

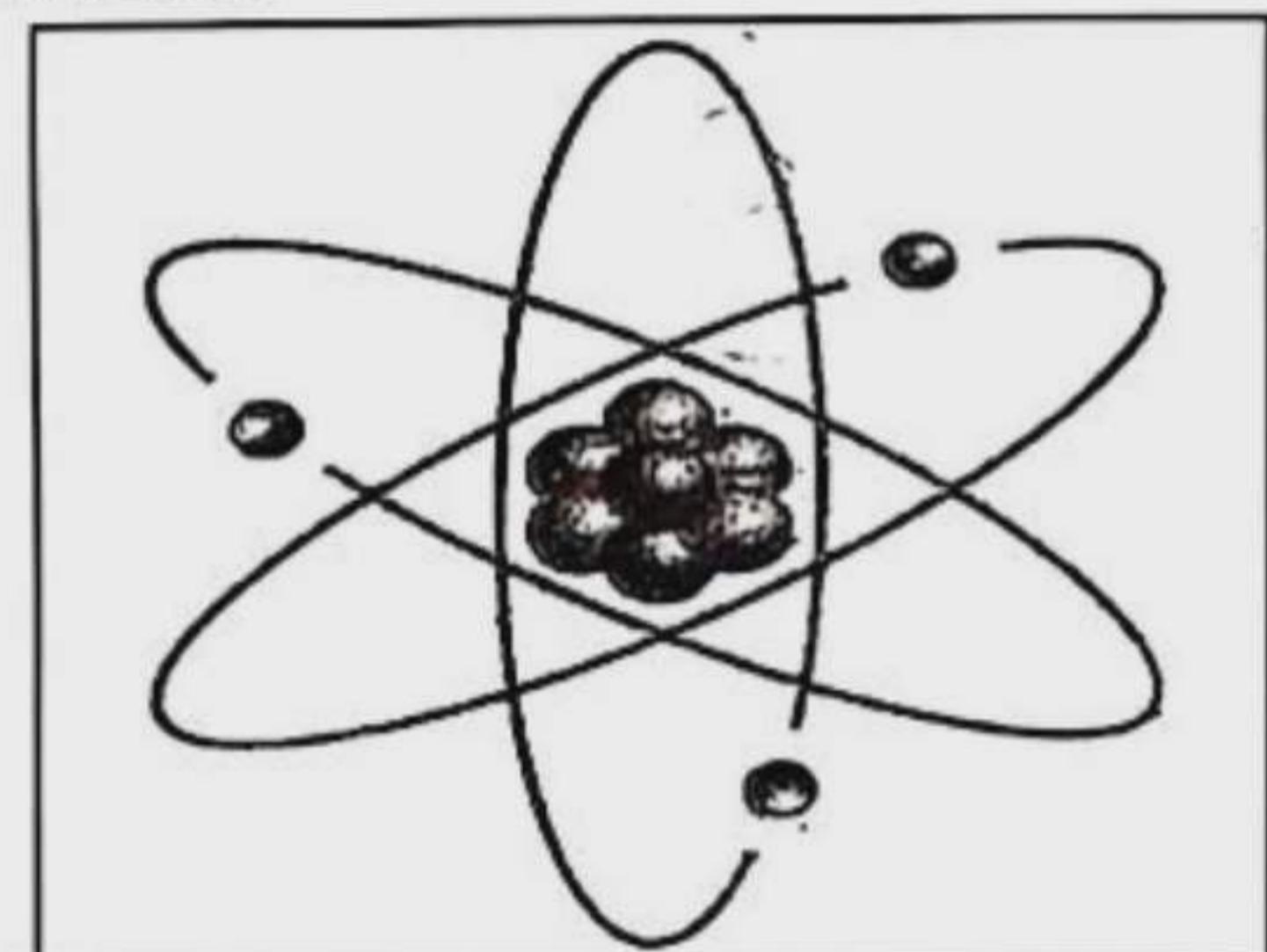
The Structure of Atoms

Contents for Discussion

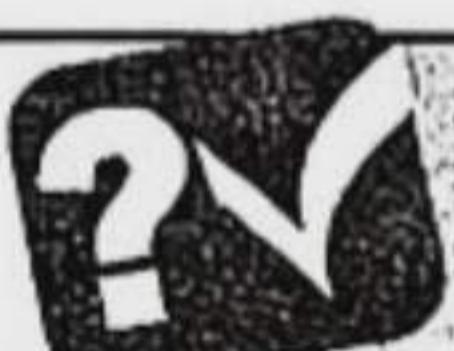
- The evolution of the idea of atoms and their structure
- The properties and application of isotopes
- The way the electrons are distributed in an atom
- The electron distribution and properties of elements.
- Atomic number, mass number and isotopes

Learning Outcomes : After studying this chapter I will be able to—

- explain the structure of the atom;
- explain the atomic number and mass number;
- explain what is isotope;
- explain the distribution of electrons in atoms;
- explain how ions are formed;
- distinguish between cation and anion;
- formulate the chemical formula by using anion and cation;
- describe the use of isotope;
- appreciate the importance of isotopes in our life.



Practice



Multiple Choice, Short & Creative Q/A
following 100% accurate format for best prep.

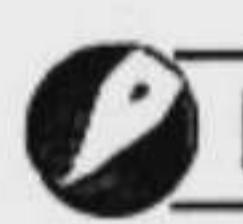
Dear learners, the Q/A of this chapter have been divided into exercise, multiple choice, short, creative & exercise-based activities in light of the learning outcomes. Practice the questions well to ensure the best preparation in the exam.



Textual Q/A



Let's learn the textbook Q/A



Fill in the Blanks



1. According to the opinion of — atoms are indivisible.
2. Most of the mass of the atom is in the —.
3. Most of the space of the atom is —.
4. The number of — in an atom is called the atomic number.
5. The number of protons in the isotopes of an element is —.

Ans. 1. Democritus; 2. nucleus; 3. empty; 4. protons; 5. same.

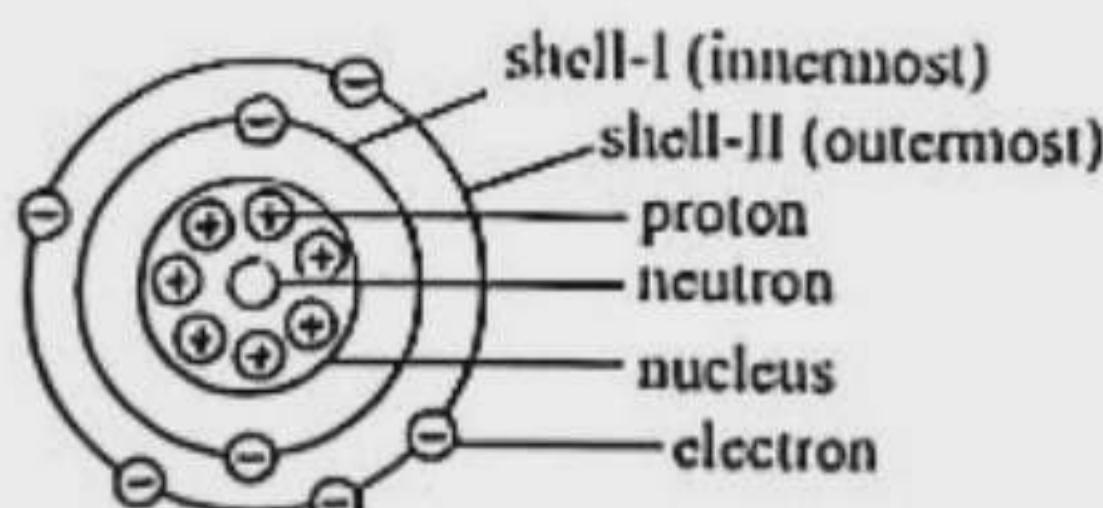


Short Answer Questions



Question 1. Describe and show with diagram the positions in an atom where electrons, protons and neutrons are located.

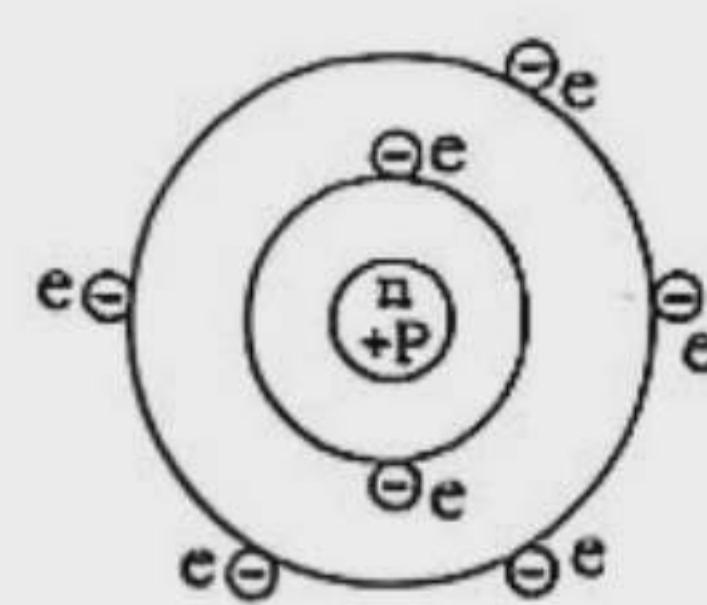
Ans.



Both proton and neutron lie still together in the nucleus while the electrons rotate along the shells around the nucleus like the earth's plunging into the sun. We have considered an atom that has seven protons and one neutrons. We see, these two lie together in the nucleus. Since the elements proton number is seven, electron number is also seven. These electrons are orbitting around the nucleus along two shells. The inner shell contains two electrons while the outer one contains five electrons.

Question 2. The atomic number of Nitrogen is 7. Show with diagram the distribution of electrons in a Nitrogen atom.

Ans. The following diagram represents a nitrogen atom having atomic number 7 and showing distribution of its electrons :



Question 3. Discuss the application of isotopes in Medical treatments and Agriculture.

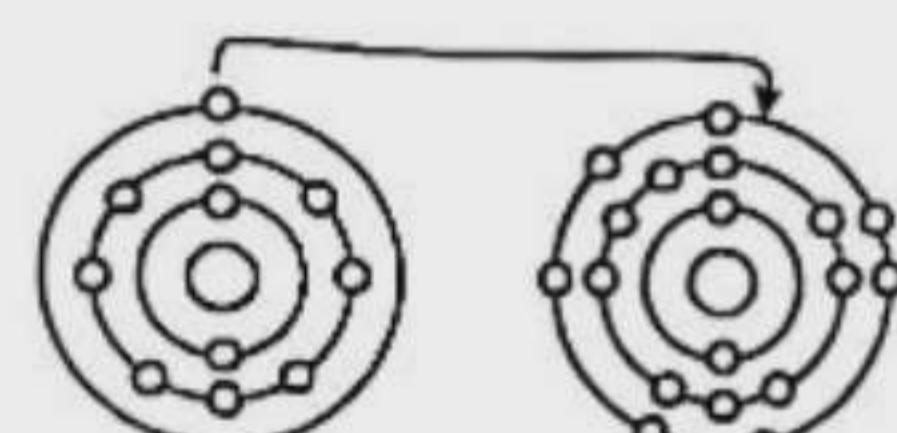
Ans. Application of isotope in medical treatment : Isotope is used in diagnosis and cure of certain diseases. Any affected vein or artery can be detected by transmitting isotope with bloodstream. In the same way, affected cancer cells can be detected. Again, the cancerous cells can also be demolished by applying radioactive rays of isotope. Besides these, isotopic radioactive ray is used to sterilize surgical instrument.

Application of isotope in agriculture :

- Radioactive ray of the isotopes are used in pest management.
- Radioactive ray kills germs including bacteria and so it is used in preserving food items including fruits by making them germ free.

Question 4. Explain with examples how cation and anions are formed.

Ans. We know, the number of protons in an atom never changes but some atoms can either gain and lose electrons. If an atom gains electrons, it becomes negatively charged. It is anion. On the contrary, if an atom loses electrons, it becomes positively charged. It is cation. Anion and cation make ionic bond making a compound. For example,



Sodium atom
(electron donor,
anion⁺)

Chlorine atom
(electron gainer,
cation⁻)

According to the diagram, a sodium atom has a single electron in its outermost shell. Again, a chlorine atom has seven electrons in its outermost shell. The two atoms make a bond by giving and receiving an electron; sodium atom is the donor (cation) and chlorine atom is the receiver (anion). Thus they make sodium chloride.



MCQs with Answers

1. How many electrons can stay in the second orbit of an atom?

- b. @ 2 ⑤ 8 ⑥ 18 ⑦ 32

► Explanation : The maximum electron capacity in an atomic orbit is determined by the formula $2n^2$, Where $n = 1, 2, 3$ etc. represent the orbit number.

So, for the 2nd orbit, where, $n = 2$

Maximum number of electron in the 2nd orbit
 $= 2 \times 2^2 = 2 \times 4 = 8$

2. It can be concluded from the experiment of Rutherford that —.

i. atoms are indivisible.

ii. atoms can be divided

iii. most of the space in an atom is empty

Which of the followings is correct?

- c. ④ ii ⑤ iii ⑥ i & iii ⑦ ii & iii

► Explanation : Information obtained from the experiment of scientist Rutherford :

In the center of the atom there is a positively charged nucleus.

Most of the space in the atom is empty.

In the center of the atom, there are protons and neutrons in the nucleus and negatively charged electrons revolve around the nucleus.

■ After reading the sentence below, give answers to questions no. 3 and 4 :

In an atom of an element there are 10 protons and 8 neutrons.

3. What is the mass number of the atom?

- c. ④ 10 ⑤ 16 ⑥ 18 ⑦ 26

► Explanation :

Here, the number of protons in the atom = 10

Number of neutrons = 8

To be found, mass number = ?

It is known that mass number = number of protons + number of neutrons = $10 + 8 = 18$

Therefore, the deterministic mass number = 18

4. Which element is this?

- | | |
|----------|-----------|
| ④ Oxygen | ⑤ Sulphur |
| ⑥ Sodium | ⑦ Neon |

► Explanation : Given, the proton number of the mentioned element is 10.

Since the number of protons in the atom of the element is called the atomic number.

That is, the atomic number of the element is 10.

It is known that the element with atomic number 10 is Neon (Ne).

Creative Questions with Answers

Ques. 01 The atomic number of atom X is 11. On the other hand, the atomic number of atom Y is 17 and the number of neutron in the atom is 18.

a. How many isotopes of carbon are there? 1

b. What is meant by cation? 2

c. What is the mass number of atom Y? 3

d. Show the distribution of electrons in X and Y atoms and explain their ability to form bond between them? 4

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Answer to Question No. 01 :

- a. Carbon has three isotopes.

b An atom gets ionised, either positive or negative, by losing or gaining electrons. This phenomenon takes place in the outermost shell of an atom. The atom that gains electrons gets a negative ion which is called anion. Symbolically, for example, $F + e^- \rightarrow F^-$ (Florine anion)

c The mass number of atom Y is 35. It is the sum of the atom's atomic number (= proton number) and neutron number. In this case, mass number of Y is $(17 + 18)$ or 35. We know, the proton number of an atom is its atomic number and its mass number is the sum of the number of protons and that of neutrons. Clear, the atom belongs to the element chlorine.

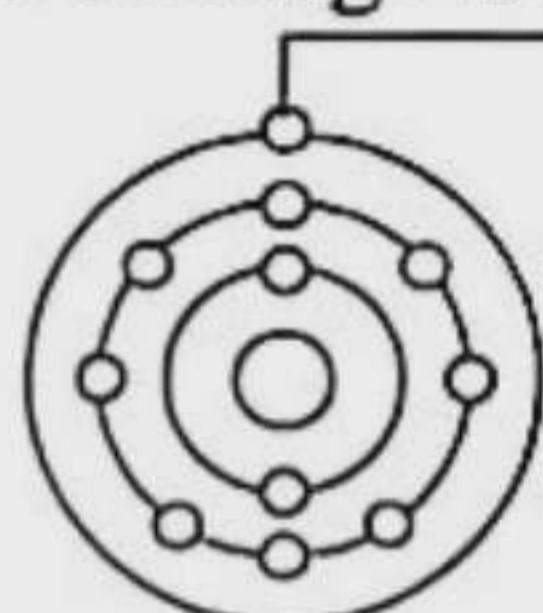
d

Atomic no. of X = 11

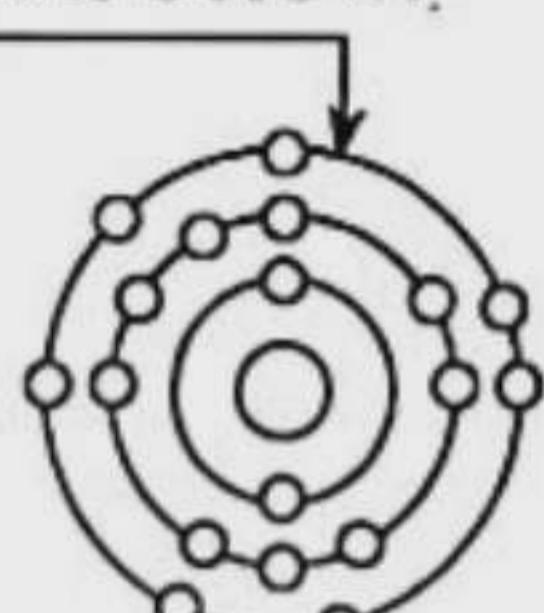
Atomic no. of Y = 17

No. of shell	No. of electron	No. of shell	No. of electron
1	2	1	2
2	8	2	8
3	1	3	7
$(2 + 8 + 1 = 11)$		$(2 + 8 + 7 = 17)$	

No doubt X is a sodium atom and Y is a chlorine atom. Their bondage is shown below.



