



Name :

Roll No. :

Invigilator's Signature :

CS / B.TECH(CHE) / SEM-8 / CHE-804A / 2012

2012

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 the following :

10 × 1 = 10

- i) Nanotechnology gives us the ability to manipulate minimum material dimensions of
 - a) the width of human hair
 - b) the width of the head of a pin
 - c) the atomic level
 - d) the wavelength of ultraviolet light.
- ii) Silver nanoparticles are used in

a) car paints	b) medicinal bandages
c) sports goods	d) sunscreens.

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- iii) Lab-on-a-chip technology is
 - a) used in the semiconductor industry
 - b) used as a hand-held device for diagnostic purposes
 - c) used in the automotive industry
 - d) used only for laboratory purposes.
- iv) Optical Microscopy
 - a) is limited by the wavelength of visible light
 - b) allows us to see viruses
 - c) allows us to see red blood cells
 - d) can distinguish in the nanometer range.
- v) 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.
- vi) Atomic Force Microscope tips are generally made of
 - a) silicon
 - b) germanium
 - c) platinum
 - d) tungsten.
- vii) Scanning tunneling microscope works best
 - a) with conductor materials
 - b) with insulator materials
 - c) with metalloids
 - d) with semiconductor materials.

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- viii) Transmission Electron Microscope
- can see minimum particles of size 0.2 nm
 - can see minimum particles of size 2 nm
 - can see minimum particles of size 1 nm
 - can see minimum particles of size 0.1 nm.
- ix) Dendrimers are
- essentially polymers
 - branched monomers
 - have lengths in the range of microns
 - are monolithic structures.
- x) Fullerenes are
- carbon nano-tubes
 - a form of carbon
 - same as graphite
 - are non-carbonaceous material.

GROUP – B

(Short Answer Type Questions)

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

- Explain molecular self assembly with an example. Why is molecular self assembly preferred over conventional fabrication techniques ?
- What is dip-pen lithography ? Where is it used ?
- Describe two processes by which carbon nanotubes are made.
- What are nano-shells ? Where are they used in health-care application ?
- What is the goal of drug-delivery systems ? How is lab-on-chip technology used in advanced drug delivery ?

CS/B.TECH(CHE)/SEM-8/CHE-804A/2012



GROUP – C

(Long Answer Type Questions)

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

7. What is the role of resist in photolithography ? Draw a schematic to explain steps in photolithography.
8. What is soft lithography ? Describe the process with a schematic.
9. Explain the process of self-assembling in mono-layers. Draw a schematic of the process.
10. What are linkers and spacers ? Explain with examples.
11. Explain two nano-lithography processes. What are some of the special applications of each process ?

