



|                                |                                                    |                                        |
|--------------------------------|----------------------------------------------------|----------------------------------------|
| Class: IX                      | Department: SCIENCE 2023-2024<br>SUBJECT-CHEMISTRY | Date :04/11/23                         |
| Worksheet<br>+Answers-<br>No:3 | Topic: STRUCTURE OF THE ATOM                       | Note:<br>A4 FILE FORMAT<br>[PORTFOLIO] |
| NAME OF THE STUDENT            | CLASS & SEC:                                       | ROLL NO.                               |

### OBJECTIVE TYPE QUESTIONS

- Which of the following is are true for an element
  - Atomic number = number of protons + number of electrons
  - Mass number = number of protons + number of neutrons
  - Atomic mass = number of protons = number of neutrons
  - Atomic number = number of protons = number of electrons

i. a & b   ii. a & c   iii. b & c   iv. b & d
- The atomic number of sodium is 11 and its mass number is 23. It has
  - 11 neutrons and 12 protons
  - 12 protons and 11 electrons
  - 11 electrons and 12 neutrons
  - 12 electrons and 11 neutrons
- The electronic configuration of Silicon is
  - 2, 8, 4
  - 2,8,8,4
  - 2, 11,
  - 8,2,3
- The isotope used to remove the brain tumours and treatment of cancer is
  - U-235
  - Na-24
  - Iodine
  - Co-60
- The isotopes of an element have:
  - Same number of neutrons
  - Same atomic number
  - Same mass number
  - None of these

### ASSERTION AND REASONING

- Assertion: Atom is electrically neutral.  
Reason: Equal number of protons and electrons are present in an atom.
- Assertion: Inert elements show zero valency.  
Reason: Atoms of inert element have fully filled outermost orbit.

### VERY SHORT ANSWER TYPE QUESTIONS (1 MARK)

8. If 'K' and 'L' shells of an atom are completely filled, then what would be its valency?
9. For chlorine,  $Z = 17$ ,  $A = 35$ . Give the number of protons, electrons and neutrons in chlorine atom.
10. The K and L shells of an atom are completely filled. Find the number of electrons present in it. State the name of the element. . (CBSE 2012, 2013)

### SHORT ANSWER TYPE QUESTIONS (2 mark questions)

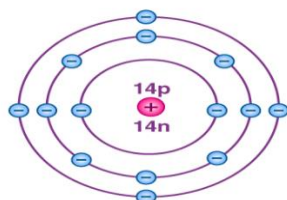
11. Define the terms (a) isotope, (b) isobar
12. A certain particle X has 17 protons, 17 electrons and 18 neutrons  
(i) what is the mass number of X?  
(ii) What is atomic number of X ?  
(iii) What is valency of X?  
(iv) Identify the element.
13. What are valence shell and valence electrons ? (CBSE 2013)
14. The total number of nucleons in the atoms of calcium and argon is 40 and the atomic numbers of calcium and argon are 20 and 18 respectively. Name the pair of these two elements and also find out the number of neutrons present in the nucleus of argon atom. (CBSE 2013)
15. An atom has 2 electrons in M-shell. What is the atomic number of the element? (CBSE 2014)
16. The composition of two atoms A and B is given :

| Atom A       | Atom B       |
|--------------|--------------|
| 17 protons   | 17 protons   |
| 18 neutrons  | 20 neutrons  |
| 17 electrons | 17 electrons |

- (a) What are the mass numbers and atomic numbers of A and B?  
(b) What is the relation between the two chemical species?  
(c) Which element or elements do they represent?
17. Out of elements  $^{34}\text{X}_{17}$  and  $^{40}\text{Y}_{18}$ , which is chemically more reactive and why?
18. An element's atomic mass is equal to twice its atomic number. If the L-shell contains six electrons, then  
a) Predict its valency  
b) Find the name of the element.