Sodium atom
(electron donor,
cation⁺)



Chlorine atom
(electron gainer, anion⁻)

According to the diagram, a sodium atom has a single electron in its outermost shell. Again a chlorine atom has seven electrons in its outermost shell. The two atoms makes a bond by giving and receiving an electron; sodium atom is the donor (cation) and chlorine atom is the receiver (anion). Thus they make sodium chloride.



Ques. 02

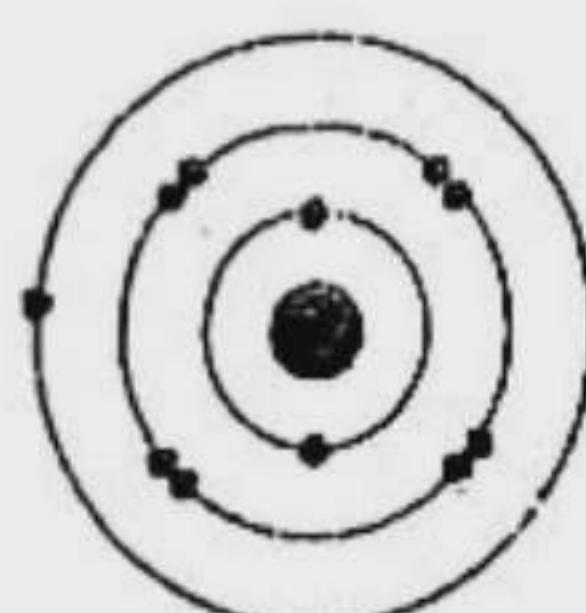


Fig-1



Fig-2

- What is meant by the word atom? 1
- What is meant, when it is said that the atomic number of oxygen is 8? 2
- Explain whether the Fig.- 1 of stimulus is active or inactive. 3
- Give a comparative description of the atomic structure of the number 1 and number 2 atoms. 4

Answer to Question No. 02 :

a The word 'atom' means the smallest particle of an element that cannot be broken down.

b The atomic number of oxygen is 8. It means that an oxygen atom has 8 protons. We know, an atom has equal number of protons and electrons. So the number of electrons in an oxygen atom is 8 and that of neutron number is also 8. So, the mass number of oxygen is $8 + 8 = 16$.

c In the paragraph, the figure- 1 atom has 11 electrons. So, it is sodium (Na) atom. Its electron distribution is 2, 8, 1. If the number of electrons in the last orbit or the highest state is such that it can complete it either by borrowing electrons or losing electrons, it will tend to do so. The sodium atom will easily lose one electron from the third orbit if some neighbouring atom has the tendency to grab an electron to fill its outermost orbit.

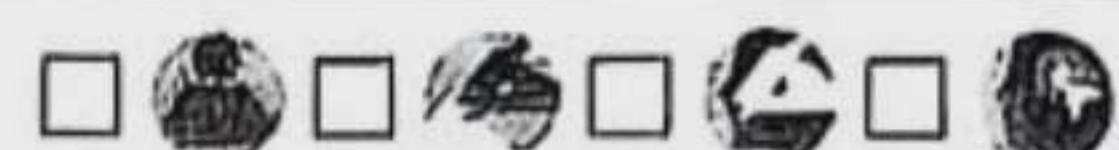
But when the sodium atom loses one electron it is no longer charge neutral. Normal sodium atom is charge neutral, because it has the same number of protons in the nucleus as the number of electrons in the orbits. By losing one electron the sodium atom becomes positively charged.

This positively charged ion is called cation. So, it is seen that sodium atom can form compound by forming ion. Therefore, it is active.

d A comparative study of atomic structures of atom-1 and atom-2 is given below—

Atom-1	Atom-2
• Has three shells.	• Has one shell.
• No. of electrons = 2 + 8 + 1 = 11.	• No. of electron = 1.
• Needs either to lose 1 electron or to gain 7 electrons in outermost shell.	• Needs either to lose the only electron or to gain an electron.
• It is sodium (Na) atom.	• It is hydrogen atom (H).
• Atomic number = 11 or proton number.	• Atomic number = 1.
• Neutron number = 12.	• Neutron number = 1.
• Mass number = $11 + 12 = 23$.	• Mass number = $1 + 1 = 2$.



**Multiple Choice Q/A****Designed as per topic****Lesson-3 : The evolution of the idea of atoms and their structure** ▶ Textbook Page 58

1. Who first thought about atom? (Knowledge)
 - (A) Democritus (B) Theophrustus
 - (C) Aristotle (D) Plato
2. When was atom thought about first? (Knowledge)
 - (A) in 200 B.C. (B) in 200 A.D.
 - (C) in 400 B.C. (D) in 400 A.D.
3. When was the idea about atom originated? (Comprehension)
 - (A) 2700 years ago (B) 2600 years ago
 - (C) 2500 years ago (D) 2400 years ago
4. What language was the word 'atom' derived? (Comprehension)
 - (A) Greek (B) Roman
 - (C) Latin (D) French
5. Whose theory replaced the doctrine of Aristotle about atom? (Application)
 - (A) John Dalton (B) Albert Einstein
 - (C) Isaac Newton (D) Max Plank
6. Which model about atom is compared to the solar system?
 - (A) Raman model (B) Rutherford model
 - (C) Lucas model (D) Plank model
7. What are the number of fundamental elements? [DJB '17]
 - (A) 109 (B) 112 (C) 115 (D) 118

Lesson 4-6 : Atomic number, mass number and isotopes ▶ Textbook Page 60

8. Atoms differ from one to the another because of —. (Knowledge)
 - (A) difference in number of neutrons
 - (B) difference in number of protons
 - (C) difference in number of electrons
 - (D) all the above
9. What is an atom composed of? (Application)
 - (A) Electron (B) Proton
 - (C) Neutron (D) All the above
10. Which one of the following equations is correct? (Higher ability)
 - (A) Number of proton = number of neutron
 - (B) Number of neutron = number of electron
 - (C) Number of electron = number of proton
 - (D) Number of shells = number of nucleus
11. Isotope is a —. (Higher ability)
 - i. strong germicide
 - ii. strong pesticide
 - iii. strong antigen

Which one is correct?

 - (A) i & ii (B) ii & iii (C) i & iii (D) i, ii & iii

12. What is the mass number of second isotope of Carbon? (Knowledge) [R.B.-'19]
 - (A) 7 (B) 8
 - (C) 12 (D) 13
13. What is the number of atoms of $(CH_3COO)_2$? (Application) [C.B.-'19]
 - (A) 03 (B) 05
 - (C) 06 (D) 15
14. How many proton is an oxygen atom? (Application) [Ctg.B.-'19]
 - (A) TWO (B) Eight
 - (B) Sixteen (C) Thirty two
15. What is the atomic number of carbon? (Comprehension) [SB '19]
 - (A) 6 (B) 7
 - (C) 8 (D) 9
16. What is the atomic number of Neon? (Knowledge) [BB '19]
 - (A) 8 (B) 9
 - (C) 10 (D) 11
17. The atomic number of an element is 17 and mass-number 35. What is the neutron number of this element? (Application) [DJB '19]
 - (A) 15 (B) 16
 - (C) 17 (D) 18
18. What is the number of Neutron in Tritium? (Knowledge) [MB '19]
 - (A) 0 (B) 1
 - (C) 2 (D) 3
19. If the atomic number of oxygen is 8 — (Comprehension) [RB '18]
 - i. number of proton is 8
 - ii. 6 electrons in second orbit
 - iii. mass number is 8

Which one of the following is correct?

 - (A) i & ii (B) i & iii (C) ii & iii (D) i, ii & iii
20. Which is the atomic number of aluminium? (Comprehension) [DJB '18]
 - (A) 11 (B) 12 (C) 13 (D) 14
21. Isotope applies to —. (Higher ability)
 - i. hydrogen
 - ii. argon
 - iii. carbon

Which one is correct?

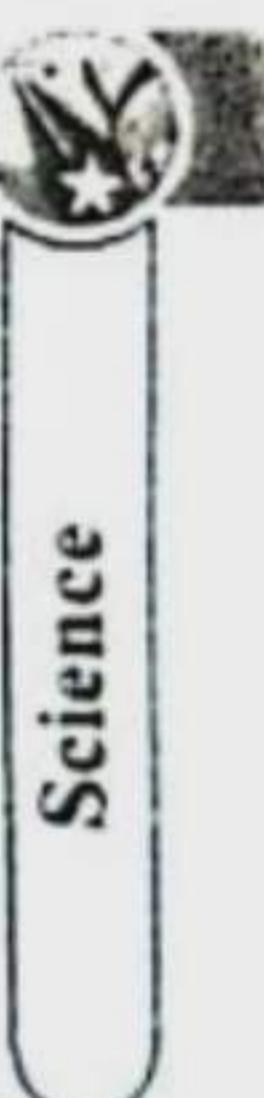
 - (A) i & ii (B) ii & iii (C) i & iii (D) i, ii & iii
22. Isotope is used in —. (Application)
 - i. meteorology
 - ii. Palaeontology
 - iii. anthropology

Which one is correct?

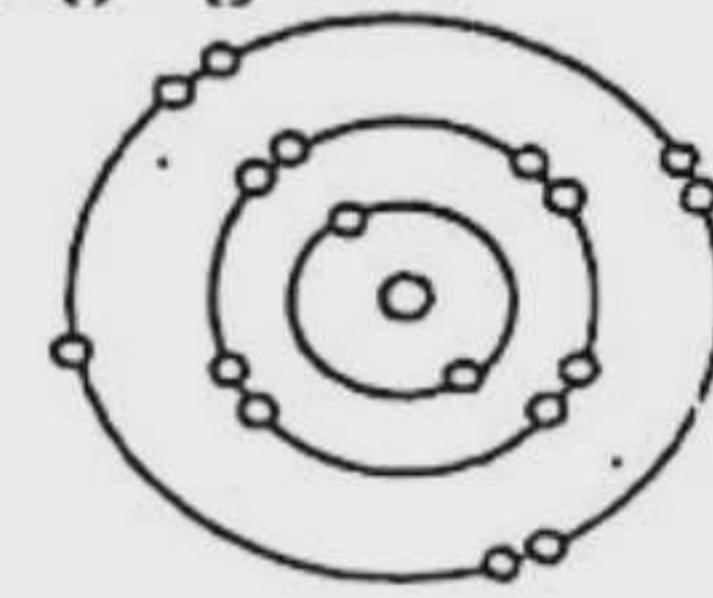
 - (A) i & ii (B) ii & iii (C) i & iii (D) i, ii & iii

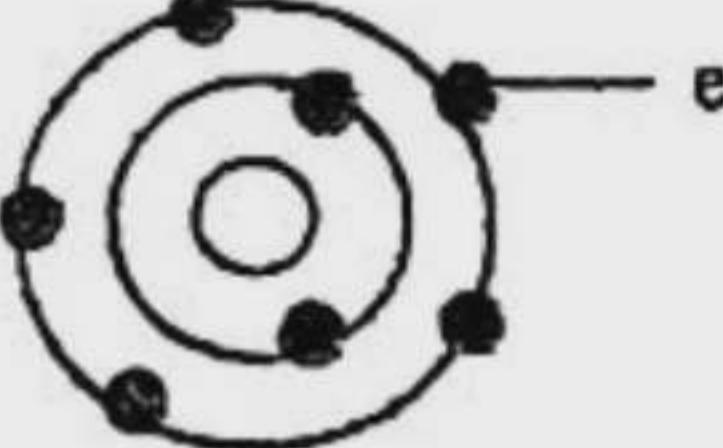
23. Of which element is Tritium an isotope? (Knowledge) [D.B.'19]
- Ⓐ Hydrogen Ⓑ Oxygen
Ⓑ Silicon Ⓒ Carbon
24. What is the mass number of second isotope of carbon? (Comprehension) [CtgB '19]
- Ⓐ 7 Ⓑ 8
Ⓑ 12 Ⓒ 13
25. Age of fossil can be known— (Higher ability) [DJB '19]
- i. by observing the decay of isotope
ii. by observing the decay of fossil
iii. from the ratio of stable and non-stable isotope
Which one is correct?
Ⓐ i & ii Ⓑ i & iii
Ⓑ ii & iii Ⓒ i, ii & iii
26. Isotope is used—. (Comprehension) [CtgB '18]
- i. to control insects in agricultural field
ii. to determine cells attacked by cancer
iii. to determine disease of colon
Which one of the following is correct?
Ⓐ Ⓐ i & ii Ⓑ i & iii Ⓒ ii & iii Ⓓ i, ii & iii
27. For the isotope—. (Higher ability) [SB '17]
- i. Proton No. is same
ii. Mass No. is different
iii. Neutron No. is different
Which one is correct?
Ⓐ Ⓐ i & ii Ⓑ i & iii Ⓒ ii & iii Ⓓ i, ii & iii
- Lesson 9-11: The way the electrons are distributed in an atom → Textbook Page 63
28. $2n^2$ ($n = 1, 2, 3 \dots$) refers to—. (Higher ability)
- Ⓐ arrangement of protons
Ⓑ arrangement of neutrons
Ⓒ arrangement of positrons
Ⓓ arrangement of electrons
29. How many electrons are there in the outermost orbit of sodium atom? (Knowledge) [JB '19]
- Ⓐ 1 Ⓑ 2
Ⓑ 8 Ⓒ 11
- Answer the questions No. 30 and 31 on the basis of figure :
-
- Here, shows the electron numbers outermost orbit of the element. [J.B.-'19]
30. The atom belongs to which element? (Knowledge)
- Ⓐ Chlorine Ⓑ Potassium
Ⓑ Calcium Ⓒ Fluorine

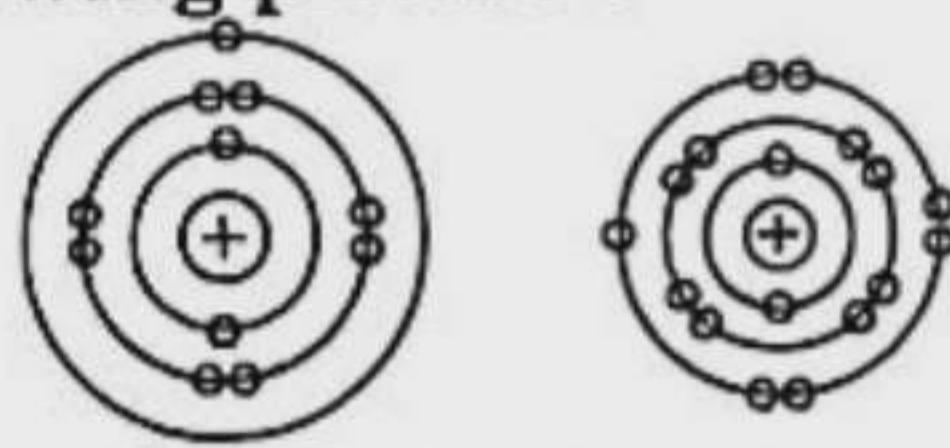
31. What is the neutron number of that element? (Comprehension) [qitium]
- Ⓐ 17 Ⓑ 18
Ⓑ 20 Ⓒ 35
32. How many electrons are in the last orbit of phosphorus? (Comprehension) [S.B.-'19]
- Ⓐ 4 Ⓑ 5
Ⓑ 6 Ⓒ 7
33. 2, 8, 2 is the distribution of electrons of the element? (Comprehension) [DB '18]
- Ⓐ Na Ⓑ K Ⓒ Al Ⓓ Mg
- Notice figure below and answer to the question No. 34 and 35 :
-
34. What is the mass number of molecule of the atom? (Knowledge) [DB '18]
- Ⓐ 6 Ⓑ 5 Ⓒ 4 Ⓓ 3
35. This molecule is able to—. (Application)
- i. create cation
ii. create reaction with non metal
iii. an isotopes
Which one of the following is correct?
Ⓐ Ⓐ i & ii Ⓑ i & iii Ⓒ ii & iii Ⓓ i, ii & iii
36. In which rule the electrons are distributed? (Comprehension) [DB '17]
- Ⓐ $2n$ Ⓑ $2n^2$ Ⓒ n^2 Ⓓ $4n^2$
37. How many electrons are there in the second orbit when $n = 2$? (Application) [DB '17]
- Ⓐ Four Ⓑ Six Ⓒ Eight Ⓓ Ten
- Lesson 12-13: The electron distribution and properties of elements → Textbook Page 65
38. Inactive elements include—. (Comprehension)
- i. Helium
ii. Lithium
iii. Neon
Which one is correct?
Ⓒ Ⓐ i & ii Ⓑ ii & iii Ⓒ i & iii Ⓓ i, ii & iii
- Look at the diagram and answer to the following question numbers 39 – 40 :
-
39. What atom is it? (Knowledge)
- Ⓐ Oxygen Ⓑ Hydrogen
Ⓑ Nitrogen Ⓒ Chlorine
40. What type of family can the diagram be compared to? (Application)
- Ⓐ Nuclear family Ⓑ Molecular family
Ⓑ Joint family Ⓒ Chaotic family



