Homework #1

1. Please calculate the wavelength of electron at 100keV and 1.8 eV.
2. How many gold atoms are contained in a nanogram ? a pictogram ?
3. What is the limit on feature size if 600 nm radiation is used in a photolithography (assuming N.A. = 0.8, K = 0.5)?
4. How to improve the resolution of photolithography if one would like to have the feature in the 50 nm region without using VUV source?
5. What is the particle size produced by monolayer of 400 nm nanoparticle in nanosphere lithography?
6. Please describe molecular beam epitaxy (MBE) technique and atomic layer deposition technique.
7. Please describe the operational principle of STM and AFM
8. Please calculate the diffusion constant of 5 nm quantum dots in water at 20^0C (assuming the viscosity of water is 6.915 x 10^{-4} Pa.s)
9. Please describe the procedure for making microfluidic system by soft lithography
10. What is the sensitivity of QCM? Can it detect the adsorption of a monolayer of alkanethiol?