

Ex/SC/CHEM/PG/CORE/TH/IX-IP-2/2023(S)

**M. SC. CHEMISTRY (SPECIAL SUPPLEMENTARY)**

**EXAMINATION, 2023**

(3rd Semester)

**PAPER: IX-IP-2**

**[INORGANIC CHEMISTRY (I2)+PHYSICAL CHEMISTRY (P2)]**

Time : Two Hours

Full Marks : 40

(20 marks for each Unit)

Use a separate answer script for each Unit.

**UNIT – 309-I-2**

1. a) Using relativistic principle explain 'Lanthanide Contraction' and give two examples of applications of this effect. 3
- b) Calculate the magnetic moment ( $\mu$ ) of  $\text{Eu}^{3+}$  ( $4f^6$ ). Compare with the experimental value, 3.55 BM. Explain difference, if any. 5
- c) Account for the superconductivity of  $\text{YBa}_2\text{Cu}_2\text{O}_7$ . 2

OR

2. a) Explain the weak transition probabilities in the lanthanide compounds and account for the origin of line like spectral band. "Some of the transitions are exceptionally intense and broad." Explain this 'abnormality'. 5
- b) Write a short note on the use of  $\text{Gd}^{3+}$  complexes in the Magnetic Resonance Imaging (MRI) technique. 2.5

[ Turn over

[ 2 ]

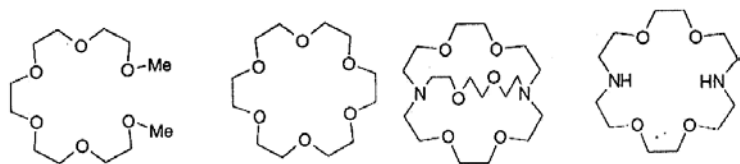
c) Write about the chemistry in 'Nuclear Waste Processing' or 'Lanthanide Shift Reagents'. 2.5

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

a) Define hydrogen bond. Write down some characteristics of a hydrogen bond.

b) Make brief explanatory note on preorganisation and complementarity.

c) The logarithms of the  $K^+$  binding constants ( $M^{-1}$ , MeOH, 25°C) for four hosts are shown below. Explain this large variation.



log  $K$ : 23

6.08

10.0

2.04

d) How are macrocyclic ligands synthesized in the absence of suitable templates? Discuss.

e) What are the main challenges in designing of hosts for anions? How can a host for cation be changed to a host for anion? Give suitable example.

f) How are crown ethers synthesized? How do crown ethers differ from podands in metal ion binding?

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### UNIT – 309-P-2

4. Answer **any five** questions.  $5 \times 4$

a) Why does activity of a material changes when its size is changed from bulk to nano-dimension? On what factors does reactivity of carbon nanotubes depend?

b) Metal to nonmetal transitions occur for nano-sized metal particles – explain why. When can an organic molecule conduct electricity?

c) What are nanocomposites? What does make polymer nanocomposites unique?

d) Define surface plasmon resonance. On what factors do the position of surface plasmon resonance band depend?

e) State and explain the types of stabilization of nanostructure against aggregation. What is the advantages of using SEM over TEM?

f) What are the differences between thermotropic and lyotropic liquid crystals? Smectic state is more solid like than nematic – Explain.