41. In this case there will be —. (Application)
- ionisation
 - radiation
 - no charge
- Which one is correct?
- a** @ i & ii **b** ii & iii **c** i, ii & iii **d** i & iii
42. This case is common to —. (Higher ability)
- hydrogen
 - carbon
 - uranium
- Which one is correct?
- a** @ i, ii & iii **b** i & ii **c** i & iii **d** ii & iii
- Look at the diagram below and answer to the following question numbers 43 and 44 :
- 
43. What is the element? (Knowledge)
- a** Cadmium **b** Carbon
c Calcium **d** Copper
44. The statements relating to the atom —. (Higher ability)
- its number of neutrons differs from atom to atom
 - its mass number is 12
 - it is radioactive
- Which one is correct?
- a** @ i & ii **b** ii & iii
c @ i & iii **d** i, ii & iii
45. How many atoms are there in a molecule of calcium sulphate? (Knowledge) [D.B.-'19]
- a** 1 **b** 2
c 3 **d** 6
46. The electronic configuration of an element is 2, 8, 5— which is the element? (Knowledge) [R.B.-'19]
- a** Chlorine **b** Fluorine
c Sulphur **d** Phosphorus
47. How many electrons are there in the element oxygen? (Knowledge) [J.B.-'19]
- a** 2 **b** 6
c 8 **d** 16
48. What is the electron distribution of Mg^{2+} ? (Knowledge) [B.B.-'19]
- a** 2, 8 **b** 2, 8, 1
c 2, 8, 2 **d** 2, 8, 4
- Observe the stem and, answer the questions No. 49 and 50 :
- There is 8 protons and 8 neutrons in an atom of an element. [Din.B.-'19]
49. What is the name of the element? (Knowledge)
- a** Nitrogen **b** Oxygen
c Fluorine **d** Chlorine

50. What is the mass-number of this element? (Knowledge)
- a** 8 **b** 16
c 0 **d** 18
51. How many electrons stay in 4th orbit of an atom? (Knowledge) [Ctg.B.-'19]
- a** 8 **b** 18
c 32 **d** 50
52. How many proton are there in oxygen atom? (Knowledge) [DB-'18]
- b** @ 4 **b** 8 **c** 16 **d** 32
53. How many electrons are there in the third orbit of phosphorus atom? (Comprehension) [RB-'18]
- b** @ 2 **b** 5 **c** 8 **d** 18
54. What is the number of electrons in sulphur? (Comprehension) [RB-'18]
- b** @ 12 **b** 16 **c** 20 **d** 22
55. How many neutrons of the element if it's mass number is 31 and proton number is 15? (Knowledge) [JB-'18]
- d** @ 46 **b** 35 **c** 17 **d** 16
- Answer the questions No. 56 and 57 from the following figure :
- 
56. What is the number of proton of the molecule in the figure? (Application) [JB-'18]
- d** @ 2 **b** 7 **c** 10 **d** 17
57. The molecule of the figure— (Comprehension)
- is able to accept electron
 - is able to make compound with sulphur
 - turns into anion
- Which one is correct?
- b** @ i & ii **b** i & iii **c** ii & iii **d** i, ii & iii
58. How many neutrons in phosphorus when the mass number is 32? (Knowledge) [CB-'18]
- b** @ 15 **b** 17 **c** 47 **d** 57
59. How many electron stay in the thrid shell of a atom? (Knowledge) [CB-'18]
- c** @ 2 **b** 8 **c** 18 **d** 32
60. How many electrons are there in magnesium? (Application) [CtgB-'18]
- b** @ 18 **b** 12 **c** 11 **d** 10
61. How many electron are there in the last orbit of Aluminium. (Application) [CtgB-'18]
- c** @ 1 **b** 2 **c** 3 **d** 5
- Answer questions number 62 and 63 from the following stem :
- The electronic configurations of an element is 2, 4. [SB-'18]

62. What is the name of the stem's element? (Knowledge)
- A Carbon B Nitrogen
 C Oxygen D Fluorine
63. The number of isotopes of the element is —. (Knowledge)
- B 2 C 3 D 4 E 7
64. 2, 8, 2 electron arrangement is of which element? (Knowledge) [BB '18]
- C D Na B K C Al D Mg
- 
65. The electronic configuration of which element in the figure is? (Comprehension) [DJB '18]
- A Carbon B Nitrogen
 C Oxygen D Fluorine
66. 2, 8, 7 is the electronic configuration of which element? (Higher ability) [RB '17]
- A Sodium B Argon
 C Chlorine D Sulphur
67. How many electron stay at the outermost shell of oxygen? (Higher ability) [JB '17]
- C D 4 B 5 A 6 E 7
68. Which one is the electronics configuration of Chlorine? (Knowledge) [SB '17]
- B A 2, 8, 8 C 2, 8, 7 D 2, 8, 5 E 2, 8, 1
69. Which one is the electronic configuration in Nitrogen? (Comprehension) [BB '17]
- B A 2, 1 C 2, 5 D 2, 8, 1 E 2, 8, 7
70. How many atoms are there in two molecules of water? (Application) [BB '17]
- C A 2 B 3 D 6 E 8

71. How many maximum number of electrons can exist in the third orbit of an atom? (Application) [DJB '17]
- C A 2 B 8 D 18 E 32
72. According to the Rutherford atomic model— (Comprehension) [JB '17]
- most of the space in an atom is empty
 - negative charge particle have negligible mass
 - negative charge particle revolves around fixed orbit
- Which one is correct?
- D A i & ii B i & iii C ii & iii E i, ii & iii
73. The electron distribution of "P" is 2,8. Here "P" is— (Comprehension) [CB '17]
- Ne
 - Na¹⁺
 - Mg²⁺
- Which one is correct?
- D A i & ii B i & iii C ii & iii E i, ii & iii
- Answer questions number 74 and 75 from the following picture :
- 
- Fig : element A Fig : element B
- [A and B are not actually any symbol of any element]
74. What is the number of proton of the element in picture A? (Knowledge) [CtgB '17]
- D A 18 B 17 C 12 E 11
75. At the time of forming compound —. (Higher ability) [CtgB '17]
- B becomes anion
 - A releases electron
 - cation will be Na²⁺
- Which one is correct?
- A B i & ii C i & iii D ii & iii E i, ii & iii



Short Q/A



Designed as per topic



► Lesson 1–3 : The evolution of the idea of atoms and their structure ► Textbook Page 58

Question 1. Explain Democritus's theory of the structure of matter.

Ans. The Greek philosopher Democritus was the first to propose a theory about the smallest particles of matter in 400 BC. According to him, all matter is made up of tiny indivisible (that cannot be broken down further) particles. He called these particles atoms.

Question 2. Explain the theory of Plato and Aristotle regarding the structure of matter.

Ans. Philosophers Plato and Aristotle disagreed with Democritus's theory about the structure of

matter. According to Aristotle, matter is continuous, and no matter how much it is broken down, the particles of matter will continue to get smaller and smaller.

Question 3. Why was Aristotle's theory of the structure of matter rejected?

Ans. In 1803, English scientist John Dalton, based on experimental evidence, stated that the smallest particle of an element is an atom, which cannot be divided further. Dalton's theory was accepted. As a result, Aristotle's theory was rejected.

Question 4. Why is an atom not indivisible?

Ans. Atoms are not indivisible and are not the smallest particles of matter. Atoms are divisible



and consist of smaller particles such as electrons, protons, and neutrons. Because atoms can be broken down into smaller particles like electrons, protons, and neutrons, they cannot be considered indivisible.

Question 5. Explain the initial concept of the nucleus by scientist Rutherford.

Ans. Scientist Rutherford and his colleagues conducted an experiment that provided a good understanding of the structure of matter. Based on the results of the experiment, Rutherford stated that the positive charge and mass in an atom are concentrated in a small region. This region is located at the center of the atom, so he named it the nucleus. In this way, he was the first to introduce the concept of the nucleus.

Question 6. Explain the results obtained from Rutherford's experiment.

Ans. Based on the results of the experiment, Rutherford stated that the positive charge and mass in an atom are concentrated in a small region. He further explained that most of the atom is empty, and the negatively charged particles have negligible mass and revolve around the nucleus. However, Rutherford did not specify any particular orbit for the electrons.

Question 7. Rutherford's model is similar to the solar system - explain.

Ans. Scientist Rutherford explained that most of the atom is empty, and the negatively charged particles have negligible mass and revolve around the nucleus. This is similar to how planets revolve around the sun in the solar system. That's why Rutherford's model is compared to the solar system.

Question 8. Explain the structure of an atom.

Ans. Atoms are made up of electrons, protons, and neutrons. At the center of the atom is the nucleus, which contains positively charged protons and charge-neutral neutrons. Almost all of the atom's mass is concentrated in the nucleus. Negatively charged electrons revolve around the nucleus in specific orbits. The space between the electrons and the nucleus is empty.

► Lesson 4–6 : Atomic number, mass number and isotopes ➤ Textbook Page 60

Question 9. Why are the properties of atoms different?

Ans. Atoms are very small particles, so it is not easy to understand their structure. However, scientists have gained a clear understanding of the structure and properties of atoms through various experiments and observations. The main reason for the differences in the properties of atoms is the variation in the number of electrons, protons, and neutrons in atoms.

Question 10. Why is the atom of hydrogen gas different from the atom of oxygen gas?

Ans. Each element has different atoms, such as the atom of hydrogen gas being different from the atom of oxygen gas. The size, mass, and properties of atoms of one element are different from those of another element. The main reason for the difference between hydrogen and oxygen atoms is the difference in the number of protons or electrons in their atoms.

Question 11. Why are the atomic numbers of hydrogen and oxygen different?

Ans. The number of protons in an atom of an element is called its atomic number. A hydrogen atom has one proton, so its atomic number is 1. An oxygen atom has 8 protons, so its atomic number is 8. In other words, the atomic numbers of hydrogen and oxygen are different because of the difference in the number of protons.

Question 12. What information can be obtained from the atomic number of carbon being 6?

Ans. The atomic number of carbon being 6 means that a carbon atom has 6 protons. Since the atomic number refers to the number of protons in an element and the number of protons is equal to the number of electrons in an atom, it is understood that a carbon atom has 6 electrons.

Question 13. How is the number of neutrons in an atom calculated?

Ans. Almost all of an atom's mass is concentrated in its nucleus. In other words, the mass of an atom is the sum of the masses of its protons and neutrons. The masses of neutrons and protons are almost equal. The total number of protons and neutrons in an atom of an element is expressed as its mass number. Therefore, the number of neutrons in an atom can be calculated using the formula: Number of neutrons = Mass number - Atomic number.

Question 14. How is the mass number of an atom determined?

Ans. The total number of protons and neutrons in an atom of an element is expressed as its mass number. In other words, the mass number of an element = (number of protons + number of neutrons) in an atom of that element. For example, an oxygen atom has 8 protons and 8 neutrons in its nucleus, so its mass number is $(8+8) = 16$.

Again, a sodium atom has 11 protons and 12 neutrons in its nucleus, so its mass number is $(11+12) = 23$.

Question 15. Determine the number of electrons, protons, and neutrons in the element $^{40}_{19}\text{A}$.

Ans. The atomic number of element A is 19, so it has 19 protons. The number of protons and electrons in an atom is equal, meaning element A also has 19 electrons.

Again, the mass number of an element = proton number + neutron number.

That is, the neutron number of an element = mass number - proton number

Therefore, the number of neutrons in element A is $40 - 19 = 21$.

Question 16. Explain why protium and deuterium are isotopes of each other.

Ans. Isotopes are atoms of the same element that have the same number of protons in their nucleus but different numbers of neutrons. Protium is the most common isotope of hydrogen, with one proton and no neutrons in its nucleus. On the other hand, deuterium has one proton and one neutron in its nucleus. In other words, both protium and deuterium are isotopes of hydrogen because they have the same number of protons but different mass numbers due to the varying number of neutrons.

Question 17. Explain isotopes of carbon.

Ans. Most carbon atoms have 6 protons and 6 neutrons. However, some carbon atoms may have 7 or 8 neutrons. This means there are two other types of carbon atoms with the same number of protons but different mass numbers due to varying numbers of neutrons. Therefore, there are mainly three isotopes of carbon in nature.

Question 18. Why do isotopes have the same chemical properties?

Ans. The chemical properties of an element are influenced by its number of protons. Different isotopes of the same element have the same number of protons and electrons. Therefore, there is no significant difference in the chemical properties between isotopes of the same element.

Question 19. Why are isotopes radioactive?

Ans. Generally, isotopes are unstable. Unstable isotopes emit various types of radioactive rays and particles. This phenomenon of emitting radioactive rays is called radioactivity. Isotopes that exhibit radioactivity are called radioactive isotopes. In other words, isotopes are radioactive due to their instability.

► **Lesson 7–8 : The properties and application of isotopes** ► Textbook Page 62

Question 20. How are isotopes used in medicine?

Ans. Isotopes are used to diagnose and treat various diseases. Radioactive isotopes of certain elements can be introduced into the bloodstream to detect damage in small blood vessels. Similarly, isotopes can be used to identify cancer-affected cells in cancer patients. Radioactive radiation from isotopes can also be used to destroy cancer cells. Additionally, radioactive rays are used to sterilize medical equipment.

Question 21. Write two uses of isotopes in agriculture.

Ans. Two uses of isotopes in agriculture are :

1. Radioactive rays from isotopes are used to control pests in agriculture.
2. Radioactive isotopes are used to determine the type and amount of fertilizer needed for specific crops.

Question 22. Why are isotopes used in food preservation?

Ans. Many bacteria and other germs are killed by radioactive rays. Therefore, radioactive rays can be used to eliminate germs from food and fruits. That's why radioactive isotopes are used in food preservation.

Question 23. How is the age of a fossil determined?

Ans. Over time, unstable isotopes decay, while stable isotopes do not. Therefore, the ratio of stable and unstable isotopes in a fossil provides an estimate of its age. In other words, the age of a fossil is determined by the decay or breakdown of radioactive isotopes.

► **Lesson 9–13 : The electron distribution and properties of elements** ► Textbook Page 65

Question 24. Explain why the electron configuration of lithium and carbon is different.

Ans. The electron configuration of lithium (Li) and carbon (C) is as follows :

Li(3) \rightarrow 2, 1

C(6) \rightarrow 2, 4

Lithium has 3 electrons: 2 in the first orbit and 1 in the second orbit. Similarly, carbon has 6 electrons: 2 in the first orbit and 4 in the second orbit. Therefore, the electron configurations of Li and C are different.

Question 25. Mention the electron configurations of magnesium and aluminum.

Ans. The electron configurations of magnesium and aluminum are as follows:

Element	Symbol	Electron Configuration
Magnesium	Mg	2, 8, 2
Aluminum	Al	2, 8, 3

Question 26. What determines the inertness, activity, or charge of an atom?

Ans. The properties of an element depend on the number of electrons in its atoms. More specifically, the properties of an atom vary with its electron configuration. In other words, elements are generally inert, active, or charged due to differences in their electron configurations.

Question 27. How do atoms achieve stability?

Ans. Atoms achieve stability by filling their outermost electron shell. Generally, an atom is stable when it has 8 electrons in its outermost shell

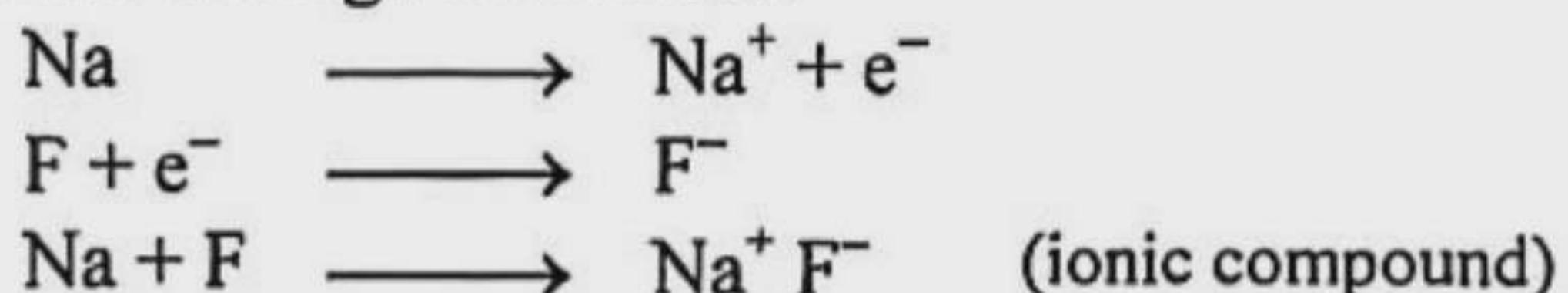
(octet rule). To achieve this stability, atoms donate, accept, or share electrons. For example, the electron configuration of sodium is 2, 8, 1. To achieve stability, a sodium atom donates one electron.

