M. Sc. Chemistry Examination, 2023

(3rd Semester, CBCS)

Paper: IX-IP-1

Time : Two Hours Full Marks : 40

(20 marks for each unit)

Use a separate answer script for each unit.

UNIT - 309-I-1

1. Answer ***all*** questions : 2x5
   (a) Distinguish between the fundamental ring and the shortest circuit in a structure.
   (b) Compare between MoS_2 and $Mg(OH)_2$ network.
   (c) Draw the layer sequences (perpendicular to z axis) of a cristobalite structure.
   (d) Mention the differences between NaCl and NiAs structures.
   (e) Write the coordinates of atoms in A and B type cubic pervoskite structure (ABX_3).

2. (a) How has SHAB principle been exploited in the design of coordination polymers? 2
   (b) What will be the general structural transformation in metal organic framework if the ligand to metal ratio is increased from 1:1 to 1.5:1? 2

(c) Write one advantage and one disadvantage of using tetrafluoroborate as a counter anion, in the synthesis of coordination polymer. 1

3. (a) What is a functional porous material? How does if differ from supramolecular porous material? 1+1

(b) Discuss the methods of characterizations of permanent porosity in functional porous materials. 3

UNIT - 309 - P - 1

4. Answer any ***four*** questions :

(a) How does Flory-Huggins theory take into account the difference in size between solvent and polymer molecules in the derivation of entropy of mixing? Mention two limitations of Flory-Huggins theory. 3+2

(b) Describe briefly the method of obtaining the average molecular weight of a polymer by vapour pressure osmometry. What kind of molecular weight is it? 4+1

(c) Derive the expression of mass fraction (W_k) of polymer molecules of k-mer in solution in terms of probability (P) of linkage formation and give representative plot of Wk versus k for different values of P. 3+2

(d) (i) On which factors does the Flory-Huggins polymer-solvent interaction parameter (χ) depend?

(ii) Light Scattering measurement were carried out for a protein in 0.1M KI at pH 4.8 using light of wavelength of 546 nm. Following data were obtained:

$10^3 C/gcm^{-3}$	0.936	0.902
$10^4 \tau/cm^{-1}$	2.88	5.75

Give refractive index (n) of solution = 1.3342; specific refractive index increment (dn/dC) = 0.168 $g^{-1}cm^3$. Find the weight average molecular weight. τ =light scattering calibration constant. 2+3

(e) What is Donnan membrane potential? For a macromolecule with net charge of –10, at a concentration of 1 mM dialysed against 0.1M NaCl. Calculate the ratio of Na^+ ions in side-1 (with macromolecule) and side-2. Find the value of Donnan membrane potential at 25^0C. 2+2+1