3. Atomic Structure

Evaluation

1 A. Question

The same proportion of carbon and oxygen in the carbon dioxide obtained from different sources proves the law of_____

a) Reciprocal proportion b) definite proportion c) multiple proportions

Answer

(b) definite proportion

Because the law of definite proportion says that a pure chemical compound prepared by using any chemical method consists of the same elements which combine together in a fixed ratio by mass.

1 B. Question

In water, hydrogen and oxygen are combined in the ratio of ___by mass.

a) 1:8 b) 8:1 c) 2:3

Answer

(a) 1:8

Because this follows the law of definite proportion. According to which the elements of the compound are proportionate by mass. Mass of hydrogen is 1 and that of oxygen is 8, which makes the ratio 1:8, the right answer.

1 C. Question

Which one of the following is a wrong statement, regarding the postulates of Dalton's Atomic Theory?

a) The matter is made up of small indivisible particles called atoms.

b) Atoms of the same element are different in all respects.

c) Atoms of different elements are different in all respects.

Answer

(b) Atoms of the same element are different in all respects.

Because atoms of the same elements are identical in all respects. They contain the same number of protons and electrons.

1 D. Question

Dalton's Atomic Theory successfully explained the Law of _____.

i) Conservation of Mass

ii) Definite Proportions

iii) Radioactivity

iv) Multiple Proportions

a) (i), (ii) and (iii) b) (i), (iii) and (iv) c) (i) ,(ii) and (iv)

Answer

(c)

Because he performed experiments to prove the law of conservation of mass, law of definite proportion, and multiple proportions. None of his experiments involved radioactivity.

1 E. Question

Based on the Thomson's model of an atom, say which of the following statements are correct.

i) The positive charge is assumed to be uniformly distributed over the atom.

ii) The electrons are uniformly distributed in the positively charged sphere.

iii) The electrons attract each other to stabilize the atom.

iv) The mass of the atom is assumed to be uniformly distributed over the atom.

a) (i) ,(ii) and (iv) b) (i),(ii) and (iii) c) (i) and (iii)

Answer

(a)

According to Thompson's model, an atom consists of uniformly distributed positive charge (protons) and the electrons are embedded in this sphere of the atom. The electrons do not attract each other, instead, they repel. Mass of the atom is given by the protons, hence it is uniformly distributed over the surface.

2. Question

Fill in the blanks:

1. _____is a negatively charged particle. (Electron/Proton)

2. Proton is deflected towards the___ charged plate. (positively, negatively)

Answer

1. Electron.

Reason- In experiment conducted by J.J. Thompson, he proved that cathode rays emit negativell charged particles called electrons.

2. Negatively

Reason- Because protons are positively charged particles emitted from anode.

3. Question

Match the entries of column I with the appropriate entries of column II and column III: (Double matching)

Property (Column I)	Cathode rays (Column II)	Anode rays (Column III)
i) Type of charge present	a) independent	A) positive charge
ii) Particle present	b) negative charge	B) dependent
iii) Nature of gas taken in the discharge tube	c) cathode	C) proton
iv) Origin	d) electron	D) anode

Answer

(i)- (b)- (A)

Reason- Types of charges present at the cathode rays are negative while at anode rays are positive. That is why they move in the opposite direction as they attract each other.

(ii)- (d)- (C)

Reason- Particles present at the cathode rays are electrons and the anode rays are protons.

(iii)- (a)- (B)

Reason- The properties of the cathode rays are independent of the nature of the gas taken in discharge tube while the properties are dependent upon the nature of the gas in the discharge tube.

(iv)- (c)-(D)

Reason- Origin of cathode rays is cathode end while for anode rays is anode end.

4. Question

Identify the wrong statement regarding the properties of cathode rays and correct it.

1. Cathode rays are made up of large particles with mass and kinetic energy.

2. Cathode rays are deflected by the magnetic field.

3. Cathode rays depend on the nature of the gas inside the tube.

Answer

(3)

Reason- Cathode rays do not depend on the nature of the gas inside the tube as demonstrated by J.J. Thompson in his experiment.

5 A. Question

Why does a light paddle wheel placed in the path of cathode rays begin to rotate, when cathode rays fall on it?

Answer

A light paddle wheel, when placed in the path of the cathode rays, began to rotate because the small particles of the cathode rays (electrons) have mass and energy. This energy is used in rotating the paddle wheel.

