1. What are canal rays?

Answer: Canal rays are beams of positively charged ions. It was discovered in 1886 by Goldstein. Canal rays are also known as anode rays.

2. If an atom contains one electron and one proton, will it carry any charge or not?

Answer: An atom carrying one electron and one proton will carry no charge as the negatively charged particle will combine with the positively charged particles and the overall magnitude of the atom will be zero.

3. On the basis of Thomson's model of an atom, explain how the atom is neutral as a whole.

Answer: According to Thomson's model of the atom:

1. An atom consists of both negatively and positively charged particles.

2. The negatively charged particles are embedded in the positively charged sphere.

3. These negative and positive charges are equal in magnitude.

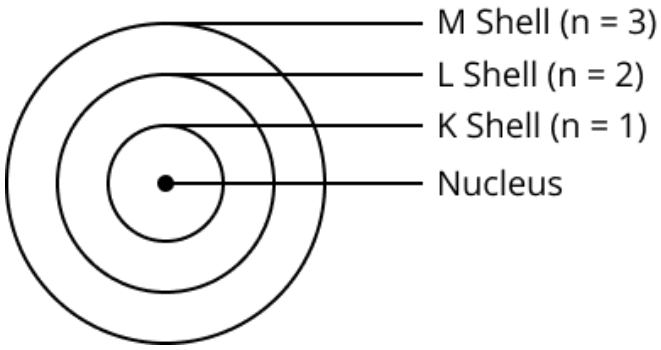
4. They counterbalance each other's effect and make an atom neutral.

4. On the basis of Rutherford's model of an atom, which subatomic particle is present in the nucleus of an atom?

Answer: According to Rutherford's model of an atom, protons are present in the nucleus of an atom

5. Draw a sketch of Bohr's model of an atom with three shells.

Answer:



6. Name the three subatomic particles of an atom.

Answer:: Three subatomic particles of an atom are as follows:

i. Proton

ii. Electron

iii. Neutron.

7. Helium atom has an atomic mass of 4 u and two protons in its nucleus. How many neutrons does it have?

Answer:: Number of protons in Helium Atom = 22

Atomic Mass = Number of Protons + Number of Neutrons

4 = 2+ Number of Neutrons

Number of Neutrons = 4 - 2 = 2

8. Write the distribution of electrons in carbon and sodium atoms?

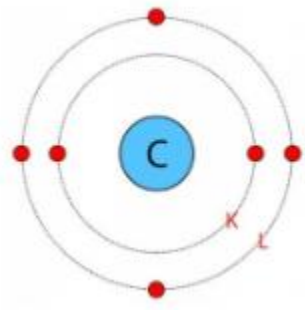
Answer:: Atomic number of carbon = 66 = Number of protons = Number of electrons

The distribution of electrons in carbon atom is given by:

First orbit or K-shell = 2 electrons

Second orbit or L-shell = 4 electrons

or, we can write the distribution of electrons in a carbon atom as 2,4



Atomic number of sodium = 11 = Number of protons = Number of electrons

The distribution of electrons in sodium atom is given by:

First orbit or K-shell = 2 electrons

Second orbit or L-shell = 8 electrons

Third orbit or M-shell = 1 electron

Or, we can write the distribution of electrons in a sodium atom as 2, 8 ,1

9. If K and L shells of an atom are full, then what would be the total number of electrons in the atom?

Answer: Maximum number of electron in K-shell = 2

Maximum number of electron in L-shell = 8

If K and L-shells of an atom are full,

then the total number of electrons in the atom would be (2 + 8) = 10 electrons.

10. How will you find the valency of chlorine, sulphur and magnesium?

Answer: If the number of electrons in the outermost shell is less than 44 then,

Valency of an atom = number of electrons in the outermost shell of the atom.

1. In the case of magnesium,

Thus, the valency of magnesium = 2

If the number of electrons in the outermost shell is less than 4 then,

Valency of an atom = 8 – Number of electrons in the outermost shell.

2. In case of sulphur,

The valency of sulphur = 8 − 6 = 2

3. In case of chlorine,

The valency of chlorine = 8 −7 = 1

11. If the number of electrons in an atom is 8 and the number of protons are also 8, then

(i) What is the atomic number of the atom and (ii) What is the charge on the atom?

Answer:

1. The atomic number = number of protons.

Hence, the atomic number of the atom is 8.

2. Since the number of both electrons and protons is equal, therefore, the charge on the atom is 0 i.e., it is a neutral atom.