Question 28. How are compounds formed?

Ans. Atoms become ions by accepting or donating electrons. The atom that donates electrons becomes a cation, and the atom that accepts electrons becomes an anion. As a result, an electrical attraction force acts between them. In other words, compounds are formed when atoms rearrange their electron configurations and bond with each other through attraction forces.

Question 29. Show the formation of NaF compound through a reaction.

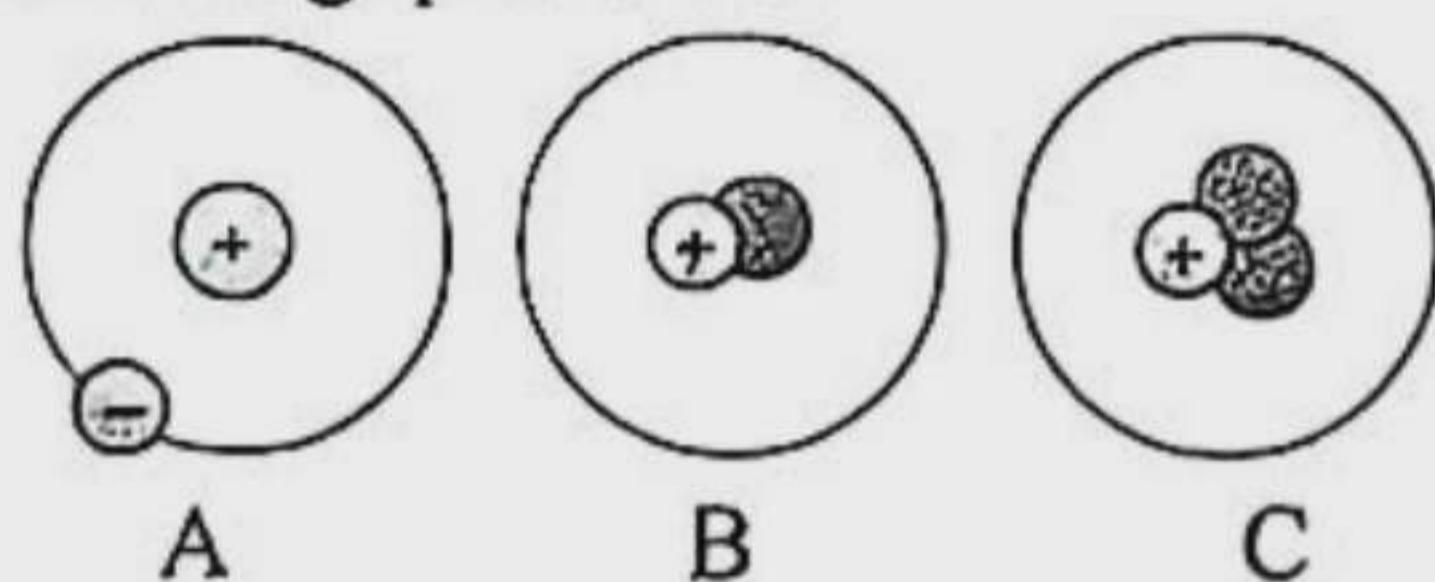
Ans. The formation of NaF compound is shown below through a reaction :



Creative Q/A

Designed as per learning outcomes

Ques. 01 Look at the diagrams below and answer to the following questions.



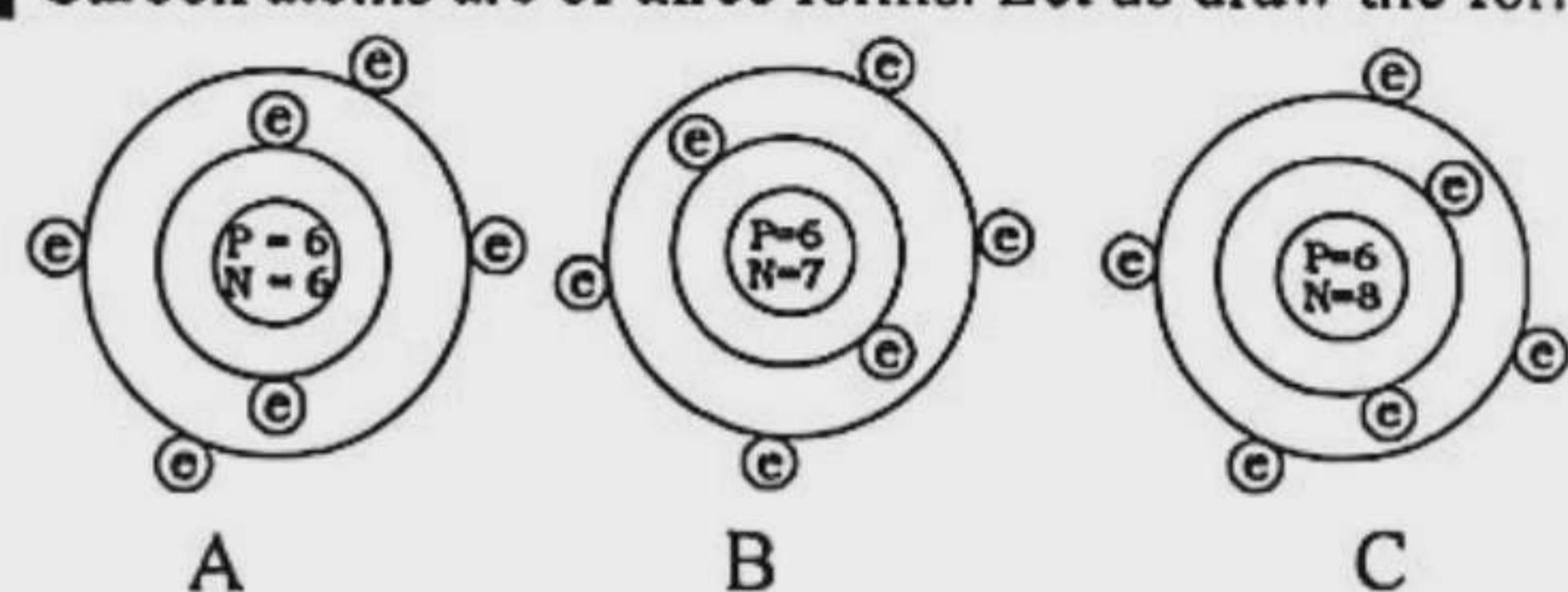
- These are the three atoms of an element. What is the element? 1
- Which atom is an ion? How? 2
- Draw similar figures in case of carbon. 3
- Comment on the figures. 'Our government should launch the use of this nuclear phenomenon in at least the district level hospitals'. How far do you agree at the suggestion? Give reasons. 4

Answer to Question No. 01 :

a The element is hydrogen.

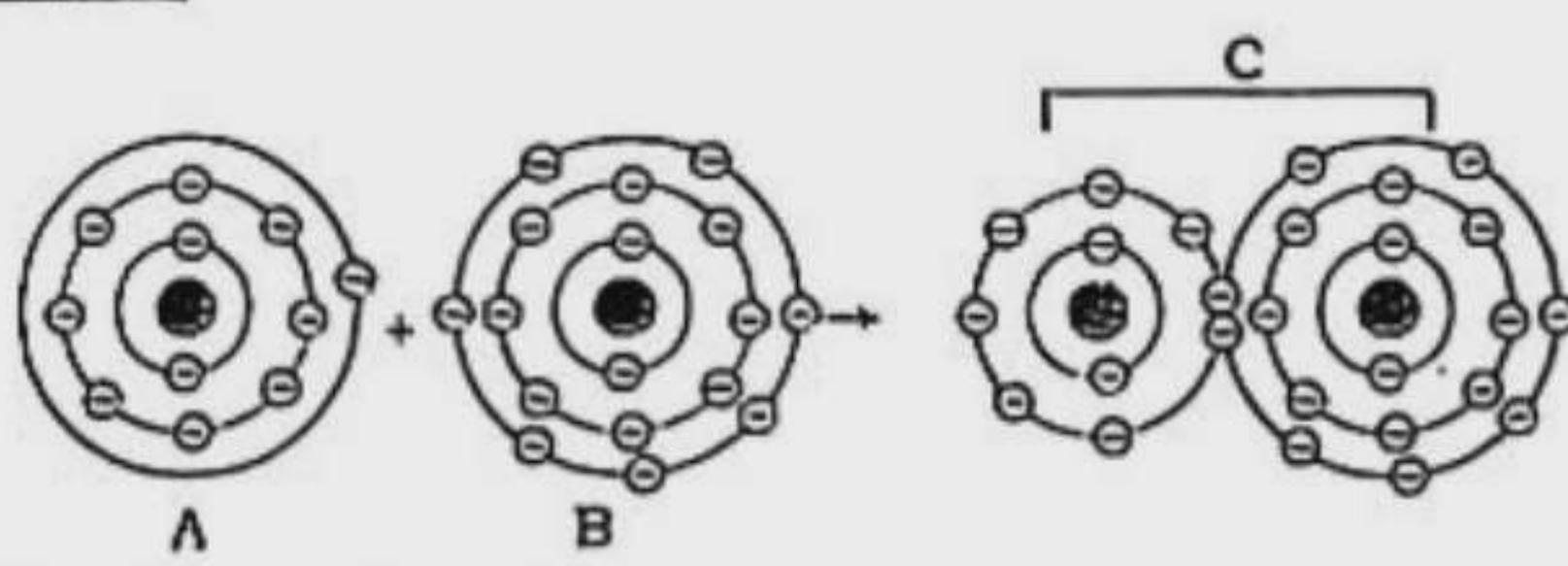
b An atom that carries an electrical charge is called an ion. It may both be positive and negative. Positive ion means the atom can give electrons. Negative ion means the atom needs electrons to be neutralized. In atom A, there should be two electrons in the only shell while it has one electron. It requires another electron and so it is a negatively charged ion.

c Carbon atoms are of three forms. Let us draw the forms.



Comment : A, B and C are three isotopes of carbon because in all cases, there is no change in the numbers of either proton or electron (atomic number is the same) but the number of neutrons is 6 in A, 7 in B and 8 in C (mass number differs).

d Yes, I agree at the suggestion that our government should launch the use of this nuclear phenomenon in at least the district level hospitals. The phenomenon is isotope. It is extensively used in medical treatment, especially diseases of veins and arteries, detecting cancer cells and destroying those. The poor villagers attacked with these deadly diseases often dare not come to Dhaka to have treatment. Most of them do not even know what deadly disease they are suffering from. They simply take recourse of black art including amulets. I think government should render this treatment facility to people's doorsteps. It should not be blocked in Dhaka only.

Ques. 02

- a. What is cation? 1
 b. In what sense an atom is different from an ion? 2
 c. Give an explanation to the formation of the compound indicated with the diagram. 3
 d. C is a salt. A great many salts can be produced by replacing A with metals or B with radical compounds. Prove the statement. Elucidate the comment. 4

Answer to Question No. 02 :

- a** A positively charged ion is called cation.
b Atom is the smallest particle of any elements that can no more be broken down. On the contrary, an atom that carries electrical charge is called an ion. An atom cannot be positive or negative but an ion can either be positive or negative.
c A and B are the atoms of two elements while C is a molecule of a compound. When two or more atoms of different elements having different properties combine together, they make a molecule of a compound. In other words, the molecules of a compound is composed of atoms always in a definite proportion. Atomic structure of elements A :

No. of shells = 3

No. of electron in the 1st shell = 2

No. of electron in the 2nd shell = 8

No. of electron in the 3rd shell = 1

$$\therefore \text{Atomic no.} = 2 + 8 + 1 = 11$$

\therefore The element is sodium.

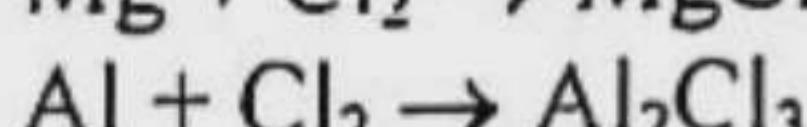
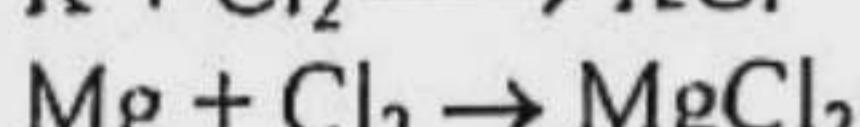
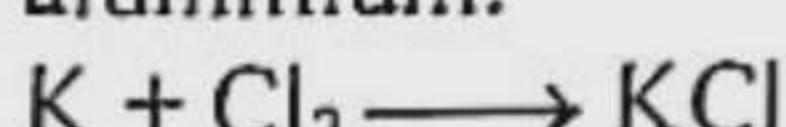
In case of B, atomic nr. = $2 + 8 + 7 = 17$.

\therefore The element is chlorine.

A turns neutralized by giving while

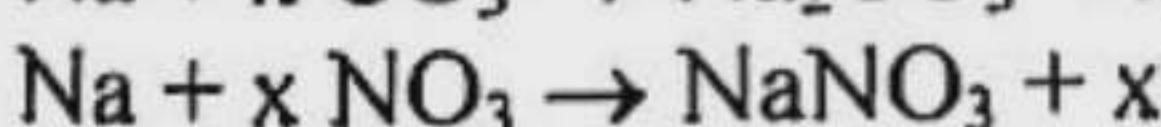
B turns neutralized by taking an electron forming compound C (sodium chloride).

- d** A and B stands for sodium and chlorine while C stands for common salt, sodium chloride. Now let us replace A with potassium, magnesium and aluminium.



KCl, MgCl₂ and Al₂Cl₃ are salts.

Again, let us replace B with sulphate, carbonate and nitrate.



(x is an element in each case)

We see, Na₂SO₄, Na₂CO₃ and NaNO₃ are salts.

So it is proved that a great many salts can be produced by replacing A with metals or B with radical compounds.

Ques. 03

Element	X	Y	Z
Atomic Number	18	11	9

- a. What is atom? 1
 b. The atomic number of Magnesium is 12— Explain. 2
 c. Show the electron division of X molecule by a figure. 3
 d. Analyze the ability of molecules, Y and Z in the formation of compound. 4

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Answer to Question No. 03 :

- a** The word 'atom' means the smallest particle of an element that cannot be broken down. Atoms are formed by electrons, protons and neutrons.

- b** The number of protons in the nucleus of an atom of an element is its atomic number. The atomic number of magnesium is 12. It means the number of protons in the nucleus of magnesium is 12. As the number of protons is equal to the number of electrons in each atom. So, magnesium atom must have 12 electrons.

- c** Atomic number of 'X' molecule of the stem is 18. So, it is argon. According to the rule, the maximum number of allowed electrons in the first orbit is two, in the second orbit the number is eight. And in the third orbit the number is eighteen. The electron division of argon is shown below by a figure—

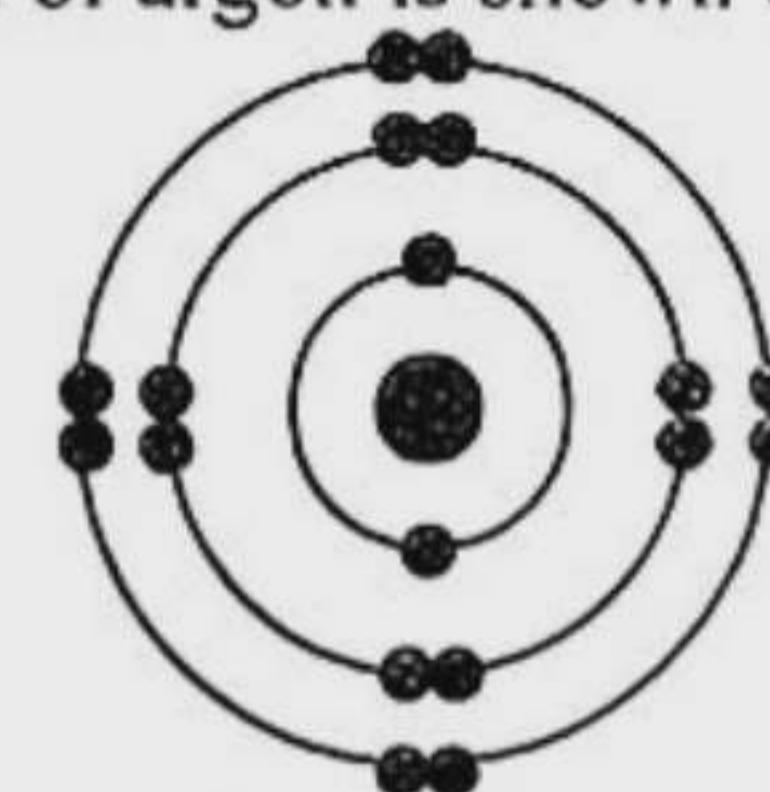


fig : Argon

- d** 'Y' element of the stem is sodium (Na) and 'Z' element is florin (F).

