

6th February 2014

Max Marks 20

Time 1 hour

Que 1. (a) Arrange the following entities in the increasing order of size in the scale of 0.1 nm to 10 microns (Place each one of them at Approx size in this scale) (2)

Fullerene, Cesium atom, water molecule C-C bond length, Bacteria, DNA molecule, Protein Macromolecule, Virus, Hair

(b) What is the difference between "Top Down and Bottom UP Approach"? With the help of a typical example of a textile material, explain how nature nanotechnology is an excellent example of "Bottom up Technology". (3)

Que 2 Which of the following statements are true? If not, why and write the correct statement. (6)

- (a) A blue shift in optical illumination results when the size of nanocrystals increases.
- (b) Quantum Confinement effects are observed when the size of the particles is of the same magnitude as the wavelength of the "Electron Wave function".
- (c) Quantum confinement is responsible for the decrease of energy difference between energy states and band gap in nanoparticles.

Que 3 Suspensions or sols of metal nanoparticles like silver and gold show intense colours which changes with their shapes and size. Explain the phenomenon. (4)

Que 4. Plot a graph for surface area/volume ratio vs particle size varying in the range of 10 nm, 100nm, 1 micron, 100 micron, 1000 micron (assume the shape of the particle to be Spherical). List two properties which change with respect to bulk as the size varies in nano range for Gold metal vs. bulk Gold .

Que 5. Name the scientists famous for:

- i. Termed the word 'Nanotechnology' *Drexler.*
- ii. Author of "Engines of Creation"
- iii. Lecture on "There is plenty of room at the bottom" *Richard Feynman.*
- iv. Invention of AFM -Atomic Force Microscopy (Company and scientists) *IBM.*
- v. Discovery of carbon nanotubes (CNT)
- vi. Discovery of magic numbers in nanoclusters