M. Sc. Chemistry Examination, 2018

(4th Semester)

Physical Chemistry Special

Paper - XV-P

Time : Two hours   Full Marks : 50

(25 marks for each unit)

Use a separate answerscript for each unit.

UNIT – P- 4151

Answer Question No. 1 and *any two* from the rest

1. Explain briefly the importance of *" radial distribution function"* to understand the structure of liquids. Find out the relation between *"perturbed free energy"* and *"radial distribution function"*. (Consider only first order density function).$1\frac{1}{2}+3\frac{1}{2}$

2. Considering Einstein's model for the evolution of distribution of Brownian particles in space (1-dimension) and time, show that the root mean square displacement of Brownian particles is proportional to the *square root of time*. Explain the *"dynamic equilibrium condition"* for suspended Brownian particles irregularly dispersed in a liquid. For the Brownian system under the condition of dynamic equilibrium, obtain a suitable expression for the experimental verification of *Avogadro Number*.

5+2+3

[Turn over

3. Deduce the Kramers equation for the Brownian motion with describing the significance of various terms appeared in the equation. Show that the equation obeys the Maxwell-Boltzmann distribution under equilibrium condition. Describe the essential postulates of Krmers rate theory for unidirectional chemical process. 4+3+3

4. Evaluate the theoretical basis for the existence of random force to describe the perpetual irregular motion of a Brownian particle of mass (m) = 2.5×10^{-18}kg and diameter (r) = 2.5×10^{-8}m in the medium of viscosity $(\eta) = 0.01$ poise. What is meant by *drift* and *diffusion* terms for the Brownian motion in velocity space ? Find out the expression for *diffusion coefficient* in velocity space for the Brownian particle of certain mass (m) in a medium with damping constant α at temperature T.

4+2+4

UNIT – P- 4152

5. Answer *any five* questions 5×5=25

   a) How does the hydrophobic interaction play an important role in protein structure ? Discuss the role of solvent on the structure of a protein.

   b) How does a nerve impulse generate and what is the mechanism of its propagation ?

   c) Why is sequence of DNA so important in a biological system? What is melting of DNA ? How does melting temperature of DNA vary in presence of salt ?

   d) Discuss the cooperative and non-cooperative binding of ligands to multiple sites of a bio-polymer. How can you explain electrostatic intreaction in multiple equilibrium ?

   e) What is stacking interaction ? On which factors does stacking depend ? Why is heparin more effective than DNA to stack dye molecules ?

   f) What is the machanism of muscle contraction ?

   g) Write notes on -

      i) Dynamic fluid structure of cell membrane.

      ii) Synaptic transmission.