

## 06. WHAT IS INSIDE THE ATOM ?

### Questions and Answers

#### 1. What are the three subatomic particles?

A. The three subatomic particles are electron, proton and neutron.

#### 2. Compare the characteristics of electrons, protons and neutrons?

A. **Electron:** Electron is a negatively charged particle. It is denoted with “e<sup>-</sup>”. The mass of electron is 0.00055 amu. They revolve around the nucleus in an atom.

**Proton:** Proton is a positively charged particle. It is denoted with “p<sup>+</sup>”. The mass of proton is 1.0078 amu. They are present in the nucleus in an atom.

**Neutron:** Neutron is an uncharged particle. It is denoted with “n<sub>0</sub>”. The mass of neutron is 1.0087 amu. They are present in the nucleus in an atom.

#### 3. What are the limitations of J.J.Thomson’s model of the atom?

A. Thomson said that the mass in atom is equally distributed. That means the positive and negative charge combined with each other. As per the laws of classical physics the different charged particles can not gathered together.

Also Thomson’s model could not have any experimental evidence to support. It couldn’t explain the spectrum of an atom.

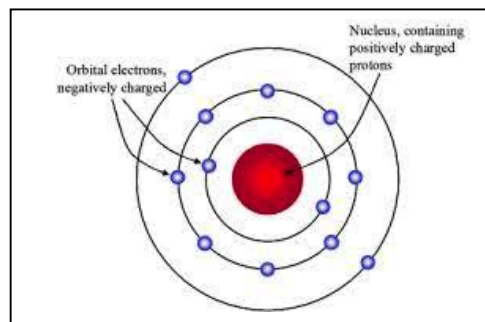
#### 4. What were the three major observations Rutherford made in the gold foil experiment?

- A. The three observations of Rutherford through gold foil experiment are:
- (i) All the positively charged material in an atom present at the centre called nucleus.
  - (ii) The negatively charged electrons revolve around the nucleus in well defined orbits. This is called planetary model of atom.
  - (iii) The size of the nucleus is very small

#### 5. Sketch Rutherford's atomic model.

Why Rutherford's model of the atom is called the planetary model?

A.



According to Rutherford's Atomic model The electron Revolves around the nucleus like the planets around the sun. So Rutherford's atomic model was also called planetary atomic model.

#### 6. Put tick (✓) against correct choice and cross (✗) against wrong choice:

(i) In Rutherford's gold foil experiment, majority of alpha particles passed directly through the gold foil. This observation leads to which conclusion?

- a) The positive region of the atom is very small. [ ✓ ]
- b) The majority of the atom must consist of empty space. [ ✓ ]
- c) The alpha particle makes a direct hit on the positive region. [ ✗ ]
- d) The positive region of the atom is very dense. [ ✗ ]

#### 7. 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. [ d ]

A. The atomic number of Sodium (Na) is 11. Its electronic configuration is 2,8,1 Hence choice (d) is the correct answer.

**8. Give the main postulates of Bohr's model of an atom.**

**A. Main postulates of Bohr's atomic model:**

- (i) The electron revolve around the nucleus in specified paths called orbits. The orbits are called energy levels.
- (ii) While electrons revolving in the discrete orbits they do not loss their energy. These orbits are called stationary orbits.
- (iii) The orbits are represented by K,L,M,N,O... The 'n' value for orbits are 0,1,2,3,4,... respectively.

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

**A. J.J.Thomson:** He suggested that the electrons are embedded in a sphere of positive charge. He compared his structure with the water melon.

**Rutherford:** He suggested that all the positive charge is located in very small space called nucleus. The negatively charged electrons revolve around the nucleus. He compared his structure with the solar system.

**Bohr:** He suggested that the electrons revolve around the nucleus in specified fixed energy levels called orbits. He explained the spectrum of Hydrogen. He explained the jumping of electrons from one orbit to another orbit.

**10. Define valency by taking examples of nitrogen and boron.**

- A. (i)** Nitrogen (N) atomic number is 7. Its electronic configuration is 2,5. Means 5 electrons present in the outermost orbit of Nitrogen. It can gain 3 electrons bonded with three hydrogen atoms to get octet configuration. So valency of Nitrogen atom is 3.
- (ii)** Boron (B) atomic number is 5. Its electronic configuration is 2,3. Means 3 electrons present in the outermost orbit

of Boron. It can loose 3 electrons to get octet configuration. So valency of Boron atom is 3.

- (iii)** To determine the valency of an element first take the number of valence electrons in the atom. Then subtract it from 8. The valency of the atom is equal to the number which ever is less.