5 B. Question

a) What happens in the discharge tube if a high voltage is applied at a gas pressure of 760 mm mercury?

b) What will happen if the pressure is reduced to 0.01mm of mercury?

Answer

a) When a high voltage is applied at a gas pressure of 760mm mercury, the discharge tube might burst with the flow of particles of cathode rays and high-pressure mercury particles.

b) If the pressure is reduced to 0.01mm of mercury, the rays from the cathode end will move towards the anode end. As the cathode ray contains particles which are negatively charged.

5 C. Question

How can we prove that the electrons carry a negative charge?

Answer

When cathode rays are passed through an electric field they are deflected towards the positive plate. This shows that cathode rays emitted from cathode carry a negative charge. The particles of these cathode rays are known as electrons.

5 D. Question

Selvi took a conical flask, put some ice cubes into it and closed it with a stopper. Then, she found the weight of the conical flask using a balance. Its weight was 150 g. After some time, ice started melting and turned into water. She weighed the flask again. The weight was 150 g. What inference would you draw from this experiment?

Answer

This experiment verifies the Law of conservation of mass, which states that mass can neither be created nor be destroyed during the physical or chemical change. Hence, the mass of ice is the same as water in this physical change experiment.

5 E. Question

Kannagi, Goutam, David, and Saleem collected different samples of water from a well, a pond, a river and underground water. All these samples were sent to a testing laboratory. The test result showed the ratio of hydrogen to oxygen as 1:8.

a) What conclusion would you draw from the above experiment?

b) Which law of chemical combination does it obey?

Answer

(a). We can conclude from the above experiment that a pure chemical compound prepared by any chemical method contains the same element in a fixed ratio by their masses.

(b). It obeys the Law of Definite proportions.

5 F. Question

The postulates of Dalton's law are given below:

a) Atom can neither be created nor destroyed.

b) Atoms of different elements may combine with each other in a fixed simple whole number ratio to form compound atoms.

i. Which postulate of Dalton's atomic theory is based on the Law of Definite Proportions?

ii. Which postulate of Dalton's Atomic Theory is based on the Law of Conservation of Mass?

Answer

(i) Atoms of different elements may combine with each other in a fixed simple whole number ratio to form compound atoms is based on the Law of Definite Proportions.

(ii) Atom can neither be created nor destroyed is based on Dalton's Law of Conservation of Mass.

5 G. Question

Rani prepared carbon monoxide in the laboratory. It contained 15g of carbon and 20g of oxygen. Ram also prepared carbon monoxide but using another method. It contained 42.9% of carbon. Show that the data of Rani and Ram are in accordance with the Law of Definite Proportions.

Answer

Law of Definite Proportion says that a pure chemical compound prepared by any chemical method contains the same element in a fixed ratio by their masses. So here the mass percentage of carbon calculated by Rani's data give the same result as Ram. It can be as followed:-

Mass of an element in the compound X100

Sum of all the elements in the compound

= (15÷35) X100

=42.9% of carbon

Hence, the elements of the compound are in proportion.

5 H. Question

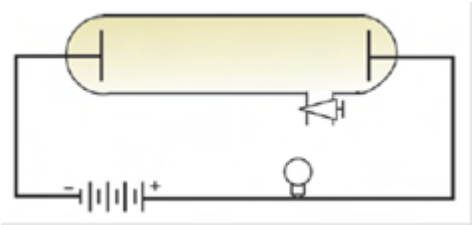
Cathode rays fall on a small object between the cathode and the anode. A shadow of the same size and shape as that of the object is observed on the wall opposite to the cathode. What conclusion can you draw from the above statement regarding the properties of cathode rays?

Answer

It can be concluded that cathode rays travel in straight lines parallel to each other.

5 I. Question

Gomathi filled a discharge tube with a particular gas and connected it as shown in the figure.



