Review of questions II (not an assignment):

1. Describe the preparation and capping of gold and other metal nanoparticles. Describe the formation of nanocrystal superlattices. What would diffraction from a superlattice look like ?
2. What is digestive ripening and how is it used to sharpen size distribution in gold nanoparticles ?
3. Describe how the LaMer criterion of separating nucleation and growth stages of formation/crystallization in order to obtain a monodisperse product. What parameters could you tune in order to change the degree of supersaturation ?
4. Describe three different ways of making CdSe quantum dots. Why is CdSe a good material for size confinement effects to manifest. How is a QD distinct as a luminescent material, when compared with molecules, and with bulk solids.
5. Compare thermolytic and hydrolytic methods of preparation for oxide nanoparticles.
6. What is superparamagnetism ? How is a superparamagnetic material distinct from a soft ferromagnetic material. What is blocking ?
7. How do carbon nanotubes roll up and how do their ends cap ? How are chiral nanotubes formed. What do "zigzag" and "armchair" mean and why are the electronic properties of these different ?
8. Describe how nanotubes can be wired in a deterministic manner, and describe how they can be functionalized.
9. What are some other crystalline materials that can be induced to form nanotubes. Discuss the thermodynamics of nanotube formation. Are nanotubes thermodynamically stable (as opposed to metastable) phases ?
10. What is the VLS mechanism for the growth of nanowires ? How is nanowire formation reminiscent of the Czochralsk crystal growth method. What are the implications for doping.
11. Describe methods of wiring up single nanowires in devices.
12. Describe the structures and electronic properties of the series of organic-inorganic hybrids: $[RNH_3]_2[CH_3NH_3]_{n-1}A_nI_{3n+1}$; A = Sn or Pb.
13. What is the structural principle in supertetrahedral cluster crystals. How are generations of supertetrahedral clusters described.