CBSE

STRUCTURE OF ATOM WS 6

Class 09 - Science

Section A

1. Hydrogen exists in three isotopic forms, ${}_{1}^{1}\mathrm{H}, {}_{1}^{2}\mathrm{H}, {}_{1}^{3}\mathrm{H}$ respectively known as protium, deuterium and tritium. Why are all the isotopes neutral in nature? **[1]**

   a) All the isotopes have one electron and one proton, hence they are neutral.

   b) All the isotopes have one proton and one neutron, hence they are neutral.

   c) Equal number of protons and neutrons in the isotopes make them neutral.

   d) All the isotopes contain same number of neutrons hence, they are electrically neutral.

2. ${}_{88}^{226}A, {}_{87}^{228}B, {}_{88}^{228}C, {}_{90}^{228}D$ **[1]**

   Which of the following nuclei are isotopes?

   a) ${}_{88}^{226}A, {}_{88}^{228}C$

   b) ${}_{87}^{228}B, {}_{88}^{228}C$

   c) Both ${}_{87}^{228}B, {}_{88}^{228}C$ and ${}_{88}^{228}C, {}_{90}^{228}D$

   d) ${}_{88}^{228}C, {}_{90}^{228}D$

3. The isotopes of hydrogen which contain same number of electrons, protons and neutrons? **[1]**

   a) Deuterium

   b) Tritium

   c) Pratium

   d) Protium

4. 1 mole of diatomic element X_2 contains 34 and 40 moles of electrons and neutrons respectively. The isotopic formula of the element is **[1]**

   a) ${}_{34}^{40}X$

   b) ${}_{17}^{37}X$

   c) ${}_{40}^{74}X$

   d) ${}_{34}^{74}X$

5. Isotopes of an element have **[1]**

   a) Same physical properties

   b) Different chemical properties

   c) Different atomic number

   d) Different number of neutrons

6. Isotopes of an element have**:** **[1]**

   a. Same chemical properties
   b. Same atomic masses
   c. Different atomic numbers
   d. Atoms of the same element

   a) All of these

   b) (a) and (d) are correct

   c) (b) and (c) are correct

   d) (a), (b) and (c) are correct

7. Which of the following are isotopes and which are isobars? **[1]**

   Argon (Ar), Deuterium (D), Calcium (Ca), Tritium (T), Protium (P)

a) Ar, Ca are isotopes and D, T, P are isobars

b) D, P are isotopes

c) Ar, Ca are isobars and D, T, P are isotopes

d) Ar, P, T are isobars

8. Which of the following represents the correct composition of the three isotopes of carbon? **[1]**

a) C - 12 : 6p + 6n, C - 13 : 12p + 1n, C - 14 : 5p + 9n

b) C - 12 : 6p + 6n, C -13 : 6p + 7n, C - 14 : 6p + 8n

c) C - 12 : 6p + 6n, C - 13 : 5p + 8n, C - 14 : 7p + 7n

d) C - 12 : 6p + 6n, C - 13 : 7p + 6n, C - 14 : 8p + 6n

9. In a sample of ethyl ethanoate ($CH_3COOC_2H_5$) the two oxygen atoms have the same number electrons but different number of neutrons. Which of the following is the correct reason for it ? **[1]**

a) The two oxygen atoms are isobars

b) One of the oxygen atom has gained neutrons

c) One of the oxygen atom has gained electrons

d) The two oxygen atoms are isotopes

10. 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.

11. The average atomic mass of boron is 10.8 u. If the isotopic mass of B-10 is 10.013 and that of B-11 is 11.009, then the relative abundance of these isotopes is respectively **[1]**

a) 11% and 89%

b) 20.98% and 79.02%

c) 10.001% and 89.9%

d) 80.1% and 19.9%

12. **Statement 1:** Isobars have different chemical properties. **[1]**
Statement 2: The sum of protons and neutrons in isobars is always different.

a) Statement 1 is true and statement 2 is false.

b) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.

c) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.

d) Both statements 1 and 2 are false.

13. The isotope of carbon which has same number of neutrons as ${}_8O^{16}$, is used in radiocarbon dating to determine age of old samples of living organisms? **[1]**

a) ${}_6C^{15}$

b) ${}_6C^{12}$

c) ${}_6C^{14}$

d) ${}_6C^{13}$

14. There are two atomic species X and Y, such that **[1]**

Atomic species	X	Y
Protons	8	8

Protons	8	10

Which of the following statements is true about X and Y?

a) X and Y have different chemical properties.
b) X and Y are isobars.
c) X and Y have different physical properties.
d) All are correct.