### LONG ANSWER TYPE QUESTIONS (5 MARKS)

19. The atomic structure of a silicon atom is depicted in the figure below. Please respond to the following questions.



- i) What is the atomic weight of an atom of silicon?
  - ii) What is the atomic number of an atom of silicon?
  - iii) How many valence electrons are there in a silicon atom?
  - iv) How many electrons exist in a silicon atom?
  - v) Silicon atoms orbiting electrons are arranged in shells. How many shells are there?
20. An atom of an element has two electrons in outermost M-shell. State its
- (a) Electronic configuration
  - (b) Number of protons
  - (c) Atomic number
  - (e) Valency
  - (f) Name (CBSE 2011)
21. Explain why:
- (a) These isotopes of hydrogen have identical chemical properties.
  - (b) These isotopes are electrically neutral
  - (c) These isotopes differ in their masses. (CBSE 2011, 2016)
22. In the following table, the mass number and the atomic number of certain elements are given:

| Elements   | A | B | C  | D  | E  |
|------------|---|---|----|----|----|
| Mass no.   | 1 | 7 | 14 | 40 | 40 |
| Atomic no. | 1 | 3 | 7  | 18 | 20 |

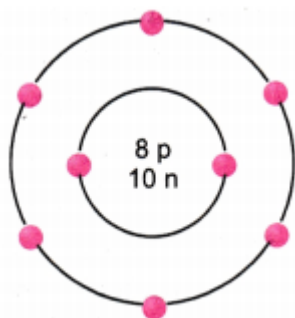
- (a) Select the pair of isobars from the above table.
- (b) What would be the valency of the element C listed in the above table?
- (c) Which two sub-atomic particles are equal in number in a neutral atom? (CBSE 2011)

### BOARD BASED QUESTIONS

23. Complete the following table:

| Atom                  | Mass no. | Atomic no. | No. of neutrons |
|-----------------------|----------|------------|-----------------|
| $^{60}\text{Co}_{27}$ |          |            |                 |
| $^{23}\text{Na}_{11}$ | 23       | 11         |                 |
| $^{37}\text{Cl}_{17}$ |          |            | 20              |

- 24. Define valency by taking examples of silicon and oxygen.
- 25. The atomic number of lithium is 3. Its mass number is 7.
  - (a) How many protons and neutrons are present in a lithium atom?
  - (b) Draw the diagram of a Lithium atom.
- 26. The given figure depicts the atomic structure of an atom of an element 'X'. Write the following information about the element 'X'.



- Atomic number of 'X'
- Atomic mass of 'X'
- Valence electrons
- Valency of 'X'

- Helium atom has 2 electrons in its valence shell but its valency is not 2. Explain.
- The atomic number of lithium is 3. Its mass number is 7.
  - How many protons and neutrons are present in a lithium atom?
  - Draw the diagram of a lithium atom.

### PASSAGE BASED QUESTIONS

The **atomic number** or **proton number** (symbol  $Z$ ) of a chemical element is the number of protons found in the nucleus of every atom of that element. The atomic number uniquely identifies a chemical element. It is identical to the charge number of the nucleus.

In an uncharged atom, the atomic number is also equal to the number of electrons.

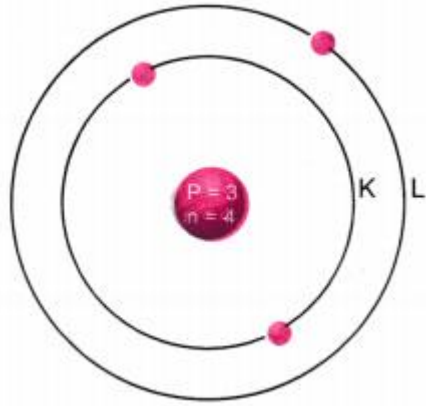
In the following table, the mass number and atomic number of certain elements are given

| Elements | Mass No. | Atomic No. |
|----------|----------|------------|
| A        | 2        | 1          |
| B        | 3        | 1          |
| C        | 3        | 2          |
| D        | 6        | 3          |
| E        | 9        | 4          |
| F        | 11       | 5          |
| G        | 19       | 9          |
| H        | 23       | 11         |

- How many neutrons are present in F?
- Which atoms are isotopes of the same element?
- Which atom will form singly positively charged ion?
- Which is the atom of an inert gas?
- Which will form singly negatively charged ion?
- Which of these has 11 electrons?

