CBSE Test Paper 01

Chapter 04 Structure of Atom

1. Nitrogen is: **(1)**

   a. Diatomic
   b. Monatomic
   c. Triatomic
   d. Tetratomic

2. Na^+ has 12 neutrons and 10 electrons. Which of the following statement is correct? **(1)**

   a. Na+ has atomic number equal to 10 and mass number 23
   b. Na+ has atomic number equal to 11 and mass number 23
   c. Na+ has atomic number equal to 11 and mass number 22
   d. Na+ has atomic number equal to 10 and mass number 22

3. Which of the following statements is/are correct about β-particles: **(1)**

   (a) They are electrons.
   (b) They are deflected towards positive electrode.
   (c) They travel at the speed of sound.
   (d) They are deflected towards negative electrode.

   a. All of these
   b. (a) and (b) are correct
   c. (b) and (c) are correct
   d. (a), (b) and (c) are correct

4. What is the e/m value of an electron? **(1)**

   a. 1.8×10^{12} C/kg
   b. None of these
   c. 1.76×10^{11} C/kg
   d. 1.6×10^{11} C/kg

5. Atomic number of an element is equal to: **(1)**

a. Number of Protons
b. Number of neutrons
c. Both a) and b)
d. Number of electrons

6. On the basis of Rutherford's model of an atom, which sub-atomic particle is present in the nucleus of an atom? **(1)**

7. Are mass number and atomic mass of an element equal in all respects? **(1)**

8. What are ions? What are its two types? **(1)**

9. The element aluminium is written by the symbol $^{27}_{13}Al$. Write the number of protons, electrons and neutrons present in it. **(1)**

10. Out of C-12 and C-14 isotopes of carbon, which is of radioactive nature? **(1)**

11. Which of the two will be chemically more reactive ; element X with atomic number 16 or element Y with atomic number 17? **(3)**

12. How do you know that nucleus is very small as compared to the size of atom? **(3)**

13. The average atomic mass of a sample of an element X is 16.2 u. What are the percentages of isotopes $^{16}_{8}X$ and $^{18}_{8}X$? **(3)**

14. Explain the variation of atomic radius along a period and down a group. **(5)**

15. Describe valency by taking the examples of silicon and oxygen. **(5)**

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Answers

1. a. Diatomic

   Explanation: Nitrogen (N_2) is diatomic. A **nitrogen** atom has 5 electrons in its outer shell. It forms three covalent bonds with another nitrogen atom and makes a nitrogen molecule.

2. b. Na^+ has atomic number equal to 11 and mass number 23

   Explanation: Atomic number of sodium = 11

   Therefore number of electrons = 11

   Na^+ has 12 neutrons and 10 electrons.

   So, atomic number of Na^+ = 11 and

   Mass number = 12 + 11 = 23

3. b. (a) and (b) are correct

   Explanation: β - particles are electrons. They are deflected towards the positive electrode.

4. c. 1.76×10^{11} C/kg

   Explanation: The charge on an electron is 1.6 x 10^{-19} C and mass of one electron is 9.1 x 10^{-31} kg. Therefore e/m ratio will be 1.6 x 10^{-19} C / 9.1 x 10^{-31} kg = 1.76 x 10^{11} C/kg

5. a. Number of Protons

   Explanation: Atomic number (Z) of a chemical element is the **number of protons** in the nucleus of that atom. It is a characteristic of the element and determines its place in the periodic table. Atomic number = number of protons.

6. The scientific idea is that an atom has electrons surrounding a nucleus that contains protons and neutrons. The nucleus of atom is positively charged according to Rutherford's model of an atom. All the proton's in an atom are therefore, present in the nucleus.

7. It is not necessary that they be numerically same.

The mass number of the atom (M) is equal to the sum of the number of protons and neutrons in the nucleus.

Mass number = No. of protons + No. of nuetrons

The number of protons in the nucleus of the atom is equal to the atomic number (Z).

