

1. Multiple choice questions (Tick the correct option).

- Which one of the following proposed the atomic theory of matter?
(a) John Dalton (b) J.J. Thomson
(c) Rutherford (d) Niels Bohr
- Nucleons are
(a) protons only (b) neutrons only
(c) protons and neutrons (d) protons and electrons
- The maximum number of electrons in the L shell are
(a) 2 (b) 18 (c) 32 (d) 8
- Atoms of the same element having different physical properties, but same chemical properties, are called
(a) isobars (b) allotropes (c) isotopes (d) none of the above
- The outermost shell of an atom cannot have more than
(a) 2 electrons (b) 8 electrons (c) 18 electrons (d) 32 electron

Ans. 1. (a) 2. (c) 3. (d) 4. (c) 5. (b)

2. State whether the following statements are true or false. If false, write the correct statement.

- According to the modern atomic theory, atoms of the same element are alike in all respects.

Ans.

False: According to the modern atomic theory, atoms of the same element may not be alike in all respects as seen in the case of isotopes.

- J.J. Thomson saw that the cathode rays were deflected by a negatively charged plate in the cathode tube.

Ans.

False: J.J. Thomson saw that the cathode rays were deflected by a positively charged plate in the cathode tube.

- An atom consists of a central nucleus containing protons and neutrons and the electrons revolve around the nucleus in imaginary paths called shells.

Ans.

True.

- Atomic number is equal to the number of protons and also equal to the number of neutrons.

Ans.

False: Atomic number is equal to the number of protons and also equal to the number of electrons in a neutral atom.

5. An element 'X' has atomic number 19. Its electronic configuration is 2,8,9.

Ans.

False:

An element 'X' has atomic number 19. Its electronic configuration is 2, 8, 8, 1.

3. What are isotopes? How does the existence of isotopes contradict Dalton's atomic theory?

Answer:

Atoms of an element must have the same atomic number, but their mass number can be different due to the presence of different number of neutrons. These atoms of an element having different number of neutrons are called groups.

According to Dalton's theory, all atoms of an element are similar to all respects, for example, they have the same shape, size etc. and have similar physical and chemical properties like mass, density and reactivity. Whereas isotopes of an element have atoms that are similar as they have same number of protons and electrons but differ in the number of neutrons. So, the isotopes have atoms that are not similar in all aspects.

4. (a) What are the two main parts of which an atom is made of?

(b) Where is the nucleus of an atom situated ?

(c) What are orbits or shells of an atom ?

Answer:

(a)

The centrally located nucleus

The outer circular orbits.

(b) The nucleus is a centrally located positively charged mass.

(c) The circular orbits (shell present) in the space available around the nucleus on which electrons revolve are called orbits or shells of an atom.

5. Explain the rule with example according to which electrons are filled in various energy levels,

Answer:

The maximum number of electrons that can be present in any shell or orbit of an atom is given by the formula $2n^2$, where n is the serial number of the shell.

Therefore:

K shell, $n = 1$, no. of electrons = $2 \times 1^2 = 2$

L shell, $n = 2$, no. of electrons = $2 \times 2^2 = 8$

M shell, $n = 3$, no. of electrons = $2 \times 3^2 = 18$

N shell, $n = 4$, no. of electrons = $2 \times 4^2 = 32$

Electrons are not accommodated in a given shell, unless the inner shells are filled.

That is, the shells are filled in a stepwise manner.

6. The atomic number and the mass number of sodium are 11 and 23 respectively. What information is conveyed by this statement.

Answer:

Atomic number = 11; No of protons = 11

Mass number = 23 = Number of protons + Number of neutrons.

No of neutrons = 23-11 = 12.

7. Choose from the table letters (A to E) that represent
- a pair of isotopes.
 - an element with mass number 19.
 - an element having atomic number 7.

Element	Neutron	Proton	Electron
A	22	18	18
B	18	17	17
C	10	9	9
D	7	7	7
E	20	17	17

Ans.

- (a) B and E.

Atoms of elements having the same atomic number (no. of protons) but different mass number or different number of neutrons are isotopes.

- (b) C: Mass number = no. of protons + no. of neutrons.

- (c) D: Atomic number = no. of protons.

8. (a) What are the two main features of Rutherford's atomic model?
(b) State its one drawback.

Answer:

- (a) According to Rutherford's model an atom consists of:

- The centrally located nucleus:** The nucleus is a centrally located positively charged mass. The entire mass of the atom is concentrated in it. It is the densest part of the atom. Its size is very small as compare to the atom as a whole.
- The outer circular orbits:** Electrons revolve in circular orbits (shell) in the space available around the nucleus. An atom is electrically neutral i.e., number of protons and electrons present in an atom are equal.

(b) Rutherford's atomic model could not explain the stability of the atom as it is like a solar system, the sun is at the centre and the planets revolve around it, in an atom the electrons revolve around the centrally located nucleus containing protons.

9. (a) Define:

- (i) Valency
- (ii) Variable valency.

(b) Name two elements having variable valency and state their valencies.

Ans.

(a) (i) Valency: The number of electrons donated or accepted by an atom of an element so as to achieve a stable electronic configuration of the nearest noble gas.

(ii) Variable valency: When elements exhibit more than one valency due to loss of electrons from the valence shell as well as from the shell before the valence shell, it shows variable valency.

(b) Copper and silver show variable valency. Cu^{1+} , Cu^{2+} and Ag^{1+} , Ag^{2+}

10. How do the three isotopes of hydrogen differ?

Ans.

The three isotopes of hydrogen are

- (i) Protium (${}_1\text{H}^1$) or ordinary hydrogen: It has one proton and one electron.
- (ii) Deuterium (${}_2\text{H}^1$) or heavy hydrogen: It has one proton, one neutron and one electron
- (iii) Tritium (${}_3\text{H}^1$) or very heavy hydrogen: It has one proton, two neutrons and one electron. Thus, the number of neutrons differ in the three isotopes of hydrogen.