

M. Sc. CHEMISTRY EXAMINATION, 2023

(3rd Semester, CBCS)

PAPER: IX-IP-2

Time : Two Hours

Full Marks : 40

(20 marks for each unit)

Use a separate answer script for each unit.

UNIT - 309-I-2

Answer any *four* questions. $2\frac{1}{2} \times 4$

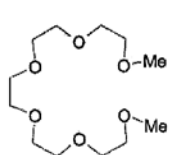
1. (i) Using electronic configuration of Sm^{3+} find out the J-J coupled states and calculate the magnetic moment. Explain, if there is any difference with experimental magnetic moment, 1.55 BM.
- (ii) What are the differences of the Absorption spectra of d-block transition metals and Ln^{3+} complexes? Why do some of the spectra of Ln^{3+} spectra show unusual broadening?
- (iii) Do you observe any difference in the ^1H NMR spectrum of 1-hexanol before and after addition of $\text{Eu}(\text{acac})_3$? Justify your answer.
- (iv) What are the problems in the separation of lanthanide from one another and how does one overcome the problem?

[2]

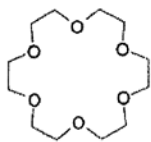
- (v) Explain the role of Nd-YAG in LASER generation in NIR region.
- (vi) Describe the structure and metal-metal bond order in $[\text{Mo}_6\text{Cl}_8]$, $[\text{Nb}_6\text{Cl}_{12}]^{2+}$, $[\text{Mo}_6\text{S}_8]^{3-}$ and $[\text{Pt}_6\text{Cl}_{12}]$.

2. Answer any **four** questions : 2¹/₂x4

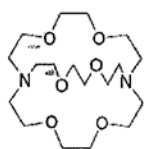
- (a) Edge-to-face $\pi - \pi$ interactions are responsible for the characteristic herringbone packing in the crystal structures of benzene. Are these interactions attractive? Explain in detail.
- (b) Define hydrogen bond. Write down some characteristics of hydrogen bond.
- (c) Rationalize the observed binding constant value ($\log K$) of K^+ ion in methanol at 25⁰C with the following hosts.



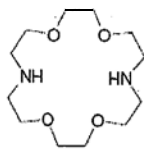
$\log K$: 2.3



6.08



10.0



2.04

- (d) Discuss, with suitable example, the 'allosteric effect' for the binding of two different metal ions to a particular host.
- (e) What do you mean by template effect? How does thermodynamic template effect differ from kinetic template effect? Give examples.

[3]

- (f) Define self-assembly. Briefly discuss various classes of self-assembly.

UNIT - 309-P-2

3. Answer any **five** questions : 5x4=20

- (a) Chemical reactivity of carbon nanotubes (CNT) is directly related to the curvature of CNT surface – Why? Explain anomalous melting point for nanosized particles with an example.
- (b) Metal to nonmetal transitions occur for nanosized metal particles – explain why. When can an organic molecule conduct electricity?
- (c) What are nanocomposites? What are the major types of nanocomposites?
- (d) How are the surface of nanoparticles characterized by AFM technique? What are the advantages of using SEM over TEM?
- (e) Explain the role of stabilizer during the synthesis of nanoparticles. State the types of stabilization of nanostructure against aggregation.
- (f) Increase in magnetization of Fe_3O_4 nanoparticles is observed with decrease in size – Explain.
- (g) What are the differences between thermotropic and lyotropic liquid crystals? Smectic state is more solid like than nematic – Explain.