M. Sc. Chemistry Examination, 2017

(4th Semester)

Physical Chemistry Special

Paper - XV-P

Time : Two hours   Full Marks : 50

Use a separate answerscript for each unit.

UNIT – P- 4151

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

1. a) Write the expression of configuration integral in terms of average of the perturbed potential. Show that the amount of perturbed free energy of a system is equal to the magnitude of perturbed potential (consider only first order density function).   1+3

   b) What is pair potential ? Derive the following Van-der Waals equation of state mentioning various approximations by considering the statistical mechanical perturbation theory.

   $$\frac{p}{k_B T} = \frac{\rho}{1-b\rho} - \frac{a\rho^2}{k_B T}$$

   (The terms having their usual meaning)   1+4

2. State and explain the essential postulates for Einstein's model for Brownian motion. According to this model show that the spreading of Brownian particle distribution with time occurs by following a Gaussian curve and further show that the square of the mean displacement is proportional to time.

2+4+2

3. Deduce the expression for the change of particle density with time in velocity space under no external force field for the Brownian particles and hence calculate the value of diffusion coefficient with stating the significance of various terms appeared in those expressions. 4+4

4. Discuss the salient feature and essential consideration in Langevin equation for describing the Brownian motion of a suspended particle in liquids. From this description, show that the random force is counter balanced to a same extent by the viscous force. 3+5

UNIT – P- 4152

Answer *any five* questions   5×5

5. Discuss the causes and effects of protein denaturation. What is the role of molecular chaperone when a protein gets denatured ?

6. Describe with illustration the double helix structure of DNA. Why does melting temperature of DNA increase in presence of salt ?

7. What is active transport ? Which macromolecule is considered as pumping device for active transport ? Give the thermodynamic scheme for active transport showing the exchange cycle and chemical cycle.

8. Discuss briefly the mechanism of synaptic nerve conduction. Which one of the following is the result of total paralysis ?

   i)   Na-channel is blocked

   ii) K-channel is blocked

       Explain why.

9. How can you determine change in enthalpy (ΔH), starting from the plot of the fractional saturation of sites (ν) vs. logC in multiple equilibrium ?

10. How does muscle contraction start ? What is the role of Ca^{2+} ions in muscle contraction ?