1.STRUCTURE OF ATOM

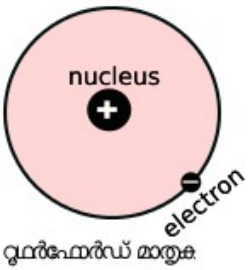
Dalton's Atomic Theory: Major Ideas.

* Matter is made up of minute particles called atoms.
* Atoms can neither be created or destroyed.
* Atoms of the same elements are identical in properties, size and mass.
* Atoms of different elements differ in their properties and mass.
* Atom is the smallest particle that can take part in chemical reaction.
*Compounds are formed when atoms of two or more elements combine in a simple ratio.

Sub Atomic particles: According to Dalton's theory, it is impossible to have sub atomic particles in an atom. But the electrification of substances by rubbing different objects, the results of experiments conducted Faraday and Davy by passing electricity through solutions gave the indications of the presence of sub atomic particles in atoms. Later the presence of sub atomic particles electron (having negative charge), proton (having positive charge) and neutron (neutral particle) were confirmed.

Rutherford's Planetary Model of Atom: Major Ideas.

* Atoms have a centre called nucleus. * Size of the nucleus is too small compared to the size of the atom. * Almost complete mass of an atom is concentrated in its nucleus.
* Electrons revolve around the nucleus in shells.



Limitation of Rutherford's Atom model: According to electromagnetic theory, electrons should radiate electromagnetic radiation while it is revolving and eventually collapse into the nucleus when their energy is completely lost. But this does not happen in atoms. Rutherford could not explain the reason for this.

Bohr's Model of Atom: The stability of atoms couldn't be explained by Rutherford's Model of Atom**.** Neil's Bohr, a Danish scientist, proposed this new model with better explanation to Rutherford Model.

Main Ideas of Bohr Model:

* Electrons revolve around the nucleus of an atom in fixed paths called orbits or shells.
* Electrons in each shell have a definite energy. Hence the shells are also called Energy levels.
* As long as an electron revolves in a particular orbit, its energy remains constant.
* The energy of the shells increases as the distance from the nucleus increases.
* The shells can be represented as 1,2,3,4 Or K,L,M,N from near the nucleus.

Fundamental particles in atom: Electron, proton and neutron are the fundamental particles. Of them electron is negatively charged particle, proton is positive and neutron is charge less particle. Mass of proton and neutron are almost equal and is 1 atomic mass unit (1 amu). Since the mass of electron is too small as compared to the masses of proton and neutron, mass of electron is considered as zero.

Mass number of atom(A): The total number of protons and neutrons in an atom is called its mass number. It is represented by the letter 'A'.

Atomic number: The total number of protons in an atom is called its atomic number. It is represented by the letter 'Z'.

The following relation can be used to find the fundamental particles in an atom.

Atomic number Z = Number of protons = Number of electrons
Mass number A = Number of protons + Number of neutrons
Number of neutrons = Mass number - Atomic number = A – Z

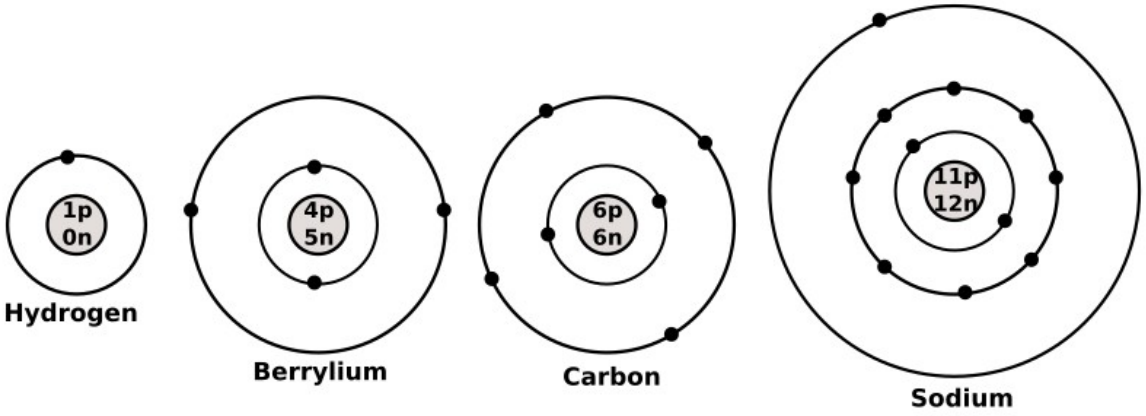
Representation of mass number and atomic number along with symbol: By entering mass number and atomic number along with the symbol, more details about an an atom can be inferred. Usually mass number is written on the top left and atomic number on the bottom left side of the symbol as ${}^{A}_{Z}X$.

