[This question paper contains 7 printed pages]

Your Roll No. : .....

Sl. No. of Q. Paper : **9903** **I**

Unique Paper Code : 2173010042

Name of the Paper : DSE/Interfaces, Macromolecules and Biophysical Chemistry

Name of the Course : **B.Sc. (H) Chemistry**

Semester : VII

Time : 2 Hours ***Maximum Marks : 60***

Instructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Answer any **4** (four) questions.

(c) **All** questions carry equal marks.

1. Attempt any **three** of the following : 5×3=15

(a) Why are surfactants known as surface-active agents ? Discuss micellization and factors that influence the micellization process.

(b) How do we calculate the thermodynamics parameters of micellization of surfactant through conductivity measurements ?

P.T.O.

(c) What is packing parameters ? How does packing parameter defines the shape of micelles ?

(d) How does critical micelle concentration (CMC) affect :

(i) Surface tension and

(ii) Solubilization

2. Attempt any **three** of the following : 5×3=15

(a) Differentiate between :

(i) Adsorbent and adsorbate.

(ii) Physisorption and chemisorption.

(iii) Langmuir adsorption isotherm and Brunauer-Emmett-Teller (BET) adsorption isotherm.

(b) Explain the determination of Surface area of surfactant molecule by Gibb's adsorption isotherm.

(c) What is capillary electrophoresis ? State its advantages over traditional electrophoresis. Discuss how does isoelectric point help in separation of mixture of proteins ?

(d) What is chromatography ? Discuss basic principles of ion exchange chromatography and size exclusion chromatography for separation of biological samples like amino acids and protein.

3. Attempt any **three** of the following : 5×3=15

(a) Differentiate between amorphous and crystalline polymers ? How does :

(i) Polymer's Chain flexibility and

(ii) molecular forces affects glass transition temperature (T_g).

(b) Discuss the following polymerization reaction :

(i) Addition polymerization of polypropylene (PP) and

(ii) Condensation polymerization of polyethylene terephthalate (PET).

(c) What are factors that influences polymer crystallinity ? Discuss how the polymers' crystallinity affects its properties.

(d) A polydisperse sample of polyethylene is prepared by mixing three monodispersed samples in the following propertions.

2 g 10,000 Da

2 g 15,000 Da

1 g 20,000 Da.

Using this information calculate the number average molecular weight, $\overline{M}_n$, weight average molecular weight $\overline{M}_w$ and the polydispersity Index (PDI) of the polymer.

4. Attempt any **three** of the following : 5×3=15

(a) Discuss electronic Circular Dichroism (ECD) and vibration Circular Dichroism (VCD) ? State the advantage of VCD over ECD and how VCD help in analysis of biological samples like Deoxyribonucleic acid (DNA) and Protein.

(b) An intrinsic viscosity (η_i) of polymeric solutions of polyvinyl alcohol (PVA) through viscometry method was found to be 200 cm^2/gm, the Mark-Houwink constant K is 3.6×10^{-2} and empirical constant (a) is 0.64. What will be its viscosity average molecular weight $(\overline{M}_v)$?

(c) A surfactant molecule at critical micelle concentration (CMC) forms a micelle whose diameter is measures as 8 nm and the area of head group of surfactant molecule is 0.3 nm^2. Calculate the number of surfactants forming the micelle.

(d) What is adsorption isotherm ? Discuss Type II, Type IV BET adsorption isotherm.

5. Attempt any **three** of the following : 5×3=15

(a) What are enzymes ? Define enzymes catalysis and give one suitable example of it ? For an enzyme catalytic reaction prove that at low concentration the rate of reaction is first order reaction.

(b) What is specificity constant in enzyme catalytic reaction and state its significant ? How will you determine Michaelis constant (K_m) from Lineweaver-Burk plot ?

(c) How will you determine the isoelectric point of an amino acid using pH metric titration ?

(d) What is Hill coefficient (n) and Hill plot for cooperative binding of ligand to macromolecules ? Discuss the significant of Hill coefficient (n) ?

6 Attempt any **three** of the following : 5×3=15

(a) What is conformation of protein ? Discuss the primary, secondary, tertiary and quaternary structure of protein.

(b) For a simple protein to ligand binding interaction equilibrium,

$P + L \rightleftharpoons PL$

Proved that $K_{eq} = K_A = \frac{1}{K_D}$ Where, K_A and K_D are the association and dissociation constant respectively and K_{eq} is the equilibrium constant.

(c) Discuss the principle involved in the separation of serum protein using electrophoresis ?

(d) State four major differences between Absorption and Fluorescence spectroscopy ? Discuss the application of Absorption and Fluorescence spectroscopy in analyzing biological samples.

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