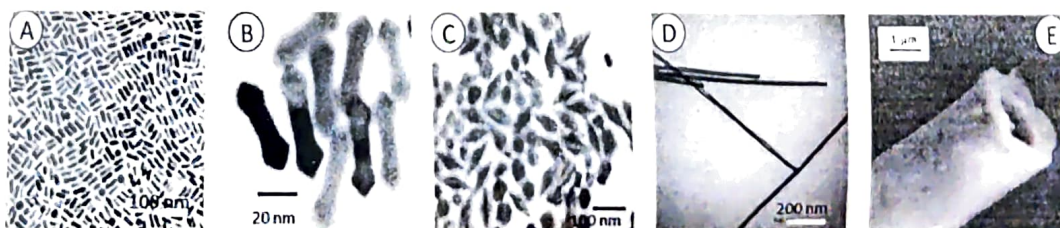
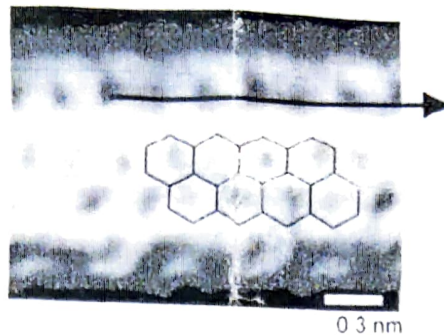


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1. State whether the following statements are true or false: [2×5]
 - (a) In the STM imaging technique one can actually “see” an individual atom while in AFM it’s almost impossible.
 - (b) The light emitted from a semiconductor, upon external stimulation, has a longer wavelength as the particle size of the semiconductor decreases.
 - (c) Buckyballs are actual molecules and not extended materials because they have a well-defined atomic structure and molecular weight.
 - (d) In convergent methods, the dendrimer is synthesized stepwise from the end groups to the inward.
 - (e) Increasing the size of the silica core and decreasing the thickness of the gold shell in the core-shell nanoparticles cause the plasmon resonance to shift toward the longer wavelength NIR.
2. Fill in the blanks with correct words. [2×5]
 - (i) If one dimension of the 3D nanostructure is quantum confined, it is called a
 - (ii) If all the three dimensions of the nanostructure are at the nanoscale, then it is called a
 - (iii) If two dimensions of the 3D nanostructure are at the nanoscale, then it is called a
 - (iv) The melting temperature of metal nanoparticles when their size decreases.
 - (v) In the context of fluorescence spectrum, the wavelength of the emitted light is than that of the excitation wavelength.
3. Write the conventional names used to identify the nanoparticles as shown in the following images (A, B, C, D, & E). [2×5]



4. In the following Figure an STM image of a CNT is shown. Feedback parameters are $V = 0.1$ V, $I = 20$ pA with images taken in constant current mode. State whether the CNT shown in the STM image (the arrow is in the direction of the tube axis) is a zigzag, armchair, or chiral type. [2]



5. Mention two microscopy (nanoscopy) techniques that can measure/image the surface topography of nanomaterials. [2]
6. Name a nanoscopy technique whose work environment can be air or liquid, not necessarily vacuum. [2]
7. Mention two special properties of magnetic nanomaterials. [2+2]
8. What is LSPR? [2]
9. If someone uses carbonate particles as templates in the nanocapsule formation, describe briefly how to remove the template without disassembling the nanocapsule structure. [2]
10. Mention two major differences between organic and inorganic nanomaterials. [2]
11. In the clinical area, PEG-intronTM is used to treat hepatitis C, multiple sclerosis, and HIV/AIDS. PEG-intronTM belongs to which special class and subclass of nanomaterials? [2]
12. What is an artificial atom? Why is it called so? [1+2]
13. Under high-intensity illumination conditions, QDs are better suited as fluorescent probes than organic fluorophores. Why? [2]
14. You wish to track the motions of two proteins within a cell. To protein A, you attach a quantum dot that emits yellow light, and to protein B, a quantum dot of the same substance that emits blue light. Which quantum dot is larger? Explain. [3]
15. In the following, the chiral vectors of some CNTs are given: (i) $c = 10a_1 + 9a_2$ (ii) $c = 9a_1 + 9a_2$ and (iii) $c = 9a_2$.
- (a) What is the type of nanotube formed in each case? [3]
- (b) Arrange these tubes in the order of increasing diameter. [2×3]