3. Structure of atom

Exercises

1 A. Question

The heaviest fundamental particle is

A. proton

B. electron

C. neutron

D. hydrogen

Answer

The heaviest fundamental particle is neutron. The mass of electron is negligible. The mass of proton is slightly less than that of neutron.

1 B. Question

In the scattering experiment the deflection of alpha particle is due to

A. increase in kinetic energy

B. force of repulsion

C. force of attraction

D. decrease in kinetic energy

Answer

The deflection of the alpha particle (positively charged particle) is due to the force of repulsion. This indicates that the atom also contains positive charge. We know that the like charges repel each other. Hence, the alpha particles get deflected from their path.

1 C. Question

The simplest atom that does not contain neutron is

A. deuterium

B. tritium

C. hydrogen

D. helium

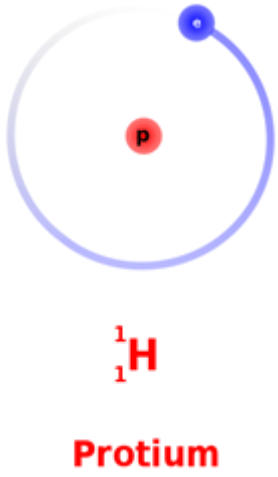
Answer

The simplest atom that does not contain neutron is hydrogen (protium). The mass number (atomic mass) of hydrogen is 1 and no. of proton is 1.

Hence, no. of neutron = Mass number – No. of proton

No. of neutron = 1-1 = 0

Thus, the hydrogen atom does not contain neutron.



1 D. Question

The reason for the existence of isotopes is change in

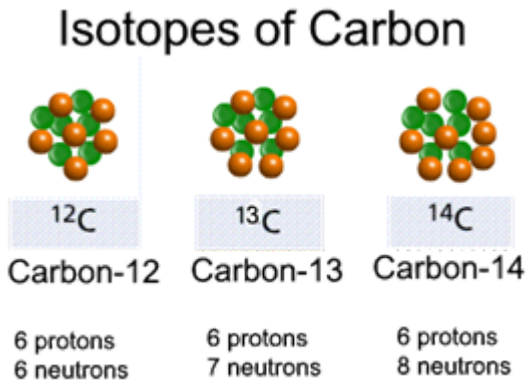
A. atomic number

B. electron number

C. neutron numberD. proton number

Answer

The reason for the existence of isotopes is change in neutron number. For example:



2 A. Question

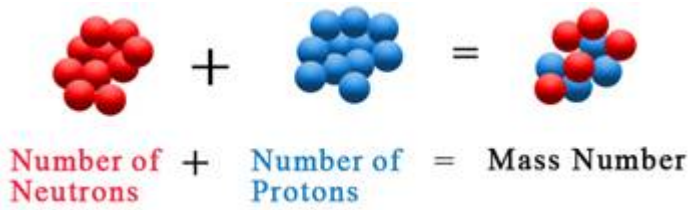
Fill in the blanks with suitable words:

The total number of protons and neutrons in the nucleus of an atom is known as _____ .

Answer

Mass number (atomic mass)

Explanation: Mass number: The total number of protons and neutrons present in the nucleus of an atom is known as mass number. It is represented by the symbol A.



2 B. Question

Fill in the blanks with suitable words:

Almost all the mass of an atom is concentrated in a small region of space called the _____.

Answer

nucleus

Explanation: Rutherford proposed that the mass of an atom is concentrated in the nucleus. The volume of nucleus is very small as compared to the volume of an atom.

2 C. Question

Fill in the blanks with suitable words:

The particle of an atom that has no charge is _____ .

Answer

neutral

Explanation: The particle of an atom that has no charge is neutral. In an atom, the number of electrons outside the nucleus (circular orbits) is equal to the number of positively charged particles in the nucleus. Hence the atom is neutral.

2 D. Question

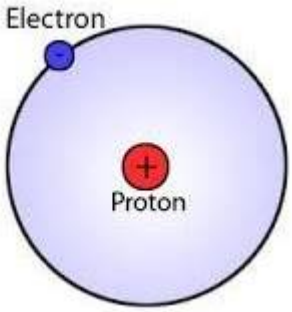
Fill in the blanks with suitable words:

The fundamental particle not present in a normal hydrogen atom is _____ .

Answer

neutron

Explanation: There are three fundamental particles which are protons, electrons and neutrons. Among them, the fundamental particle that is not present in a normal hydrogen atom is neutron.