12. With the help of the given table, find out the mass number of oxygen and sulphur atom.

Table: Composition of Atoms of the First Eighteen Elements with Electron Distribution in Various Shells.

Name of Element	Symbol	Atomic number	Number of Protons	Number of Neutrons	Number of electrons	Distribution of electrons K L M N				Valency
Hydrogen	H	1	1	–	1	1	–	–	–	1
Helium	He	2	2	2	2	2	–	–	–	0
Lithium	Li	3	3	4	3	2	1	–	–	1
Beryllium	Be	4	4	5	4	2	2	–	–	2
Boron	B	5	5	6	5	2	3	–	–	3
Carbon	C	6	6	6	6	2	4	–	–	4

Nitrogen	N	7	7	7	7	2	5	–	–	3
Oxygen	O	8	8	8	8	2	6	–	–	2
Fluorine	F	9	9	10	9	2	7	–	–	1
Neon	Ne	10	10	10	10	2	8	–	—	0
Sodium	Na	11	11	12	11	2	8	1	–	1
Magnesium	Mg	12	12	12	12	2	8	2	–	2
Aluminium	Al	13	13	14	13	2	8	3	–	3
Silicon	Si	14	14	14	14	2	8	4	–	4
Phosphorus	P	15	15	16	15	2	8	5	–	3,5
Sulphur	S	16	16	16	16	2	8	6	–	2
Chlorine	Cl	17	17	18	17	2	8	7	–	1
Argon	Ar	18	18	22	18	2	8	8		0

Answer:

(a) To find the mass number of Oxygen,

Number of protons = 8

Number of neutrons = 8

Atomic number = 8

Atomic mass number = Number of protons + number of neutrons = 8 + 8 = 16

Therefore, the mass number of oxygen = 16

(b) To find the mass number of Sulphur,

Number of protons = 16

Number of neutrons = 16

Atomic number = 16

Atomic mass number = Number of protons + number of neutrons = 16 + 16 = 32

13. For the symbols H, D and T, tabulate three subatomic particles found in each of them.

Answer:

The following table depicts the subatomic particles in Hydrogen (H), Deuterium (D), and Tritium(T).

Isotope	Symbol	Mass no.	Atomic no.	No. of electrons	No. of protons	No. of neutrons
Hydrogen	H	1	1	1	1	0

Deuterium	D	2	1	1	1	1
Tritium	T	3	1	1	1	2

14. With the help of Table 4.1, find out the mass number of oxygen and sulphur atom.

Answer: Mass number = Number of protons + Number of neutrons

Mass number of O2 = 8 + 8 = 16

Mass number of S = 16 + 16 = 32

13. For the symbols H, D and T tabulate three sub-atomic particles found in each of them.

Ans:

Symbol	**Electron**	**Proton**	**Neutron**
H	1	1	0
D	1	1	1
T	1	1	2

14. Write the electronic configuration of any one pair of isotopes and isobars.

Answer: Two isotopes of carbon are :

1. ${}^{12}_{6}C$ 2. ${}^{14}_{6}C$

The electronic configuration of ${}^{12}_{6}C$ is 2,4

The electronic configuration of ${}^{14}_{6}C$ is 2,4

Two isobars of carbon are :

1. ${}^{40}_{20}Ca$

2. ${}^{40}_{18}Ar$

The electronic configuration of ${}^{40}_{20}Ca$ is 2,8,8,2

The electronic configuration of . ${}^{40}_{18}Ar$ is 2,8,8

Exercise Questions:

1. Compare the properties of electrons, protons and neutrons.

Answer: The difference between electron, proton and neutrons are as follows:

Property	Electrons	Protons	Neutrons
Charge	Negatively charged	Positively charged	No charge.
Location	Located outside the nucleus	Located within the nucleus	Located inside the nucleus of an atom
Weight	Mass is negligible	1 a.m.u	1 a.m.u
Affinity	Attracted towards positively charged	Attracted towards negatively charged	Do not get attracted to any charged particle

2. What are the limitations of J.J. Thomson's model of the atom?

Answer: Limitations of J.J. Thomson's model of the atom.

a. It fails to explain the stability of an atom.

b. It doesn't talk about the nucleus of an atom.

c. It failed to explain the reason for positive and negative charges binding together.

d. It also doesn't explain Rutherford's model.

