

## CBSE – Class – IX . Sc. Q.A.

### CH. 4a. STRUCTURE OF THE ATOM

#### Syllabus :

Charged particles in matter; The structure of an atom; Distribution of electrons in shells; Valence electrons and valency; Atomic number and mass number; Isotopes.

#### Important Questions

Q. 1. How can you say that matter is electrical in nature ?

Ans.:- (i) By rubbing ebonite rod with cat skin we see that ebonite rod is negatively charged and cat's skin is positively charged.

(ii) A glass rod gets a positive charge when rubbed with silk and silk gets negative charge.

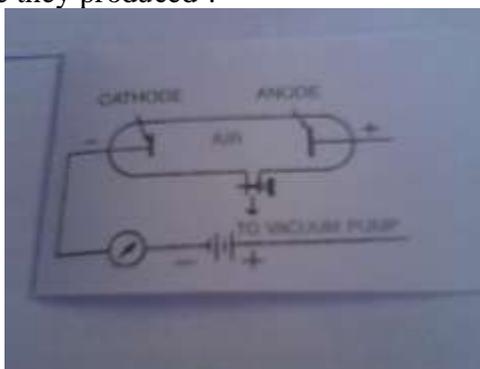
(iii) A nylon comb is charged when rubbed with hair.

The above phenomena proves that matter is electrical in nature.

Q. 2. Write about a discharge tube.

Ans.:- A discharge tube is a glass tube of diameter 5 cm and length 70 cm. Two metal electrodes are sealed at the either end and connected with a battery. A side tube fused at the centre serves to pump out air from it using a suction pump.

Q. 3. State the cathode rays. How are they produced ?



Ans.:-

fig.

When pressure inside the discharge tube falls below 0.001 mm Hg and a potential difference of about 10,000 volts is applied across the electrodes, the wall of the discharge tube opposite to the cathode starts glowing with a faint greenish light. This is due to the bombardment of wall by cathode rays.

They are produced when an electric current is passed at high voltage, through any gas at very low pressure.

Q. 4. Give important properties of cathode rays.

Ans.:- Properties of cathode rays :

(i) They travel in a straight line and cast a shadow of objects placed in their path.

(ii) They possess material particles as they can rotate a light paddle placed in their path.

(iii) They are deflected towards positive plate of electrodes.

- (iv) They ionizes gas through which they pass.
- (v) They are deflected by magnetic field.
- (vi) The nature of cathode rays do not depend on the material of the cathode.
- (vii) They can penetrate through thin metallic sheet.
- (viii) They can produce X-rays.
- (ix) The mass of cathode ray particle is very-very small as compared to the mass of the atom from which it is formed.

Q. 5. Write the observation made, while conducting a discharge experiments, which showed that :

- (i) Cathode rays travel in straight line.
- (ii) Cathode rays are made up of material particles having mass and kinetic energy.
- (iii) Cathode rays are negatively charged.

Ans.:- (i) Cathode rays cast shadow of the objects placed in their path which proves that they travel in a straight line.

(ii) Cathode rays can rotate a light paddle placed in their path. This proves that cathode rays have mass and kinetic energy.

(iii) Cathode rays are deflected towards positive plate of the electric field. This proves that they are negatively charged.

Q. 6. How will you explain the flow of current in a cathode ray experiment, knowing that gases are bad conductors of electricity ?

Ans.:- The gas in the discharge tube experiment (at low pressure and high voltage) is decomposed. Negatively charged particles are produced which travel, helping the flow of current.

Q. 7. A part of the glass glow in the discharge tube experiment. Why ? Name the scientist who performed this experiment for the first time.

Ans.:- The part of the glass tube opposite to the cathode glow in the discharge tube as the cathode rays emitted from the cathode strike the anode and produces light radiations. This experiment was first performed by William Crooks in 1879.

Q. 8. What are X-rays ?

Ans.:- X-rays are electromagnetic waves with very short wavelengths. These rays are formed when fast moving electrons are suddenly by putting some obstacle. In the discharge tube X-rays are produced if cathode rays are made to strike against the metal target.

Q. 9. State the properties of X-rays.

Ans.:- Properties of X-rays are :

- (i) X-rays travel in a straight line.
- (ii) X-rays travel with the speed of light.
- (iii) X- rays are not deflected by magnetic or electric field.
- (iv) They are more penetrating than cathode rays.
- (v) They can pass through opaque material.
- (vi) They effect photographic plate.

(vii) They cause fluorescence in several materials.

Q. 10. State the use of X-rays.

Ans.:- Use of X-rays :

- (i) They are used to locate the broken part of bones in the body.
- (ii) They are used by detective agencies to examine the contents of the parcel or diamond/gems hidden in the body by smugglers.
- (iii) They are used in the treatment of tumours and cancer.
- (iv) They are used to study the nature and structure of the materials.

