



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech/CHE/SEM-8/CHE-804A/2013

2013

NANOTECHNOLOGY

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :
 $10 \times 1 = 10$

- i) Silver nanoparticles are used in
 - a) Car paints
 - b) Medicinal bandages
 - c) Sporting goods
 - d) Sunscreens.
- ii) The FCC crystal structure
 - a) has 5 atoms/molecule on each face
 - b) has 4 atoms/molecule on each face
 - c) is found in amorphous solids
 - d) is rarely found in nature.



- iii) Optical microscopy is based on the principle of
- a) light diffraction
 - b) a pulsed laser
 - c) light transmission through a dichoric mirror
 - d) is not applicable for particles > 0.2 microns.
- iv) Ratio of surface area to volume
- a) increases as objects get smaller
 - b) decreases as objects get smaller
 - c) has no relation with the size of the object
 - d) none of these.
- v) Steric repulsion in colloids
- a) exists between macromolecules in a colloid
 - b) only exists between charged particles
 - c) is a function of electrostatic double layer repulsion
 - d) exists in organic solvents.



vi) Silicon is a/an

- a) direct band-gap semiconductor
- b) intrinsic and direct band-gap semiconductor
- c) intrinsic and indirect band-gap semiconductor
- d) extrinsic and direct band-gap semiconductor.

vii) Amphiphilic molecules

- a) are found in oil water emulsions
- b) are water loving molecules
- c) are found in soaps and detergents
- d) can separate water and oil layer.

viii) Langmuir-Blogett process

- a) is a film deposition process
- b) is used in microemulsions
- c) is a bottom-up film deposition process
- d) is used for micellar reactions.



- ix) Xerogels are
- a) found in dense ceramics
 - b) can be sprayed or spin coated on a substrate
 - c) are similar to aerogels
 - d) are obtained by evaporation of gel structure.
- x) Atomic force microscope tips are generally made of
- a) Silicon
 - b) Germanium
 - c) Platinum
 - d) Tungsten.
- xi) Fullerenes are
- a) carbon nanotubes
 - b) a form of carbon
 - c) same as graphite
 - d) are non-carbonaceous material.



xii) Dendrimers are

- a) essentially polymers
- b) branched monomers
- c) monolithic structures
- d) none of these.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Draw a labelled diagram of the Langmuir-Schaeffer process.
Explain self-assembly with reference to this process.
3. Explain the significant difference between molecular beam epitaxy and sputter deposition process. Give examples of two processes.
4. What is plasma ? How is it advantageous to use plasma in combination with other film deposition techniques ?

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5. Explain with one example, how biological templates are used for nanomaterial deposition.
6. What is porous silicon ? How is it different from ordinary silicon ?

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. Explain with a labelled diagram the principle behind AFM and give examples of its applications. What are the three modes of operation of AFM ? What is phototunnelling ?
8. Explain the process of soft lithography. With examples, describe the process difference between microcontact printing and microtransfer molding.
9. Describe with a diagram two predominant processes by which CNTs are manufactured. What are the different types of carbon nanotube structures found ? Draw a diagram for each.



10. Explain two nano-lithography processes. What are some of the special applications of each process ?

11. What are linkers and spacers ? Explain with examples.

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