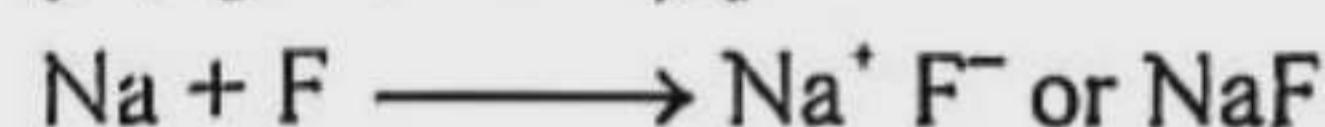
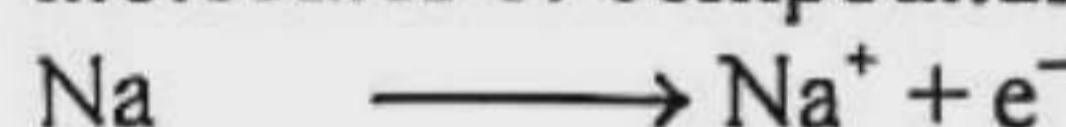
The case of Sodium atom, it has 2 electrons in the first orbit, 8 electrons in the second orbit and 1 electron in the third orbit. If the sodium atom can lose the single electron in the third orbit, its outer most second orbit becomes full and the atom will become stable.

The sodium atom will easily lose one electron from the third orbit if some neighbouring atom has the tendency to grab an electron to fill its outermost orbit. But when the sodium atom lose one electron it is no longer charge neutral. Normal sodium atom

is charge neutral, because it has the same number of protons in the nucleus as the number of electrons in the orbits. By losing one electron the sodium atom becomes positively charged. This charged atom is called an ion. If the charge is positive it is called cation. Thus sodium atom by losing an electron becomes anion.

Florine atom has electron distribution as 2, 7. For stability it needs 8 electrons in the outermost orbit. It can either lose 7 electrons from the second orbit or can grab one extra electron to complete the second orbit. From the energy consideration it is far more favourable to snatch one extra electron to complete the second orbit. In the vicinity of sodium atoms it can easily take one electron from the sodium atom. After receiving one electron from outside the fluorine atom becomes negatively charged. This makes it a negatively charged ion. It is called anion.

Thus by receiving or losing electron, atoms become ionized. Of the two atoms, the one which loses electron becomes cation. The atom which grabs electron becomes anion or negatively charged ion. As a result an attractive force works between these oppositely charged ions and they form a bond, in this way atoms of elements form molecules of compounds.

**Ques. 04**

Element	Electron Number	Element	Atomic Number
(i)	18	(ii)	3
		(iii)	10
X		(iv)	17
		Y	

- What is called atom? 1
- Why tritium is an isotope? 2
- If the neutron number is 19 in element 'X' calculate its mass number. 3
- The two elements of the chart 'Y' are able to form compound—Analyze. 4

• Rajshahi Board 2019

Answer to Question No. 04 :

- The word 'atom' means the smallest particle of an element that cannot be broken down. Atoms are formed by electrons, protons and neutrons. 1
- The different atoms of an element which have the same number of protons and electrons but different mass number is called isotope of that 2

element. Tritium is an isotope of hydrogen atom. Because it has one electron, one proton and two neutrons. So, its mass number is 3.

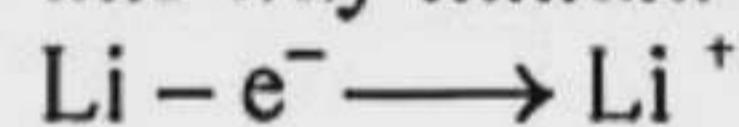
c The mass number of an atom of an element is expressed as the total number of protons and neutrons in the atom. Thus the mass number of an element is equal to the number of protons in an atom of the element plus the number of neutrons in the atom. Since, the number of protons is equal to the number of electrons in each atom. The number of proton of 'X' element = 18. And, the number of neutron of 'X' element = 19.

So, the mass number of 'X' element = $(18 + 19) = 37$.

d The atomic number of three elements of 'Y' are 3, 10 and 17. So, the three elements are lithium, neon and chlorine respectively. Among these three elements, lithium (3) and chlorine (17) are able to form compound. But neon can not form compound as it is an inert gas.

In case of lithium atom, it has 2 electrons in the first orbit and 1 electron in the second orbit. If the lithium atom can lose the single electron in the second orbit, its outermost orbit becomes full and the atom will become stable.

The lithium atom will easily lose one electron from the second orbit if some neighboring atom has the tendency to grab an electron to fill its outermost orbit. When it loses one electron it is no longer charge neutral. But losing one electron it becomes positively charged. This charged atom is called cation. On the other hand, chlorine atom has electron distribution as 2, 8, 7. For stability it needs 1 electron in the outermost orbit. So, chlorine atom will take an electron from lithium atom for its 3rd orbit. After receiving one electron chlorine atom becomes negatively charged atom or anion. As a result, an attractive force work between these oppositely charged ion and they form a bond. In this way lithium chloride (LiCl) is formed.

**Ques. 05** "A" and "B" are two elements those have atomic number 11 and 17 respectively, Mass number are 23 and 35 respectively of that elements.

- What is isotope? 1
- What do you mean by the mass number of oxygen is 16? 2
- Calculate the electron, proton and neutron number of 'A' element. 3
- Explain the process by which the atoms of above mentioned two elements get stability. 4

• Jashore Board 2019

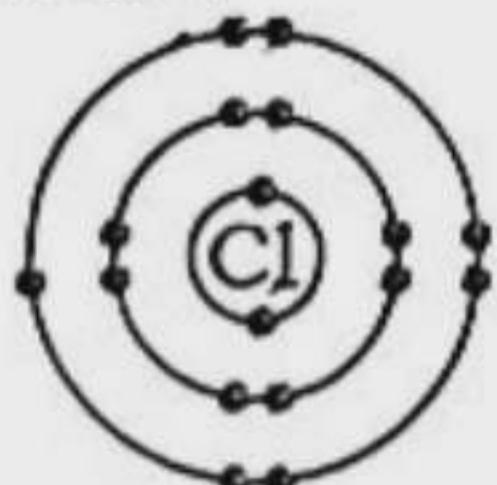
Answer to Question No. 05 :

a The different atoms of an element which have the same number of protons and electrons but different mass number are called isotopes of the element.

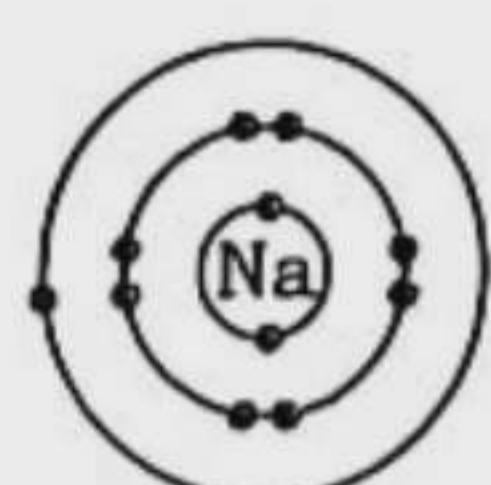
b The mass number of an atom of an element is expressed as the total number of protons and neutrons in the atom. So, the mass number of oxygen is 16 means the total number of protons and neutrons in oxygen atom is 16. As the proton number of oxygen is 8, the neutron number should be 8.

c According to the stem, the atomic number of element 'A' is 11 and the mass number is 23. The atomic number indicates the number of protons and the number of protons is equal to the number of electrons. So, the number of protons of 'A' element is 11. And the number of electrons is 11. Again, in an atom the number of protons + the number of neutrons = mass number of an atom. Therefore, the number of neutrons in an atom of the element A = mass number of the element—the number of protons of the element. Thus the number of neutron of an atom of element A = $23 - 11 = 12$.

d Atomic number of A is 11. So, it is sodium. On the other hand, electron number of B is 17. As the electron number is equal to proton number or atomic number of an element, so atomic number of Q element is 17. We know that the atomic number of sodium (Na) and chlorine (Cl) are 11 and 17 respectively. Now, according to electronic configuration, the distribution of electrons in an atom of sodium is 2, 8, 1 and that of chlorine is 2, 8, 7 and it can be shown as under :

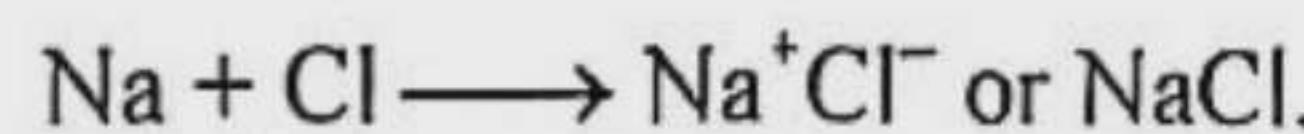
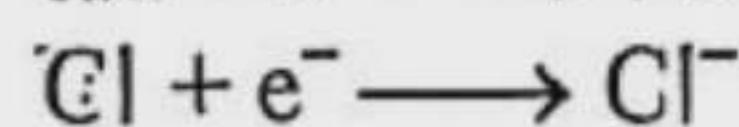
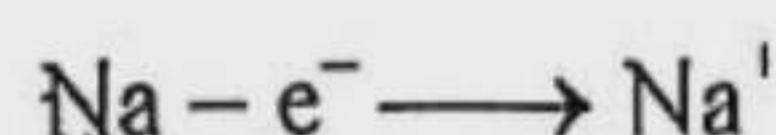


Chlorine atom Sodium atom



Now, if sodium atom comes in contact of chlorine atom, then sodium atom will give the only electron present in the 3rd orbit. By losing one electron the sodium atom becomes positively charged. This positively charged atom is called cation.

On the other hand, chlorine atom has electron distribution as 2, 8, 7. For stability it needs 1 electron in the outermost orbit. So, chlorine atom will take an electron from sodium atom for its 3rd orbit. After receiving one electron chlorine atom becomes negatively charged atom or anion. As a result, an attractive force work between these oppositely charged ion and they form a bond. In this way NaCl is formed.



इनुन डॉग

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Ques. 06 The number of atom of the molecule

A is 6, But the number of mass is different in different atoms. Again the number of atom in another molecule B is 3 which is not stable.

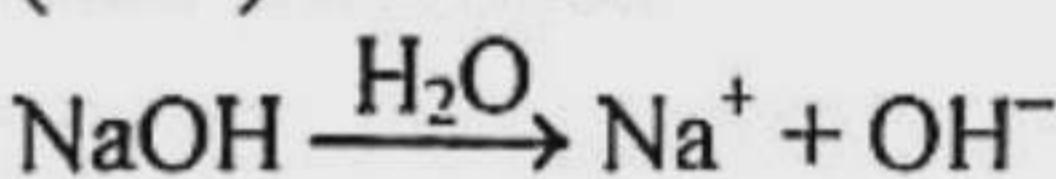
- What Is symbol? 1
- NaOH Is an alkali—Explain. 2
- Explain the cause of difference of mass number of element A. 3
- How will the element B mentioned in the stem attain stability? Analyze. 4

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Answer to Question No. 06 :

a The short expression of an element is called symbol. For example H is the symbol of hydrogen.

b Those chemical substances which have hydrogen and oxygen atoms and produce hydroxide OH^- in water are base. The base which are dissolved in water are called alkali. NaOH is an alkali because it dissolves in water and produces hydroxide ion (OH^-) in water.



c Element A of the stem is carbon. Carbon has atomic number 6. The mass of an atom is due to the mass of the nucleus.

The mass number of an atom of an element is expressed as the total number of protons and neutrons in the atom. Thus the mass number of an element is equal to sum of the number of protons and the number of neutrons in the atom. Most of the carbon atoms have 6 protons and 6 neutrons in their nuclei. But some atoms have 7 or 8 neutrons in their nuclei. Thus carbon has difference in mass number. They are called isotope to each other.

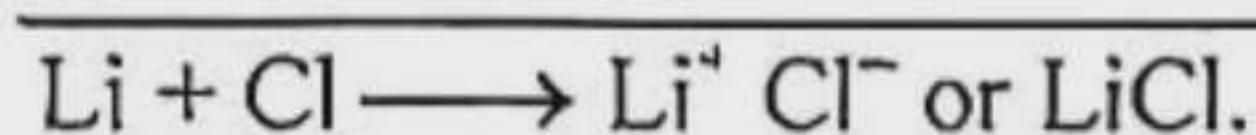
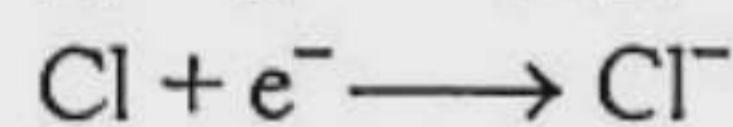
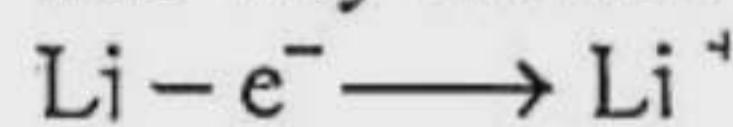
d The element 'B' mentioned in the stem is lithium (Li). Its atomic number is 3. That means it has 3 protons and 3 electrons.

In case of lithium atoms, it has 2 electrons in the first orbit and 1 electron in the second orbit. If the lithium atom can lose the single electron in the second orbit, its outermost orbit becomes full and the atom will become stable.

The lithium atom will easily lose one electron from the second orbit if some neighboring atom has the tendency to grab an electron to fill its outermost orbit. When it lose one electron it is no longer charge neutral. But losing one electron it becomes positively charged. This charged atom is called



cation. On the other hand, chlorine atom has electron distribution as 2, 8, 7. For stability it needs 1 electron in the outermost orbit. So, chlorine atoms will take an electron from lithium atom for its 3rd orbit. After receiving one electron chlorine atom becomes negatively charged atom or anion. As a result, an attractive force work between these oppositely charged on and they form a bond. In this way lithium chloride (LiCl) is formed.


Ques. 07

Element	Electron Number
(i)	16

Element	Atomic Number
(ii)	3
(iii)	17
(iv)	18

- What is called atom? 1
- Why deuterium is an isotope? 2
- If the neutron number is 16 in element of the chart: X calculate its mass number. 3
- The two elements of the chart: Y is able to form compound—Analyze. 4

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Answer to Question No. 07 :

a) The word 'atom' means the smallest particle of an element that cannot be broken down. Atoms are formed by electrons, protons and neutrons.

b) The different atoms of an element which have the same number of protons and electrons but different mass number is called isotope of that element. Deuterium is an isotope of hydrogen atom. Because it has one electron, one proton and one neutron. So, its mass number is 2.

c) The mass number of an atom of an element is expressed as the total number of protons and neutrons in the atom. Thus the mass number of an element is equal to sum of the number of protons in an and the number of neutrons in the atom.

Since, the number of protons is equal to the number of electrons in each atom. The number of proton of element in X is 16. And, the number of neutron of the element = 16.

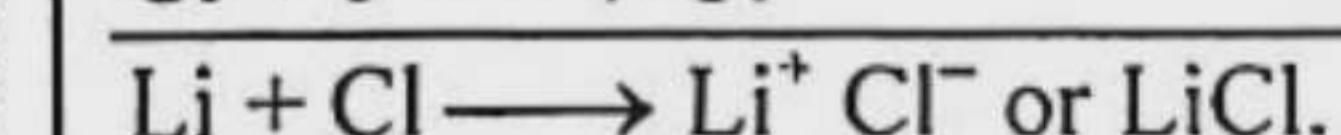
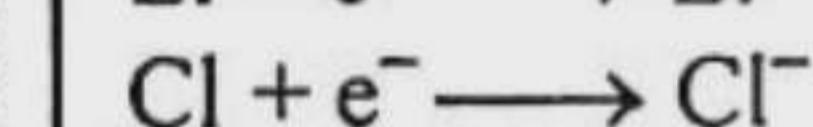
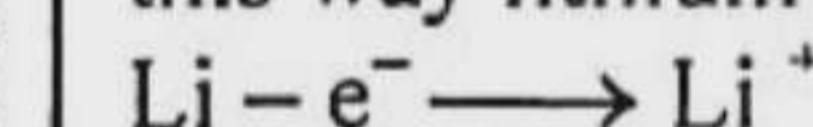
So, the mass number of the element in 'X' is = $(16 + 16) = 32$

d) The atomic number of three elements of chart 'Y' are 3, 17 and 18. So, the three elements are lithium, chlorine and argon respectively. Among

these three elements, lithium (3) and chlorine (17) are able to form compound. But argon (18) can not form compound as it an inert gas.

