CHEMISTRY-2

Atomic Structure

[Set-2]

SECTION-A

1. The wavelength of a spectral line of an electronic transition is inversely related to the

   (i) number of electrons undergoing the transition

   (ii) nuclear charge of the atom

   (iii) difference in the energy of the energy levels involved in the transition

   (iv) velocity of the electron undergoing the transition

2. The energies E_1 and E_2 of two radiations are 25 eV and 50 eV respectively. The relation between their wavelength λ_1 and λ_2 will be

   (i) $\lambda_1 = \lambda_2$ (ii) $\lambda_1 = 2\lambda_2$ (iii) $\lambda_1 = (\sqrt{25 \times 50})\lambda_2$ (iv) $2\lambda_1 = \lambda_2$

3. For d-electron, the orbital angular momentum is

   (a) $\frac{\sqrt{2}h}{2\pi}$ (b) $\frac{\sqrt{2}h}{\pi}$ (iii) $\frac{\sqrt{2 \times 4}}{2\pi}h$ (d) $\frac{\sqrt{6}}{2\pi}h$

4. If uncertainty in position and momentum are equal then the minimum uncertainty in velocity is

   (i) $\frac{1}{m}\sqrt{\frac{h}{\pi}}$ (ii) $\sqrt{\frac{h}{\pi}}$ (iii) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$ (iv) $\frac{h}{4\pi}$

5. Match the following:

Column-I	**Column-II**
A. Principal quantum number	1. Orientation of orbital
B. Azimuthal quantum number	2. Energy and size of orbital
C. Magnetic quantum number	3. Spin of electron
D. Spin quantum number	4. Shape of orbital

	A	B	C	D
(i)	2	1	4	3
(ii)	2	4	1	3
(iii)	(2, 4)	1	(3, 4)	3
(iv)	(1, 2)	(2, 4)	3	3

Assertion-Reason type Questions:

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true and R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

6. A: The potassium has the highest energy electron is 4s orbital and not in 3d orbital.

   R: (n + *l*) rule is followed for determining the orbital with the lowest energy state.

7. A: In Lyman series of H-spectrum, the maximum wavelength of line is 91 nm.

   R: The wavelength is maximum when transition is from n = 1 o n = 2.

Passage bases questions

ψ^2 determines the probability of finding the electron in a given region in space. The ψ^2 varies with the distance from the nucleus as well as direction. A node is a point at which the ψ^2 is zero or ψ changes its sign. The different orbitals have different nodes i.e., radial as well as angular.

8. In which of the following orbitals probability of finding electron is same in all directions?

   (i) 2s, 3s (ii) 2s, 2p (iii) $2p_x$, $2p_y$, (iv) 3p, 3d

9. In which of the following set of orbitals, the second orbital has more number of nodes than the first?

   (i) 3s, 3p (ii) 3p, 3d (iii) 3d, 4f (iv) 2s, $2p_x$

10. Incorrect statement about $2p_x$, $2p_y$ and $2p_z$ is

    (i) All three have the same size

    (ii) All three have the same energy

    (iii) All three have the same shape and same *l* value

    (iv) All three have one radial node

SECTION-B

11. (i) Why is the electronic configuration of N(Z = 7) $1s^2\ 2s^2\ 2p_x^2\ 2p_y^1\ 2p_z^0$ not correct?

    (ii) What is the physical significance of ψ^2?

12. (i) State Heisenberg's uncertainty principle.

    (ii) Draw the graph between ψ^2 and the distance from the nucleus for 2s.

OR

(i) Who applied the Planck's quantum theory first and where?

(ii) Which quantum number are required to define the subshell?

13. Calculate the wavelength of the second line of the Lymen series in He^+. In which part of the spectrum does this line belongs to ?

OR

Calculate the number of photons each of wavelength 300 nm that can provide energy equal to 2J. ($h = 6.62 \times 10^{-34}$ Js)

14. Calculate the uncertainty in position of a dust particles with a mass equal to 1 mg if the uncertainty in its velocity is 5.5×10^{-20} m/s

15. (i) Two particles A and B are in motion. If the wavelength associated with particle A is 5×10^{-8} m, calculate the wavelength associated with particle B if its momentum is half of A.

(ii) Draw orbital diagram for atom with the electronic configuration: $1s^2\ 2s^2\ 2p^5$.

(iii) Which orbital in each of the following pairs is lower in energy in a many-electron system?

(a) 2s, 2p (b) 4d, 5f

OR

(i) Which quantum number (s) determine

(a) The energy of an electrons in a H-atom and in many electron atom

(b) The size of an orbital

(c) The shape of an orbital

(d) The orientation of an orbital in space

(ii) Explain the meaning of the symbol $4d^6$.

(iii) For each of the following pair of orbitals for H-atom, indicate which is higher in energy?

(a) 1s, 2s (b) 2p, 3p (c) $3d_{xy}, 3d_{xz}$ (d) 3s, 3d