| Q.No | Answers                         |
|------|---------------------------------|
| 1    | iv. b & d                       |
| 2    | c. 11 electrons and 12 neutrons |
| 3    | a. 2,8,4                        |
| 4    | d. Co-60                        |
| 5    | b. Same atomic number           |
| 6    | Both are correct                |
| 7    | Both are correct                |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8   | Valency of the atom = zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 9   | In chlorine atom (Cl)<br>Number of protons (Z) = 17<br>Number of neutrons = A - Z = 35 - 17 = 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 10  | Number of electrons present: K(2), L(8) = 10. The element is neon (Ne).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 11  | Isotopes may be defined as : the different atoms of the same element having same atomic number but different mass numbers.<br><br>Isobars may be defined as the atoms belonging to the different elements with same mass numbers but different atomic numbers.                                                                                                                                                                                                                                                                                                                                                                     |
| 12. | (i) Mass no. of X = No. of p + No. of n = 17 + 18 = 35<br>(ii) Atomic no. of X = No. of p = 17<br>(iii) Electronic configuration of X = 2, 8, 7<br>Valency of X = (8 - 7) = 1<br>(iv) Name of element X = Chlorine (Cl).                                                                                                                                                                                                                                                                                                                                                                                                           |
| 13  | Valence shell is the outermost shell in an atom. The electrons present in it are called valence electrons.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 14  | The elements which have same no. of nucleons but different atomic numbers are called isobars. Therefore, calcium (Ca) and argon (Ar) represent a pair of isobars.<br>No. of neutrons in the nucleus of Ar = 40 - 18 = 22.                                                                                                                                                                                                                                                                                                                                                                                                          |
| 15  | K and L shells of the atom are filled and M shell has two electrons. Therefore,<br>Total number of electrons in the atom = 2 + 8 + 2 = 12<br>Atomic number (Z) of the element = 12.                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 16. | a) Mass number of A = 17 + 18 = 35 u<br>Mass number of B = 17 + 20 = 37 u<br>(b) The two chemical species exist as pair of isotopes since they have the same number of protons and electrons.<br>(c) They represent the element chlorine.                                                                                                                                                                                                                                                                                                                                                                                          |
| 17  | The elements $^{34}\text{X}_{17}$ is more reactive because its outermost shell is incomplete.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 18  | Valency-2<br>Element-(2+6 = electrons) -)Oxygen                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 19  | i) Atomic weight of an atom of silicon is the sum of the number of neutrons and protons. It is equal to 14+14=28<br>ii) Atomic number is the measure of the number of protons in the nucleus. Hence, it is equal to 14.<br>iii) We can clearly see that the outermost shell consists of 4 electrons. The electrons in the outermost shell are the valence electrons. Hence equal to 4.<br>iv) For a neutral atom, the number of electrons is equal to the number of protons. Therefore, it is equal to 14.<br>v) We can see from the figure that electrons are filled in K L M shells as 2.8.4. Therefore, there are three shells. |
| 20  | (a) Since the atom has two electrons in outermost M-shell, this means that K and L shells are already filled. Therefore, electronic configuration is 2(K) ,8(L) ,2(M)<br>(b) Number of protons = Number of electrons = 12<br>(c) Atomic number = Number of protons = 12                                                                                                                                                                                                                                                                                                                                                            |