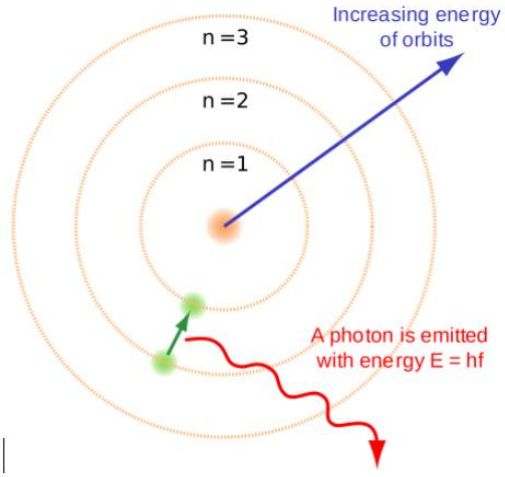
3. What are the limitations of Rutherford's model of the atom?

Answer: Rutherford's model of the atom fails to explain the stability of an atom. He argued that electrons move in a circular path called the orbit. The Revolution of electrons in the orbit will radiate energy which will make the atom unstable and electrons will fall inside the nucleus. But in reality this is not the case and Rutherford's model fails to explain the reason for the same.

4. Describe Bohr's model of the atom.

Answer:

- An atom holds the nucleus at the centre.
- Negatively charged electrons revolve around the nucleus.
- The atoms in it contain distinct orbits of electrons.
- Electrons do not radiate energy when they are in their orbits.
- The distinct orbits are named K, L, M, and N orbits. Numbers used to denote them are n = 1, 2, 3, 4

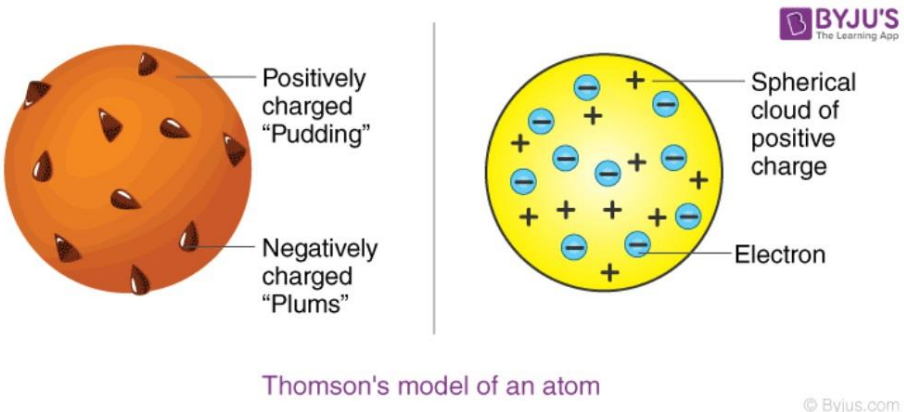


5. Compare all the proposed models of an atom given in this chapter.

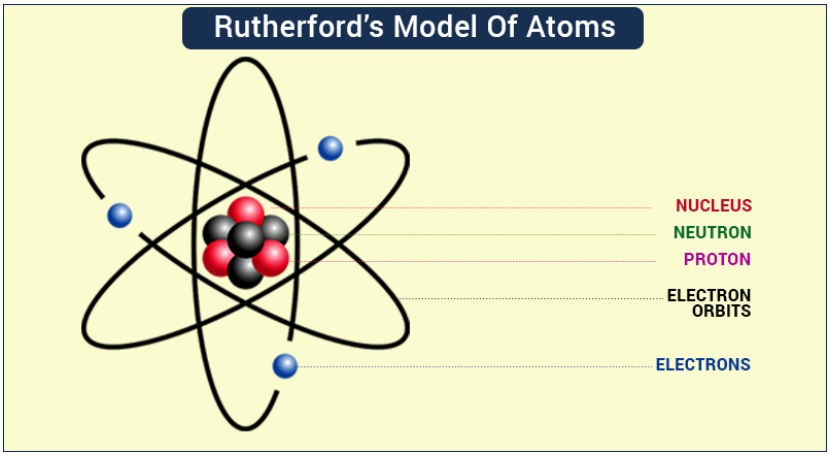
Answer:

