

Total number of printed pages-6

14 (CHM-4) 407

2022

CHEMISTRY

Paper : CH-407

(Supramolecular Chemistry)

Full Marks : 80

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer Q. No. 1 and **any two** from Q. No. 2-4.

1. How do you define "supermolecules" in the context "Supramolecular Chemistry" ? Identify the important types of interaction that characterise supermolecules. 1+3=4
2. What do you mean by non-covalent interactions ? Discuss about various non-covalent interactions present in a supramolecular system. 2+4=6

Contd.

3. What is preorganization ? Explain why Cryptand system has higher binding affinity towards metal cation compared to its Crown analogue ? 2+4=6

4. Define hydrogen bond using a suitable example. Discuss the hydrogen bond interactions present between the nitrogenous bases in DNA double helix. 3+3=6

5. Answer **any three** questions : 5×3=15

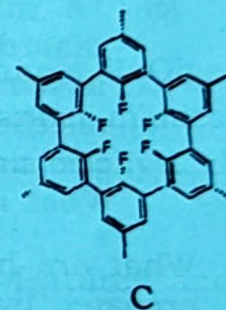
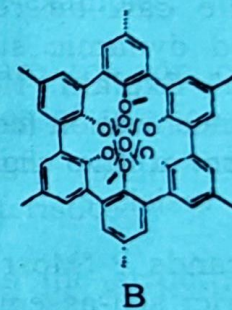
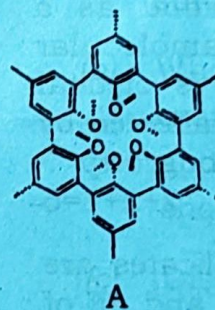
(a) Discuss the synthesis of N-pivot and C-pivot lariat ethers. What do you mean by Bibrachial Lariat Ethers ?

(b) Discuss Pedersen's first synthesis of dibenzo [18] crown-6 showing the reaction scheme. What was the role of the impurity, catechol present in the reaction mixture ?

(c) What do you mean by α , β and γ -cyclodextrin ? Discuss the synthesis and two industrial applications of cyclodextrin.

(d) Discuss about the possible conformation of *p*-tert-butylcalix [4] arene. Explain the reason behind the statement "During cation binding Li^+/Na^+ binds in the lower rim whereas K^+/Ag^+ binds in the upper rim of calixarene host" with a pictorial representation.

6. The Li^+ binding ability of the listed Spherands are $A > B$; whereas Spherand C does not bind any cation. Explain with appropriate justification. 2



7. Answer **any two** of the following : 5×2=10

(a) How can you synthesize rotaxanes via threading ? Explain with an example.

2+3=5

(b) What are molecular graphs ?

Name the following :

1+4=5



(c) "A micelle can be regarded as a disordered dynamic supramolecular assembly." Explain. How is critical micelle concentration (cmc) affected by the nature of the organic group ? What is a vesicle ?

2+2+1=5

8. What are helicands ? "Most helicates are prepared by strict self-assembly and all of the helix-forming information must be pre-programmed into the system. This may be achieved by either metal-imposed constraints or ligand-imposed constraints." Briefly discuss, giving suitable examples, what you understand by metal-imposed constraints and ligand-imposed constraints.

1+3=4

Or

What do you mean by topological connection? What are topological isomers ? Explain with proper examples.

2+2=4

9. Answer **any three** of the following questions :

5×3=15

- Suggest reasons why the cyclodextrins have been commonly used as artificial catalysts ? Comment on their application as enzyme mimics with suitable examples.
- What are the ion channels ? Give examples of *two* ion channel mimics and briefly explain their major physical characteristics.
- Discuss the structural features and catalytic mechanisms of zinc containing enzyme models of *β -lactamase* and *alcohol dehydrogenase*.
- Define the following terms with suitable examples : (i) Speculative Models, and (ii) Corroborative Models.

10. Answer **any three** of the following questions:

6×3=18

(a) What does the term molecular machine refer to ? How will you distinguish a molecular machine from a large molecular system ? 2+4=6

(b) Discuss the mechanisms involved in electron transfer and energy transfer in a molecular machine. Write briefly about the application of FRET. 4+2=6

(c) (i) What are the electronic transitions involved in octahedral transition metal complex ? Discuss briefly with suitable diagram. 4

(ii) Why bipyridine type ligands are suitable to construct a molecular machine ? 2

(d) What is supramolecular semiochemistry? Write briefly about photophysical sensing and imaging. 3+3=6
