



Date:

Registration number:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27
M.Sc. CHEMISTRY - IV SEMESTER
SEMESTER EXAMINATION: APRIL 2022
(Examination conducted in July 2022)
CHDE0517 – CHEMISTRY OF MATERIALS

Time- 2½ hrs

Max Marks: 70

This question paper contains __2_ printed pages and three parts

Part A

Answer any SIX of the following

[6x2=12]

1. Give any two advantages of nanocomposites.
2. State the basic principle of PIXE.
3. Write the role of capping agents in the synthesis of nanoparticles.
4. What are polymer-ceramic nanocomposites? Give an example.
5. Give two biological applications of semiconductor nanoparticles.
6. Name a surfactant used in the synthesis of MCM. What is its role in the synthesis?
7. Give an example of nanomaterials used in (a) supercapacitors (b) fuel cells.
8. Mention any two methods by which nanomaterials get ingested in to the body.

PART-B

Answer any FOUR of the following questions

[4x12=48]

9. a) What is hydrothermal synthesis? Discuss how zeolites are synthesized by this method.
b) With respect to heteropoly acids, answer the following:
i) Give the name and molecular formulae of any two heteropoly acids.
ii) Write the structure of any one heteropoly acid.
c) Give any two methods of synthesis of bulk materials. (4+4+4)
10. a) What is the importance of surface modification? Give an example.
b) How is surface area of a material determined by BET technique?
c) Discuss how nanoparticles are synthesized by (a) combustion method (b) sol-gel method. (4+4+4)
11. a) What is graphene? Give one method of preparing graphene from graphite oxide.
b) Differentiate between scanning electron microscopy (SEM) and transmission electron microscopy (TEM).
c) Write a note on the synthesis and applications of polymer-inorganic nanocomposites. (4+4+4)
12. a) How are nanomaterials used in photocatalysis? Explain with an example.

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- b) List three methods of preparing thin films. Explain one method with an example.
 c) How are nanomaterials characterized using powder X-ray diffraction? (4+4+4)
13. a) What are the different types of functionalization of carbon nanotubes?
 b) What is incipient wetness impregnation method of preparation of catalytic materials? Give an example.
 c) Discuss the preparation and any one applications of ceramic nanocomposites. (4+4+4)
14. a) Cationic clays like aluminosilicates and anionic clays like layered double hydroxides are complementary to each other. Give reasons for the above statement by comparing the structures of the two classes of solids.
 b) How can core-shell nanoparticles be synthesized by inverse micelle method?
 c) What are the three primary imaging modes of AFM? Which mode has the highest resolution? (4+4+4)

PART-C

Answer any TWO of the following questions

[2x5=10]

15. a) Arrange the following particles in increasing order of band gap and give reasons.
 (i) 2 nm ZnO (ii) 6 nm ZnO (iii) 600 nm ZnO (iv) 6000 nm ZnO
 b) What is the role of the specified nanomaterial in the following composites?
 (i) reduced graphene oxide in rgo-VO₂ composites for Lithium-ion battery applications.
 (ii) CNT in CNT-polymer composite in automobile body parts. (3+2)
16. a) Compare vanadium core photoelectron spectra of VO₂ and V₂O₅. Which one has higher kinetic energy?
 b) Name an organic linker and a metal source in metal organic frameworks (MOF). (3+2)
17. a) Suggest a method to synthesize iron oxide nanoparticles soluble in water. Give the starting compound, reaction type and conditions.
 b) The as synthesized polyacetylene is a poor conductor. How does one improve its conductivity? (3+2)