In case of lithium atoms, it has 2 electrons in the first orbit and 1 electron in the second orbit. If the lithium atom can lose the single electron from the second orbit, its outermost orbit becomes full and the atom will become stable.

The lithium atom will easily lose one electron from the second orbit if some neighboring atom has the tendency to grab an electron to fill its outermost orbit. When it lose one electron it is no longer charge neutral. But losing one electron it becomes positively charged. This charged atom is called cation. On the other hand, chlorine atom has electron distribution as 2, 8, 7. For stability it needs 1 electron in the outermost orbit. So, chlorine atoms will take an electron from lithium atom for its 3rd orbit. After receiving one electrons chlorine atom becomes negatively charged atom or anion. As a result, an attractive force acts between these oppositely charged on and they form a bond. In this way lithium chloride (LiCl) is formed.


Ques. 08

Element	Electron distribution
X	2, 8, 2
Y	2, 8, 6

- What is isotope? 1
- CaSO_4 is a electrolyte component—Explain. 2
- Determine the neutron number of element-Y, if the mass number of it is 32. 3
- Do the elements X and Y make a compound by forming bond to each other? Analyze with logic. 4

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Answer to Question No. 08 :

a) The different atoms of an element which have the same number of protons and electrons but different mass number are called isotopes of the element.

b) These materials which in the dissolved state or melted state allow electricity to pass through it are called electrolyte substance. It is found in case of salt. Calcium sulphat (CaSO_4) is a salt. Due to flow of electricity, chemical change occurs in the salt which produce sulphate ion (SO_4^{2-}) and calcium. As CaSO_4 allow electricity to pass through it, it is an electrolyte substance.

c Electron distribution of 'Y' element is 2, 8, 6. So electron number of the element is 16 and the element is sulphur. Since the electron number of an element is equal to its proton number. So proton number of sulphur is 16.

In an atom, the number of protons + the number of neutrons = mass number of an atom. Therefore the number of neutrons in atom of the element Y = mass number of the element Y – the number of protons in the atom of element Y.

∴ Mass number of element Y = 32

Proton „ „ „ = 16

So, the number of neutrons in an atom of element Y = $(32 - 16) = 16$.

d According to the stem, electron number of 'X' element is 12 (2, 8, 2) and that of 'Y' element is 16(2, 8, 6). So, 'X' element is magnesium and 'Y' element is sulphur. Electron distribution of Magnesium and sulphur atom is shown below—

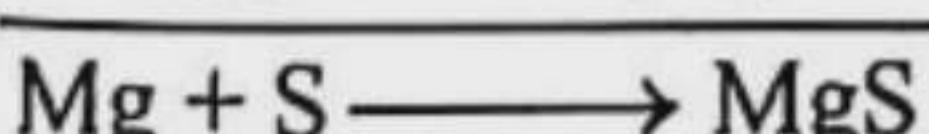
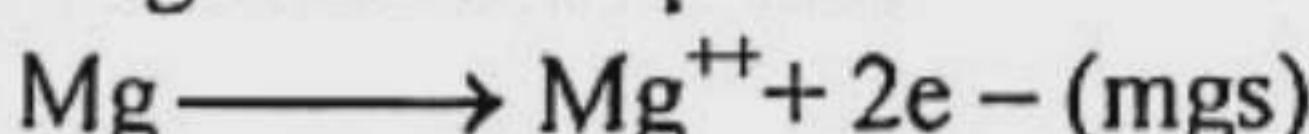


Magnesium atom



Sulphur atom

The properties of element are basically determined by the electron distribution in their orbits. Generally atoms become active or inactive or charged due to difference in electron distribution is 12 that means it has 12 electrons and its electron configuration is 2, 8, 2. According to the rule, the maximum number of allowed electrons in the third orbit is eighteen. If the magnesium atom can lose its outermost two electrons, its second orbit becomes full and the atom will become stable. Thus by losing two electrons magnesium atom becomes positively charged. This positively charged ion is called cation. On the other hand, sulphur atom has electron distribution 2, 8, 6. For its stability it needs 2 electrons in outmost orbit. After receiving 2 electron from outside, the sulphur atom becomes negatively charged. This makes it a negatively charged ion called anion. As a result an attractive force works between these oppositely charged ions and they form a bond. It this way magnesium atom and sulphur atom from a compound named magnesium sulphate.



Ques. 09

Element	X	Y	Z
Atomic number	11	17	18

- What is mass-number? 1
- When does the atom charge neutralize? Explain. 2
- Explain the inactivity of the 'Z' element. 3
- Whether 'X' and 'Y' can form compounds? Give your opinion with logic. 4

• Dinajpur Board 2019

Answer to Question No. 09 :

a The mass number of an atom of an element is expressed as the total number of protons and neutrons in the atom.

b Atoms are the smallest particles of an element. Atoms consists of smaller particles known as electron, proton and neutron. Electrons are negatively charged particles which revolve in certain allowed orbits. Protons are positively charged particles which stay with charge neutral particles neutrons in a small region of atom. The number of protons and the number of electrons are same in the atom. For this reason, an atom is electrically neutral.

c According to the stem, element Z having atomic number 18 refers to inert gas argon (Ar). The electronic configuration of the element Z is given below.

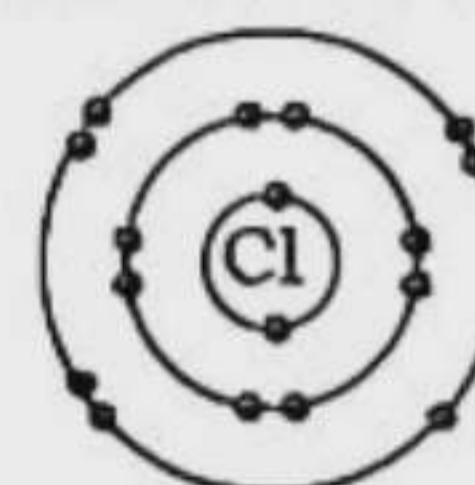
$\text{Z}(18) : 2, 8, 8$

The last orbit is filled with 8 electrons. Element Z can neither donate nor share electron. For this reason, it can not form any compound with other element even with itself.

d Atomic number of X is 11. So it is sodium. Atomic number of Y is 17. So it is chlorine. According to electronic configuration, the distribution of electron in a sodium atom (Na) is 2, 8, 1 and that of chlorine is 2, 8, 7. It can be shown below.



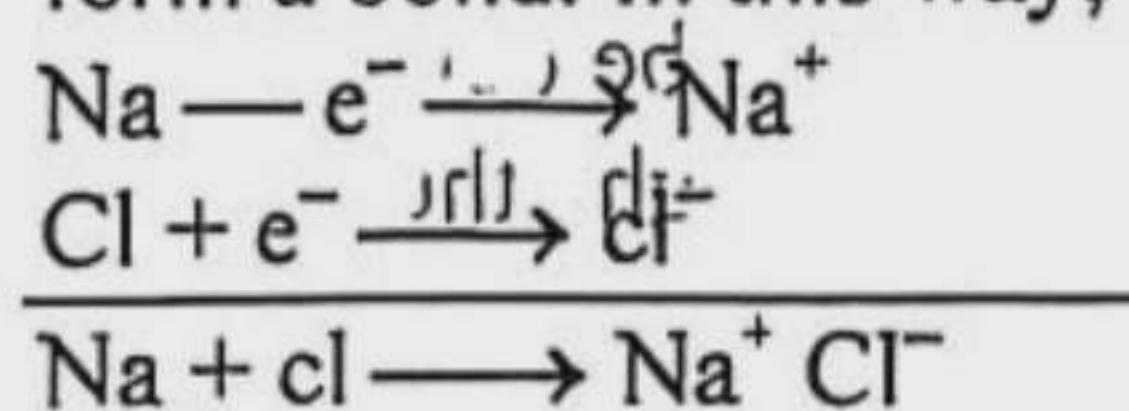
Sodium atom



Chlorine atom

If sodium atom comes in contact with chlorine atom, sodium atom will donate one electron present in the third orbit. By losing one electron, sodium atom becomes positively charged. This positively charged atom is called cation. On the other hand, there are seven electrons in the outermost orbit of chlorine atom. For stability, it needs one electron in the outermost orbit. So

chlorine atom receives one electron from the 3rd orbit of sodium atom. After receiving one electron, chlorine atom becomes negatively charged atom called anion. As a result, an attractive force acts between these two oppositely charged ion and they form a bond. In this way, NaCl is formed.



- Ques. 10** Atoms consists of electrons, protons and neutrons. There are some elements or compound which have the same number of electrons and protons but their atomic mass number is different. On the other the atomic number of an element is 11 and mass number is 23.
- What is reproduction? 1
 - There is a tendency of asexual reproduction by spore production.— Explain. 2
 - Determine the neutron number of the last element of the stem. 3
 - The use of the element of different mass number mentioned in the stem is different from other elements.— Analyze 4

• Dhaka Board 2018

Answer to Question No. 10 :

a The complex process by which an organism produces its offsprings is known as reproduction.

b The tendency of asexual reproduction by spore production is found mainly in lower plants. The modified somatic cells of the plant body produced organs which contains spores. These are known as spore case (sac) or sporangium. A fully formed sporangium generally bears numerous spores. But sometimes sporangium bears a single spore. Spore may develop outside the sporangium. These are known as exospores. Some exospores are known as conidium. *Mucor* reproduces asexually by forming enormous number of microscopic spores inside sporangium. *Penicillium* reproduces by formation of conidia.

c The atomic number of the element is 11 and its mass number is 23. Since the atomic number is equal to the number of protons, the numbers of protons in the atom of the element is 11.

In an atom the number of protons + the number of neutrons = mass number of an atom.

Therefore the number of neutrons in an atom of the element = mass number of the element the number of protons in the atom of element.

So, the number of neutron of an atom of element of the stem = $(23 - 11) = 12$.

d The atoms of same elements having the same number of protons but different mass number are called isotopes.

The uses of isotopes are described below :

Medical uses of isotopes: Isotopes are used in diagnosis and treatment of diseases. If there is any defect in a narrow artery, it can be detected by sending radioactive isotope through the blood flowing in the artery. In the same way the affected cell of a cancer patient can be determined by sending radioactive isotopes. Again, radioactive isotope can be used to destroy the cancer affected cells. Another use of radioactive materials is to use its radiation to sterilize surgical instruments.

Application in Agriculture: In agriculture the radiation from isotopes is used to control insects. Also it can be used to find out what type of fertilizer and what amount of fertilizer are needed for a specific crop.

Food Production: Germs and bacteria can be killed by the radiation from radioactive isotopes. Therefore radioactive isotopes can be used to make food and fruits free from germs.

Use of Isotopes in geological research : From the ratio of the stable and unstable isotopes, it is possible to find out how old the fossil is.

So, the use of the element of different mass number is different from other elements.

Ques. 11

Elements	Atomic Number
X	11
Y	17
Z	18

- What is atom? 1
- Write down the uses of same element those mass number is different. 2
- Determine the mass number of Z element whose Neutron number is 22. 3
- Which two elements of the stem be able to form compound? Give your opinion with electronic configuration. 4

• Rajshahi Board 2018

Answer to Question No. 11 :

a The word 'atom' means the smallest particle of an element that cannot be broken down. Atoms are formed by electrons, protons and neutrons.

b The same type of elements those mass number is different are called isotopes. The uses of isotopes are following —.

- diagnosis and treatment of diseases.
- in agriculture.
- in food production.
- in geological research.

c The atomic number of element Z is 18. Since the atomic number is equal to the number of protons the number of protons in the atom of the element is 18. Again the number of electrons in an atom is equal to the number of the protons. So, the number of electrons is 18.

In an atom the number of protons + the numbers of neutrons = mass number of an atom.

Here, atomic numbers of Z element is 18, and neutron number is 22.

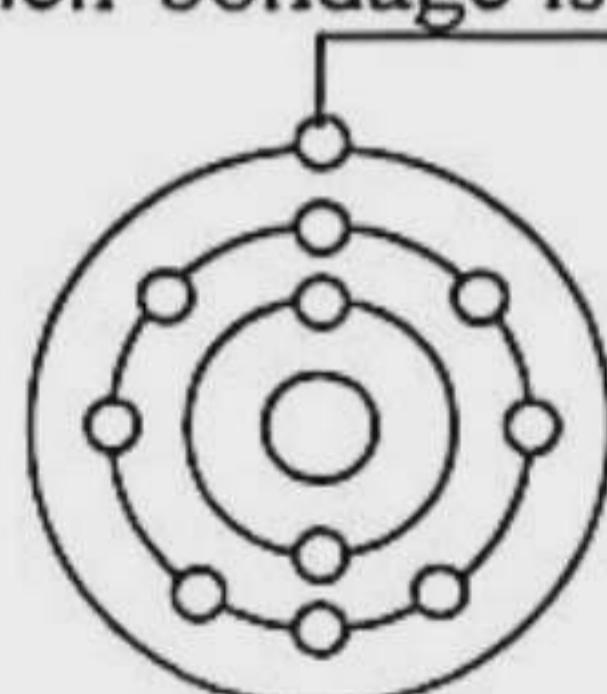
∴ The mass number of Z element = $18 + 22 = 40$

d Three elements X, Y, Z are mentioned in the stem. Atomic number of the elements are 11, 17 and 18 respectively. So, X element is sodium (11), Y element is chlorine (17) and Z element is Argon (18). Among them, X and Y elements be able to form compound. Argon (18) can not be able to form compound because Argon is an inert gas (2, 8, 8). Formation of compound between X and Y element is described below :—

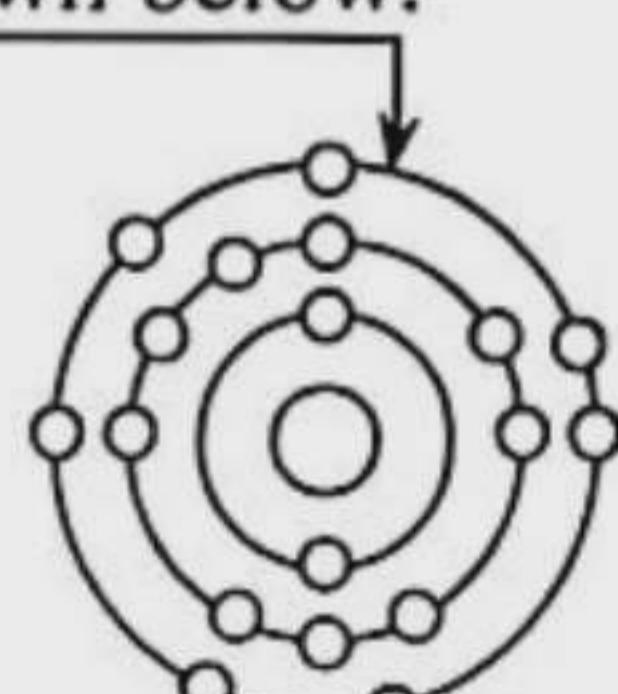
Atomic no. of X = 11 Atomic no. of Y = 17

No. of shell	No. of electron	No. of shell	No. of electron
1	2	1	2
2	8	2	8
3	1	3	7
$(2 + 8 + 1 = 11)$		$(2 + 8 + 7 = 17)$	

No doubt X is a Sodium atom and Y is a Chlorine atom. Their bondage is shown below.



Sodium atom



Chlorine atom

(electron donor, cation⁺) (electron gainer, anion⁻)
According to the diagram, a sodium atom has a single electron in its outermost shell. Again a chlorine atom has seven electrons in its outermost shell. The two atoms makes a bond by giving and receiving an electron; sodium atom is the donor (cation) and chlorine atom is the receiver (anion). Thus they make sodium chloride.



Ques. 12 X, Y and Z are the elements. Their atomic number are 10, 11 and 17 respectively.

- What is called atom? 1
- Why isotope is used in medical sector? 2
- Draw the electronic configuration of the element 'X' with explanation. 3
- Are the elements Y and Z able to form compound?— Give your opinion with logic. 4

Answer to Question No. 12 : (in more)

a Atom means the smallest particle of an element that can not be broken down.

b **Medical uses of isotopes :** Isotopes are used in the diagnosis and treatment of diseases. If there is any defect in a narrow artery, it can be detected by sending radioactive isotope through the blood flowing in the artery. In the same way the affected cell of a cancer patient can be determined by sending radioactive isotopes. Again radioactive isotope can be used to destroy the cancer affected cells. Another use of radioactive materials is to use its radiation to sterilize medical instruments.

c The element X has atomic number 10. The element has proton number 10. Hence the element has 10 electrons. How these electrons are distributed in different orbits? They must be in the order 2, 8. This means in the first orbit there will be 2 electrons, in the second orbit there will be 8 electrons.

