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

Ans. :

Electrons	Protons	Neutrons
They are negatively charged particle.	They are positively charged.	They have no charge.
They are present in outer shells within an atom.	They are present within the nucleus.	They are present inside the nucleus of an atom.
The mass of an electron is about 1/2000 times the mass of an hydrogen atom.	The mass of a proton is taken as one unit and equals to neutron.	The mass of a neutron is taken as one unit and equals to that of proton.
Attracted towards positive charge	Attracted towards negative charge	Do not get attracted to any charged particle.
An electron is represented as e^-.	A proton is represented as p^+.	A neutron is represented as n.

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

Ans. : (i) The model of an atom proposed by J.J. Thomson states that negatively charged electrons are embedded in a positive sphere. But he did not give any experimental evidence in his support.

(ii) The model was not able to explain the scattering of light in experiment also.

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

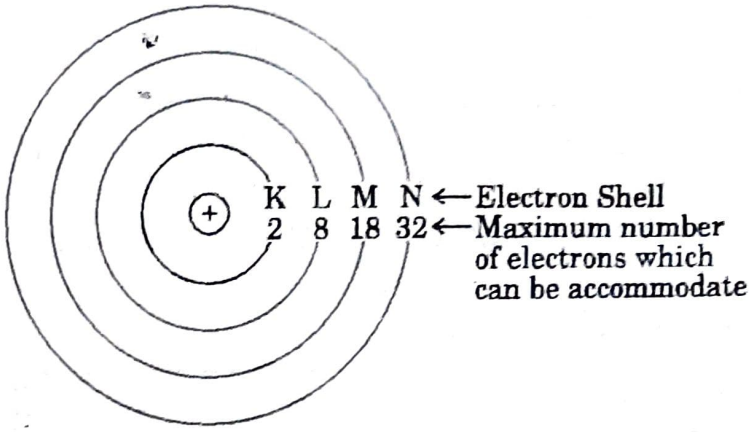
Ans. : In the model of the atom, Rutherford states that the electrons revolve around the nucleus of an atom in the same way the Earth revolves around the Sun.

But, whenever this situation prevails, the revolving particle gains acceleration and radiates its energy outwards. With continuous radiation of energy, the electron would lose its energy and fall into the nucleus which makes the atom highly unstable. But on the contrary, we find the atom as a highly stable particle which disproves the assumption.

Q. 4. Describe Bohr's model of the atom.

Ans. : • The nucleus of an atom is present in the centre.

- Around this nucleus, the negatively charged electrons revolve.
- Discrete orbits of electrons are present inside the atom.
- While in this orbits, the electrons do not radiate energy.
- These discrete orbits are represented as K, L, M, N..... orbits or denoted with the numbers as 1, 2, 3, 4 .....



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

Ans. :

S. No.	Thomson's Model	Rutherford's Model	Bohr's Model
1.	An atom is a sphere of uniform positive charge in which electrons are embedded.	An atom consists of a heavy, rigid and positively charged part at the centre of the atom. It is called nucleus.	An atom consists of positively charged nucleus at its centre.
2.	The total positive charge in the sphere is equally balanced by sufficient number of electrons embedded in it.	The total positive charge and almost the entire mass of the atom is concentrated in the nucleus.	Out of the several possible orbits, electrons move only in certain discrete, circular orbits called stationary states or energy levels or shells.
3.	The mass and charge are uniformly distributed.	Electrons move around the nucleus in circular orbits.	While moving in an allowed orbit, an electron is associated with a definite amount of energy.
	Limitations : It failed to explain the observations of Rutherford's scattering experiment.	**Limitations :** Rutherford's model failed to explain the stability of the atom.	**Advantage :** Bohr's theory successfully explains the stability of atom.

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

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

- 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 ; $2n^2 = 2(4)^2 = 32$
- Given number of electrons is 18.
- The electrons are not taken unless the inner shells are filled.
- Hence, the highest element has K – 2; L – 8; M – 8.

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

Ans. : The valency of an element is defined as the number of electrons lost or gained by an atom to complete its outermost shell. It can also be defined as the combining capacity of an element.

For example : Silicon and oxygen.

