**ASSIGNMENT

 CLASS: 9th

 SUBJECT: CHEMISTRY**

# SESSION : 2019-2020

# UNIT 2ND

# STRUCTURE OF THE ATOM

 **Q1: What are canal rays?**

 Ans: The positively charged radiations produced in a discharge tube containing a gas at low pressure when a high potential difference is applied between the electrodes, are called canal rays. They are found to travel towards the oppositely charged cathode.

 **Q2: If an atom contains one electron and one proton, will it carry any charge or not?**

 Ans: No, the atom will not carry any charge.

**Q3: On the basis of Thomson’s model of atom, explain how the atom is neutral as a whole?**

 Ans: According to Thomson’s model, the atom is considered as a sphere of positive charge in which negatively electrons are embedded like seeds in a watermelon. The total negative charge on the electrons is equal to the total positive charge on the sphere. Hence, the atom as a whole is electrically neutral.

 **Q4: On the basis of Rutherford’s model of an atom, which sub–atomic particle is present in the nucleus of an atom?**

 Ans: Protons.

**Q5: Draw a sketch of Bohr’s model of an atom with three shells.**

3rd shell(n=3) or M-shell

2nd shell (n=2) or L-shell

Ist shell (n=1) or K-shell

+

**Q6: What do you think would be the observation if the α-particle scattering experiment is carried out using a foil of a metal other than gold?**

 Ans: With the foil of any heavy metal like gold, example; platinum, silver etc. the observation will be same but with the oil of a light metal, e.g. that of lithium, the massive α-particles may push the nucleus and may not be deflected back.

 **Q7: Name the sub-atomic particles o an atom**.

 Ans: Electron, proton and neutron.

 **Q8: Helium atom has an atomic mass of 4µ and two protons in its nucleus. How many neutrons does it have?**

 Ans: Mass no. (atomic mass)= 4

 No. of protons = 2, i.e., atomic no. =2

 No. of neutrons= mass no.-atomic no.=4-2=2.

 **Q9: Write the distribution of electrons in carbon and sodium atoms.**

 Ans: i) Atomic no. of carbon= 6, i.e. total no. of electrons=6. Hence, Ist-shell(k-shell) will have 2 electrons and the remaining electrons, i.e., 4 will be present in the 2nd shell, i.e., L-shell. Thus, the distribution will be:K L.

 2 4

ii) Atomic no. of sodium=11, i.e., total no. of electrons=11. Hence, distribution will be:

 K L M

 2 8 1

 **Q10: If K and L-shells of an atom are full, then what would be the total no. of electrons in the atom?**

 Ans: Maximum no. of electrons in K-shell=2

 Maximum no. of electrons in L-shell=8

 When both K and L-shells are full, total no. of electrons in the atom=2+8=10

 **Q11: How will you find the valency of chlorine, sulphur and magnesium?**

 Ans: 1. Atomic no. of chlorine =17

$∴$Distribution of electrons=K L M

 2 8 7

 Thus, outermost shell has 7 electrons. It can easily complete its octet by gaining one electron. Hence, its valency=1.

1. Atomic no. of sulphur=16

$∴$distribution of electrons= K L M

 2 8 6

 Thus, outermost shell has 6 electrons. Hence, valency=8-6=2

1. Atomic no. of magnesium=12

$∴$distribution of electrons= K L M

 2 8 2

 Thus, outermost shell has only 2 electrons. It can easily lose these two electrons to complete its octet. Hence, valency=2.

**Q12: If no. of electrons in an atom is 8 and no. of protons is also 8, then (i) What is the atomic no. of the atom? And (ii) What is the charge on the atom?**

 Ans: (i) Atomic no. = No. of protons = 8

 (ii) As no. of protons is equal to the no. of electrons, the atom will be neutral, i.e, there is no charge on the atom.

 **Q13: With the help of table 10.1, find out the mass no. of oxygen and sulphur atom.**

 Ans: According to the table oxygen atom has 8 electrons, 8 protons and 8 neutrons and sulphur atom has 16 electrons, 16 protons and 16 neutrons.

 Mass no. of oxygen= No. of protons + No. of neutrons

 = 8 + 8 =16.

