetic energy.

v. These rays are deflected towards electric and magnetic fields.

Q5. Explain discovery of proton by discharge tube. Also write properties of Anode rays(protons).

DISCOVERY OF PROTONS BY DISCHARGE TUBE:

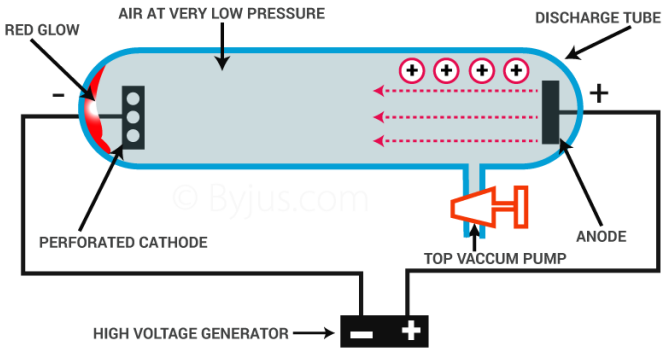
INTRODUCTION:

In 1886 a German Chemist Gold Stein discovered protons by same apparatus by which electrons were discovered that is discharge tube.

EXPERIMENT:

Discharge tube is filled with hydrogen gas while cathode is perforated. When high voltage is provided to the gas at very low pressure then light is observed behind the cathode. This light is observed due to the ionization of gas filled in the tube.

e.g: $H \longrightarrow H^+ + e^-$



PROPERTIES OF POSITIVE RAYS:

i. They are deflected towards the negative plate of electric field which proved that these rays carry positive charge.

ii. These particles are parallel to each other.

iii. The mass of positive rays is equal to the mass of hydrogen ion (H^+). These positive ions are called protons.

iv. These rays also travel in straight line from anode to cathode.

Q6. Explain discovery of neutrons.

DISCOVERY OF NEUTRONS:

In 1932 the British Physicist James Chadwick discovered a third fundamental particle of atom with the help of artificial radioactivity. This particle is neutral in nature having mass nearly equal to the mass of a proton.

Q7. Write three properties of electron, proton and neutron.

PROPERTIES OF ELECTRON:

i. Electron is a negatively charged particles (e^-).

ii. The electric charge is equal to 1.602×10^{-19} coulombs.

iii. The mass of an electron is 9.109×10^{-31}kg.

PROPERTIES OF PROTON:

i. Proton is a positively charged particles.

ii. The electric charge is equal to 1.602×10^{-19} coulombs.

iii. The mass of proton is 1.602×10^{-27} kg.

PROPERTIES OF NEUTRON:

i. Neutron is a neutral particle.

ii. It has no charge.

iii. The mass of neutron is 1.76×10^{-27} kg.

Q8. Define radioactivity. Who discovered the nature of radioactivity (types of rays) show by an experiment.

INTRODUCTION:

In 1896 a French Physicist Henry Becqueral discovered radioactivity.

RADIOACTIVITY:

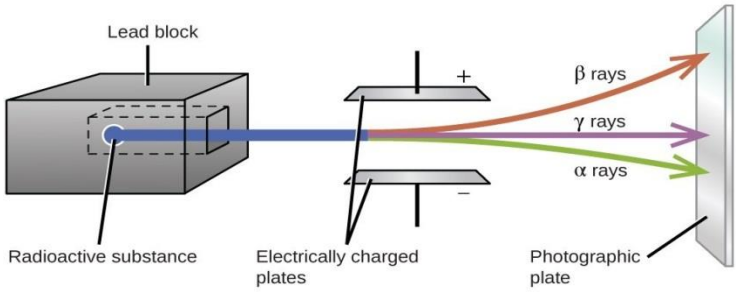
Radioactivity is the spontaneous disintegration of nucleus of an atom in which invisible radiations are emitted from the nucleus of atom. Substance which emits such kind of radiations are known as radioactive element and the phenomenon is termed as radioactivity.

NATURE OF RADIOACTIVITY (Types of rays):

The British physicist Ernest Rutherford in 1902 determined the nature of radioactive rays by the following experiment and showed that it is composed of three types of rays.

EXPERIMENT:

A sample of radioactive substance was placed in a lead block between the two oppositely charged plates (electric field). The radiations were resolved into three components. One components was deflected towards the negative plate, proving that it carried a positive charge. These were named (Alpha) α-rays. The second component deflected towards the negative charge and this were named (Beta) β-rays. The third type carried no charge and were not deflected towards electric field, this were named (Gamma) ϒ-rays.



Q9. Write down the properties of α, β and ϒ rays.

PROPERTIES OF α RAYS:

i. They are nucleus of Hellium atom. They are doubly positively charged He^{2+}.

ii. They moved with the speed equal to the $^{1}/_{10th}$ of the speed of light.

iii. They cannot pass through thick metal foil.

PROPERTIES β OF RAYS:

i. They are negatively charged.

ii. They move with the speed equal to the speed of light.

iii. The ionization power of these rays is very small.

PROPERTIES ϒ OF RAYS:

i. They are electromagnetic radiation.

ii. They have no charge.

iii. They travel with the speed equal to the speed of light.