2 E. Question

Fill in the blanks with suitable words:

The atomic mass of an atom is 23 and its atomic number is 11. the atom has _____ neutrons.

Answer

12

Explanation: Given: Atomic mass = 23

Atomic number = 11

Number of neutrons = atomic mass – atomic number

Number of neutrons = 23 -11

Number of neutrons = 12

Hence, the atom has 12 neutrons.

3 A. Question

Answer the following:

State the postulates of Dalton's atomic theory.

Answer

Postulates of Dalton's atomic theory are:

i. Elements are made up of very small indivisible particles called atoms.

ii. All atoms of a particular element are identical in shape.

iii. The properties of atoms of a particular element are different from the atoms of other elements.

iv. An atom can neither be created nor destroyed.

v. Atoms of one element cannot be converted into those of another element.

3 B. Question

Answer the following:

Describe J.J. Thomson's experiment on the discovery of electrons.

Answer

J.J. Thomson's experiment on the discovery of electrons:

i. J.J Thomson conducted the experiment using discharge tube apparatus.

ii. A discharge tube is glass tube connected to a vacuum pump.

iii. Metal electrodes are fixed to the ends of the glass tube.

iv. He created a very low pressure inside the discharge tube and applied high voltage.

v. The rays released from cathode are called cathode rays.

vi. He named these particles as electrons (negatively charged particles).

vii. The electron is much lighter than the hydrogen atom.

3 C. Question

Answer the following:

List the characteristics of anode rays.

Answer

The characteristics of anode rays are:

i. Anode rays contain positively charged particles and are also called positive rays.

ii. Anode rays travel in the direction of opposite to that of the cathode rays.

iii. The path of the anode rays deflected towards cathode.

iv. The deflection of anode rays in an electric field was very little when compared to the deflection of cathode rays.

3 D. Question

Answer the following:

Describe Rutherford's model of an atom.

Answer

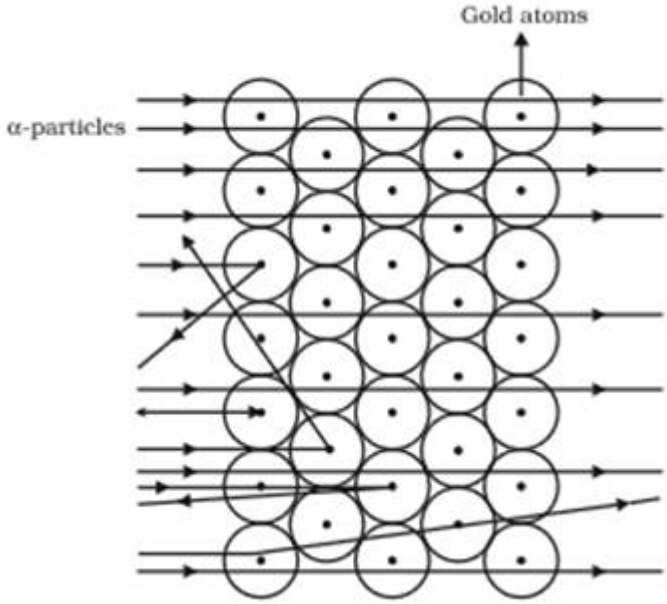
Rutherford's model of an atom:

i. He conducted an experiment in which he directed high speed positively charged particles called alpha particles towards a thin gold foil.

ii. He observed that most of the alpha particles passed through the foil without the deflection.

iii. A few them were deflected at very small angles.

iv. Few were turned back on their path.



3 E. Question

Answer the following:

Describe Neils Bohr's atomic model.

Answer

Neils Bohr's atomic model:

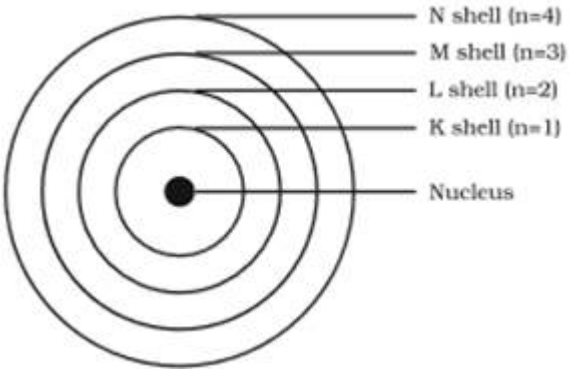
i. Electrons revolve around the nucleus in certain circular orbits (shells)

ii. The first shell nearest to the nucleus is called "K shell". The subsequent shells as we move away from the nucleus are L, M, N,O respectively.

iii. The energy of an electron remains same as long as it revolves around its own shell.

iv. The shells also represent energy levels.

v. He proposed that each shell can accommodate a maximum of $2n^2$ electrons (n= shell number)



3 F. Question

Answer the following:

Mention the properties of cathode rays.

