

SECOND SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, MAY 2019

B.Sc. Chemistry

CHE 2B 02—THEORETICAL AND INORGANIC CHEMISTRY—II

Time : Three Hours

Maximum : 80 Marks

Section A

*Answer in one word or sentence.**Answer all questions.*

1. *Hamiltonian operator* H' = _____.
2. Wave functions ψ_1 and ψ_2 is said to be orthogonal functions when _____.
3. A 1s orbital has _____ radial nodes.
4. The electronic configuration of Zn^{2+} is [Ar]_____.
5. Li shows diagonal relationship with _____.
6. What is the state of hybridization of S in SF_6 .
7. H_3O^+ has _____ geometry.
8. What is the dipole moment of CO_2 molecule.
9. What is the bond order of NO molecule.
10. Name a compound that shows intermolecular hydrogen bonding.

(10 × 1 = 10 marks)

Section B

*Answer any ten questions.**Each question carries 2 marks.*

11. Explain the term Linear operator.
12. What is meant by a well behaved wave function ?
13. State and explain Pauli's exclusion principle.
14. Write the designation given to sublevels having (a) $n = 3 ; l = 1$ (b) $n = 4 ; l = 3$.
15. Write the Schrodinger wave equation for hydrogen atom in cartesian co-ordinates.
16. Calculate the effective nuclear charge felt by a 1s electron of nitrogen atom.

17. What are the factors which affect the lattice energy of an ionic compound ?
18. What is meant by polar covalent bond ?
19. PCl_5 is a reactive molecule. Explain.
20. Write the molecular orbital configuration of O_2 molecule and calculate its bond order.
21. Write the resonance structures of nitrate ion.
22. What is electronegativity ? Arrange the following elements in the increasing order of electronegativity. F, Cl, Br, I.

(10 × 2 = 20marks)

Section C

Answer any five questions.

Each question carries 6 marks

23. What are Laplacian and Hermitian operators ? Explain.
24. Calculate the ground state energy of an electron in a 1D box of side 1nm. (mass of electron = 9.1×10^{-31} kg ; $h = 6.626 \times 10^{-34}$ Js. Also calculate the wavelength corresponds to spectral transition between the $n = 1$ and $n = 2$ levels.
25. Explain the terms eigen value and eigen function.
26. Define ionization enthalpy of an element. What are the factors affecting it ?
27. Explain the shape of BCl_3 molecule on the basis of VSEPR theory.
28. Draw the MO energy diagram for CO molecule. Calculate the bond order.
29. Distinguish between bonding and antibonding molecular orbitals.
30. Write any two applications of dipole moment measurement for determining molecular structure. Explain with examples.

(5 × 6 = 30 marks)

Section D

Answer any two questions.

Each question carries 10 marks

31. What are quantum numbers ? Discuss the significance of each quantum number.
32. Explain the terms screening effect and effective nuclear charge. Give the Slaters rule and discuss its application.
33. Illustrate Born-Haber cycle with an example. What are its applications ?
34. What is a hydrogen bond ? What are the effects of hydrogen bonding on the properties of compounds ? Distinguish between inter and intra molecular hydrogen bonds with suitable examples. Describe the unique properties of water on the basis of hydrogen bond.