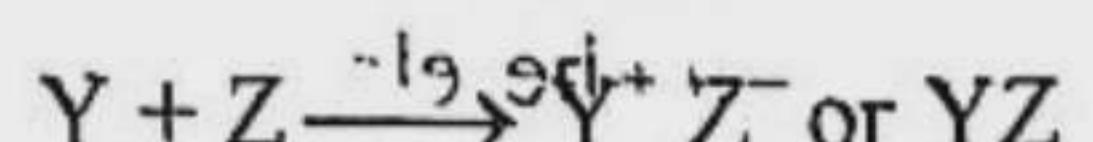
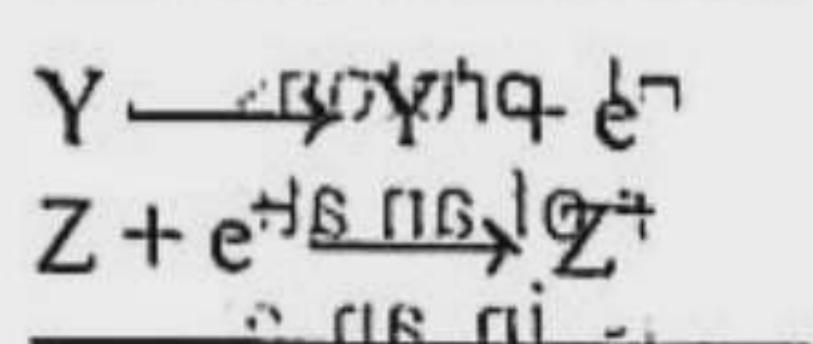


The above diagram shows the electron distribution of element X (10).

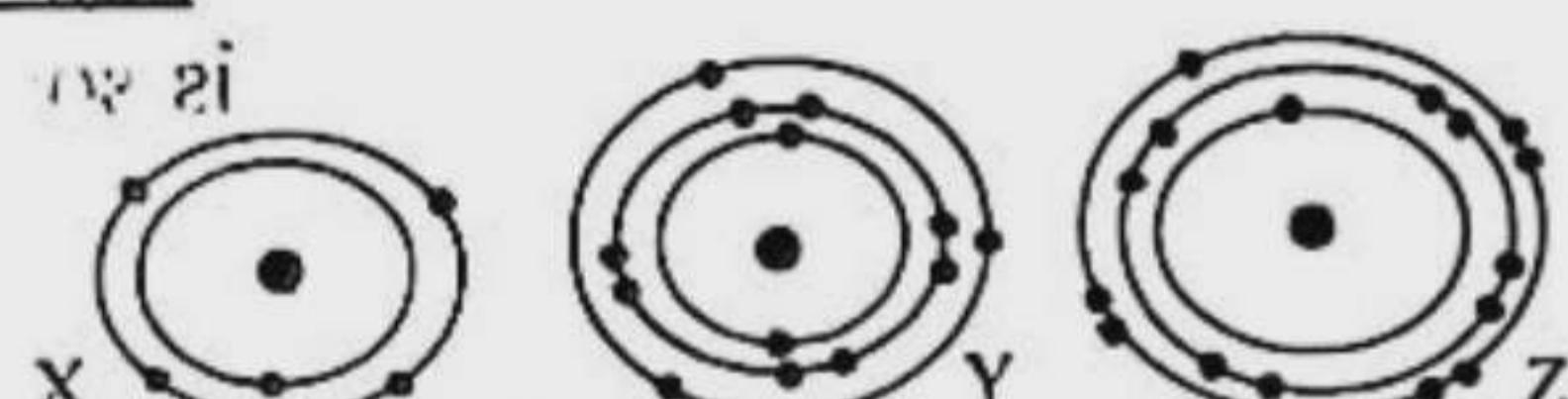
d The element Y and Z are able to form compound. How they form a compound is explained below : The element Y and Z have atomic number 11 and 17 respectively. The electron distribution of element Y is 2, 8, 1 and of element Z is 2, 8, 7. Both of them are not in stable state. To become stable, element Y loses the electron of its outer most shell. Thus, it becomes positively charged cation. On the other hand, element Z needs 8 electrons in the outermost shell. It can either lose 7 electrons from 3rd shell or can grab one extra electron to complete the second orbit. From the energy consideration it is far more favourable to take one extra electron to complete 3rd orbit. In the vicinity of element Y and Z can easily take one electron from Y. After receiving one electron from outside the Z become negatively charged which is called anion.

Now we have two atoms where one is positively charged cation and another one negatively charged anion. As a result an attractive force acts between these oppositely charged ions and they form a bond.





Thus, Y and Z can form a bond.

Ques. 13


- a. What is radical? 1
- b. "The mass number of sodium is 23"— What does it mean? 2
- c. Explain the isotopes of "X" element. 3
- d. How can the two elements Y and Z gain their stability? Explain it. 4

• Sylhet Board 2018

Answer to Question No. 13 :

a A group of atoms which participates in compound formation like elemental atom is called a radical.

b The mass number of sodium is 23. It means sodium atom has 11 protons and 12 neutrons in the nucleus of it.

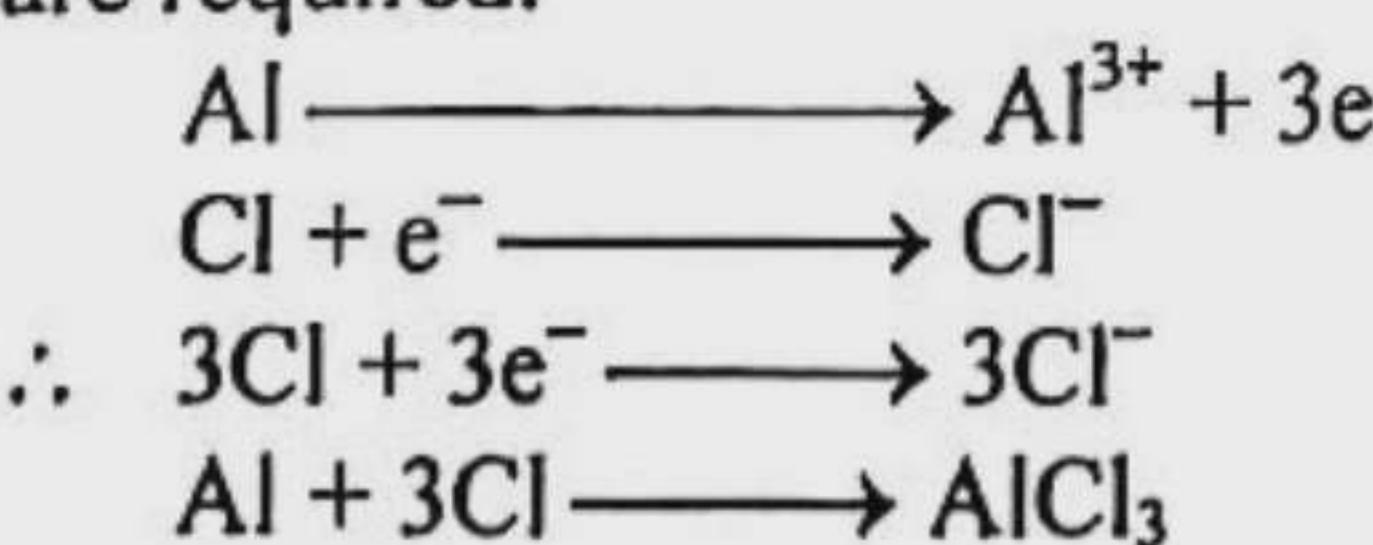
c In the stem, the element X has 6 electrons. Carbon has proton number 6. So, the given element (X) is the element of carbon.

The different atoms of an element which have the same number of protons and electrons but different mass numbers are called isotopes of that element. Most carbon atoms have 6 protons and 6 neutrons in their nuclei. But some atoms have 7 or 8 neutrons in their nuclei. Thus carbon (i.e., X) has 3 isotopes.

d The element Y and Z have electronic configuration. Their electronic configuration are given below according to stem.

For element Y, electronic configuration is 2, 8, 3 and for Z is 2, 8, 7.

The element Y is aluminium (Al) and Z is chlorine (Cl). The number of electron in last orbit of Al is 3 and of Cl is 7. The chlorine atom can receive one electron to form stable electron configuration of Argon gas. Again, Al can donate 3 electron from its last shell to form electronic configuration of Neon. For receiving 3 electrons, 3 chlorine atoms are required.



Ques. 14 For an element 'M' the atomic number is 11 and the mass number 23. The another element 'N' in which electrons number is 17 and mass number is 35.

- a. What is the radioactive isotopes? 1
- b. What do you mean by $2n^2$? 2
- c. Calculate the neutrons number of the element 'M'. 3
- d. Explain the ionic bond formation of the compound produced by the elements 'M' and 'N'. 4

• Dinajpur Board 2018

Answer to Question No. 14 :

a The isotopes that radiate different radiations and particles due to decay are called radioactive isotopes.

b Electrons revolve around the nucleus. The electrons have definite orbits.

The rule by which the electrons are distributed in the orbits is given by $2n^2$ (here $n = 1, 2, 3 \dots$ are the successive numbers of orbits). According to the rule, the maximum number of allowed electrons in the first orbit is two, in the second orbit the number is eight. And in the third orbit the number is eighteen and so on.

c According to the stem, the atomic number of element 'M' is 11 and the mass number is 23. The atomic number indicates the number of protons and the number of protons is equal to the number of electrons. So, the number of protons of 'M' element is 11. And the number of electrons is 11. Again, in an atom the number of protons + the number of neutrons = mass number of an atom.

Therefore, the number of neutrons in an atom of the element P = mass number of the element—the number of protons of the element.

Thus the number of neutron of an atom of element P = $23 - 11 = 12$.

d Atomic number of M is 11. So, it is a sodium atom. On the other hand, electron number of N is 17. As the electron number is equal to proton number or atomic number of an element, so atomic number of N element is 17. We know that the atomic number of sodium (Na) and chlorine (Cl) are 11 and 17 respectively. Now, according to electronic configuration, the distribution of electrons in an atom of sodium is 2, 8, 1 and that of chlorine is 2, 8, 7 and it can be shown as follows :



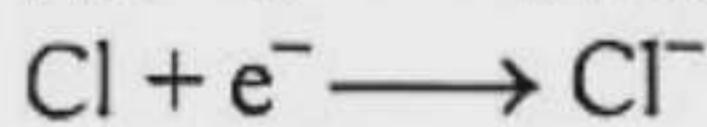
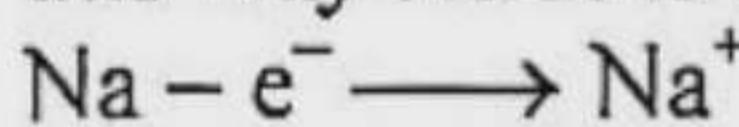
Chlorine atom



Sodium atom

Now, if sodium atom comes in contact of chlorine atom, then sodium atom will give the only electron present in the 3rd orbit. By losing one electron the sodium atom becomes positively charged. This positively charged atom is called cation.

On the other hand, chlorine atom has electron distribution as 2, 8, 7. For stability, it needs 1 electron in the outermost orbit. So, chlorine atom will take an electron from sodium atom for its 3rd orbit. After receiving one electron, chlorine atom becomes negatively charged atom or anion. As a result, an attractive force works between these oppositely charged ion and they form a bond. In this way NaCl is formed.



Ques. 15 The atomic number of element "P" is 11 and the mass number is 23. So the number of electron Q is 17.

- a. What is the oxygen atomic number? 1
- b. What do you mean by isotope? 2
- c. What is the number of element "P" electron, proton and neutrons? 3
- d. Show the equation of forming compound of after demonstrating the electron of the two element. 4

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Answer to Question No. 15 :

a. The atomic number of oxygen is 8.

b. Isotopes : The different atoms of an element which have the same number of protons and electrons but different mass number are called isotopes of the element. For example, most of the carbon atoms have 6 protons and 6 neutrons in their nuclei. But some atoms have 7 or 8 neutrons in their nuclei. Thus carbon has three isotopes.

c. According to the stem, the atomic number of element 'P' is 11 and the mass number is 23. The atomic number indicates the number of protons and the number of protons is equal to the number of electrons. So, the number of protons of 'P' element is 11. And the number of electrons is 11.

Again, in an atom the number of protons + the number of neutrons = mass number of an atom. Therefore, the number of neutrons in an atom of the element P = mass number of the element—the number of protons of the element.

Thus the number of neutron of an atom of element P = 23 – 11 = 12.

d. Atomic number of P is 11. So, it is sodium. On the other hand, electron number of Q is 17. As the electron number is equal to proton number or atomic number of an element, so atomic number of Q element is 17. We know that the atomic number of sodium (Na) and chlorine (Cl) are 11 and 17 respectively. Now, according to electroffic configuration, the distribution of electrons in an atom of sodium is 2, 8, 1 and that of chlorine is 2, 8, 7 and it can be shown as under :



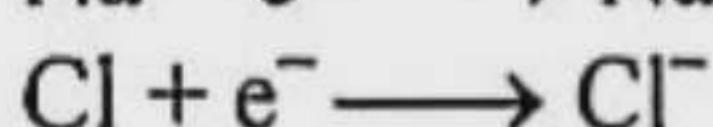
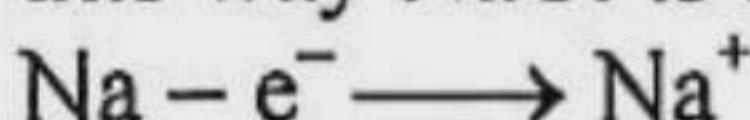
Chlorine atom



Sodium atom

Now, if sodium atom comes in contact of chlorine atom, then sodium atom will give the only electron present in the 3rd orbit. By losing one electron the sodium atom becomes positively charged. This positively charged atom is called cation.

On the other hand, chlorine atom has electron distribution as 2, 8, 7. For stability it needs 1 electron in the outermost orbit. So, chlorine atom will take an electron from sodium atom for its 3rd orbit. After receiving one electron chlorine atom becomes negatively charged atom or anion. As a result, an attractive force work between these oppositely charged ion and they form a bond. In this way NaCl is formed.



Knowledge & Comprehension-based Q/A



Designed as per topic

Preparatory Knowledge-based Q/A

Question 1. Who did first put forward the idea that all matters are formed of tiny particles called atom?

Ans. The Greek philosopher named Democritus put forward for the first time the idea that all matters are formed of tiny particles called atom.

Question 2. What does the word 'atom' mean?

Ans. Atom means indivisible.

Question 3. What does exist at the centre of an atom?

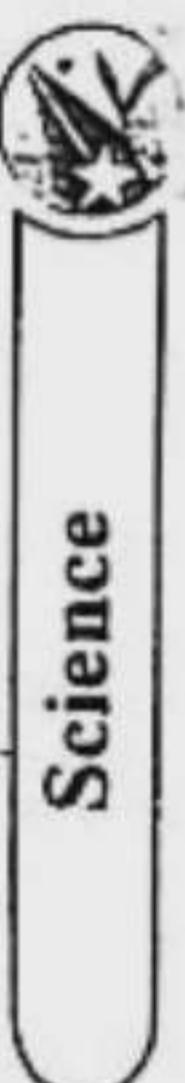
Ans. Nucleus exists at the centre of an atom.

Question 4. Who did use the quantum theory of planks in the atomic model?

Ans. Neils Bohr used the quantum theory of planks in the atomic model.

Question 5. How are atoms formed by?

Ans. Atoms are formed by electrons, protons and neutrons.



Question 6. What does make the difference in behaviour of atoms of different types?

Ans. The number of protons and electrons makes the difference in behaviour of atoms of different types.

Question 7. What is the net charge in a normal atom?

Ans. The net charge in a normal atom is zero.

Question 8. What is the atomic number of carbon?

Ans. The atomic number of carbon is 6.

Question 9. What does an unstable isotope do?

Ans. An unstable isotope radiate different radiations and particles due to radioactive decay.

Question 10. What is the rule by which the electrons of an atom are distributed in the orbits?

Ans. The rule by which the electrons of an atom are distributed in the orbit is $2n^2$ where n belongs to set of natural numbers.

Preparatory Comprehension-based Q/A

Question 1. Write about the structure of an atom.

Ans. An atom is formed by electrons, protons and neutrons. Protons (with +ve charge) and neutrons (without charge) exist at the centre of the atom whereas electrons revolve around the nucleus along definite orbits. Electrons are distributed in the orbits according to the rules given by $2n^2$ where $n \in \mathbb{N}$. The space between proton-neutron and electron is void.

Question 2. What do you mean by 'the mass number of sodium is 23'?

Ans. The mass number of an atom of an element is nothing but the total number of protons and neutrons in the atom. So, the mass number of

sodium is 23 means the total number of proton (11 in number) and neutron (12 in number) is $(11 + 12)$ or 23.