Answer

The properties of cathode rays:

i. Cathode rays contain negatively charged particles and are also called negative rays.

ii. Cathode rays travel in the direction of opposite to that of the anode rays.

iii. The path of the cathode rays deflected towards anode.

iv. The cathode rays are named as electrons.

v. These electrons are lighter than hydrogen atom.

3 G. Question

Answer the following:

Who proposed that atomic nucleus is positively charged?

Answer

Rutherford proposed that atomic nucleus is positively charged.

i. On the basis of Rutherford model atom, he assumed that positively charged particles of an atom are held together in the centre of atom.

ii. It is called nucleus. Nucleus is surrounded by electrons.

iii. The volume is nucleus is small when compared to the volume of an atom.

iv. The nucleus is positively charged which is different in magnitude for different elements.

3 H. Question

Answer the following:

State the conclusions drawn by alpha ray scattering experiment of Rutherford?

Answer

The conclusions drawn by alpha ray scattering experiment of Rutherford are:

i. Most of the space inside the atom is empty because most of the alpha-particles passed without getting deflected.

ii. Very few particles were deflected from their path, indicating that the positive charge of the atom occupies very little space.

iii. A very small fraction of alpha-particles were deflected by 180°, this indicates that all the positive charge and mass of the gold atom were concentrated in a very small volume within the atom.

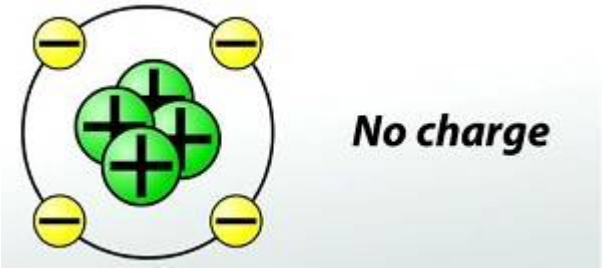
3 I. Question

Answer the following:

Why is an atom neutral in spite of the presence of charged particles in it?

Answer

In an atom, the number of electrons outside the nucleus is equal to the number of positively charged particles in the nucleus. Hence the atom is neutral (no charge).



3 J. Question

Answer the following:

List the three fundamental particles and their properties.

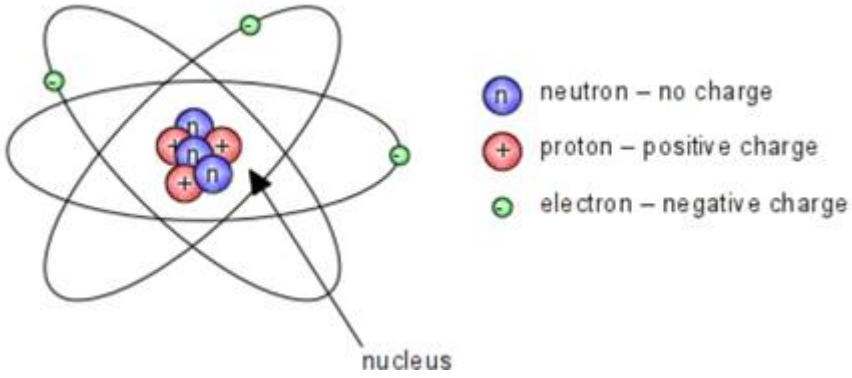
Answer

The properties of three fundamental particles are:

i. Electrons: Electrons are negatively charged particles. They have a negligible mass. These are much lighter than hydrogen atom. Electrons revolve in a circular orbit around the nucleus.

ii. Protons: Protons are positively charged particles. It remains inside the nucleus. Their mass is slightly less than that of neutrons.

iii. Neutrons: Neutrons has no charge and a mass nearly equal to that of proton. These are present in the nucleus of all atoms, except hydrogen. These are the heaviest fundamental particle.



3 K. Question

Answer the following:

Define the terms atomic number and mass number of an element.

Answer

Atomic number: The number of protons present in the nucleus of an atom is known as atomic number. It represents the number of electrons in the orbits. It is denoted by Z.

Mass number: The total number of protons and neutrons present in the nucleus of an atom is known as mass number. It is represented by the symbol A.

3 L. Question

Answer the following:

Define the term 'isotope' of an atom with a suitable example.

