

Short QAs

1. Who measured the charge to mass ratio of electron? J.

J. Thomson measured the charge to mass ratio of electron.

2. In which year did Thomson determine the e/m ratio?

He determined it in 1897.

3. What is the value of charge to mass ratio of electron?

The charge-to-mass ratio of an electron is:

$$\frac{e}{m_e} = 1.758820 \times 10^{11} \text{ C kg}^{-1}$$

Where:

- e = charge of electron
- m_e = mass of electron
- Unit = coulomb per kilogram (C kg^{-1})

This value was determined by

J. J. Thomson using cathode ray experiments.

4. What happens when only electric field is applied in cathode ray tube?

Electrons deviate from their path.

5. What happens when only magnetic field is applied?

Electrons deviate in the opposite direction.

6. On what factors does electron deflection depend?

- Charge on particle
- Mass of particle
- Strength of field

7. How does mass affect deflection of electrons?

Lighter particles show greater deflection.

8. Who determined the charge on electron?

Robert Andrews Millikan determined the charge on electron.

9. Which experiment was used to determine charge on electron?

Oil drop experiment.

10. What is the charge on electron?

The charge of an electron is:

$$e = -1.602 \times 10^{-19} \text{ C}$$

- e = charge of electron
- Unit = coulomb (C)

11. What is the mass of electron?

The mass of an electron is:

$$m_e = 9.1094 \times 10^{-31} \text{ kg}$$

- m_e = mass of electron
- Unit = kilogram (kg)

12. What are canal rays?

They are positively charged rays produced in modified cathode ray tube.

13. How do canal rays differ from cathode rays?

Canal rays are positively charged while cathode rays are negatively charged.

14. Which particle is the lightest positive ion?

Proton.

15. From which gas was proton obtained?

Hydrogen gas.

16. In which year was proton identified?

Proton was identified in 1919.

17. Who discovered neutron?

James Chadwick discovered neutron.

18. In which year was neutron discovered?

Neutron was discovered in 1932.

19. How was neutron discovered?

By bombarding beryllium with alpha particles.

20. What is the charge on neutron?

Neutron has no charge.

21. What is meant by quantization of charge?

Charge exists in integral multiples of electronic charge.

22. Write the formula for quantization of charge.

The formula for total charge is:

$$q = ne$$

- q = total charge
- n = number of electrons
- e = charge of one electron

23. Which particle is negatively charged?

Electron.

24. Which particle is positively charged?

Proton.

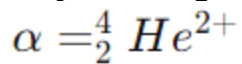
25. Which subatomic particle is electrically neutral?

Neutron.

Note- Alpha particles

Alpha particles are positively charged particles emitted by certain radioactive substances.

They are represented as:



An alpha particle is actually the nucleus of a helium atom.

An alpha particle contains:

- 2 protons
- 2 neutrons
- No electrons

Properties of Alpha Particles

1. Positively Charged

Alpha particles carry a double positive charge (+2).

2. Heavy Particles

They are much heavier than electrons.

3. Low Penetrating Power

They cannot penetrate thick materials.

A sheet of paper can stop them.

4. High Ionising Power

They ionise gases strongly because of their large mass and charge.

5. Deflection in Electric and Magnetic Fields

Alpha particles are deflected towards the negative plate because they are positively charged.

Their deflection is smaller than electrons because they are heavier.

Discovery and Use

Ernest Rutherford used alpha particles in the famous gold foil experiment to study atomic structure.

Gold Foil Experiment

In Rutherford's experiment:

Most alpha particles passed straight through the gold foil.

Some were slightly deflected.

Very few bounced back.

This led to the discovery of the nucleus.

Important Points

Symbol of alpha particle: α \alpha

MCQs – Charge to Mass Ratio, Proton and Neutron

1. Who measured the charge to mass ratio of electron?

- A) John Dalton
- B) J. J. Thomson
- C) James Chadwick
- D) Niels Bohr

Answer: B) J. J. Thomson

Explanation: J. J. Thomson measured the charge to mass ratio of electron using cathode ray tube experiments in 1897.

2. The value of e/m ratio of electron is:

- A) $1.758820 \times 10^{11} \text{ C kg}^{-1}$
- B) $1.602 \times 10^{-19} \text{ C}$
- C) $9.109 \times 10^{-31} \text{ kg}$
- D) 6.023×10^{23}

Answer: A) $1.758820 \times 10^{11} \text{ C kg}^{-1}$

Explanation: J. J. Thomson experimentally determined the charge-to-mass ratio of the electron using cathode ray experiments.

$$\frac{e}{m_e} = 1.758820 \times 10^{11} \text{ C kg}^{-1}$$

3. Electron is deflected in electric and magnetic fields because it is:

- A) Neutral
- B) Positively charged
- C) Negatively charged
- D) Heavy particle

Answer: C) Negatively charged

Explanation: Electrons carry negative charge, so they are attracted or repelled by electric and magnetic fields.

