NCERT TEXTUAL EXERCISE (SOLVED)

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

Ans.

Particle	*Mass*	*Charge*	*Representation*
Electron	Negligible	1 unit negative charge	e^-
Proton	1 unit	1 unit positive charge	${}^{1}_{1}p^+$
Neutron	1 unit	Electrically neutral	${}^{1}_{0}n^0$

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

Ans. Although J. J Thomson's model explained the electrically neutral nature of an atom, the results of experiments carried out by other scientists could not be explained by this model.

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

Ans. According to Rutherford's model of an atom, electrons revolve around nucleus in a circular orbit. Any particle in a circular orbit would undergo accleration. During acceleration, charged particles would radiate energy. Thus, the revolving electron would lose energy and finally fall into the nucleus. Thus, the atom should be highly unstable and hence, matter would not exist in the form that we know. But in reality atoms are very stable.

This can not be explained by Rutherford's model of atom.

4. Describe Bohr's model of the atom.

Ans. Neils Bohr (1913) proposed a new model of atom based upon quantum theory of radiations. Main postulates of this model are as follows:

- ❖ The electrons in an atom revolve around the nucleus only in certain selected circular orbits.
- ❖ The orbits are associated with definite energies and are called energy shells or energy levels. These are numbered as 1, 2, 3, 4, 5, ... etc. or designated as K, L, M, N, O ... etc. shells. The energy of the electron is minimum in the orbit nearest to the nucleus, i.e., K shell. The energy of the electron increases as it moves away from the nucleus.
- ❖ An electron does not lose or gain energy as long as it remains in a particular orbit. In other words, energy of an electron in a particular orbit remains constant. That is why, these orbits are also known as stationary states.
- ❖ When energy from some external source is supplied to the electron, it may jump to some outer orbit by absorbing a definite amount of energy (equal to the difference in energy between the two energy

levels). When the electron jumps back to the inner energy level, it radiates the same amount of energy in the form of a quantum of radiation.

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

Ans.

Thomson's model	*Rutherford's model*	*Bohr's model*
An atom consists of a positively charged sphere with electrons embedded in it.	An atom consists of a positively charged particles concentrated at the centre known as the nucleus. The size of the nucleus is very small as compared to the size of the atom. The electrons revolve around the nucleus in well-defined orbits.	There are only certain orbits known as discrete orbits inside the atom in which electrons revolve around the nucleus. Electrons do not radiate energy while revolving.

6. Summarise the rules for writing of distribution of electrons in various shells for the first 18 elements.

Ans.

- Electrons always enter in the lowest energy orbit first.
- Once the orbit is completely filled, the electron enters in the next orbit.
- The maximum number of electrons that can enter in any orbit is given by rule, $2 \times n^2$ where n is the number of orbit.
- Even, if any orbit has capacity to accommodate more than 8 electrons, if that orbit is last orbit, then only 8 electrons can enter into it (irrespective of its capacity).

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

Ans. Valency is the number of electrons which can be gained, lost or shared to complete the octet. For example, the electronic configuration of Si is,

Si – (2, 8 and 4), hence, to complete octet silicon needs 4 electrons to be shared with its valence electrons and hence, valency of silicon is 4.

Electronic configuration of oxygen is (2 and 6); hence, to complete octet, it needs 2 electrons; hence, oxygen has valency 2.

8. Explain with examples: (i) Atomic number, (ii) Mass number, (iii) Isotopes and (iv) Isobars. Give any two uses of isotopes.

Ans. (i) Atomic number (Z) is the number of protons present in the nucleus of an atom or the number of extra nuclear electrons. For example, example, Carbon has its atomic number 6.

(ii) Mass number (A) is the sum of the number of protons and neutrons present in the nucleus of an atom. For example, in the case of carbon atom there are 6 protons and 6 neutrons in its nucleus and hence, its mass number is 12.

(iii) Isotopes are the atoms of an element having the same atomic number but different atomic mass number, e.g., carbon has two isotopes with atomic mass number 12 and 14 which is represented as $^{12}_{6}C$, $^{14}_{6}C$.

(iv) Isobars are atoms having different atomic numbers but same mass numbers. For example, $^{40}_{18}Ar$ and $^{40}_{20}Ca$, have different atomic number but the same mass number.

Two uses of isotopes:

- ❖ An isotope of uranium is used as a fuel in nuclear reactors.
- ❖ An isotope of cobalt is used in the treatment of cancer.
- ❖ An isotope of iodine is used in the treatment of goitre.

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

Ans. Na atom has electronic configuration (2, 8 and 1) and hence, it loses its one electron to form stable ion Na^+ which has 2 electrons in 1st orbit (K shell) and 8 electrons in L shell.

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.

Ans. Average Isotopic mass of $^{79}_{35}Br$ and $^{81}_{35}Br$

$$= \frac{79 \times 49.7 + 81 \times 50.3}{100} = \frac{3926.3 + 4074.3}{100} = \frac{8000.6}{100}$$

$$= 80.006$$

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 percentage of $^{16}_{8}X$ be x% then percentage of $^{18}_{8}X$ will be $(100 - x)$%.

$$\text{Average atomic mass} = \frac{16 \times x + 18(100 - x)}{100}$$

$$\therefore \quad 16.2 = \frac{16x + 1800 - 18x}{100}$$

$$\therefore \quad 1620 = 1800 - 2x$$