CBSE Test Paper 05

Chapter 04 Structure of the Atom

1. The electronic configuration of Cl^- ion is **(1)**

   a. 2, 8, 6
   b. 2, 8, 7
   c. 2, 8, 8, 1
   d. 2, 8, 8

2. Example of isobars are**: (1)**

   a. ${}^{35}_{17}Cl, {}^{37}_{17}Cl$
   b. ${}^{16}_{6}O, {}^{18}_{6}O$
   c. None of the options
   d. ${}^{1}_{1}H, {}^{2}_{1}H, {}^{3}_{1}H$

3. Number of valence electrons in Cl^- ion is**: (1)**

   a. 8
   b. 18
   c. 17
   d. 16

4. The difference between isotopes and isobars **(1)**

   a. Isotopes have same physical properties but isobars have different
   b. Isobars have same chemical properties but isotopes have different chemical proerties
   c. Both have same physical properties
   d. Isotopes have same chemical properties but isobars have different

5. Match the following with the correct response **: (1)**

Column A	Column B

(1) Electron	(A) E.Goldstein
(2) Proton	(B) Rutherford
(3) Neutron	(C) James Chadwick
(4) Atomic nucleus	(D) J.J.Thomson

a. 1-D, 2-A, 3-C, 4-B

b. 1-C, 2-B, 3-D, 4-A

c. 1-A, 2-C, 3-B, 4-D

d. 1-B, 2-D, 3-A, 4-C

6. Match the following with the correct response**: (1)**

Column A	**Column B**
(1) Discovery of subatomic particles	(A) Orbits
(2) Energy levels	(B) Positively charged
(3) Universal particles	(C) Electrons
(4) Canal rays	(D) Discharge tube

a. 1-B, 2-D, 3-A, 4-C

b. 1-A, 2-C, 3-B, 4-D

c. 1-D, 2-A, 3-C, 4-B

d. 1-C, 2-B, 3-D, 4-A

7. According to $2n^2$ rule, which shell in an atom can accomodate 32 electrons **: (1)**

a. K-shell

b. M-shell

c. N-shell

d. L-shell

8. Name the three sub-atomic particles in an atom. **(1)**

9. Which isotope of hydrogen is present in heavy water? **(1)**

10. Are the electrons stationary in the stationary states? **(1)**

11. Write the distribution of electrons in carbon and sodium atoms. **(3)**

12. Name a species which has (i) one proton and one electron (ii) one proton and two electrons **(3)**

13. If K and L shells of an atom are full, then what would be the total number of electrons in the atom? **(3)**

14. Explain with examples**:**

a. Atomic number,
b. Mass number,
c. Isotopes and
d. Isobars.

Give any two uses of isotopes. **(5)**

15. Show diagrammatically the electron distribution in a sodium atom and a sodium ion and also give their atomic number.

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Answers

1. d. 2, 8, 8

   Explanation: Neutral Chlorine ($_{17}Cl$) has an electronic configuration as 2, 8,7. Now we observe that Chlorine is one electron less than achieving the stable electronic configuration of its nearest Noble gas, Argon. So Chloride gains (steals) an electron (not from empty space, either from metal, semi-metal etc.) and becomes Chloride ion (so it becomes stable like Argon). So the electronic configuration of Chloride ion will be 2,8,8.

2. c. None of the options

   Explanation: Isobars are two or more atoms of different elements having the same mass number but different atomic numbers. As all the given atoms belong to the same element, none of them are isobars.

3. a. 8

   Explanation: Atomic number of Chlorine is 17 (Configuration 2, 8, 7). Since the atom gains an electron during the formation of Cl^- ion, the number of valence electrons in Cl^- ion is 8.

4. d. Isotopes have same chemical properties but isobars have different

   Explanation: Isotope compound have same number of electrons. Isotopes have same chemical properties as the number of electrons present in them are same because only electrons participate in chemical reactions.While isobar compounds have same mass number but different atomic number and chemical properties depend upon number of electrons so isobars have different chemical properties.

5. a. 1-D, 2-A, 3-C, 4-B

   Explanation:

(1) Electron	(D) Discovered by J.J.Thomson
(2) Proton	(A) Discovered by E.Goldstein

(3) Neutron	(C) Discovered by James Chadwick
(4) Atomic nucleus	(B) Discovered by Rutherford

6. c. 1-D, 2-A, 3-C, 4-B

Explanation: Discharge tube is a tube containing charged electrodes and filled with a gas in which ionization is induced with the help of an electric field. The gas molecules emit light as they return to the ground state. It was used in the discovery of subatomic particles. Neils Bohr explained that electrons do not move in orbits around the nucleus - rather they occupy discrete energy levels. Electron is considered as a universal particle as it is present in all atoms. It also provides the chemical properties to the atoms. Canal rays are positively charged.

