C 62590 (Pages : 2) Name...

Reg. No

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

B Sc. Chemistry

CHE 2B 02—THEORETICAL AND INORGANIC CHEMISTRY—I1

Time : Three Hours Maximum : 80 Marks

Section A

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

1. *Hamiltonian* operator H' = ————
2. Wave functions y_i and $'V_2$ 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 x 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 is electron of nitrogen atom.

Turn over

17. What are the factors which affect the lattice energy of an ionic compound ?
18. What is meant by polar covalent bond ?
19. $PC1_5$ 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 x 2 = 20mark.$)

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 **lnm.** (mass of electron = 9.1 x 10^{-31} kg ; h = 6.626 x 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 BCI_3 molecule on the basis of VSEPP, theory.
28. Draw the MO energy diagram for CO molecule.Calcula the bond order.
29. Distinguish between bonding and antibonding molecular orbitals.
30. Write any two applications of dipolemoment measurement for determining molecular structure. Explain with examples.

(5 x 6 = 30 marks)

Section D

Answer any **two** *questions.*
Each question carries 10 *marks*

31. What are quantum numbers ? Discuss the significa.nce 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. •

(2 x 10 = 20 marks)