Q. 11. Explain how X-rays are used to locate cracks in fractured bones.

Ans.:- X-rays can penetrate the flesh easily and are stopped by the bones. Clear picture of the bones are formed on the photographic plate. A study of photographic plate can easily reveal the cracks in the bone.

Q. 12. Give one use of X-rays giving the property which makes this use possible.

Ans.:- X-rays are used to locate cracks in the fractured bones. This is because X-rays can penetrate the flesh easily but are stopped by the bones. The clear picture of the bones is formed on the photographic plate. By studying photographic plate, cracks in the bones are revealed.

Q. 13. What is the mass and charge of an electron ?

Ans.:- Mass of an electron is  $9.0 \times 10^{-31}$  Kg. The charge of an electron is negative. It has a charge of  $1.6 \times 10^{-19}$  coulomb which is one unit of negative charge.

Q. 14. Draw a diagram to show the presence of charge on cathode rays in the discharge tube and label it.

Ans.:-

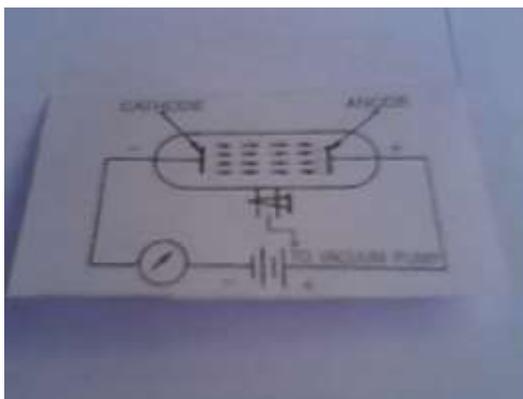


Fig.

Q. 15. “Electrons are common constituents of all matter”. Comment.

Ans.:- The above statement is true because :

- (i) Whatever may be the nature of the gas or the material of the cathode, the charge to mass ratio of the electron is the same i.e.  $e/m = 1.7589 \times 10^{11}$  C Kg<sup>-1</sup>.
- (ii) The electrons obtained by different methods are identical.

Q. 16. How can you say that cathode rays are negatively charged particles ?

Ans.:- When a electric discharge of very high voltage and very low pressure is passed through discharge tube containing air, it was found that cathode rays emerged from cathode and proceed towards anode. This led to the conclusion that cathode rays are negatively charged particles.

Q. 17. Experimentally show that cathode rays travel in straight line.

Ans.:-

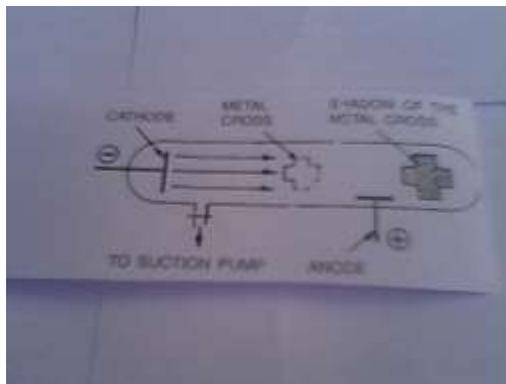


fig.

In 1879, William Crookes demonstrated that cathode rays travel in straight line. He placed an opaque cross in the path of cathode rays and found the shadow of the cross behind the cross. This proves that cathode rays travel in a straight line.

Q. 18. What is phosphorescence ?

Ans.:- A phenomena in which one observes emission of visible light when a substance is irradiated with either cathode rays or X-rays or even ultraviolet rays is called phosphorescence. The light emission continues even after the radiation, responsible for producing phosphorescence is removed.

Q. 19. Describe the different stages observed when a discharge tube is connected to a high voltage source and the pressure of the air in it is reduced gradually.

Ans.:- The observation in the discharge tube under high voltage when the air pressure is gradually reduced are :

- (i) At normal air pressure – No change.
- (ii) At slightly reduced air pressure – Unsteady light emission.
- (iii) At still lower pressure – Tube fills up with uniform glow with magenta-red colour.
- (iv) At pressure below 0.001 mm Hg – Tube appears dark and the cathode starts glowing with a faint greenish light.

Q. 20. What happens when the cathode rays are passed through an electric field between two parallel plates ? What do you conclude with this experiment ?

Ans.:- When the cathode rays are passed through an electric field between two parallel plates, the cathode rays are deflected towards positive plate. We conclude with this experiment that the cathode rays are negatively charged particles.

Q. 21. State anode or positive rays. How are they produced ?

Ans.:- E. Goldstein observed that in a discharge tube with perforated cathode, high voltage is applied when the pressure inside the tube is below 0.001 mm Hg, a new type of rays come through the perforation in the cathode. Initially it was called canal rays. Now these are called positive rays or anode rays as they move away from anode. In the discharge tube when the atoms of gas loose electrons, they acquire positive charge and move away from anode. Thus anode rays are positively charged particles emanated from the anode.