**11. State the valencies of the following elements : Magnesium and Sodium**

- A. (i)** Magnesium (Mg) atomic number is 12. The electronic configuration is 2,8,2. Number of valence electrons is 2. Valency of Magnesium is 2.
- (ii)** Sodium (Na) atomic number is 11. The electronic configuration is 2,8,1. Number of valence electrons is 1. Valency of Sodium is 1.

**12. If Z = 5, what would be the valency of the element?**

- A.** The atomic number of an element is 5. The electronic configuration is 2,3. Number of valence electrons is 3. Valency of the element is 3.

**13. Write the atomic number and the symbol of an element which has mass number 32 and the number of neutrons 16 in the nucleus.**

- A.** Mass number of an element (A) = 32  
Number of neutrons (N) = 16  
Atomic number (Z) = A – N  
= 32 – 16  
= 16

**14. Cl<sup>-</sup> has completely filled K&L shells. Explain.**

- A.** Atomic number of Chlorine (Cl) is 17. If chlorine gain one electro it converts to Cl<sup>-</sup> ion. Cl<sup>-</sup> has 18 electrons in it.

Element/ Ion	K-shell	L-shell	M-shell
Cl <sup>-</sup>	2	8	8

So K and L shell's in Chloride ion has completely filled.

**15. What is the main difference between isotopes of the same element?**

A. Isotopes are the atoms of same element which have the same atomic number but different mass number.

Ex: (i)  ${}_1\text{H}^1$ ,  ${}_1\text{H}^2$ ,  ${}_1\text{H}^3$  (ii)  ${}_6\text{C}^{12}$ ,  ${}_6\text{C}^{13}$ ,  ${}_6\text{C}^{14}$

**16. 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. [ F ]

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

c. The mass of an electron is 1/2000 times that of proton. [ T ]

**17. Fill in the missing information in the following table.**

Name	Symbol	Atomic number (Z)	Mass Number (A)	Number of neutrons (N)	Number of electrons (e)
Oxygen	${}^{16}\text{O}_8$	8	16	8	8
		7		7	7
Sulphur					
Beryllium			9	5	
		12	24		
		12	25		

A.

Name	Symbol	Atomic number (Z)	Mass Number (A)	Number of neutrons (N)	Number of electrons (e)
Oxygen	${}^{16}\text{O}_8$	8	16	8	8
<b>Nitrogen</b>	${}^{14}\text{N}_7$	7	<b>14</b>	7	<b>7</b>
Sulphur	${}^{34}\text{S}_{16}$	<b>16</b>	<b>34</b>	<b>18</b>	<b>16</b>
Beryllium	${}^9\text{Be}_4$	<b>4</b>	9	<b>5</b>	<b>4</b>
<b>Magnesium</b>	${}^{24}\text{Mg}_{12}$	12	24	<b>12</b>	<b>12</b>
<b>Magnesium</b>	${}^{25}\text{Mg}_{12}$	12	25	<b>13</b>	<b>12</b>

**18. How do you appreciate the efforts made by scientists to explain the structure of atom by developing various atomic models?**

A. (i) John Dalton says that Atom is an invisible particle. We can't see atom with our naked eye. It is also not possible with microscope.

(ii) But after the discovery of discharge tube J.J. Thomson discovered the electrons, which are in the atom. He stated the water melon structure of an atom.

(iii) Rutherford corrected the defects in Thomson's model and introduced planetary atomic model. He observed the nucleus in the atom. He explained the charge distribution.

(iv) Bohr corrected the defects on Rutherford's model and explain the different energy levels in the atom. He can explained the spectrum of Hydrogen atom.

(v) All the discoveries made by the scientists are very helpful for further research and they are useful in making the life of mankind satisfactory. We appreciate the role of scientists.

**19. Geeta got a doubt, "Why atomic nucleus contains proton and neutrons inside it? Why can't electrons and neutrons?" Can you help to clarify her doubt? Explain.**

A. Mass of electron is negligible

compared to that of proton. The mass of proton is 1836 times of mass of electron. Generally the heavy mass present in the nucleus. So the positive charged protons are present in the nucleus of an atom.

There exist force of repulsion between same charged particles. To reduce the repulsion force between proton in the nucleus, neutron can exist in the nucleus.

The electrons revolve around the nucleus in specified paths.

**\* ADDITIONAL QUESTIONS \***

20. Write the applications of Isotopes?

21. Explain Rutherford's alpha particles scattering experiment with a neat diagram.

22. Draw a neat diagram to show Bohr's atomic model.

23. Explain " ${}_Z\text{X}^A$ ".

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