PG – 597

I Semester M.Sc. Examination, January 2015
(CBCS)
CHEMISTRY
C – 103 : Physical Chemistry – I

Time : 3 Hours Max. Marks : 70

Instruction *: Answer question no.* ***1*** *and* ***any five*** *of the* ***remaining*** *questions.*

1. Answer **any ten** of the following : **(2×10=20)**
   a) Explain the significance of eigen functions.
   b) Write down the Hamiltonian operator for normal the atom and explain each term.
   c) Define Ladder operators.
   d) Give a comparative account of spin and angular momenta.
   e) Define Pauli-exclusion principle.
   f) List the possible values of J for 4_D and 3_P terms.
   g) What is temperature coefficient ? Explain.
   h) State the steps involved in chain reactions with an example.
   i) Give reasons for inadequacy of conventional techniques to study fast reactions.
   j) Explain autocatalytic reaction with an example.
   k) Show graphically the different types of adsorption isotherms.
   l) How do activators and inhibitors act on enzyme activity ?

2. a) State the postulates of quantum mechanics.
   b) Derive the time independent Schrodinger wave equation.
   c) Show that the function $e^{im\phi}$ is an eigen function of the angular momentum operators $\hat{L}_2$ as well $\hat{L}^2$. Give the respective eigen values. **(3+3+4=10)**

3. a) Formulate the Schrodinger equation for the hydrogen atom and separate into γ, θ and ϕ equations.
   b) Write a note on quantum numbers and their significance. **(5+5=10)**

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4. a) Discuss the primary salt effect on ionic reactions in solution.
   b) Explain the mechanism of pyrolysis of acetaldehyde. **(6+4=10)**

5. a) Discuss the Lock and Key theory in enzyme catalyzed reactions.
   b) Explain the pH dependence on rate of enzyme catalyzed reactions.
   c) Write about the significance of Michaelis-Menten constant. **(4+3+3=10)**

6. a) Briefly discuss the condition of normalization.
   b) Explain quantum mechanical degeneracy.
   c) Write a note on Zeemen effect. **(3+4+3=10)**

7. a) Describe the stopped flow method for the study of fast reactions.
   b) Derive Gibbs adsorption equation and give its significance. **(5+5=10)**

8. a) Give an account of Hinshelwood theory of unimolecular reactions.
   b) When a sample of pure water is subjected to the temperature jump experiment, the relaxation time is 40μ sec at 25° C. Calculate the rate constants for the forward and reverse reactions assuming first order in both directions.
   c) Explain Slater determinants. **(4+3+3=10)**