Q. 22. State the important properties of anode rays.

Ans.:- Properties of anode rays :

- (i) They travel in straight line – they cast shadow of the solid objects placed in their path.
- (ii) They are positively charged – they are deflected towards the negative plate of an electric field.

Q. 23. State the observation that led to the conclusion that the nature of the anode rays depend upon the gas used in the cathode rays tube.

Ans.:- For the different gases in the cathode rays tube the value of  $e/m$  for positive rays are different. This is because different gases give different types of positive rays which contain particles having different masses and different charges.

Q. 24. What can you say about the mass of the particles of anode rays ?

Ans.:- The mass of a positively charged particle in anode rays is equal to the mass of the atom of the gas.

Q. 25. Explain how electricity is conducted through gases at very low pressures.

Ans.:- When a high electric voltage is applied, the electric energy splits the gaseous atoms into negatively and positively charged particles. The negatively charged particles form cathode rays and positively charged particles form anode rays. These charged particles conduct electric current through the discharge tube. When gas in the discharge tube is at the atmospheric pressure, a large number of gas atoms collide with the electrons and prevent them from reaching the anode. In such case, no current flows through the discharge tube.

Q. 26. What is proton ? State its characteristics.

Ans.:- A proton is the lightest positive particles.

Characteristics of proton :

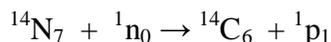
- (i) It is one of the fundamental particles of the atom and is present in the nucleus of atom.
- (ii) Charge on the proton is positive equal to  $+1.6 \times 10^{-19}$  coulomb.
- (iii) Mass of proton is equal to the mass of one hydrogen atom which is equal to  $1.67 \times 10^{-27}$  Kg.

Q. 27. Differentiate between cathode rays and positive rays.

Ans.:- Cathode rays	!	Anode (positive) rays
(1) They are made up of negatively charged particles called electrons.	!	(1) They are made up of positively charged particles called protons.
(2) The nature of cathode rays does not depend upon the nature of the gas from which these are produced.	!	(2) The nature of anode rays depends upon the nature of the gas from which these are produced.
(3) The mass of the cathode rays particle is very-very small compared to the mass of the atom from which it is formed.	!	(3) The mass of an anode rays particle is equal to the mass of the atom from which it is formed.
(4) These particles were found to be about 2000 times smaller in mass than the hydrogen atom.	!	(4) The mass of anode rays is equal to the mass of a hydrogen atom.

Q. 28. "All substances contain protons in addition to electrons". Comment.

Ans.:- Protons are present in all substances along with electron is established by numerous experiments. They are emitted during radioactive decay of various radioactive substances. Nitrogen present in the upper layer of the atmosphere is converted into radioactive carbon by emission of a proton when the cosmic rays coming from the sun fall on it



Thus we conclude that protons are the constituent particle of all matter like electrons.

Q. 29. State the nature of charge on :

(i) X-rays (ii) Cathode rays (iii) Gamma rays (iv) Anode rays.

Ans.:- (i) X-rays – No charge. (ii) Cathode rays – Negative charge.

(iii) Gamma rays – No charge. (iv) Anode rays – Positive charge.

Q. 30. State the differences in the discharge tube used to study cathode rays and the anode rays.

Ans.:- To study the cathode rays, the discharge tube is a glass tube with closed ends. Two metal plates sealed at the two ends which serve as cathode and anode.

To study the anode rays, the discharge tube has a perforated plate for cathode and is sealed in the middle.

Q. 31. Name the fundamental particles discovered by (i) Thomson (ii) Goldstein (iii) Chadwick.

Ans.:- (i) Thomson – Electron. (ii) Goldstein – Proton. (iii) Chadwick – Neutron.

Q. 32. 'The mass and charge on positive rays change with change in nature of the gas in the discharge tube'. Give reason for this.

Ans.:- Positive rays are the remaining part of the atom after the electrons are removed. Thus the mass and charge depend on the nature of gas. When different gasses are taken in the discharge tube, positive rays with different positive charge and mass are emanated.

Q. 33. State the significance of nature of protons found in the different elements.

Ans. The number of electrons found in the atom of an element is equal to the number of protons. By knowing the number of protons, we can draw the electronic configuration of the atom and predict the chemical properties.

Q. 34. What are canal rays ?

Ans.:- Canal rays are positively charged particles which have a charge equal in magnitude but opposite in sign to that of the electron. Canal particle is 2000 times heavier than that of electron. This particle is known as proton.

Q. 35. If an atom contains one electron and one proton, will it carry any charge or not ?

Ans. The atom containing only one electron and only one proton will carry no charge as the magnitude of charge on an electron and proton is the same.

**BEST OF LUCK.**