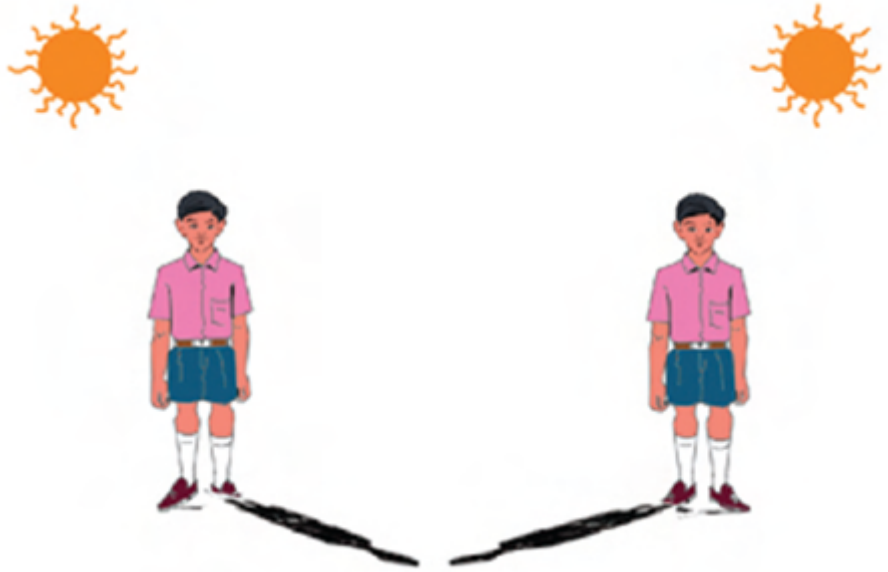
She applied high voltage but the bulb did not glow. What should Gomathi do to make the bulb glow?

Answer

Gomathi should maintain the gas in the discharge tube at low pressure. This allows the movement of electrons effectively so that the bulb could glow.

5 J. Question

Observe the size and direction of your shadow, when you stand in the sunlight in the morning and in the evening.



(i) Is the length of your shadow the same as your height?

(ii) What is the direction of the shadow? Does it fall in the direction of the source of light or in the direction opposite to the light source?

(iii) Compare the nature of the shadow formed in this activity with that of the shadow formed when an object is kept in the path of the cathode rays.

Answer

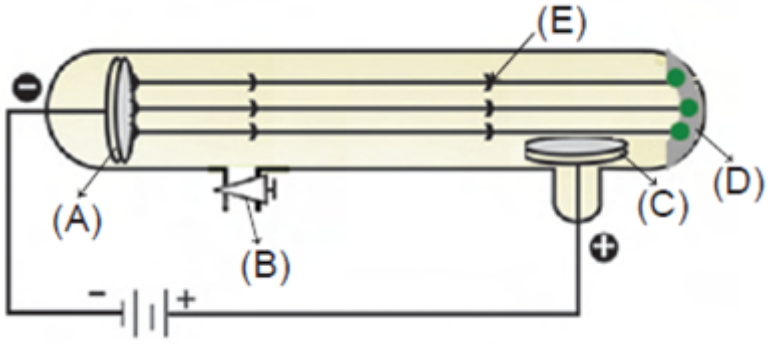
(i) No, the length of the shadow is not the same as the height.

(ii) The direction of the shadow falls in the direction opposite to the light source.

(iii) The shadow formed when an object is kept in the path of cathode rays is of the same size and shape to that of the object whiles here the shadow of the boy is smaller in shape and size.

5 K. Question

(i) Sketch and label the parts A,B,C,D and E in the figure given below:



(ii) What is the purpose of B?

(iii) What is the function of D?

Answer

(i) A= Cathode

B= Pump

C= Anode

D=Bright spot

E=Cathode rays

(ii) B= pump. It is used to lower the pressure of the gas inside the discharge tube.

(iii)D= Bright spot. The presence of bright spot confirms the working of cathode rays.

5 L. Question

Cathode and Anode rays are negatively and positively charged particles respectively. They travel in a direction opposite to each other. Why don't they get neutralized?

Answer

The speed of an electron (negatively charged particles) is more than the speed of protons(positively charged particles). This difference in speed between the two does not allow them to get neutralized.

5 M. Question

Why did Thomson assume that electrons are embedded in a positively charged sphere? Why did he not assume that they are positively charged particles embedded in a negatively charged sphere?

Answer

Before putting forth his model, he concluded from the experiments that:

1. Atoms contain negatively charged particle called electrons.

2. Atom is neutral in nature.

So, to neutralize the negative effects of electrons, he explained his model as a large sphere where positive charge is continuously distributed and electrons are embedded in it.

Project Work

1. Question

Construct a model of Thomson's atom using a cardboard, chart paper cut in round shape, gum, cotton, red colour sketch pen /water colour and dry black watermelon seeds or black beads. Label the model and display it in your classroom. Write a brief description of the Thomson's model.

Answer

According to Thomson's model of atom, Atom is a large sphere where positive charge is continuously distributed and electrons are embedded in it.

The positive and negative charges are equal in magnitude, hence an atom is neutral in nature.