Example: Sodium atom is represented as ${}^{23}_{11}Na$. That is, mass number of sodium is 23 and atomic number is 1

Electronic Configuration of an atom: The maximum number of electrons that can be accommodated in a shell can be calculated by using the relation of $2n^2$. Where 'n' is the shell number. According to this relation , the maximum number of electrons that can be accommodated in the shells K,L,M,N and O are 2,8,18,32 and 50 respectively.

Filling up of electrons in shells of higher energy happens only after the shells of lower energy are filled. No any atom can accommodate more than 8 electrons in its outermost shell.
Electronic configuration and Bohr Model of a few elements are given.

Element	Z	A	Electronic configuration
H	1	1	1
He	2	4	2
Li	3	7	2,1
Be	4	9	2,2
B	5	10	2,3
C	6	12	2,4
Ne	10	20	2,8
Na	11	23	2,8,1
Ar	18	40	2,8,8



Isotopes

Atoms of the same element having the same atomic number but different mass number are called isotopes.
Example:1. Protium ($_1^1H$), Deuterium ($_1^2H$) and Tritium ($_1^3H$) are the isotopes of hydrogen.
Atomic number of all these atoms are one. But their mass numbers are 1,2 and 3 respectively.
Example:2. Carbon-12 ($_6^{12}C$), Carbon -13 ($_6^{13}C$) and Carbon – 14 ($_6^{14}C$) are isotopes of carbon.

Many of the Isotopes are of great importance.
Example: Deuterium, isotope of hydrogen, is used in Nuclear reactors.
Carbon – 14 is used to determine age of fossils.
Phosphorous - 31 is used as tracers for identifying the nutrient exchange in plants.
Iodine – 131and Cobalt – 60 are used for diagnosis and treatment.
Uranium - 235 is used as fuel in nuclear reactor.

PRACTICE QUESTIONS

1. The presence of which fundamental particle was discovered by J J Thomson? What is the charge of this particle?
2. Which was the experiment that led to the Rutherford Atom Model.
3. Name the scientist who confirmed the presence of protons in atom.
4. According to Rutherford model, where is the location of electrons in an atom?
6. What was the major limitation of Rutherford Atom Model?
7. What are the major ideas proposed by Bohr Atom Model?
8.The shells of atoms are also called energy levels. How are the shells represented?
9. Which is the neutral particle in an atom? Who did confirm the presence of this particle?
10. What are the fundamental particles? Where are they located in an atom?
11. Which are the fundamental particles having more less similar mass?
12. Explain mass number and atomic number.
13. An atom consists sub atomic charged particle. But an atom is electrically neutral. Why?
14. Which is the fundamental particle that displaced during chemical reactions?
15. An atom consists three types of fundamental particles. Name the particle that determine the identity of an element?
13. The atomic number and mass number of an atom X is 11 and 23 respectively. How does it express along with its symbol? Find the number of protons, electrons and neutrons in this atom.
15. Write down the equation for finding out the number of maximum electrons that can be accommodated in a shell. And find out the number of electrons in the first four shell.
16. It is given a few elements and their atomic numbers. Write down their electronic configuration and draw Bohr Atom model. a. Boron -5 b. Sodium - 11, c. Argon-18 d.Berryllium -4
17. What are Isotopes? Which are the isotopes of hydrogen? Which isotope of hydrogen is used in nuclear rectors?
18. Carbon -14, Phosphorous -31, Cobalt – 60 and Uranium -235 are a few isotopes having great importance. Write down one use of each.
19. Who were the two scientist who conducted experiment by passing current through solutions and gave the indication of the presence of charged particles in atoms?
20. Fill the second pair according to the first pair.
a. K shell: 2 Electrons; M shell: …….. b. Deuterium: Mass number - 2 ; Protium: ……..
c. Carbon -12: 6 protons; Carbon -14: ….. protons

PRACTICE QUESTIONS

1. The presence of which fundamental particle was discovered by J J Thomson? What is the charge of this particle?

Ans. Electron. It is a negatively charged particle.

2. Which was the experiment that led to the Rutherford Atom Model.

Ans. By passing alpha particle through thin gold foil.

3. Name the scientist who confirmed the presence of protons in atom.

Ans. Rutherford.

4. According to Rutherford model, where is the location of electrons in an atom?

Ans. In shells.

6. What was the major limitation of Rutherford Atom Model?

Ans. According to electromagnetic theory, electrons should radiate electromagnetic radiation while it is revolving around the nucleus and eventually collapse into the nucleus when their energy is lost completely. But this does not happen in atoms. Rutherford could not explain the reason for this.

7. What are the major ideas proposed by Bohr Atom Model?

Ans. Electrons revolve around the nucleus of an atom in fixed paths called orbits or shells.

* Electrons in each shell have a definite energy. Hence the shells are also called Energy levels.
* As long as an electron revolves in a particular orbit, its energy remains constant.
* The energy of the shells increases as the distance from the nucleus increases.

8.The shells of atoms are also called energy levels. How are the shells represented?

Ans. They are represented as 1,2,3,4,5 Or K,L,M,N,O.

