C 82979

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Name...

Reg. No.....................................

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2015

(CUCBCSS–UG)

Core Course

Chemistry

CHE 2B 02—THEORETICAL AND INORGANIC CHEMISTRY—II

Time : Three Hours

Maximum : 80 Marks

Section A (One Word)

Answer **all** *questions.*
Each question carries 1 mark.

1. The quantum mechanical operator for momentum is ———————.

2. If a quantum mechanical operator is to be the Hermitian, then the Eigen value corresponding to that is ———————.

3. In the equation $\psi = \psi_n$ A sin $n\pi x/a$, the value of A can be evaluated by a process called ———————.

4. The element with highest electron affinity is ———————.

5. Ionisation energy of Nitrogen is than that of oxygen because of :

    (i) attraction of electrons by the nucleus.

    (ii) the smaller size of the Nitrogen atom.

    (iii) the extra stability of half filled *p*-orbital

    (iv) higher penetrating effect of electrons in Nitrogen.

6. Carbon tetrachloride has no net dipole moment because of :

    (i) its polar structure.

    (ii) its regular tetrahedral structure.

    (iii) similar size of Carbon and Chlorine atoms.

    (iv) similar electron affinities of Carbon and Chlorine atoms.

7. The unexpectedly high boiling point of H_2O is attributed to ———————.

8. The bond order of He molecule is ———————.

9. Total number of σ and π bonds in ethylene molecule is ———————.

10. Linear combination of atomic orbitals form ———————.

(10 × 1 = 10 marks)

Turn over

Section B (Short Answer)

Answer any ten questions.
Each question carries 2 marks.

11. What are Eigen functions and Eigen values ?

12. What is zero point energy ?

13. Draw the radial probability distribution curves of 2s and 2p orbitals.

14. Explain Octet rule. Give any *two* examples where the rule is violated

15. Write the Born-Lande equation and explain the terms.

16. Calculate the percentage ionic character of C-Cl bond. Electronegativity of C is 2.5 and that pf Cl is 3.0.

17. Explain Mullikan scale of electro negativity.

18. What is modern periodic law ? What is its significance ?

19. Explain the variation of ionisation enthalpy along a period and down a group.

20. Distinguish between intermolecular and intramolecular hydrogen bonding.

21. Give an account of free electron theory of metallic bond.

22. Draw the resonance structures of carbonate ion.

$$(10 \times 2 = 20 \text{ marks})$$

Section C (Paragraph)

Answer any five questions.
Each question carries 6 marks.

23. Sketch the shapes of different *d* orbitals.

24. What are quantum numbers? Discuss the significance of each quantum number.

25. Explain the diagonal relationship of elements in the periodic table with suitable examples.

26. Write Slater rule with its applications.

27. Explain the shapes of NH_3 and H_2O molecules using VSEPR theory.

28. Explain the determination of lattice energy of NaCl crystal using Bom-Haber cycle.

29. Explain the different modes by which vander Waals forces originate.

30. Write the MO configuration of O_2, O_2^+, O_2^{2+} and O_2^{2-} and compare their bond energies.

$$(5 \times 6 = 30 \text{ marks})$$

Section D (Essay)

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

31. Write briefly on :

    (i)   Aufbau principle ;   (ii)   Pauli's exclusion principle ;

    (iii) Hund's rule ;   (iv)   Fajan's rule.

32. Derive the time independent Schrodinger wave equation for particle in one dimensional box.

33. Explain sp^3d, sp^3d^2 and sp^3d^3 hybridisations with suitable examples.

34. With the help of molecular orbital diagrams, calculate the bond order of CO and NO molecules.

$(2 \times 10 = 20$ marks)