Class-IX

STRUCTURE OF THE ATOM INTRODUCTION OF STRUCTURE OF ATOM

✤ CATHODE RAYS: -

(Discovery of e⁻):

In 1859 **"Julius Plucker"** started the study of conduction of electricity through gases at low pressure in a discharge tube. When a high voltage of 10,000 volts or more was impressed across the electrodes, some sort of inversible rays moved from the negative electrodes to the positive electrode. Since the negative electrode is referred to as cathode. These rays were called cathode rays.



Properties of cathode rays:

- These rays travels in straight line away from cathode with very high velocity ranging from 10⁷ to 10⁹ m/sec.
- > A shadow of metallic object placed in the path is cast on the wall opposite to cathode.
- Cathode rays cause green fluorescence on glass surface, i.e., the glasss surface on which the cathode rays strike show a coloured shine.
- Cathode rays consist of matter particles, and posses' energy by the virtue of their mass and velocity. Cathode rays set a paddle wheel into motion when it is placed in the path of these rays. This is due to the impact of the particles of the cathode rays on the blades of the paddle wheel.



Cathode ray particles strike the blades of the paddle wheel, and set it into motion

- These rays are deflected by the electric of magnetic fields when the rays are passed between two electrically charged plates, these are deflected towards the positively charged plates. It shows that cathode rays carry negative charge. These particles carrying negative charge. These particles carrying negative charge were called negatrons by Thomson. The name negatron was changed "Electron by Strong".
- These rays produce heat energy when they collide with the matter. It shows that cathode rays possess kinetic energy which is converted into heat energy when stopped by matter.
- > These rays affect the photographic plate.
- > Cathode rays can penetrate the thin foil of solid materials.
- > Cathode rays can ionize the gases through which they pass.
- The nature of cathode rays independent of
 - (a) The nature of cathode
 - (b) The gas in discharge tube

Ques. What are cathode rays?

Measurement of e/m for electron:

In 1897 J.J. Thomson determine the e/m value, charge/mass of the electron by studying the deflection of cathode rays in electric & magnetic fields.

The value of e/m has been found to be -1.7588×10^8 coulomb/unit. The absolute value of the charge in an e⁻ was measured by R.A. Milikan 1909 by the Milikan's oil drops experiment.

[NCERT]

ANODE RAYS OR CANAL RAYS: -

It has been established that electron is a negatively charged particle present in all the atoms. As an atom is electrically neutral, there must be some positively charged particle present in the atom to neutralize the negative charge of the electrons. It has been confirmed by experiment "Goldstein" in 1886 discovered the existence of a new type of rays in discharge tube.



He carried out experiment in discharge tube containing perforated cathode. These rays moved towards cathode and passed through the perforation in the cathode.

- Initially these rays were called canal rays because they pass through the canals or holes of the cathode.
- > These rays are also called anode rays since they originate from the anode side.
- Anode rays are positively charged, therefore these were named positive rays by Sir J.J. Thomson.

Characteristics of anode rays:

- Anode rays travel in straight lines. These rays rotate the light paddle wheel placed in their path. Anode rays are deflected by magnetic or electric field towards negatively charged plate. This indicates that these rays are positively charged.
- > The anode rays affect photographic plate.

- The nature of anode rays depends upon the type of gas used. The charge (e) to mass
 (m) ratio (e/m) of anode rays particle is different for different gases. The value of
 e/m is maximum for hydrogen gas.
- The positive rays obtained from hydrogen are made up the same type of positive particles. These particles are known as protons.
 In the discharge tube the atoms of gas lose negatively charged electrons. These atoms, thus acquire a positive charge. The positively charge particle produced from hydrogen gas were called "protons". (Proton)

✤ INTRODUCTION

According to John Dalton: All matter was composed of small particle called atom.

Atom is a Greek word and its meaning **Indivisible** i.e., an ultimate particle which cannot be further subdivided.

Atom Not divisible (According to Dalton) Not Divisible A Tom (Greek word)



Not divisible (According to Da lton)

According to Dalton's theory -

- (1) Atom is the smallest indivisible part of matter which takes part in chemical reaction.
- (2) Atom is neither be created nor be destroyed.
- (3) Atoms of the same element are similar in size, mass and characteristics; however, atoms of different elements have different size, mass and characteristics.
 - An atom is made up of three subatomic particle electron, proton & neutrons. These three particles are called fundamental particles of matter.

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PARTICLES	SCIENTIST	CHARGE	MASS
Electron (e ⁻)	J.J. T homson	-ve	9.1×10 ⁻³¹ kg(1/1837=0.000599amu)
Proton(p)	E. Goldstein	+ve	1.67×10^{-27} kg
Neutron (n)	Chadw ic k	Zero	1.675×10^{-27} kg

DO YOU KNOW: Mass of Proton is 2000 times more than electron