M.Sc. Examination, 2017

Semester-IV

Chemistry

Course: CH-1019 (Elective)

(Physical Chemistry)

Time: Three Hours **Full Marks: 40**

Questions are of value as indicated in the margin.

Answer ***any four*** questions.

1. a) What are the possible photophysical processes may occur in the electronic excited state of a molecule. 4
   b) Sketch Jabolnski diagram in this regard in details. 2
   c) Define fluorescence lifetime and fluorescence quantum yield. Is there any relation between these two qualities. 2+0.5
   d) Derive an expression which relate fluorescence intensity and molar excitation coefficient. 1.5

2. a) What is Franck-Codon integral? 1
   b) Discuss environmental effect on absorption and emission spectra in the electronic spectroscopy region. 4
   c) Describe both spectroscopic and thermodynamic method of determination of excited state acidity constant of photoacid. 5

3. a) Mention how, according to free electron gas model, the thermal equilibrium is maintained. 1
   b) Given that for Au, free electron density, $n = 5.9 \times 10^{22} / cm^3$ and resistivity, $\rho = 2.5 \mu\Omega cm$ at 300 K. Calculate the relaxation time of electron at that temperature. 2
   c) Derive the electronic equation of motion in presence of an external static electric field. 4
   d) What is magnetoresistance? How does it depend on the external magnetic field? 1
   e) Define electron and hole conduction. How does one can distinguish between them by experimental measurement? 2

4. a) Show that the reciprocal of simple hexagonal Bravais lattice is also simple hexagonal with different lattice constants rotated through 30^o about the major axis. 4
   b) Define [111] plane of FCC in terms of reciprocal lattice vector and hence calculate the inter-planer distance. 2
   c) Prove that the condition of constructive interference in a crystal diffraction is when the component of incident wave vector (**k**) along the reciprocal lattice vector (**K**) is just half of the length of **K**. 4

5. a) Explain why the experimental value of number-average degree of polymerization are very much lower than calculated value. 2
   b) What is ceiling temperature? 2
   c) What is Flory-Huggins polymer solvent interaction parameter? 2
   d) In GPC Gibbs free energy change ΔG_p^o for permeation is mostly dependent on entropy change – Explain the statement. 2
   e) What is excess Rayleigh ratio? On which factor the value of excess Rayleigh ratio depends upon for static light scattering. 2

6. a) Why Clausius-Musottic equation is applicable for non-polar molecule and not for polar molecule. 2

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b) The molar polarization of a polar molecule varies with temperature where that of a non polar molecules is independent of temperature. Explain why it is so. 2.5

c) How magnetic field strength (H) and magnetic induction (B) related to each other. What are the units of H in Gaussian and SI system? 2

d) How are paramagnetism and diamagnetism explained from the molecular point of view? 2

e) How molar magnetic susceptibility helps to calculate the no. of unpained electron in a molecule of a substance? 1.5

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