**B.Sc II SEM Question bank (Paper-II)**

**QUANTUM MECHANICS AND ATOMIC STRUCTURE**

**2 mark questions.**

1. State Heisenberg’s uncertainty principle and write its mathematical form.

2. Write radial probability distribution curve for 1s electron.

3. Explain the significance of wave function.

4. Define the term orbital in an atom.

5. Give any two limitations of Bohr’s theory of atomic structure.

6. Calculate the wavelength of wave associated with electron moving with velocity 4.00x106 ms-1 mass of electron =9.1x10-31 kg.

7. Write Schrödinger wave equation and indicate the terms.

8. Explain wave particle duality.

9. Write the shapes of the orbital when l=0 and l=1

10. Differentiate between orbit and orbital.

11. What are radial probability and angular probability distribution?

12. Calculate the energy associated with Bohr’s 3rd orbit, given the energy of Bohr’s first orbit is -2.17 x10-18 J.

13. Calculate the wavelength of a moving ball of mass 200 g travelling with a velocity 150 m/s.

14. What is quantization of angular momentum of election?

15. Write de-Borogslis equation? Explain the terms.

16. What is the physical significance of 

17. Write the values of quantum numbers for 2s1 electron.

18. Calculate the wave number of the 1st line in the blamer series of H-spectrum. (R=1.096 x107m-1)

19. Write all possible values of l, m, and s for n=3. How many electron can be placed at n=3.

20. Calculate the wave number of the spectral line obtained when an electron jumps from n =4 to n=2

21. Draw the shapes of s and p orbitals.

22. Calculate the wave number of a spectral line obtained when e- jumps from n=4 to n=2.

23. Write the S.W. E for a particle in one dimensional box. Explain the terms involved in it.

**4 Marks questions.**

1. Derive an expression for the energy of the first Bohr orbit in H-atom.

2. Explain the terms i) Hamiltonian operator ii) Laplacean operator.

3. What are quantum numbers? Explain their significance.

4. Give the postulates of quantum mechanics.

5. Set up Schrödinger equation for particle in one dimensional box and solve for the variables.

6. Explain Eigen values and Eigen functions in quantum mechanics.

7. Write any four postulates of Bohr’s atomic model.

8. Define ionization energy. Derive 1st ionization energy for hydrogen atom.

9. Explain the significance of i) Principle quantum numberii) spin quantum number

10. Derive the expression for radius of nth orbit of H-atom

11. What is de-Broglie’s hypothesis? Obtain an expression for the wave length of electron based on this.

12. Derive time independent S.W. E.

 **CHEMICAL BONDING**

**TWO MARKS EACH:**

1. Define lattice energy. What is its effect on the solubility of ionic compounds?
2. Arrange the following in the increasing order of covalency. Justify your answer based on Fazan’s rules: O2-, Cl-, N3-.
3. What is the hybridization of the central atom in the following? Give their geometry: (i)BeCl2 ii) PCl5/SF6,H2O
4. Write Born-Lande equation for the calculation of lattice energy and explain the terms involved.
5. Give the consequence of hydrogen bonding in: (i) DNA (ii) proteins.
6. Define dipole moment. Which of the following is a polar molecule: H2O or CO2 and why? / Mention its unit.
7. Based on the molecular orbital theory, give the electronic configuration of nitrogen/oxygen molecule.
8. Draw the molecular orbital diagram of N2 molecule.
9. What are polar and non-polar molecules?
10. How is bond order related to the bond length? Of the two molecules,oxygen and nitrogen, which is more stable?
11. Oxygen molecule is paramagnetic where as nitrogen molecule is diamagnetic. Explain.
12. Calculate the bond order of He2+/O2- ion.
13. What is intermolecular hydrogen bonding? Give an example/ explain inter molecular hydrogen bonding with an example.
14. Name the type of hybridization involved in SF6 molecule. What is its shape?
15. Distinguish between sigma and pi bonds.
16. Mention the properties of ionic/covalent compounds
17. What is meant by polarizability?
18. Compare the dipole moments of cis and trans isomers of C2H2Cl2 molecule.
19. What are intrinsic semiconductors? Give one example.
20. Give an example each for the compound with: (a) intermolecular hydrogen
21. bond (b) intramolecular hydrogen bond.
22. Ammonia is pyramidal but not tetrahedral why?
23. ortho nitro phenol has lower boiling point than para and meta isomers. Why?
24. Write the structure of BeCl2/PCl5. Indicate the type of hybridization in it.
25. What are n-type semiconductors?
26. HF has higher boiling point than HCl. Why?
27. What is bond order? Give its significance.
28. Account for the conducting property of semiconductors based on the band
29. theory.
30. Why bond angles in ammonia and water molecules are different even though the central atom in both undergo sp3 hybridization?
31. Write the electronic configuration of oxygen molecule. Predict its magnetic property.
32. Define the terms (i) bond length (ii) bond angle.

 **FOUR MARKS EACH:**

1. Discuss the structure of BrF3/NH3 based on VSEPR theory.
2. On the basis of VSEPR theory explain the shape of NH3 molecule.
3. Explain the magnetic behaviour of oxygen molecule with the help of molecular orbital theory/Set up molecular orbital diagram for oxygen molecule. Explain why it is paramagnetic.
4. Based on band theory, explain variation in conduction with temperature in the case of semiconductors.
5. Set up Born-Haber cycle for the formation of NaCl/MgO crystal and hence write the expression for the lattice energy,
6. How lattice energy is determined using Born- Haber cycle.
7. Explain sp3/sp2 hybidization taking SiCl4/BF3 as an example.
8. Explain inter molecular and intra molecular hydrogen bonding with suitable examples.
9. What is lattice energy? calculate the lattice energy of NaCl from the following data:

∆Hf = 410kJmol-1, ∆HS =109kJmol-1, ∆HEA =-355kJmol-1, ½∆HD =121kJmol-1 and

∆HI= 495kJmol-1

1. Based on molecular orbital theory write the electro configuration of oxygen molecule and calculate the bond order.
2. Give Fazan’s rules of polarization.
3. Write a note on (i) hydrogen bonding in biological molecules (ii) polar and non polar molecules.
4. Discuss the hybridization involved in the formation of BF3.