Oxygen	Silicon
Atomic number : 8	Atomic Number : 14
Electronic configuration : K – 2; L – 6.	Electronic configuration : K – 2; L – 8; M – 4.
Valence electrons : 6	Valence electrons : 4
Valency : 8 – 6 = 2	Valency : 8 – 4 = 4

Q. 8. Explain with examples :
(a) Atomic number **(b) Mass number**
(c) Isotopes **(d) Isobars**
Give any two uses of isotopes.

Ans. : (a) Atomic number of an atom is defined as the number of positively charged protons present in the nucleus. For example – Hydrogen has one proton in its nucleus; so, its atomic number is one.

(b) Mass number of an atom is defined as the total number of protons and neutrons. This takes into account the elements that contribute to the atomic mass of the atom. The mass of electrons are negligible as compared to the protons and neutrons of the corresponding element. For example – Hydrogen has 1 proton and 1 nutronin its nucleus. So its mass number is $2\binom{2}{1}4$

(c) **Isotopes :** Isotopes are atoms which have the same number of protons but the number of neutrons differs or that have same atomic number but different mass number.
For example – The most simple example is the element carbon which exists as $^{12}_{6}C$ and $^{14}_{6}C$.
Uses of isotopes :
- The isotopes of iodine atom is used to treat goitre.
- Uranium isotopes is used as fuel for nuclear reactors.

(d) **Isobars :** Isobars are atoms which have the same mass number but differ in the atomic number. Examples are : $^{40}_{20}Ca$ and $^{40}_{18}Ar$.

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

Ans. : A sodium atom has 11 electrons in its orbits, hence its atomic number is also 11 and has the same number of protons and electrons. Thus, its electronic configuration is K-2; L-8; M-1; The one electron in the M shell is lost and it obtains a positive charge

since it has one more proton than the electrons, and obtains a positive charge, Na^+. Now, the configuration is K-2; L-8 and it is a filled state. Hence, it is very stable so it is difficult to remove the electron from a filled state.

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

Ans. : The atomic masses of two isotopic atoms are 79 (49.7%) and 81 (50.3%).

$$\text{Thus, total mass} = \left(79 \times \frac{49.7}{100}\right) + \left(81 \times \frac{50.3}{100}\right)$$

$$= 39.263 + 40.743 = 80.006u$$

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

Ans. : Let the percentage of $^{16}_{8}X$ be 'p' and that of $^{18}_{8}X$ be '100-p'.

$$16.2 = 16 \times \frac{p}{100} + 18 \times \frac{(100 - p)}{100}$$

$$= \frac{16p}{100} + \frac{1800}{100} - \frac{18p}{100}$$

$$1620 = -2p + 1800$$

$$p = 90$$

On solving the equation, we obtain 'p' to be 90.

Therefore, $^{16}_{8}X = 90\%$

And, $^{18}_{8}X = 10\%$

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

Ans. : Z = atomic number = 3 (given)

Electronic configuration = K-2; L-1

Thus, valency = 1

The element with atomic number 3 is lithium.

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

Protons = 6-6

Neutrons = 6-8

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

Ans. : Mass number of X : 6 + 6 = 12

Mass number of Y : 6 + 8 = 14

Since, the atomic numbers of both the species are the same, they are the same element. Also since they have different number of neutrons, their mass number is different and they are the isotopes.

Q. 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.

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

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

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

Ans. : (a) False (b) False (c) True (d) False

Put tick against correct choice and cross against wrong choice in questions 15, 16 and 17.

Q. 15. Rutherford's α-particle scattering experiment was responsible for the discovery of :

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

Ans. : (a) Atomic nucleus

Q. 16. Isotopes of an element have :

(a) the same physical properties (b) different number of neutrons
(c) different number of protons (d) different atomic number

Ans. : (b) different number of neutrons

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

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

Ans. : (b) 8

Q. 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

Ans. : (d) 2, 8, 1

Q. 19. Complete the following table :

Atomic number	Mass number	Number of neutrons	Number of protons	Number of electrons	Name of the atomic element
9	–	10	–	–	–
16	32	–	–	–	Sulphur
–	24	–	12	–	–
–	2	–	1	–	–
–	1	0	1	0	–

Ans. :

Atomic number	Mass number	Number of neutrons	Number of protons	Number of electrons	Name of the atomic element
9	19	10	9	9	Fluorine
16	32	16	16	16	Sulphur
12	24	12	12	12	Magnesium
1	2	1	1	1	Hydrogen
1	1	0	1	0	Deuterium Hydrogen