Question 3. Carbon has three isotopes—Explain.

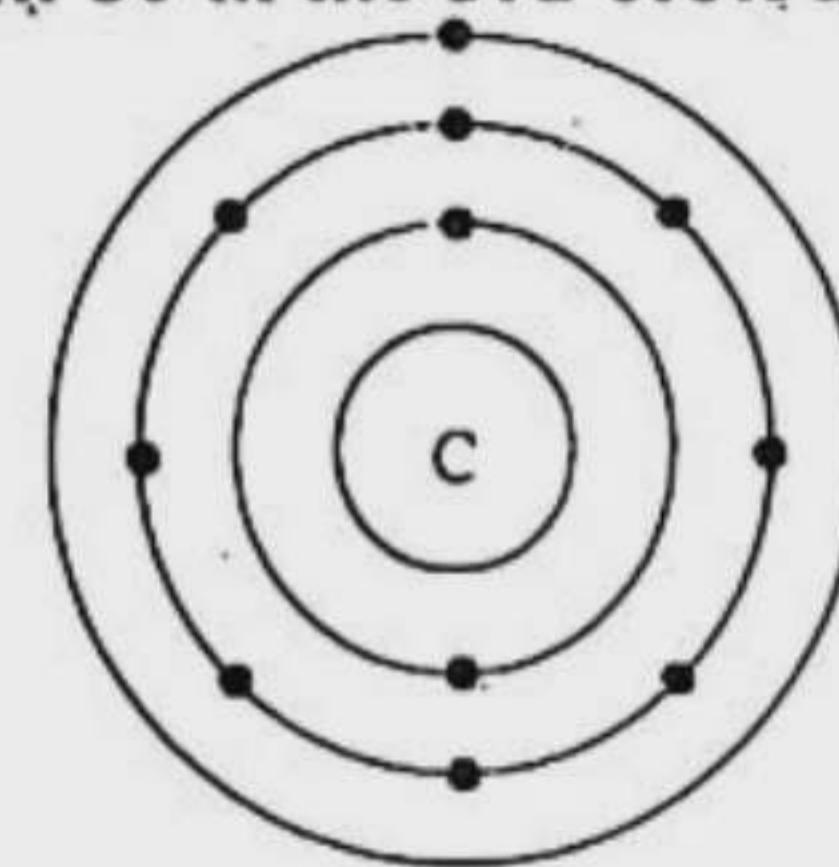
Ans. It has been experimentally found that the different atoms of an element which have the same number of protons and electrons but different mass number are called different isotopes of the element. Most of the carbon atoms have 6 protons and 6 neutrons in their nuclei. But some atoms have 7 or 8 neutrons in their nuclei. This is why, carbon has three isotopes.

Question 4. What is radioactive isotopes?

Ans. The stable isotopes do not radiate any radiation and particle whereas the unstable isotopes radiate different radiation and particles due to radioactive decay. Here the isotopes that radiate different radiations and particles due to decay are called radioactive isotopes.

Question 5. When the number of electrons in an atom of sodium is 11, what will be the distribution of electrons in the orbit of sodium atoms?

Ans. The rule of distribution of electrons of an atom is given by $2n^2$. Based on this rule, the 1st orbit will contain 2 electrons, the 2nd orbit will contain 8 electrons and the rest one electron of a sodium atom will be in the 3rd orbit as shown below :



Super Suggestions



Super Suggestions with 100% preparatory questions selected by the Master Trainer Panel

Dear learners, important multiple choice, short, creative, knowledge & comprehension-based questions of this chapter selected by Master Trainer Panel for Half-Yearly and Annual Exams are presented below. Learn the answers to the mentioned questions well to ensure 100% preparation.

Question Pattern	7	5
MCQs with Answers	Learn each MCQs in this chapter thoroughly.	
Short Q/A	4, 7, 11, 15, 17, 21, 23, 25	8, 12, 19, 24, 28
Creative Q/A	5, 7, 11	3, 6, 10
Knowledge-based Q/A	1, 3, 9, 10	2, 5, 7
Comprehension-based Q/A	1, 2, 3	4, 5

Exclusive Tips ► Master the solutions to all the activities in this chapter along with exercise and other Q/A to develop the creative thinking and assess your talent.



Assessment & Evaluation



A question bank presented in the form
of a class test to assess the preparation

Class Test

Time : 3 hours

Science

Full marks : 100

Class : Eight

Multiple Choice Questions (Each question carries 1 mark)

$1 \times 30 = 30$

[N.B. : Answer all the questions. Each question carries one mark. Block fully, with a ball-point pen, the circle of the letter that stands for the correct/best answer in the "Answer Sheet" for Multiple Choice Question Type Examination.]

1. Who first thought about atom?
 A Democritus B Theophrustus
 C Aristotle D Plato
 2. When was atom thought about first?
 A in 200 B.C. B in 200 A.D.
 C in 400 B.C. D in 400 A.D.
 3. When was the idea about atom originated?
 A 2700 years ago B 2600 years ago
 C 2500 years ago D 2400 years ago
 4. What language was the word 'atom' derived?
 A Greek B Roman C Latin D French
 5. What are the number of fundamental elements?
 A 109 B 112 C 115 D 118
 6. What is an atom composed of?
 A Electron B Proton
 C Neutron D All the above
 7. Isotope is a—.
 i. strong germicide
 ii. strong pesticide
 iii. strong antigen
 Which one is correct?
 A i & ii B ii & iii C i & iii D i, ii & iii
 8. What is the number of atoms of $(CH_3COO)_2$.
 A 03 B 05 C 06 D 15
 9. How many proton is an oxygen atom?
 A TWO B Eight
 C Sixteen D Thirty two
 10. What is the number of Neutron in Tritium?
 A 0 B 1 C 2 D 3
 11. Which is the atomic number of aluminium?
 A 11 B 12 C 13 D 14
 12. Isotope applies to—.
 i. hydrogen ii. argon
 iii. carbon
 Which one is correct?
 A i & ii B ii & iii C i & iii D i, ii & iii
 13. What is the mass number of second isotope of carbon?
 A 7 B 8 C 12 D 13
- Answer the questions No. 14 and 15 on the basis of figure :
-
- Here, shows the electron numbers outermost orbit of the element.
14. The atom belongs to which element?
 A Chlorine B Potassium
 C Calcium D Fluorine

15. What is the neutron number of that element?
 A 17 B 18 C 20 D 35
 16. 2, 8, 2 is the distribution of electrons of the element?
 A Na B K C Al D Mg
- Notice figure below and answer to the question No. 17 and 18 :
-
17. What is the mass number of molecule of the atom?
 A 6 B 5 C 4 D 3
 18. This molecule is able to—.
 i. create cation
 ii. create reaction with non metal
 iii. an isotopes
 Which one of the following is correct?
 A i & ii B i & iii C ii & iii D i, ii & iii
 19. In which rule the electrons are distributed?
 A $2n$ B $2n^2$ C n^2 D $4n^2$
 20. Inactive elements include—.
 i. Helium
 ii. Lithium
 iii. Neon
 Which one is correct?
 A i & ii B ii & iii C i & iii D i, ii & iii
 21. How many proton are there in oxygen atom?
 A 4 B 8 C 16 D 32
 22. What is the number of electrons in sulphur?
 A 12 B 16 C 20 D 22
 23. How many electron stay in the third shell of a atom?
 A 2 B 8 C 18 D 32
 24. How many electron stay at the outermost shell of oxygen?
 A 4 B 5 C 6 D 7
 25. Which one is the electronics configuration of Chlorine?
 A 2, 8, 8 B 2, 8, 7 C 2, 8, 5 D 2, 8, 1
 26. 2, 8, 7 is the electronic configuration of which element?
 A Sodium B Argon C Chlorine D Sulphur
 27. Which one is the electronic configuration in Nitrogen?
 A 2, 1 B 2, 5 C 2, 8, 1 D 2, 8, 7
 28. What is the name of the stem's element?
 A Carbon B Nitrogen
 C Oxygen D Fluorine
 29. The number of isotopes of the element is—.
 A 2 B 3 C 4 D 7
 30. How many electrons are there in magnesium?
 A 18 B 12 C 11 D 10

Answer Sheet ▶ Multiple Choice Questions

1	<input type="radio"/>	2	<input type="radio"/>	3	<input type="radio"/>	4	<input type="radio"/>	5	<input type="radio"/>	6	<input type="radio"/>	7	<input type="radio"/>	8	<input type="radio"/>	9	<input type="radio"/>	10	<input type="radio"/>	11	<input type="radio"/>	12	<input type="radio"/>	13	<input type="radio"/>	14	<input type="radio"/>	15	<input type="radio"/>
16	<input type="radio"/>	17	<input type="radio"/>	18	<input type="radio"/>	19	<input type="radio"/>	20	<input type="radio"/>	21	<input type="radio"/>	22	<input type="radio"/>	23	<input type="radio"/>	24	<input type="radio"/>	25	<input type="radio"/>	26	<input type="radio"/>	27	<input type="radio"/>	28	<input type="radio"/>	29	<input type="radio"/>	30	<input type="radio"/>

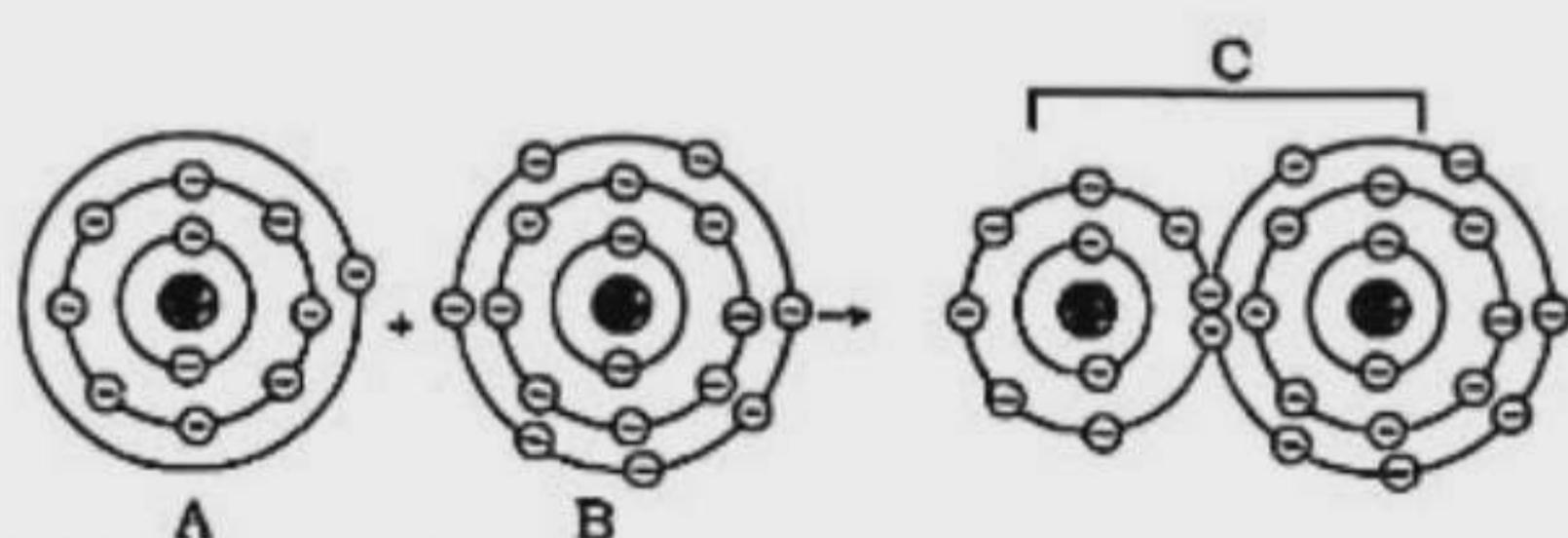
Short-Answer Question (Each question carries 2 marks)**Answer any 10 of the following questions :** **$2 \times 10 = 20$**

1. Explain Democritus's theory of the structure of matter.
2. Explain the theory of Plato and Aristotle regarding the structure of matter.
3. Why was Aristotle's theory of the structure of matter rejected?
4. Why is an atom not indivisible?
5. Explain the initial concept of the nucleus by scientist Rutherford.
6. Explain the results obtained from Rutherford's experiment.
7. Why are the properties of atoms different?

8. Why is the atom of hydrogen gas different from the atom of oxygen gas?
9. Why are the atomic numbers of hydrogen and oxygen different?
10. How is the mass number of an atom determined?
11. Explain why protium and deuterium are isotopes of each other.
12. Why do isotopes have the same chemical properties?
13. Why are isotopes radioactive?
14. Why are isotopes used in food preservation?
15. How is the age of a fossil determined?

Creative Question (Each question carries 10 marks)**Answer any 5 of the following questions :** **$10 \times 5 = 50$**

1.



- a. What is cation? 1
- b. In what sense an atom is different from an ion? 2
- c. Give an explanation to the formation of the compound indicated with the diagram. 3
- d. C is a salt. A great many salts can be produced by replacing A with metals or B with radical compounds. Prove the statement. Elucidate the comment. 4
2. "A" and "B" are two elements those have atomic number 11 and 17 respectively. Mass number are 23 and 35 respectively of that elements.
 - a. What is isotope? 1
 - b. What do you mean by the mass number of oxygen is 16? 2
 - c. Calculate the electron, proton and neutron number of 'A' element. 3
 - d. Explain the process by which the atoms of above mentioned two elements get stability. 4
3. The number of atom of the molecule A is 6, But the number of mass is different in different atoms. Again the number of atom in another molecule B is 3 which is not stable.
 - a. What Is symbol? 1
 - b. NaOH Is an alkali—Explain. 2
 - c. Explain the cause of difference of mass number of element A. 3
 - d. How will the element B mentioned in the stem attain stability? Analyze. 4
4. Atoms consists of electrons, protons and neutrons. There are some elements or compound which have the same number of electrons and protons but their atomic mass number is different. On the other the atomic number of an element is 11 and mass number is 23.
 - a. What is reproduction? 1
 - b. There is a tendency of asexual reproduction by spore production.—Explain. 2

- c. Determine the neutron number of the last element of the stem. 3
- d. The use of the element of different mass number mentioned in the stem is different from other elements.—Analyze 4
5. X, Y and Z are the elements. Their atomic number are 10, 11 and 17 respectively.
 - a. What is called atom? 1
 - b. Why isotope is used in medical sector? 2
 - c. Draw the electronic configuration of the element 'X' with explanation. 3
 - d. Are the elements Y and Z able to form compound?—Give your opinion with logic. 4
- 6.

 - a. What is radical? 1
 - b. "The mass number of sodium is 23"—What does it mean? 2
 - c. Explain the isotopes of "X" element. 3
 - d. How can the two elements Y and Z gain their stability? Explain it. 4

7. For an element 'M' the atomic number is 11 and the mass number 23. The another element 'N' in which electrons number is 17 and mass number is 35.
 - a. What is the radioactive isotopes? 1
 - b. What do you mean by $2n^2$? 2
 - c. Calculate the neutrons number of the element 'M'. 3
 - d. Explain the ionic bond formation of the compound produced by the elements 'M' and 'N'. 4
8. The atomic number of element "P" is 11 and the mass number is 23. So the number of electron Q is 17.
 - a. What is the oxygen atomic number? 1
 - b. What do you mean by isotope? 2
 - c. What is the number of element "P" electron, proton and neutrons? 3
 - d. Show the equation of forming compound of after demonstrating the electron of the two element. 4

Answering Reference ► Short-Answer Questions

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|--------------------------------|--------------------------------|---------------------------------|---------------------------------|
| 1 ► See this Chapter, Ques. 01 | 5 ► See this Chapter, Ques. 05 | 9 ► See this Chapter, Ques. 11 | 13 ► See this Chapter, Ques. 19 |
| 2 ► See this Chapter, Ques. 02 | 6 ► See this Chapter, Ques. 06 | 10 ► See this Chapter, Ques. 14 | 14 ► See this Chapter, Ques. 22 |
| 3 ► See this Chapter, Ques. 03 | 7 ► See this Chapter, Ques. 09 | 11 ► See this Chapter, Ques. 16 | 15 ► See this Chapter, Ques. 23 |
| 4 ► See this Chapter, Ques. 04 | 8 ► See this Chapter, Ques. 10 | 12 ► See this Chapter, Ques. 18 | |

Answering Reference ► Creative Questions

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|--------------------------------|----------------------------------|--------------------------------|--------------------------------|
| 1 ► See this Chapter, Ques. 02 | 3 ► See this Chapter, Ques. '06' | 5 ► See this Chapter, Ques. 12 | 7 ► See this Chapter, Ques. 14 |
| 2 ► See this Chapter, Ques. 05 | 4 ► See this Chapter, Ques. 10 | 6 ► See this Chapter, Ques. 13 | 8 ► See this Chapter, Ques. 15 |