 Mass no. of sulphur atom = No. of protons +No. of neutrons

 = 16 + 16 =32

**Q14: For the symbol H, D and T, tabulate their sub-atomic particles found in each of them.**

 Ans: i) Atomic no. of H =1

 Mass No. of H = 1

$∴$ No. of protons =No. of electrons = Atomic no. =1

 No. of neutrons = Mass no. – atomic no.

 = 1-1 =0

 ii) Atomic no. of D (Deuterium) =1

 Mass no. of D =2

$∴$ No. of protons = No. of electrons = Atomic no. =1

 No. of neutrons = Mass no. – Atomic no.

 = 2-1 =1

iii) Atomic no. of T (Tritium) = 1

 Mass no. of T = 3

$∴$ No. of protons = No. of electrons = Atomic no. =1

 No. of neutrons = Mass no. – Atomic no.

 = 3-1 =2

**To Sum Up:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Atom** | **Atomic no.**  | **Mass no.** | **No. of protons** | **No. of electrons** | **No. of neutrons** |
|  **H** |  **1** |  **1** |  **1** |  **1** |  **1-1=0** |
|  **D** |  **1** |  **2** |  **1** |  **1** |  **2-1=1** |
|  **T** |  **1** |  **3** |  **1** |  **1** |  **3-1=2** |

 **Q15**: Write the electronic configuration of any one pair of isotopes and isobars.

 Ans: Isotopes of chlorine: 3517Cl, 3717 Cl.

 Electronic configuration of each of them = K L M

 2 8 7

 Isobars: 4018Ar, 4020Ca

 Electronic configuration of 18Ar = K L M

 2 8 8

 Electronic configuration of 20Ca = K L M N

 2 8 8 2

**Exercises**

 **Q1: Compare the properties of electrons, protons and neutrons**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S. No.** |  **Property** |  **Electron**  |  **Proton**  |  **Neutron**  |
|  i. |  Charge  |  -1 unit |  +1 unit  |  No charge |
| ii. |  Mass  |  Nearly 1/1840th of H-atom |  Nearly equal to that of H-atom |  Nearly equal to that of H-atom |
| iii. |  Location  |  Present around nucleus |  Present in nucleus  | Present in nucleus  |

 **Q2: Where are the limitations of J.J Thomson’s model of atom?**

 Ans: J.J. Thomson’s model could not explain the results of the scattering experiments carried out by Rutherford.

**Q3: What are the limitations of Rutherford’s model of the atom?**

 Ans: Rutherford’s model of atom could not explain the stability of the atom.

 **Q4: Describe Bohr’s model of atom?**

 Ans: According to Neils Bohr’s model of atom:

1. An atom consists of a small heavy positively charged nucleus in the centre and electrons revolving around the nucleus in circular paths called orbits.

ii) In a particular atom, the orbits in which the electrons revolve are discrete orbits having fixed radii and energy.

iii) So long as an electron is revolving in a particular orbit, it can neither lose energy nor gain energy. Thus, the atom is stable and does not collapse. This state of the atom with lowest energy is called ground state of the atom.

1. Energy is lost or gained by an electron only when it jumps from one orbit to the other. The energy gained or lost is equal to the difference of energy o the two energy levels involved. Thus, if energy falls on an electron and it absorbs this energy, it will jump to some outer shell. The atom is then said to be in the excited(unstable) state. The electron loses or emits energy back to gain stability and jumps back to inner energy level(ground state).

 Energy absorbed Energy emitted

 . E2Nucleus

 Nucleus

 Nucleus

1. **Excited state b) Ground state.**

Electron jumping to outer shell electron jumping back to

inner shell

**Q5: Compare all the proposed models of an atom which are given in this chapter.**

 Ans**: 1. J.J. Thomson’s model of an atom**

 **Important features:**

i) An atom consists of a sphere of positively charge in which electrons were embedded just like seeds in watermelon.

ii) Total positive charge on the sphere is equal to the total negative charge present on the electrons. So atom as a whole is electrically neutral.

iii) It could not explain results of Rutherford’s scattering experiments.

**2. Rutherford’s model of atom:**

 Important features:

i) An atom consists of small positively charged nucleus in the centre and electrons revolving around it.

ii) There is very large empty space between the nucleus and the electrons.

iii) All the mass of atom is mainly concentrated in nucleus.

iv) It could not explain stability of atom.