7. c. N-shell

Explanation: K shell means n = 1, L means n = 2 and M shell means n = 3 and N shell means n = 4.

Number of electrons in N-shell = $2n^2 = 2(4)^2 = 2 \times 16 = 32$ electrons

8. Matters are made of tiny particles called atom. Atom is made of three particles; electron, proton and neutron. These particles are called fundamental particles of an atom or sub atomic particles.

9. Among the three isotopes of hydrogen, **deuterium** $\left({}_{1}^{2}H\right)$ is found in heavy water (deuterium oxide). Heavy water is composed of deuterium - the hydrogen isotope with a mass double that of ordinary hydrogen - and oxygen.

10. A stationary state is a pure quantum state with all observables independent of time. No, the electrons are not stationary. Only the energy which is associated with the electrons is stationary or fixed.

11. **For carbon atom**

Number of electrons = Atomic number = 6

Electron distribution : 2 (K - shell) ; 4(L - shell)

For sodium atom :

Number of electrons = Atomic number = 11

Electron distribution: 2 (K - shell) ; 10(L - shell) ; 1 (M - shell)

12. Protium ${}_1^1H$ an isotope of hydrogen has 1 electron, one proton and no neutron. Hydride ion (H^-) has one proton and two electrons.

13. K shell (n = 1) can accommodate a total 2 electrons ($2n^2$ electrons). L shell (n = 2) can accommodate a maximum 8 electrons ($2n^2 = 2 \times 2^2 = 8$ electrons).
If K and L shells of an atom are full, then the total number of electrons in the atom will be 2 + 8 = **10**.

14. i. **Atomic number:** It is the number of protons present inside nucleus of the atom. It is represented by Z. E.g. Atomic number of hydrogen Z = 1, because the number of protons in a hydrogen atom is 1.
ii. **Mass number:** It is the total number of **protons and neutrons** (nucleons) present inside the nucleus of an atom. Mass number is represented by A. A = Z + N where Z is the atomic number and N is the number of neutrons. E.g. Mass number of carbon is 12 because it has 6 protons and 6 neutrons inside the nucleus. A = 6 + 6 = 12. Atomic number (Z) of carbon is 6.
iii. **Isotopes:** They are atoms of the same element having the same atomic number (Z) but different mass number/atomic mass (A). For example: Carbon has 2 isotopes, ${}_6^{12}C$ and ${}_6^{14}C$.
iv. **Isobars:** They are atoms of different elements having same mass number (A) but different atomic number (Z). For example: Calcium (Atomic number 20) and Argon (Atomic number 18). The number of protons (Z) in these atoms is different, but the mass number (A) of both these elements is 40. The number of neutrons in the atoms of this pair of elements is the same.

Two uses of isotopes are as follows:-

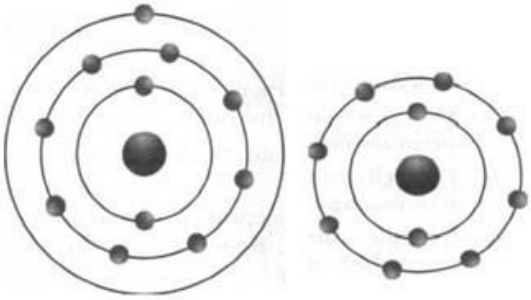
i. An isotope of uranium is used as a fuel in nuclear reactors.
ii. An isotope of cobalt is used in the treatment of cancer.

15. The atomic number of sodium atom is 11. Therefore, it has 11 electrons. K shell can have a maximum of 2 electrons. L shell accommodates a maximum number of 8 electrons. M shell will have 1 electron (remaining electron = 11 - 2 - 8).

A positively charged sodium ion (Na^+) is formed by the removal of one electron from

a sodium atom. So, a sodium ion has 11 - 1 = 10 electrons. Thus, electronic distribution of a sodium ion will be 2, 8 (2 + 8 = 10).

The atomic number of an element is equal to the number of protons in its nucleus. A sodium atom, as well as a sodium ion, contains the same number of protons. Therefore, both of them have an atomic number of 11.



Sodium atom Sodium ion