Atomic number = number of protons.

This is not necessary that every atom has same no. of neutrons as protons.

8. When one or more electron(s) is / are removed from / added to a neutral atom, a positively / negatively charged particle is formed. This charged particle is called an ion. An ion can be of two types:-
   1) Cation (positively charged ion)
   2) Anion (negatively charged ion)

9. Atomic number =13, mass number = 27
   Atomic number = number of protons = 13
   Number of neutron = Mass number – number of proton = 27 – 13 = 14
   Number of electron = No. of protons = 13

10. Carbon-12 and carbon-14 are two isotopes of the element carbon. The difference between carbon-12 and carbon-14 is the number of neutrons in each atom. Because of the different number of neutrons, carbon-12 and carbon-14 differ with respect to radioactivity. Carbon-12 is a stable isotope. Carbon-14, on the other hand, undergoes radioactive decay.

11. The electronic configuration of the two elements are as follows :
   X (Z = 16) : K (2), L(8), M(6) = (2,8,6)
   Y(Z = 17) : K(2), L(8), M(7) = (2,8,7)
   To complete its octet, X will gain 2 electrons and Y will gain only 1 electron, therefore element Y will be more reactive than element X.

12. Rutherford observed in his experiment that when alpha-particles were bombarded on a very thin foil of gold, some of them bounced back. The number of alpha-particles that deflected by more than 180 degrees was very less as compared to the number of electrons that passed through without deflection. Moreover, when he doubled the thickness of the gold foil, the number of alpha-particles bouncing back got doubled.

Therefore, he concluded that the volume of the nucleus (positive region) was very small in comparison to the total volume of the atom.

13. Let the percentage of isotope ${}^{16}_{8}X$ in the sample be x %.

Then the percentage of isotope ${}^{18}_{8}X$ in the sample will be (100 – x) %.

Average atomic mass of element X = 0.01 [(Atomic mass of isotope ${}^{16}_{8}X$) (Percentage of isotope ${}^{16}_{8}X$) + (Atomic mass of isotope ${}^{18}_{8}X$) (Percentage of isotope ${}^{18}_{8}X$)]

Therefore, average atomic mass = $\frac{16\times x+18\times(100-x)}{100}$

or 16.2 = $\frac{16x+1800-18x}{100}$

or 1620 = 1800 – 2x

or 2x = 1800 – 1620

or x = 180 / 2

or x = 90

Percentage of X-16 isotope in the sample = 90 %

Percentage of X-18 isotope in the sample = 100 – 90 = 10 %

14. Atomic radius **decreases along a period.** The first member of each period is the largest in size. As we move from left to right along a period, the atomic number of the atom increases, the positive charge inside the nucleus increases and electrons are added to the same orbit. The increased nuclear charge increases the force of attraction between the nucleus and the electrons. Group-1 atoms are the largest in their respective periods.

Atomic radius **increases down a group.** As we move down in a group, the atomic number increases, the number of shells increases and the distance of the outermost electrons from the nucleus increases.

15. The valency of an element is the combining capacity of that element. It is determined by the number of electrons present in the outermost shell (valence shell) of an atom of that element, if the number of valence electrons of an atom of an element is less than or equal to 4, then the valency of that element is equal to the number of valence

electrons.

On the other hand, if the numbcr of valence electrons of the atom of an element is greater than 4, then the valency of that element is obtained by subtracting the number of valence electrons from 8.

Valency of Silicon (Si) : Atomic number of the element is 14. Its electronic distribution is; K(2), L(8), M(4).

As silicon atom has four valence electrons, it can lose four electrons to complete its octet. At the same time, it can also gain four electrons. Thus, the valency of silicon is 4.

Valency of oxygen (O) : Atomic number of the element is 8. Its electronic distribution is : K(2), L(6)

As oxygen atom has six valence electrons, it needs two electrons to complete its octet (8 - 6 = 2). Therefore, valency of oxygen is 2.