

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2010

(C.C.S.S. Programme)

Chemistry – Core Course

CH 2B 03 – THEORETICAL CHEMISTRY

Time : Three Hours

Maximum : 30 Weightage

Section I*Answer all twelve questions.*

- Splitting of spectral lines in the magnetic field is called
 - Stark effect
 - Zeeman effect
 - Magnetic effect
 - Quantum effect
- Which of the following combinations of quantum numbers is allowed?
 - $n = 3, l = 2, m_l = 1, m_s = 0$
 - $n = 3, l = -3, m_l = -2, m_s = -\frac{1}{2}$
 - $n = 2, l = 0, m_l = 0, m_s = -\frac{1}{2}$
 - $n = 3, l = -2, m_l = 1, m_s = 0$
- The bond order of NO molecule is
 - 1.5
 - 2
 - 2.5
 - 3
- The hybridization present in PCl_5 molecule is
 - sp^3d^2
 - sp^3d
 - d^2sp^3
 - sp^3
- If the forbidden band width between a valence band and the conduction band is large, the substance will be _____.
- A positive value of bond order indicates _____.
- The kinetic energy part of Hamiltonian operator A is _____.
- The emission spectrum of hydrogen which occur in the visible region is called _____.
- Write down the expression for radius of the n^{th} Bohr orbit.
- What is a normalized wave function?
- Name the molecular orbital formed by the addition of Ψ_A and Ψ_B .
- What is the hybridization of B in BH_3 molecule?

(12 \times $\frac{1}{4}$ = 3 weightage)**Section II***Short answer type questions. Answer all nine questions.*

- What do you understand by Heisenberg's uncertainty principle?
- How are matter waves different from electromagnetic waves?

Turn over

15. What are radial and angular wave functions?
16. What is a well behaved wave function?
17. Why does He_2^+ exist whereas He_2 does not?
18. What is bond order? Give its mathematical expression.
19. Draw the structure of methane molecule. What type of hybridization is present in it?
20. Beryllium ($Z = 4$) has no unpaired electrons in its ground state. However in all its compounds beryllium shows bivalency. Explain.
21. An electron has a speed of 300m/s accurate upto 0.001%. What is the uncertainty in locating its position? (mass of electron is 9.1×10^{-31} kg)

(9 × 1 = 9 weightage)

Section III

Short paragraph answer questions.

Answer any five questions out of seven.

22. Write a short note on the spectrum of hydrogen atom.
23. What is photoelectric effect?
24. What is an operator? Explain with suitable examples eigen functions and eigen values of an operator?
25. What are quantum numbers? Explain its significance?
26. Compare valance bond theory and molecular orbital theory.
27. With the help of molecular orbital diagrams explain why the bond order in N_2^+ is higher than that in N_2 molecule.
28. Explain metallic bonding on the basis of electron sea model.

(5 × 2 = 10 weightage)

Section IV (Essay Questions)

Answer any two questions out of three.

29. Derive Schrodinger wave equation for particle in 1 dimension box and solve the equation for particle in 3 dimensional box.
30. Discuss an experiment on electron diffraction.
31. Discuss the shapes of the following molecules on the basis of hybridization: BeH_2 , SF_6 and IF_7 .

(2 × 4 = 8 weightage)