Total number of printed pages–6

14 (CHM–4) 407

2021

CHEMISTRY

Paper : CH–407

(Supramolecular Chemistry)

Full Marks : 80

Time : Three hours

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

1. What do you mean by a "host-guest complex" ? How is it different from a clathrate ? Discuss using pictorial diagrams. 5

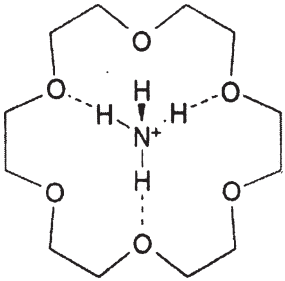
2. Discuss about the Lock and Key principle. How is it different from the induced fit model ? Explain using pictorial diagram. 5

3. Answer ***any five*** of the following : 5×5=25

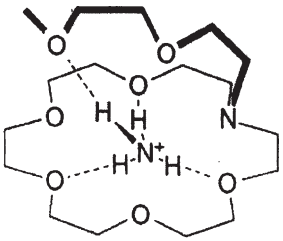
   (a) What do you mean by preorganization ? Discuss the importance of preorganization in supramolecular guest binding using a suitable example of *any* host molecule.

Contd.

(b) The NH_4^+ cation binding affinity of the following host molecules are (***log K*** represents binding constant value)—



log K= 4·35



log K = 4·75

Explain the higher binding constant value of the lariat ether compared to [18]crown-6 with appropriate justification.

(c) Arrange the following hosts in the increasing order based on the binding constant towards K^+ ion and also draw the structures of *any of two* host examples.

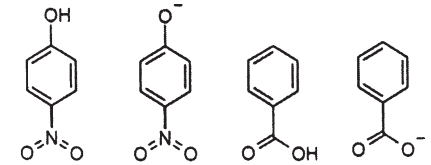
(i) [2.2.2.] cryptand,

(ii) Diaza[18]crown-6

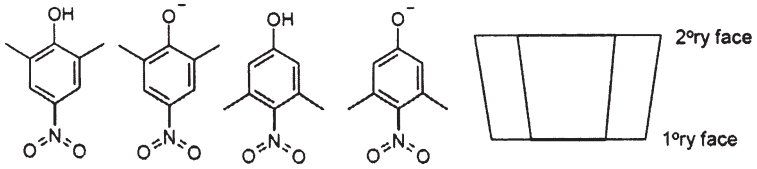
(iii) Lariate ether

(iv) Podand

(d) Binding constant data of a few guest molecules with α-cyclodextrin in water are given below :



log K_1 2.32 3.36 2.88 1.05



log K_1 1.78 3.07 ~ 0 ~ 0

Based on the value of binding constant explain —

(i) Why the binding constant value of 3,5-dimethyl-4-nitrophenolate ion is 0 whereas 2,6-dimethyl-4-nitrophenolate ion is 3.07. ?

(ii) Why benzoic acid have higher binding constant compared to benzoate anion ?

(e) Discuss about the synthesis of carcerand host considering a suitable example. Write a short note on the binding nature of carcerand host.

(f) What do you mean by supramolecular chiral recognition ? How can it be achieved for chiral guest molecule using a suitable host system ?

4. Answer ***any four*** of the following : 5×4=20

(a) What are the basic features of supramolecular catalysis that differentiate it from molecular catalysis ?

(b) What are the major criteria that need to be taken into consideration while designing the artificial ion channel mimics ?

(c) Define the following terms with suitable examples :

(i) Structural Model,

(ii) Functional Model.

(d) Give an example of abiotic supra-molecular catalysis that utilizes host-guest type chemistry. Explain the basic features of Collman's model of Cytochrome *c* Oxidase.

(e) Discuss the application of cyclodextrins as adenylatecyclase and phosphodiesterase enzyme mimics.

(f) What are the corands ? Explain their advantageous structural features. Discuss the role of corandas ATPase mimic.

5. Answer ***any five*** of the following : 5×5=25

(a) Define molecular devices. What are basic criteria of a supramolecular system to work as molecular device ?

(b) Discuss the photo-physical and photochemical processes that may occur in a molecular device.

(c) What kind of ligands are suitable to construct a molecular device ? Explain with a suitable example.

(d) Write a short note on molecular wires.

(e) Explain the coulombic and electron exchange energy transfer mechanisms in a molecular device with a suitable diagram.

(f) What are the different parts of molecular sensor ? What are the criteria for construction of useful sensors ?