1. **Bohr’s model of atom:**

**Important features:**

i) An atom consists of a small positively charged nucleus in the centre and electrons revolving around it in circular paths called orbits.

ii) An orbit in which the electrons revolve are the discrete orbits having fixed radii and energy.

iii) So long as an electron is revolving in a particular orbit, it can neither lose energy nor gain energy. Thus, atom is stable and does not collapse.

iv) Energy is lost or gained by an electron only when it jumps from one orbit to the other.

 **Q6: Summarize the rules or writing the distribution of electrons in various shells or the first eighteen elements**.

 **Ans**:The rules for writing the distribution of electrons in various shells can be summarized as:

 **i) The maximum no. of electrons that can be present in the nth shell is equal to 2n2. Thus, we have**

 Shell maximum no. of electrons

Ist shell or K-shell (n=1) 2 $×$ 12= 2

 2nd shell or L-shell (n=2) 2 $×$ 22= 8

 3rd shell or M-shell (n=3) 2 $×$ 32= 18

 4th shell or N-shell (n=4) 2 $×$ 42= 32

ii) The outermost shell cannot have more than 8 electrons even if the first rule is violated.

iii) Electrons do not enter into a new shell unless the inner shells are completely filled. Now, we can tabulate the distribution of electrons in various shells for first 18 elements as:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Element**  | **Symbol**  | **At. no.(no. of electrons)** | **Distribution**  | **of electrons** | **in different**  | **shells** |
|  |  |  |  K | L |  M |  N |
| Hydrogen  |  H |  1 | 1 |  |  |  |
| Helium  | He | 2 | 2 |  |  |  |
| Lithium  | Li | 3 | 2 | 1 |  |  |
| Beryllium  | Be | 4 | 2 | 2 |  |  |
| Boron  | B | 5 | 2 | 3 |  |  |
| Carbon  | C | 6 | 2 | 4 |  |  |
| Nitrogen  | N | 7 | 2 | 5 |  |  |
| Oxygen  | O | 8 | 2 | 6 |  |  |
| Fluorine  | F | 9 | 2 | 7 |  |  |
| Neon  | Ne | 10 | 2 | 8 |  |  |
| Sodium  | Na | 11 | 2 | 8 | 1 |  |
| Magnesium  | Mg | 12 | 2 | 8 | 2 |  |
| Aluminium  | Al | 13 | 2 | 8 | 3 |  |
| Silicon  | Si | 14 | 2 | 8 | 4 |  |
| Phosphorus  | P | 15 | 2 | 8 | 5 |  |
| Sulphur  | S | 16 | 2 | 8 | 6 |  |
| Chlorine  | Cl |  17 | 2 | 8 | 7 |  |
| Argon  | Ar | 18 | 2 | 8 | 8 |  |

**Q7: Define valency by taking examples of silicon and oxygen?**

Ans: Valency is defined as the no. of electrons which an atom can lose or gain or share with other atom/atoms so as to complete its octet, i.e., 8 electron in the outermost shell.

 Examples; i) Silicon. Atomic no.=14

$∴$No. of electrons present=14

 Electronic configuration = K L M

 2 8 4

 The outermost shell has 4 electrons which it can share with other atoms to complete its orbit. Hence, its valency is 4.

 ii) Oxygen. Atomic no.=8

$∴$No. of electrons present =8

 Electronic configuration = K L

 2 6

 Thus, the outermost shell will gain 2 electrons to complete its octet. Hence, valency =2.

**Q8: Explain with examples**.

1. Atomic no.

 Ans: Atomic no. of an element is equal to the no. of protons present in the nucleus of the atom of that element.

 For example; i) Nucleus of hydrogen atom contains only one proton, its atomic no. =1

 ii) Nucleus of carbon atom contains 6 protons, its atomic no.= 6 etc.

1. Mass no.

Ans: Mass no. of an element is the sum o the number of Protons and neutrons present in the atom of the element, i.e.,

 Mass no. of elements = No. of protons +No. of neutrons.

 For example

 i) Hydrogen atom contains 1 proton and 0 neutron So, 1+0=1. Thus, mass number o hydrogen is 1.

 ii) Sodium atom contains 11 protons and 12 neutrons so, 11+12=23. Thus, mass no. of sodium =23.