Thomson	Rutherford	Bohr
● Sphere is positively charged. ● Electrons are negatively charged and scattered all through the inside of the sphere. ● Positively charged = negatively charged ● The net charge in the atom is zero.	● The nucleus is at the centre and is positively charged, holding the entire mass. ● Electrons are negatively charged, revolving in a well-defined path ● In comparison with the nucleus, the size of the atom is very large. ● Force of attraction of the electrons towards the nucleus is balanced by centrifugal force acting away from it. As a result, electrons are not drawn close to the nucleus.	● Nucleus is present at the centre and is positively charged ● Electrons are negatively charged, revolving around but do not radiate energy. ● The distinct orbits are labelled as K, L, M, and N

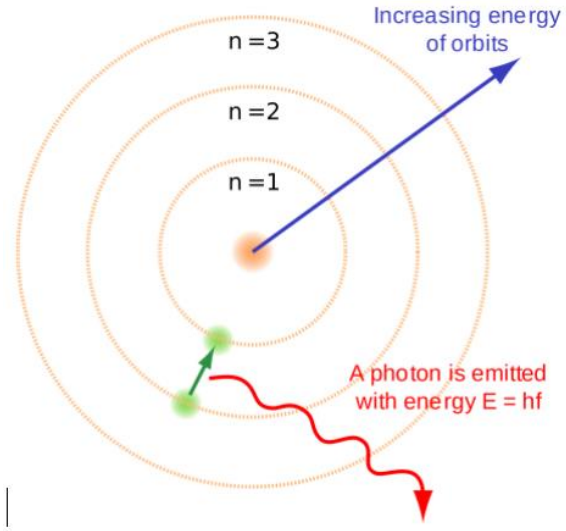
6. Thomson's Model of Atom.



7. Rutherford's Model of Atoms.



8. Bohr's model of the atom.



6. Summarize the rules for the writing of the distribution of electrons in various shells for the first eighteen elements.

Answer:

- The maximum number of electrons that can be accommodated in a shell is given by the formula: $2n^2$, where n= 1, 2, 3…
- The maximum number of electrons in different shells are:

K shell – n = 1 ; $2n^2 = 2(1)^2 = 2$

L shell – n = 2 ; $2n^2 = 2(2)^2 = 8$

M shell – n =3 ; $2n^2 = 2(3)^2 = 18$

N shell- n=4 ; $2n^2 = 2(4)^2 = 32$

- The outermost orbit can be accommodated with 8 electrons at the maximum.

- The electrons are not taken in unless the inner shells are filled, which are filled step-wise; hence, the highest element has K-2; L-8; M-8 distribution of electrons.

7. Define valency by taking examples of silicon and oxygen.

Answer: Valency of an element is defined as the number of electrons in its outermost shell.

In the case of silicon,

Outermost shell electron = 44

If the number of electrons in the outermost shell of the atom of an element is less than or equal to 44,

Valency of an atom = number of electrons in the outermost shell

Thus, the valency of silicon = 44.

In the case of oxygen,

Outermost shell electron = 66

If the number of electrons in the outermost shell of the atom of an element is greater than 44,

Then, the valency of an atom = 88 – Number of electrons in the outermost shell.

Thus, the valency of oxygen is (8 − 6) = 2(8 − 6) = 2

8. Explain with examples.

i. Atomic number

ii. Mass number,

iii. Isotopes

iv. Isobars.

Give any two uses of isotopes.

Answer: i. Atomic Number: Total number of protons present in the atom of an element is called the atomic number of that element.

Example: Oxygen has 8 protons. Thus, the atomic number of Oxygen is 8.

ii. Mass Number: The sum of the number of protons and neutrons present in the atom of an element is called the mass number.

Example: Oxygen has 8 protons and 8 neutrons.

Therefore the mass number of oxygen is 8 + 8 = 16

iii. Isotopes: Isotopes are atoms of the same element having the same atomic number, but different mass numbers.

Example : Three isotopes of Hydrogen are:

1) Protium - ^{1}H

2) Deuterium - $^{2}_{1}H$

3) Tritium - $^{3}_{1}H$

(iv) Isobars: Isobars are atoms with the same mass number but different atomic numbers, i.e., isobars are atoms with the same mass number from different elements.

Example: $^{40}_{20}Ca$ $^{40}_{18}Ar$ are two isobars

9. Na^{+} has completely filled K and L shells. Explain.

Answer: Atomic number of Na = 11 = Total number of electrons

The electronic configuration of Na = 2, 8, 1.

The electronic configuration of Na+ ion = 2 (K-shell), 8 (L-shell)

Thereby Na+ ion has completely filling K and L shells.