15. A brief information about two atoms X and Y is given: **[1]**

X: Atomic number = 7, Mass number = 14

Y: Atomic number = 7, Mass number = 15

Which of the following is correct about these two atoms?

a) Both X and Y have 5 valence electrons.
b) X has 2 electron shells while Y has 3 electron shells.
c) Electronic configuration of X is 2, 8, 4 while that of Y is 2, 8, 5.
d) Both X and Y contain 7 neutrons.

16. Which of the given pairs of atoms contain(s) the same number of neutrons? **[1]**

i. $^{114}_{48}Cd$ and $^{119}_{50}Sn$
ii. $^{59}_{27}Co$ and $^{59}_{28}Ni$
iii. $^{113}_{55}Cs$ and $^{132}_{54}Xe$
iv. $^{63}_{29}Cu$ and $^{65}_{29}Cu$

a) iii only
b) iv only
c) i and iv only
d) i and III only

17. Which of the following are isobars? **[1]**

a) $^{34}_{17}Cl$, $^{37}_{17}Cl$
b) $^{40}_{18}Ar$, $^{40}_{20}Ca$
c) $^{3}_{1}H$, $^{2}_{1}H$
d) $^{16}_{8}O$, $^{15}_{8}O$

18. **Assertion (A):** Isotopes are electrically neutral. **[1]**

Reason (R): Isotopes are species with same mass number but different atomic numbers.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

19. **Assertion (A):** Isotopes are electrically neutral. **[1]**

Reason (R): Isotopes of an element have equal number of protons and electrons.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

20. **Assertion (A):** Isotopes of an element show different valencies. **[1]**

Reason (R): Isotopes have different atomic numbers.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

21. **Assertion (A):** The atoms of different elements having same mass number but different atomic numbers are known as isobars. **[1]**

Reason (R): The sum of protons and neutrons, in the isobars is always different.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

22. **Assertion (A):** Isobars are identical in chemical properties. **[1]**

Reason (R): Isobars have same atomic number.

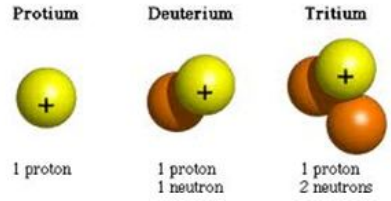
a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

23. The nuclei of the three isotopes of hydrogen are as follows: **[1]**



Which of these three isotopes of hydrogen shown above is found in nature?

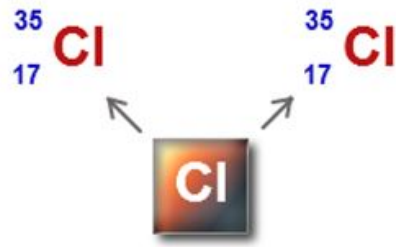
a) Deuterium

b) Protium

c) Tritium

d) Protium, Deuterium and Tritium

24. Chlorine occurs in nature in two isotopic forms, with masses 35 u and 37 u in the ratio of 3:1. Then what is the average atomic mass of chlorine? **[1]**



a) 35.5

b) 17

c) 34

d) 35

25. Match the following with the correct response**:** **[1]**

(1) Atomic number	(A) Total number of neutrons and protons
(2) Atomic mass	(B) Different atoms with same atomic masses
(3) Isotopes	(C) Atoms of same element with same atomic numbers
(4) Isobars	(D) Number of protons

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

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

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

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

26. Match the following with the correct response**:** **[1]**

(a) Deuterium	(i) Radiocarbon Dating
(b) Carbon-14	(ii) Treatment of cancer
(c) Isotope of uranium	(iii) Nuclear Reactors
(d) Cobalt-60	(iv) An isotope of Hydrogen

a) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)

b) (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)

c) (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i)

d) (a) - (iv), (b) - (i), (c) - (iii), (d) - (ii)

27. Which of the following statements is/are correct? **[1]**

A. Isotopes differ in number of neutrons but have same number of protons and electrons.

B. Isobars differ in number of neutrons but have same number of protons and electrons.

C. Isotopes differ in number of electrons, protons and neutrons and differ in chemical properties.

D. Isobars differ in number of electrons, protons and neutrons and have same chemical properties.

a) B

b) A

c) D

d) C

28. Which of the following statements is incorrect? **[1]**

A. ${}^{2}_{1}H$ is used to determine the age of old samples of water and wine.

B. Co-60 is used in treatment of cancer.

C. I-132 is used in thyroid scan and treatment of goiter.

D. C-14 is used to determine the age of old samples of living organisms.

a) A

b) B

c) C

d) D

29. Which isotope of hydrogen is present in heavy water? **[1]**

30. Will ^{35}Cl and ^{37}Cl have different valencies? Justify your answer. **[1]**

31. Which radioisotope is used for the treatment of cancer? **[1]**

32. Out of C-12 and C-14 isotopes of carbon, which is of radioactive nature? **[1]**

33. The atomic number of calcium and argon are 20 and 18 respectively, but the mass number of both these elements is 40. What is the name given to such a pair of elements? **[1]**

