11. What do you mean by cooperative interaction in multiple equilibrium ? How can you identify whether an interaction is cooperative ?

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M. Sc. Chemistry Examination, 2019

(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

1. a) Write the expression of configuration integral in terms of average perturbed potential. Show that the amount of perturbed free energy of a system is equal to such potential (consider only first order density function).   4

   b) What is pair potential ? Derive the following Van-der Waals equation of state with 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)   4

2. Derive an expression for "mean squire displacement" based on Langevin description of Brownian particle and hence show that the mean square displacement does not depend on

solvent viscosity at small time scale, but depends for large time scale.

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 with stating the significance of various terms appeared in those expressions and hence calculate the value of diffusion coefficient.   4+3

4. Based on the propositions of Kramers' rate theory for activated process, deduce the reaction rate constant for equilibrium distribution of particles.   4

UNIT – P- 4152

Answer *any five* questions   5×5=25

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

6. 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.

7. Discuss briefly the mechanism of synaptic nerve conduction. When total paralysis is the result –

    i) Na-channel is blocked

    or

    ii) K-channel is blocked ? Explain why.

8. Describe with illustration the double helix structure of DNA. Why melting temperature of DNA increases in presence of salt ?

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

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