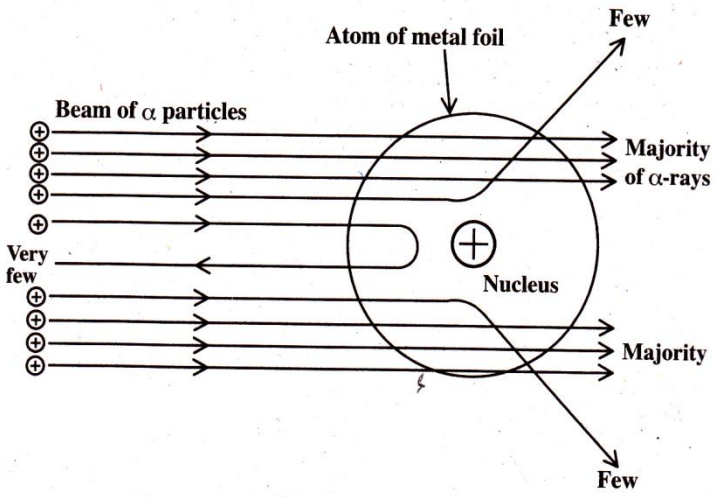
Q10. Write down the experiment of Rutherford to discovery of nucleus of an atom.

INTRODUCTION:

Lord Rutherford in 1911, carried out series of experiments. In which he discovered the nucleus of an atom.

EXPERIMENT:

He passed a beam of α-particles through a very thin gold foil. He found that most of alpha particles passed through it without any deflection. However some of them deflected at large angles and very few of them bounced back.

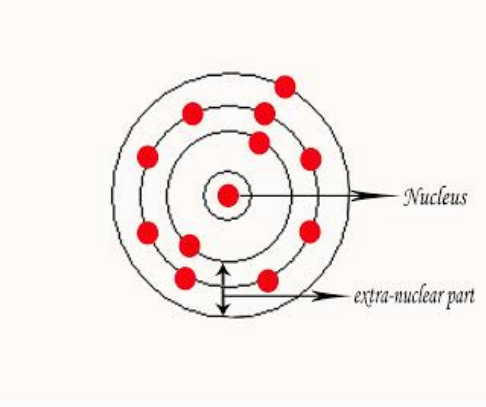


Rutherford experiment of gold metal foil.

Q11. Write down the postulates and weakness OR defects of Rutherford atomic model.

According to Rutherford an atom consists of two parts.

i. Nucleus **ii. Extra nuclear part**



POSTULATES OF RUTHERFORD'S ATOMIC MODEL:

i. The major position of an atom is empty.

ii. The total mass of an atom is present in the nucleus of an atom.

iii. The size of nucleus is very small as compared with the size of an atom.

iv. The positive charge (proton) is present in the nucleus of an atom.

v. The negative charge (electron) revolves around the nucleus of an atom.

WEAKNESS OR DEFECTS:

i. According to classical physics since electrons revolve around the nucleus constantly, it would lose energy and it ultimately falls into the nucleus.

ii. If revolving electron emits energy continuously then would be a continuous spectrum actually a line spectrum is obtained.

Q12. Write down the postulates of Neil Bohr's atomic theory.

POSTULATES OF NEIL BOHR'S ATOMIC THEORY:

i. Electron in an atom revolve around the nucleus in fixed circular path which he called orbit, shells or energy levels.

ii. As long as electron revolve in particular energy level it does not emit or absorb energy.

iii. When an electron absorb energy it moves to high energy level when its loses energy it return to lower energy level.

iv. The electron loses definite quantity of energy called quantam. The frequency of energy emitted is directly proportional to the difference between the two energy levels.

$$E_2 - E_1 = \Delta E$$

$$E_2 - E_1 = h\upsilon$$

Where Δ =Energy b/w 2 energy levels.

h =plank's constant

υ =Frequency of energy emitted

Q13. Define Isotopes? Discuss the structure of Isotopes of some elements.

ISOTOPES:

"Atom of same element having same atomic number but different atomic masses are called Isotopes. The number of proton present in the nucleus of an atom remains the same but number of neutrons may differ."

ISOTOPES OF DIFFERENT ELEMENTS:

1. ISOTOPES OF HYDROGEN:

There are three isotopes of hydrogen. These are known as protium, deuterium and tritium. Protium has one proton and no neutron, Deutrium has one proton and one neutron. Tritium has one proton and two neutron in the nucleus.

$_{1}^{1}H$	**$_{1}^{2}H(_{1}^{2}D)$**	**$_{1}^{3}H(_{1}^{3}T)$**
(Protium)	**(Deutrium)**	**(Tritium)**

2. IOSTOPES OF OXYGEN:

Oxygen atom also has three isotopes having mass number 16,17 and 18. It shows that these atom contain 8,9,10 neutrons respectively. Thus there are three isotopes of oxygen.

$_{8}^{16}O$, $_{8}^{17}O$, $_{8}^{18}O$

3. ISOTOPES OF URANIUM:

There are three common isotopes of uranium with mass number 234, 235, 236 respectively.

$_{92}^{234}U$, $_{92}^{235}U$, $_{92}^{236}U$

Q14. How many protons, electrons and neutrons are in the following elements.

i. $_{13}^{27}Al$.

Protons =13

Electrons =13

Neutrons =A-Z

Neutrons =27-13

Neutrons =14

ii. $_{15}^{31}P$.

Protons =15

Electrons =15

Neutrons = A-Z

Neutrons =31-15

Neutrons =16

- **Assignment:**

iii. $_{18}^{40}Ar$ **iv. $_{82}^{207}Pb$** **v. $_{24}^{52}Cr$** **vi. $_{87}^{223}Fr$**
vii. $_{48}^{112}Cd$ **viii. $_{53}^{157}I$** **ix. $_{47}^{108}Ag$** **x. $_{83}^{209}Bi$**