9. Which is the neutral particle in an atom? Who did confirm the presence of this particle?

Ans. Neutron is the neutral fundamental particle. James Chadwick.

10. What are the fundamental particles? Where are they located in an atom?

Ans. Electron, proton and Neutron.

Protons and neutrons are confined in the nucleus and electrons revolve around the nucleus in shells.

11. Which are the fundamental particles having more less similar mass?

Ans. Proton and neutron.

12. Explain mass number and atomic number.

Ans. Total number protons and neutrons are called mass number. The number of proton is called atomic number.

13. An atom consists sub atomic charged particle. But an atom is electrically neutral. Why?

Ans. The number of protons and electrons present in atom is equal. Since the charge of proton and electron are equal and opposite, total charge of an atom will be zero.

14. Which is the fundamental particle that displaced during chemical reactions?

Ans. Electrons.

15. An atom consists three types of fundamental particles. Name the particle that determine the identity of an element? **Ans**. Protons.

13. The atomic number and mass number of an atom X is 11 and 23 respectively. How does it express along with its symbol? Find the number of protons, electrons and neutrons in this atom.

Ans. ${}_{11}{}^{23}X$

Number of protons = 11

Number of Electrons = 11 (number of protons = number of electrons)

Number of neutrons = A – Z = 23 – 11 = 12

15. Write down the equation for finding out the number of maximum electrons that can be accommodated in a shell. And find out the number of electrons in the first four shell.

Ans. The maximum number of electrons in n^{th} shell = $2n^2$

Number of electrons in the first shell = $2n^2 = 2x1^2 = 2$

Number of electrons in the second shell = $2n^2 = 2x2^2 = 8$

Number of electrons in the third shell = $2n^2 = 2x3^2 = 18$

Number of electrons in the fourth shell = $2n^2 = 2x4^2 = 32$

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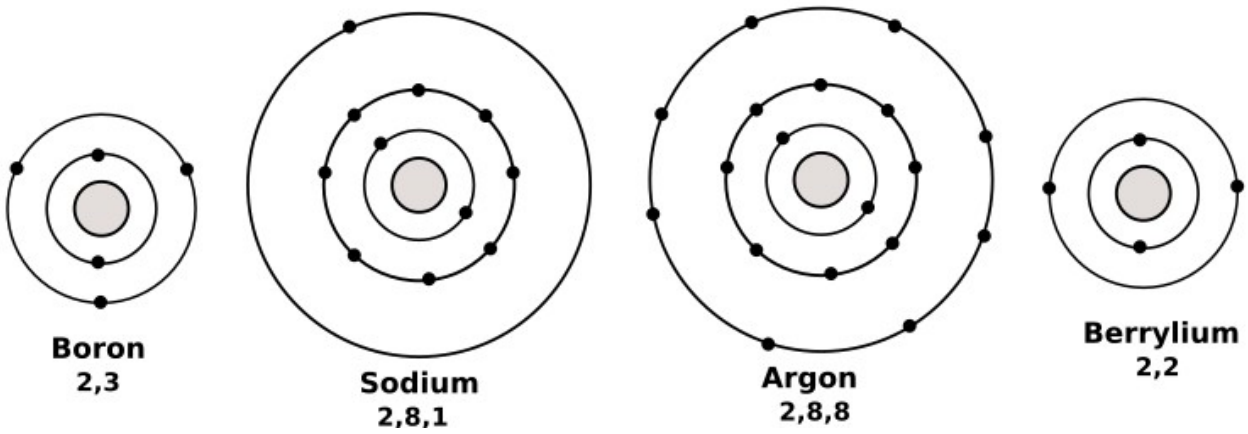

17. What are Isotopes? Which are the isotopes of hydrogen? Which isotope of hydrogen is used in nuclear rectors?

Ans. Atoms having the same atomic number but different mass number are called isotopes. Protium ($_1{}^1H$), Deuterium ($_1{}^2H$) and Tritium ($_1{}^3H$) are the isotopes of hydrogen.

Deuterium is used in Nuclear rectors.

18. Carbon -14, Phosphorous -31, Cobalt – 60 and Uranium -235 are a few isotopes having great importance. Write down one use of each.

Ans.Carbon-14: Used for finding out the age of fossils.

Phosphorous - 31: Used as tracers for identifying the nutrient exchange in plants.

Cobalt -60: Used for diagnosis and treatment.

Uranium - 235: Used as fuel in Nuclear reactor.

19. Who were the two scientist who conducted experiment by passing current through solutions and gave the indication of the presence of charged particles in atoms?

Ans. Michael Faraday and Humphry Davy.

20. Fill the second pair according to the first pair.

a. K shell: 2 Electrons; M shell: …….. b. Deuterium: Mass number - 2 ; Protium: ……..

c. Carbon -12: 6 protons; Carbon -14: ….. protons

Ans.a. 18 b. 1 c. 6 protons