**Cancer Nanotechnology (BioE479 and BioE598)**

Spring 2019

**Home Work #2**

**Due Date: 2 pm, Thursday, February 28**

1. For a metallic rod-shaped nanoparticle (called a nanorod) of 100 nm length and 20 nm diameter (that is, an aspect ratio of 5), calculate the theoretical plasmon frequencies along the long and short axes? Also, explain the concept of plasmon resonance, and predict what wavelengths and color of light would be in resonance with the plasmons along the long and short axes, respectively.
2. Please concisely describe the similarities and differences between surface plasmon resonance and quantum size confinement.
3. The first “R” in SERRS refers to a resonance effect (that is, surface-enhanced resonance Raman scattering). What is the origin of this resonance?
4. Looking at the history of SERS, who was/were the first to report this phenomenon experimentally? Who was/were the first to correctly interpret the results? Among the hundreds of thousands of scholarly papers published on surface Raman enhancement, which original research paper is currently the highest cited?

1. What is a “single magnetic domain”? Explain how superparamagnetism works, and why the superparamagnetic effect is often observed on the nanoscale.
2. “Self-assembly” is a common approach for making nanostructures, especially from amphiphilic polymers. Explain the driving forces and mechanisms for amphiphilic polymers to self-assemble into nanostructures. Using the concept of kinetic and thermodynamic control, explain whether self-assembled nanoparticles could be stable when injected into the body (diluted in blood).
3. Carbon nanotubes are a class of fascinating nanomaterials with novel electronic, optical, and magnetic properties. Explain what structures (conformations) of carbon nanotubes are conductors, what structures are semiconductors, and still what structures are insulators.