

(4)

- (e) The radial distribution function $\omega(r)$ of end to end distance r for an isolated flexible polymer chain is given by

$$\omega(r) = 4\pi \left[\frac{\beta}{\sqrt{\pi}} \right]^3 r^2 \exp(-\beta^2 r^2), \quad \text{where}$$

$\beta = \left[\frac{3}{2nl^2} \right]^{1/2}$ in which n is the number of links of length l forming the chain. Find root mean square end to end distance in terms of n and l . On which factors do the Mark Houwink parameters depend? 4+1=5

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Ex/SC/CHEM/PG/CORE/TH/IX-IP/2025

M. SC. CHEMISTRY EXAMINATION, 2025

(3rd Semester, CBCS)

CHEMISTRY (CORE)

PAPER : IX-IP-1

[Inorganic Chemistry (I-1 + Physical Chemistry (P-1))]

Time : Two Hours

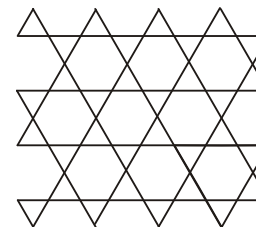
Full Marks : 40

(20 marks for each Unit)

Use a separate Answer Script for each Unit.

UNIT—309-I1

1. Answer **all** questions. 2×5=10
- (a) Describe the structure of LaGaO_3 and comment on the coordination number of the two metal ions.
- (b) All the fundamental rings are the shortest circuits but all the shortest circuits are not fundamental rings in network structure. Explain with examples.
- (c) Determine the Schläfli symbol and Vertex of symbol of Kagome Lattice (show below).



(2)

- (d) Compare the network structure of $\text{CdI}_2[(4^6.6^6.8^3)(4^3)_2]$ and $\text{MoS}_2[4^3.6^{12})(4^3)_2]$.
- (e) Write down the coordinates of silicon atoms in β -cristobalite structure and show their positions (only Si) by drawing layer sequences.

2. Answer **all** questions. 1×5=5

- (a) What do you mean by flexible ligand?
- (b) What will be the expected general structural transformation coordination polymers, if the ligand to metal ratio is increased from 1 : 1 to 2 : 1?
- (c) Write one advantage and one disadvantage of using perchlorate as a counter anion in the synthesis of coordination polymer.
- (d) What are the common techniques available for the characterization of porous coordination polymers?
- (e) What could be the expected outcomes if any metal organic framework is synthesized in non-polar solvents?

3. (a) What is third generation porous material? How does it differ from second-generation porous material? Name two unique applications of third generation porous material. 1+1+1=3

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[Continued]

(3)

- (b) How can the length of the linkers be able to control the overall structure in coordination polymers? 2

UNIT—309-P1

4. Answer *any four* questions. 5×4=20

- (a) How does Flory-Huggins theory take into account difference in size between solvent and polymer molecules in the derivation of entropy of mixing? On which factors does the Flory-Huggins polymer-solvent interaction parameter (χ) depend? 4+1=5
- (b) What is Donnan membrane equilibrium? For a macromolecule with net charge of 5, at a concentration of 10 mM dialyzed against 0.5 M NaCl. Calculate the ratio of Cl^- ions in side-1 (with macromolecule) and side-2. Find the value of Donnan membrane potential at 27°C. 2+2+1=5
- (c) Derive the expression for mass fraction of k -mer (w_k) in a solution of polymer in terms of k and probability (P) of linkage formation. Also give a representative plot of w_k versus k for two different values of P (P_1 and P_2 , where $P_1 > P_2$). 3+2=5
- (d) How can molar mass, second virial coefficient and radius of gyration molecules of a sample of polymer be determined using Zimm plot? 5

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[Turn Over]