Section B

34. **State True or False:** **[2]**

(a) The unstable isotopes which emit various types of radiations are known as radioactive isotopes. **[1]**

(b) Atoms of the same element differing in the number of neutrons in their nuclei are known as isobars. **[1]**

35. 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 ${}^{18}_{8}X$? **[2]**

36. Do isobars have also identical chemical characteristics like isotopes? **[2]**

37. There are 2 elements C and B. C emits an α-particle and B emits a β-particle. How will the resultant elements charge? **[2]**

38. Write the electronic configuration of any one pair of isotopes and isobars. **[2]**

39. Hydrogen has three isotopes. State the composition of their nuclei and write their mass number. Also represent them in the form of symbols. **[2]**

40. Why do elements which exist as isotopes have fractional atomic masses? **[2]**

41. Why are isotopes of an element chemically similar? **[2]**

42. What are isotopes? Name the isotopes of hydrogen and draw the structure of their atoms? **[2]**

43. What is the similarity and dissimilarity between two isotopic species of an element? **[2]**

44. If bromine atom is available in the form of, say, two isotopes ${}^{79}_{35}Br(49.7\%)$ and ${}^{81}_{35}Br\,(50.3\%)$. Calculate the average atomic mass of bromine atom. **[2]**

45. The relative atomic mass of copper is 63.5u. It exists as two isotopes which are ${}^{63}_{29}Cu$ and ${}^{65}_{29}Cu$. Calculate the percentage of each present in if. **[2]**

46. Explain why chlorine, whether as the element or its compounds, always has a relative atomic mass of about 35.5. **[2]**

47. The element boron occurs in nature as two isotopes having atomic masses 10u and 11u. What are the percentage abundances of these isotopes in a sample of boron having average atomic mass of 10.8u? **[2]**

48. The average atomic mass of a sample of element X is 16.2u. What are the percentages of isotopes ${}^{16}_{8}X$ and ${}^{18}_{8}X$ in the sample? **[2]**

49. The nucleus of an atom of Bi-210 (atomic number 83) emits a β-particle and becomes a polonium nuclide. Write an equation for the given nuclear change. **[2]**

Section C

50. **Fill in the blanks:** **[3]**

    (a) The atoms of different elements having different atomic numbers but the same mass number are known as _____. **[1]**

    (b) Atoms of the same element differing in the number of neutrons in their nuclei are known as _____. **[1]**

    (c) Isotopes have same _____ but different _____. **[1]**

51. What is the basic difference between the isotopes of an element? **[3]**

Section D

52. **Read the passage and answer any four questions:** **[4]**

In nature, a number of atoms of some elements have been identified, which have the same atomic number but different mass numbers. Many elements consist of a mixture of isotopes. Each isotope of an element is a pure substance. Chlorine occurs in nature in two isotopic forms. While hydrogen occurs in three isotopic forms. Isotopic have various applications such as an isotope of uranium is used as a fuel in nuclear reactors. The mass of an atom of any natural element is taken as the average mass of all the naturally occurring atoms of that element. Atoms of different elements with different atomic numbers, which have the same mass number, are known as isobars.

i. An isotope of cobalt is used in the

   a. treatment of cancer
   b. treatment of goitre
   c. as a fuel
   d. none of these

ii. The isotope deuterium of hydrogen has

   a. No neutrons and one proton
   b. One neutron and two protons
   c. One electron and two neutrons
   d. One proton and one neutron

iii. Which of the following reason correctly justifies: The identical chemical properties of all the isotopes of an element.

a. Isotopes have different atomic number

b. Isotopes have the identical electronic configuration

c. Isotopes have the different electronic configuration

d. Isotopes have identical proton

iv. There are two atomic species X and Y, such that (X: proton-8, neutron-8; Y: proton-8, neutron-10) Which of the following statements is true about X and Y?

a. X and Y are isobars

b. X and Y have different chemical properties

c. X and Y have different physical properties

d. All of these

v. Hydrogen exists in three isotopic forms, $_1H^1$, $_1H^2$, $_1H^3$ known as protium, deuterium and tritium. Why are all the isotopes neutral in nature?

a. Since neutrons are neutral in nature hence isotopes are electrically neutral.

b. All the isotopes have one electron and one proton, hence they are neutral.

c. All the isotopes have one proton and one neutron, hence they are neutral.

d. Increasing the number of protons in the isotopes make them neutral.

Section E

53. i. Write two differences between isotopes and isobars. **[5]**

ii. Write uses of Co-60 and U-235.