

Atomic Structure

Semester-I

Short questions:

1. Between which Bohr's electronic orbits of hydrogen atom, the third line in the Balmer series does correspond?
2. Assign the principal quantum number that would be associated with first 'g' subshell?
3. Write an equation which relates ordinal number with x-ray frequency? / What basic information is obtained from Moseley's experiment?
4. Write down the ground state electronic configuration of the following: Cu, Cr, Pt, Hg
5. In what ways does the spatial distribution of *s* and *p* orbitals differ?
6. Predict the probable oxidation state of an element having electronic configuration $1s^2 2s^2 2p^3$.
7. Write de' Broglie equation.
8. What is normalized and orthogonal wave functions?
9. Write down Schrödinger's wave equation.
10. Write the Pauli's Exclusion Principle.

Descriptive questions:

11. Derive an expression for energy of an electron in the *n*-th orbit of a hydrogen atom using Bohr's theory.
12. Assuming Bohr's model, deduce an expression for radius of *n*-th orbit for the movement of a particle having mass 208 times that of electron and charge equal to that of electron (*e*), around a nucleus of infinite mass and charge +3*e* (particle moves in circular orbit).
13. Find the total number of observable lines when the electron of hydrogen atom is excited gradually to a level of principal quantum number '*n*'.
14. "The principal quantum number, the azimuthal quantum number and the magnetic quantum number respectively signify size, shape and orientation of orbitals of an atom" – comment.
15. "The Aufbau configuration and the actual configuration of elemental copper differ"- write each one and mention the reason for such difference in the actual configuration.
16. State the Pauli's antisymmetry principle, Hund's rule and Aufbau Principle. Utilize these principles and rules in predicting ground state electron distributions of Si, P and S.
17. Which of the following metals requires the radiation of highest frequency to cause the emission of an electron: Na, Mg, K, Ca.
18. What are the limitations of the Bohr's model?
19. Which postulates helped in explaining final line spectrum of hydrogen atom?
20. What is Rydberg constant? Relate Rydberg constants of hydrogen atom and monocationic helium ion.
21. Elemental chromium has four unpaired electrons in its ground atomic state – comment.
22. Explain the basis of arrangement of electrons in 3d orbitals.
23. What would be the wavelength of hydrogen emission spectrum when an electron jumps from *n* = 2 to the ground state? ($h = 6.625 \times 10^{-27}$ erg-s, $m_e = 9.1 \times 10^{-28}$ g, $e = 4.8 \times 10^{-10}$ esu, $c = 3 \times 10^{10}$ cm/s).
24. What is exchange energy? From the concept of exchange pair of electrons how ground state electronic configuration of chromium can be determined?
25. Transform Bohr equation of electron in the H-atom to obtain the frequencies of the spectral lines in the Balmer series.
26. Using Bohr's theory, calculate the ionization energy of the single electron in the Be^{3+} ion in electron volt and the radius of this ion in its ground state.
27. What is significance of ψ and ψ^2 ?
28. Draw the shapes of *s*, *p*, *d* and *f* orbitals.