Reg. No. : ....

Name : ....

Final Year B.Sc. Degree Examination, March 2009
Part III – Group III : CHEMISTRY
Paper – VI : Physical Chemistry – II
(Prior to 2006 Admission)

Time : 3 Hours　　　　　　　　　　　　　　　　　　　　Max. Marks : 60

Instruction : Answer **all** Questions, choosing either **(a)** or **(b)** from **each** question.

SECTION – A

Each question carries **2** marks.

1. a) What are symmetry elements and symmetry operators ? Explain.

   b) Write down Poissoule equation and explain terms in it.

2. a) For the decomposition of an acid the rate constant was found to be 2.45×10^{-5} sec^{-1} and 4.6×10^{-5} sec^{-1} at 20° C and 35°C. Calculate energy of activation.

   b) State and explain steady state approximation.

3. a) A solution absorbs 3000 nm radiation at the rate of 1 watt. What does this correspond to in terms of Einstein per second ?

   b) The intrinsic viscosity of a polymer solution at 25°C is 180 cm^3/gram. Calculate the concentration of polymer solution if relative viscosity is 1.4.

4. a) Which of the following molecules show microwave spectrum ? HCl, HBr, O_2, $CH_3 Cl$?

   b) What are combination and difference bands ? Explain.

5. a) What is isomer shift in ESR ? Explain.

   b) Explain molar refraction and molecular refraction.

6. a) Explain hyperfine splitting with examples.

   b) ^{12}C and ^{16}O do not show NMR spectra. Give reason.

P.T.O.

7. a) Calculate the ionic strength of solution containing 0.01 M of K_2SO_4 and 0.1 M of KCl solution at room temperature.

   b) Define conductance, specific conductance, cell constant and specific resistance.

8. a) Distinguish between colloidal solution and true solution. Give examples for each.

   b) What are gels and emulsions ? Give examples.

9. a) Explain strong and weak acids and bases. Calculate pOH of 0.01 N NaOH solution.

   b) Explain Bronian motion and Tyndall effects.

10. a) A unit cell of b.C.C. space lattice has $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90°$. What crystal system does it belongs to ?

    b) What do you mean by collision number, mean free path and collision frequency of gas molecules ?

SECTION – B

Each question carries **4** marks.

11. a) Derive Bragg's equation. Give the importance of this equation in diffraction studies.

    b) Discuss osmotic pressure method determining molar masses of macromolecules.

12. a) Discuss the kinetics of enzyme catalysed reactions.

    b) Derive expression for Langmuir adsorption isotherm.

13. a) Discuss the effect of isotopic substitution on rotational energy and energy levels.

    b) Write a note on rotational Raman spectra.

14. a) What is chemical shift in NMR spectroscopy ? Give reason for chemical shift.

    b) Discuss how magnetic susceptability data are useful in assigning geometry around metal ions.

15. a) Derive Gibbs-Helmholtz equation for a EMF of a cell.

    b) Ionic conductance of Na^+ and Cl^- ions at infinite dilution are 50.11 and 76.32 cm^2/eq. respectively. Calculate transport number of Na^+ and Cl^- ions.

SECTION – C

Each question carries **10** marks.

16. a) i) If flow time for two liquids A and B through the same capillary is in the ratio of 4 : 5 and densities are 2 : 1 ratio. Calculate ratios of their viscosities.

    ii) Equal masses of polymer molecules with $M_1 = 25000$ amu and $M_2 = 40000$ amu are mixed. Calculate the number average and mass average molecular masses. Find the difference if any. Comment your results.

    iii) Derive the energy expression for microwave spectra of linear diatomic molecules.   **(3+3+4 =10)**

  b) i) Derive Clausius-Mosotti equation. Discuss its applications.

    ii) Write note on Fuel cells.

    iii) Explain the phenomenon of Electrophoresis and its applications.

                                                                   (4+3+3 =10)

17. a) i) Discuss the vibrational energy levels and vibrational spectra of an harmonic oscillator.

    ii) The specific reaction rate constant for the decomposition of N_2O_5 at 25° C and 35°C are 3.46×10^{-5} sec^{-1} and 4.87×10^{-5} sec^{-1}. Calculate energy of activation.

    iii) How Lindemann explained the theory of unimolecular reaction rates ? In what way this theory differs from bimolecular and termolecular reactions.

                                                                 (4+3+3 =10)

  b) i) Draw the ESR spectrum of p-benzosemiquinone radical ion.

    ii) How it is possible to estimate the amount of Cl^- and I^- separately in a mixture by adopting potentiometric titration ?

    iii) Describe the conductivity method for determining solubility of sparingly salts.   **(3+3+4 =10)**

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