10. If bromine atom is available in the form of, say, two isotopes $^{79}_{35}Br$ (49.7%) and $^{81}_{35}Br$ (50.3%) calculate the average atomic mass of bromine atom.

Answer: $\frac{\mathbf{79\ x\ 49.7+81\ x\ 50.3}}{\mathbf{100}}$

$= \frac{\mathbf{3926.3 + 81\ x\ 4074.3}}{\mathbf{100}} = \frac{\mathbf{8000.6}}{\mathbf{100}}$ = 80.006 = ≈80u

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

Answer:

Average atomic mass of an element X = 16.2 u

Let percentage of isotope $^{18}_{8}X$ is y

Thus, the percentage of isotope $^{18}_{8}X$ is (100−y)

Average atomic mass of element X = [Atomic mass of $^{18}_{8}X$ x percentage + Atomic mass of $^{18}_{6}X$ x percentage]

16.2 = [18 × y% + 16 × (100−y) %]

16.2 = $\left[18 \text{ x } \frac{\boldsymbol{y}}{\mathbf{100}} + 16 \text{ x } \frac{(\mathbf{100}-\boldsymbol{y})}{\mathbf{100}}\right]$

16.2 × 100 = [18y + 1600 − 16y]

1620 = 2y + 1600

1620 – 1600 = 2y

20 = 2y

Y = $\frac{20}{2}$ = 10

Thus, percentage of $^{16}_{8}X$ is 10 %

Thus, percentage of $^{18}_{8}X$ is 100 – x = 100 – 10 = 90 %

12. If Z = 3, what would be the valency of the element? Also, name the element.

Answer: Atomic number

= Z = 3.= Z = 3.

Its electronic configuration is 2, 1.

Hence, the valency of the element is 1

(Since the outermost shell has only one electron).

Therefore, the element with Z = 3 is lithium (Li).

13. Composition of the nuclei of two atomic species X and Y are given as under X Y

	X	**Y**
Protons	**6**	**6**
Neutrons	**6**	**8**

14. Give the mass numbers of X and Y. What is the relation between the two species?

Answer: Mass number = Number of protons + Number of neutrons

Mass number of X = 6 + 6 = 12

Mass number = Number of protons + Number of neutrons

Mass number of Y = 6 + 8 = 14

Atomic number = Number of protons

The atomic number of X = 6 = Atomic number of Y

These two atomic species X and Y have the same atomic number, but different mass numbers. Hence, they are isotopes.

14. For the following statements, write T for 'True' and F for 'False'.

a). J.J. Thomson proposed that the nucleus of an atom contains only nucleons.

Answer: False

b). A neutron is formed by an electron and a proton combining together. Therefore, it is neutral.

Answer: False

c). The mass of an electron is about 1/2000 times that of the proton.

Answer: True

d). An isotope of iodine is used for making tincture iodine, which is used as a medicine.

Answer: False

15. Rutherford's alpha-particle scattering experiment was responsible for the discovery of

a. Atomic nucleus b. Electron

b. Proton d. Neutron

Answer: a) Atomic Nucleus

16. Isotopes of an element have

(a) The same physical properties (b) Different chemical properties

(c) Different number of neutrons (d) Different atomic numbers

Answer: (c) Different number of neutrons

17. Number of valence electrons in Cl^- ion are

(a) 16 (b) 8 (c) 17 (d) 18

Answer: (b) 8

The electronic distribution of Cl is K-2, L-8, M-7. Valence electrons are 7; hence, chlorine gains one electron for the formation of Cl^-. Therefore, its valency is 8.

18. Which one of the following is a correct electronic configuration of Sodium?

(a) 2, 8 (b) 8, 2, 1 (c) 2, 1, 8 (d) 2, 8, 1

Answer: (d) 2, 8, 1

19. Complete the following table.

Atomic Number	Mass Number	Number of Neutrons	Number of Proton	Number of Electrons	Name of the atomic species
9	**-**	**10**	**-**	**-**	**-**
16	**32**	**-**	**-**	**-**	**Sulphur**
-	**24**	**-**	**12**	**-**	**-**
-	**2**	**-**	**1**	**-**	**-**
-	**1**	**0**	**1**	**1**	**-**

Answer:

Atomic Number	Mass Number	Number of Neutrons	Number of Proton	Number of Electrons	Name of the atomic species
9	19	10	9	9	Fluorine
16	32	16	16	16	Sulphur
12	24	12	12	12	Magnesium
1	2	1	1	1	Deuterium
1	1	0	1	1	Protonium