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.

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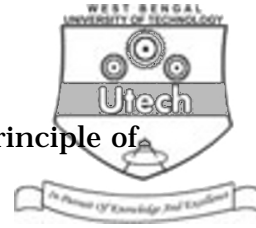
iii)   Optical microscopy is based on the principle of

   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 semicoductor

    d)   extrinsic and direct band-gap semiconductor.

vii) Amphiphillic 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 by sprayed or spin coated on a substrate

    c)   are similar to aero gels

    d)   are obtained by evaporations 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 × 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 ?
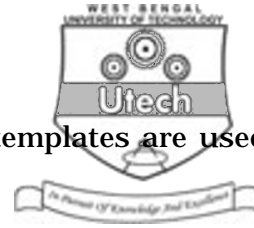
5. Explain with one example, how biological templates are used for nanomaterial deposition.

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 × 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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