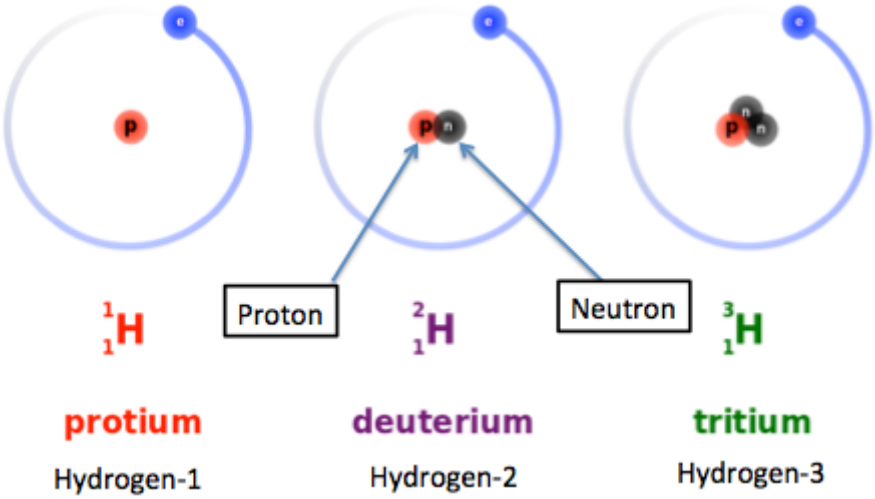
Answer

Isotope: Atoms of an element with different mass numbers are called isotopes.

Number of protons + Number of neutrons = Mass number

For example: Hydrogen has three isotopes:

H^1 (protium/hydrogen)	${}_1H^2$ (deuterium)	${}_1H^3$ (tritium)
No. of neutrons = 0 No. of proton = 1	No. of neutrons = 1 No. of proton = 1	No. of neutrons = 2 No. of proton = 1
Mass no. = 1	Mass no. = 2	Mass no. = 3



3 M. Question

Answer the following:

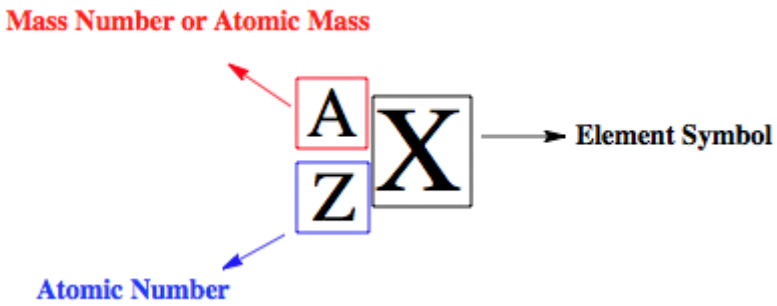
From the symbol $_{19}K^{40}$. write the following

1.mass number of Potassium

2. atomic number of Potassium

3. Write the distribution of electrons in an atom of Potassium.

Answer

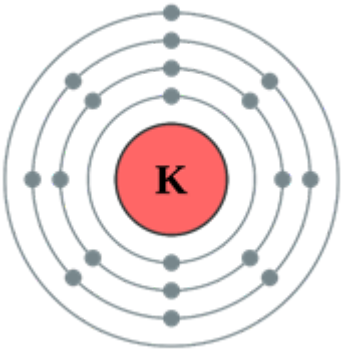


<u>For potassium:</u>

1. Mass number of potassium is 40.

2. Atomic number of potassium is 19.

3. Distribution of electrons in an atom of potassium is 2,8,8,1



4. Question

Match the following:

A	B
1. proton	a. negligible mass
2. 'L' shell	b. 32 electrons
3. electrons	c. Dalton's atomic theory
4. neutrons	d. 8 electrons
	e. electrically neutral
	f. positively charged
	g. 18 electrons.

Answer

1-f, 2-d, 3-a, 4-e

A	B
1. proton	f. positively charged
2. 'L' shell	d. 8 electrons
3. electrons	a. negligible mass
4. neutrons	e. electrically neutral

1. Protons are positively charged particles. It is represented by the symbol "p". Their mass is slightly less than that of neutron. They remain inside the nucleus.

2. L shell contains 8 electrons. As we know that every shell has $2n^2$ electrons. For L shell (n=2):

$2n^2 = 2\times 2\times 2$

8 electrons

3. The mass of an electron is considered to be negligible.

4. Neutrons are the atomic particles which have no charge. They are electrically neutral. Their mass is nearly equal to that of proton. These are

present inside the all atoms except hydrogen.