Assignment - XI science
Subject - Chemistry
Chapter - 2
Structure of Atom
Case study based questions

Case study -1

Read the following passage and answer the questions that follow:
We can pin point an Aeroplan moving in the sky. Whatever may be its speed i.e. we can locate both its
exact position as well as direction. However, it is not possible to do so in case of a moving microscopic
particle such as electron. In fact, we cannot see any such particles without disturbing it. This has been
stated by Heisenberg in the form of uncertainty principle. The mathematical form of the principle is;
$\Delta x.\ \Delta p \geq h/4\pi$ (constant). Since the product of Δx and $\Delta p(m\Delta v)$ is constant, if one is very small, other is
bound to be large. The principle as such has no significance in daily life since it applies to those particles which we cannot see.

Q-1 Heisenberg's Uncertainty principle rules out the exact simultaneous measurement of
a. Probability and intensity. b. charge density and radius.
c. Energy and velocity d. position and momentum.
Q-2 If the uncertainty in the position of electron is zero, the uncertainty in its momentum would be;
a. Zero b. less than $h/4\pi$ b. Greater than $h/4\pi$ d. Infinite.
Q-3 Given the mass of electron is 9.1 x 10-31 kg and velocity of electron is 2.2 x 106 m/s, if the uncertainty
in its velocity is 0.1%, the uncertainty in position would be;
a. 26 nm b. 32 nm c. 48 nm d. 50 nm
Q-4 If uncertainty in position and momentum are equal, then the uncertainty in velocity is-
a.infinite b.zero c.less than $h/4\pi$ d.greater than $h/4\pi$

Case study -2

Read the following passage and answer the questions that follow:
Orbitals are region or space where there is maximum probability of finding electrons.
Qualitatively, these orbitals can be distinguished by their size, shape and orientation. An orbital of small
size means there is more chance of finding the electron near the nucleus. Shape and orientation mean the

direction in which probability of finding electron is maximum. Atomic orbitals can be distinguished by
quantum numbers. Each orbital is designated by three quantum numbers n, l and ml (magnetic quantum
number) which define energy, shape and orientation but these are not sufficient to explain spectra of
multi-electrons atoms. Spin quantum number (ms) determines the spin of electron. Spin angular momentum of electron has two orientations relative to chosen axis which are distinguished by spin
quantum numbers ms which can take values +1/2 and –½

Q-1 How many orbitals are associated with n = 3?
Q-2 Describe the orbitals represented by (i) n = 2, l = 1 (ii) n = 4, l = 0.
Q-3 How many electrons are possible in an orbital? Why?
Q-4 What is shape of ’s’ and 'p' orbitals?

Case study -3

Read the following passage and answer the questions that follow:
The presence of positive charge on the nucleus is due to the protons in the nucleus. As established earlier,
the charge on the proton is equal but opposite to that of electron. Atomic number (Z) = number of protons
in the nucleus of an atom = number of electrons in a neutral atom. protons and neutrons present in the
nucleus are collectively known as nucleons. The total number of nucleons is termed as mass number (A)
of the atom. mass number (A) = number of protons (Z) + number of neutrons (n). Isobars are the atoms
with same mass number but different atomic number for example, 6 14C and 7 14N. On the other hand,
atoms with identical atomic number but different atomic mass number are known as Isotopes. For
example, considering of hydrogen atom again, 99.985%of hydrogen atoms contain only one proton. This
isotope is called protium (1 1H). Rest of the percentage of hydrogen atom contains two other isotopes,
the one containing 1 proton and 1neutron is called deuterium (2 1D, 0.015%) and the other one possessing 1 proton and 2neutrons is called tritium (1 3 T). The studies of interactions of radiations with
matter have provided immense information regarding the structure of atoms and molecules. Neils Bohr
utilized these results to improve upon the model proposed by Rutherford. Two developments played a major role in the formulation of Bohr’s model of atom.

Q-1. The pair of ions having same electronic configuration is _____.
(a) Cr^{3+}, Fe^{3+} (b) Fe^{3+}, Mn^{2+} (c) Fe^{3+}, Co^{3+} (d) Sc^{3+}, Cr^{3+}
Q-2- In which of the following
pairs, the ions are isoelectronic?
(a) Na^+, Mg^{2+} (b) Al^{3+}, O^- (c) Na^+, O^{2-} (d) N^{3-}, Cl^-
Q-3.Two atoms are said to be isobars if.
(a) they have same atomic number but different mass number.
(b) they have same number of electrons but different number of neutrons.
(c)they have same number of neutrons but different number of electrons.
(d)sum of the number of protons and neutrons is same but the number of protons is different.

Case study -4

Read the following passage and answer the questions that follow:
Bohr's model explained electrons can revolve only in certain permitted orbits who's angular could successfully explain stability of atoms and spectrum of unielectron species. Hydrogen spectrum consists of Lyman, Balmer, Paschen, Brackett and Pfund series. Bohr's theory could not explain spectrum of multi-electron species, Stark effect, Zeeman effect, dual nature of matter, de Broglie equation and Heisenberg uncertainty principle which lead to orbital concept. Electrons were filled in orbitals according to Aufbau's principle, Hund's Rule and Pauli's exclusion principle. Each electron is identified by four quantum numbers n, l, ml and ms out which n, l, ml was derived from Schrodinger's wave equation. Half-filled and completely filled orbitals are more stable due to exchange energy and symmetrical distribution of
electrons.

Q-1 Arrange 4d, 3d, 4p and 3p in increasing order of energy.
Q-2 What is name of spectrum of radiation emitted by substance that has absorbed radiation?
Q-3 What rules out the probability of existence of definite path of electrons?
Q-4 Why are Half filled and completely filled orbitals are more stable?