4. Greater the charge on a particle, the deflection will be:

- A) Smaller
- B) Zero
- C) Greater
- D) Constant

Answer: C) Greater

Explanation: Larger charge experiences stronger force in electric or magnetic fields, causing greater deflection.

5. Which particle shows greater deflection?

- A) Heavier particle
- B) Lighter particle
- C) Neutral particle
- D) Proton only

Answer: B) Lighter particle

Explanation: Lighter particles are more easily affected by external fields and hence show greater deflection.

6. Who performed the oil drop experiment?

- A) James Chadwick
- B) Michael Faraday
- C) Robert Millikan
- D) Rutherford

Answer: C) Robert Millikan

Explanation: Robert Andrews Millikan performed the oil drop experiment to determine the charge on electron.

7. The charge on electron is:

- A) $+1.602 \times 10^{-19} \text{ C}$
- B) $-1.602 \times 10^{-19} \text{ C}$
- C) 0
- D) +1

Answer: B) $-1.602 \times 10^{-19} \text{ C}$

Explanation: Electron carries one unit negative charge.

8. The SI unit of electric charge is:

- A) Volt
- B) Ampere

- C) Coulomb
- D) Ohm

Answer: C) Coulomb

Explanation: Electric charge is measured in coulomb (C).

9. The mass of electron is:

- A) $9.109 \times 10^{-31} \text{ kg}$
- B) $1.673 \times 10^{-27} \text{ kg}$
- C) $1.675 \times 10^{-27} \text{ kg}$
- D) $1.602 \times 10^{-19} \text{ kg}$

A) $9.109 \times 10^{-31} \text{ kg}$

Explanation: Electron has very small mass compared to proton and neutron.

10. Canal rays are made of:

- A) Neutral particles
- B) Positively charged particles
- C) Negatively charged particles
- D) Electromagnetic waves

Answer: B) Positively charged particles

Explanation: Canal rays consist of positively charged gaseous ions.

11. The behaviour of canal rays in fields is:

- A) Same as electrons
- B) Opposite to electrons
- C) Independent of charge
- D) Random

Answer: B) Opposite to electrons

Explanation: Canal rays are positively charged whereas electrons are negatively charged, so they move in opposite directions in fields.

12. The lightest positive particle is:

- A) Electron
- B) Neutron
- C) Proton
- D) Alpha particle

Answer: C) Proton

Explanation: Proton is the lightest positively charged subatomic particle.

13. Proton was obtained from:

- A) Oxygen
- B) Nitrogen
- C) Hydrogen
- D) Helium

Answer: C) Hydrogen

Explanation: Hydrogen gives the smallest and lightest positive ion called proton.

14. Proton was identified in:

- A) 1897
- B) 1906
- C) 1919
- D) 1932

Answer: C) 1919

Explanation: Proton was characterised as a fundamental particle in 1919.

15. Who discovered neutron?

- A) J. J. Thomson
- B) James Chadwick
- C) Rutherford
- D) Dalton

Answer: B) James Chadwick

Explanation: James Chadwick discovered neutron in 1932.

16. Neutron was discovered by bombarding beryllium with:

- A) Electrons
- B) Protons
- C) Alpha particles
- D) X-rays

Answer: C) Alpha particles

Explanation: Chadwick bombarded beryllium with alpha particles to discover neutrons.

17. The charge on neutron is:

- A) Positive
- B) Negative
- C) Neutral
- D) Double positive

Answer: C) Neutral

Explanation: Neutron carries no electrical charge.

18. Which subatomic particle has mass slightly greater than proton?

- A) Electron
- B) Positron
- C) Neutron
- D) Alpha particle

Answer: C) Neutron

Explanation: Neutron is slightly heavier than proton.

19. Quantization of charge means:

- A) Charge is always negative
- B) Charge is continuous
- C) Charge exists in integral multiples of e
- D) Charge depends on mass

Answer: C) Charge exists in integral multiples of e

Explanation: Millikan showed that electric charge always occurs as whole number multiples of electronic charge.

20. The formula for quantization of charge is:

A) $F = ma$

B) $PV = nRT$

C) $q = ne$

D) $E = mc^2$

Answer: C) $q = ne$

Explanation: Here q is total charge, n is whole number, and e is electronic charge.