1. Isotopes and its two uses:

Ans: Isotopes are the atoms of the same element which have same atomic no. but different mass numbers. E.g.,

 i) Isotopes of hydrogen are: protium(11H), Deuterium (12H), Tritium (13H).

 ii) Isotopes of oxygen are: 816O, 817O, 818O.

The two uses of isotopes are as;

1. In the nuclear reactor, an isotope of Uranium(U-235) is used as nuclear fuel.
2. In medical field, some radio isotopes are widely used for treatment of cancer, tumor etc. E.g., cobalt-60, phosphorus-32 etc.
3. Isobars:

Such atoms of different elements which have different atomic numbers but same mass number are called Isobars.

For example;

i) 1840Ar and 2040Ca are Isobars.

ii) 714N and 614C are isobars.

**Q9: Na+ has completely filled K and L shells. Explain**.

Ans: Atomic number of Na=11, i.e., it has 11 electrons. According to Bohr-Bury scheme,

Ist shell (n=1), i.e., K-shell can have maximum 2 electrons $∵$ (2n2=2$×$12)

2nd shell (n=2), i.e., L-shell can have maximum 8 electrons $∵$ (2n2=2$×$22=8)

 The remaining one electron will enter into the third shell. Thus, K and L shells are completely filled.

**Q10: If bromine atom is available in the form of, say, two isotopes 3579Br (49.7%) and 3518Br (50.3%), calculate the average atomic mass of bromine atom?**

 Ans: % of Br isotope with mass no. 79=49.7

 % of Br isotope with mass no. 81=50.3

$∴$ Average atomic mass of Br=49.7$×$79+50.3$×$81$÷$100

 =39.263+40.743=80.006µ

 **Q11: The average atomic mass of a sample of an element x is 16.2µ. What are the percentages of isotopes 816x and 818x in the sample?**

 Ans: Suppose percentage of isotope 816x = x

 Then, percentage of isotope 818x = (100-x)

$∴$ Average atomic mass = 16 $×$ x + 18 (100-x) $÷ $100

 = 1800-2x $÷$ 100 =18-0.02x

 = 16.2 (given) or 0.02x=1.8 or x=1.8 $÷$ 0.02 =90

 Hence, percentage of 816x=90% and percentage of 818x=100-90=10%.

**Q12: If Z=3, what would be the valency of the element? Also, name the element.**

Ans) Element with Z=3 is Lithium(L)

 Electronic configuration =K L

 2 1

 Thus, outermost shell has 1 electron. Hence, its valency =1

 **Q13: Composition of the nuclei of two atomic species X and Yare given as under**

 X Y

 Protons = 6 6

 Neutrons= 6 8

 Give their mass numbers and relation between them.

 Ans: Mass no. =No. of protons +No. of neutrons

 Mass no. of X =6+6=12

 Mass No. of Y= 6+8 =14

 As both contain the same no. of protons (i.e., 6), therefore, their atomic no. is same (i.e., 6), but they have different mass numbers, i.e., 12 and 14 respectively. Hence, they are isotopes (612X, 614X, i.e., 612C and 614C).

**Q14: For the following statements, write T for true and F for false.**

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

Ans: False (F)

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

Ans: False (F)

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

Ans: True (T)

(d) Isotope of iodine is used for making Tincture iodine, which is used as a medicine.

Ans: False (F)

**Q15: Rutherford’s alpha-particle scattering experiment was responsible for the discovery of**

a) Atomic nucleus (b) Electron (c) Proton (d) Neutron.

Ans: (a) Atomic nucleus.

**Q16: Isotopes of an element have**

1. The same physical properties.
2. Different chemical properties.
3. Different number of neutrons.
4. Different atomic numbers.

Ans: c) different number of neutrons.

**Q17: Number of valence electrons in Cl- ion are:**

1. 16 b) 8 c) 17 d) 18

Ans: b) 8

**Q18: Which one of the following is a correct electronic configuration of sodium?**

1. 2, 8 b) 8, 2, 1 c) 2, 1, 8 d) 2, 8, 1

Ans: d) 2, 8, 1.

**Q19: Complete the following table.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Atomic no.**  | **Mass no.** | **No. of neutrons** | **No. of protons** | **No. 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 | 0 | Protium |