|                         | (e) Valency of the element = Number of outermost electrons = 2<br>(f) The element is magnesium (Mg)                                                                                                                                                                                                                                                                                                                                                                                                         |            |                 |            |                 |                         |    |    |                |                         |    |    |                |                         |    |    |                |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------|------------|-----------------|-------------------------|----|----|----------------|-------------------------|----|----|----------------|-------------------------|----|----|----------------|
| 21                      | (a) The isotopes have identical chemical properties because all of them have one electron in the only shell (K-shell)<br>(b) The isotopes are electrically neutral because each one has one proton and one electron.<br>(c) The isotopes differ in their masses because they differ in their mass numbers (1,2 and 3 respectively).                                                                                                                                                                         |            |                 |            |                 |                         |    |    |                |                         |    |    |                |                         |    |    |                |
| 22                      | (a) Elements D and E are pair of isobars since they have same mass no. = 40<br>(b) The electronic configuration of the element C with $Z = 7$ is 2, 5.<br>It has five valence electrons. Its valency can be either 5 or 3 ( $8 - 5 = 3$ ).<br>(c) In a neutral atom, the number of electrons in the extra-nuclear portion is equal to the number of protons in the nucleus.                                                                                                                                 |            |                 |            |                 |                         |    |    |                |                         |    |    |                |                         |    |    |                |
| 23                      | <table border="1"> <thead> <tr> <th>Atom</th> <th>Mass no.</th> <th>Atomic no.</th> <th>No. of neutrons</th> </tr> </thead> <tbody> <tr> <td><math>{}^{60}_{27}\text{Co}</math></td> <td>60</td> <td>27</td> <td><math>60 - 27 = 33</math></td> </tr> <tr> <td><math>{}^{23}_{11}\text{Na}</math></td> <td>23</td> <td>11</td> <td><math>23 - 11 = 12</math></td> </tr> <tr> <td><math>{}^{37}_{17}\text{Cl}</math></td> <td>37</td> <td>17</td> <td><math>37 - 17 = 18</math></td> </tr> </tbody> </table> | Atom       | Mass no.        | Atomic no. | No. of neutrons | ${}^{60}_{27}\text{Co}$ | 60 | 27 | $60 - 27 = 33$ | ${}^{23}_{11}\text{Na}$ | 23 | 11 | $23 - 11 = 12$ | ${}^{37}_{17}\text{Cl}$ | 37 | 17 | $37 - 17 = 18$ |
| Atom                    | Mass no.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Atomic no. | No. of neutrons |            |                 |                         |    |    |                |                         |    |    |                |                         |    |    |                |
| ${}^{60}_{27}\text{Co}$ | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 27         | $60 - 27 = 33$  |            |                 |                         |    |    |                |                         |    |    |                |                         |    |    |                |
| ${}^{23}_{11}\text{Na}$ | 23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 11         | $23 - 11 = 12$  |            |                 |                         |    |    |                |                         |    |    |                |                         |    |    |                |
| ${}^{37}_{17}\text{Cl}$ | 37                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 17         | $37 - 17 = 18$  |            |                 |                         |    |    |                |                         |    |    |                |                         |    |    |                |
| 24                      | Valency is the combining capacity of an atom.<br>Atomic number of oxygen = 8<br>Atomic number of silicon = 14<br>Electronic configuration of oxygen = 2, 6<br>Electronic configuration of silicon = 2, 8, 4<br>Valency of oxygen = 2<br>Valency of silicon = 4                                                                                                                                                                                                                                              |            |                 |            |                 |                         |    |    |                |                         |    |    |                |                         |    |    |                |
| 25                      | (a) Number of neutrons = Mass number – atomic number<br>Number of neutrons = $7 - 3 = 4$<br>Number of protons = atomic number<br>$\therefore$ Number of protons = 3<br>(b) Structure of a lithium atom<br>                                                                                                                                                                                                               |            |                 |            |                 |                         |    |    |                |                         |    |    |                |                         |    |    |                |
| 26                      | a) Atomic number = Number of protons = 8<br>(b) Atomic mass = Number of protons + Number of neutrons<br>$= 8 + 10 = 18 \text{ u}$<br>(c) Valence electrons = 6                                                                                                                                                                                                                                                                                                                                              |            |                 |            |                 |                         |    |    |                |                         |    |    |                |                         |    |    |                |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | (d) Valency of 'X' = $8 - 6 = 2$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 27 | Helium atom has 2 electrons in its valence shell and its duplet is complete. Hence, the valency is zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 28 | <p>(a) Number of neutrons = Mass number – atomic number<br/>           Number of neutrons = <math>7 - 3 = 4</math><br/>           Number of protons = atomic number<br/> <math>\therefore</math> Number of protons = 3</p> <p>(b) Structure of a lithium atom</p> <p>The diagram shows a central nucleus with a red circle containing 'P = 3' and 'n = 4'. Two concentric circles represent electron shells. The inner shell is labeled 'K' and contains two electrons (red dots). The outer shell is labeled 'L' and contains one electron. The shells are labeled 'K' and 'L' on the right side.</p> |
| 29 | Number of neutrons in F equal to $11 - 5 = 6$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 30 | A and B are isotopes of the same element                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 31 | D and H can form singly positive ions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 32 | Element C is inert gas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 33 | G will form singly negatively charged ion.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 34 | H has 11 electrons.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

PREPARED BY SHYNI VINOD

CHECKED BY HoD SCIENCE