



Registration number:

Date and session:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27
M.Sc. CHEMISTRY - IV SEMESTER
SEMESTER EXAMINATION: APRIL 2023
(Examination conducted in March 2023)
CHDE0221: CHEMISTRY OF MATERIALS

Time: 2½ hrs

Max Marks: 70

This question paper contains **two** printed pages and **three** parts

PART A

Answer any SIX of the following

[6x2=12]

1. What are conducting polymers? Give an example.
2. Give an example each for 1:1 and 2:1 clay.
3. What is the role of capping agents in the synthesis of nanoparticles? Give an example of a capping agent.
4. Mention two ways by which nanoparticles can enter the human body.
5. With the help of a diagram explain entropy change with temperature in a superconductor.
6. Give any two applications of fullerenes.
7. Auger spectrum of sulphur in $\text{Na}_2\text{S}_2\text{O}_3$ exhibited two peaks. How do you account for it?
8. Explain polytypism with a suitable example.

PART B

Answer any FOUR of the following questions

[4x12=48]

9. a) What is the composition of opals and inverse opals? Give a method of synthesis of inverse opals.
b) With the help of Frolich diagram explain the momentum of a cooper pair.
c) What is EXAFS? Give an application of it. Draw the diagram for X-ray absorption edge structure arising from the bound state transition. (4+4+4)
10. a) Explain how Raman spectroscopy can be used to characterize carbon nanomaterials.
b) Discuss the applications of nanomaterials in (i) energy storage (ii) environmental amelioration.
c) Write a short note on thermoelectric materials. (4+4+4)
11. a) Give a method of synthesis of metal organic framework (MOF) materials? Name two linkers used in MOF.
b) With the help of diagram explain primary, secondary and tertiary building units in zeolites. How are Lewis and Bronsted acid sites created in zeolites?
c) What are the three imaging modes of AFM? Give an advantage for each. (4+4+4)
12. a) Explain with an example the synthesis of a metal matrix composite.
b) Discuss how single walled carbon nanotubes are classified.

- c) How can X-ray diffraction be used to characterize nanomaterials? (4+4+4)
13. a) With the help of a diagram explain the working of transmission electron microscope (TEM).
 b) What are layered chalcogenides? Give a method of synthesis of MoS₂.
 c) Give BET equation and explain the terms? How is porosity determined by BJH technique?
 d) What are high temperature superconductors? Give two examples and applications of it. (3+3+3+3)
14. a) Discuss with an example the synthesis of thin films using electrochemical deposition methods.
 b) How are nanocomposites classified based on the matrix? Give examples.
 c) Explain the GMR effect with an example. (6+3+3)

PART C

Answer any TWO of the following questions

[2x5=10]

15. a) The C (1s) ESCA spectrum of ethyl trifluoroacetate (CF₃COOCH₂CH₃) shows four peaks. How do you account for it?
 b) Which of the following has higher chemical shift value for Cl (2p) in ESCA? Give a reason. (i) HClO₂ (ii) HClO₃ (3+2)
16. a) At 0 °C and 1 atmosphere pressure the volume of nitrogen gas required to form a monolayer on a sample of zeolite is 260 cm³g⁻¹ of zeolite. Calculate the surface area per gram of zeolite. Area of cross section of N₂ molecule is 0.160(nm)².
 Avogadro number = 6.023X10²³.
 b) What is the role of the following nanomaterial in the nanocomposites listed below?
 (i) Carbon onions in carbon onion -LiCoO₂ electrodes (ii) CNT in polymer-CNT automobile parts. (3+2)
17. a) Arrange the following particle sizes of ZnO in increasing order of band gap and give a reason.
 (i) 4nm (ii) 50 nm (iii) 600 nm (iv) 8000 nm
 b) Two samples of CdSe, A and B in solution, fluoresce to give blue and red emission respectively. Which of these particles is of smaller size? Why? (3+2)