**ChemE 378, Assignment #20**

**Special Problems**

**SP4** Calculate the surface energy for a copper crystal for the (111) plane. Copper has a FCC structure with an interatomic distance of 0.255 nm (2.55 Å). The energy of vaporization is 341 kJ/mol.

**SP5** Estimate the surface energy in Joules per square meter for a covalently bonded crystal silicon (diamond structure) for a plane parallel to (100). The bond energy of Si-Si is 224 kJ/mol of bonds and the lattice constant $a$ = 0.5431 nm (5.431 Å).

**SP6** Water has a surface tension of about 72 erg/cm$^2$. When you add liquid detergent (dish soap) to water, the surface tension drops to 26 erg/cm$^2$.

a. Draw a possible structure and orientation for a detergent molecule at an air/water interface.

b. Estimate the pressure inside soap bubbles of 10 mm, 0.1 mm and 0.001 mm diameter.

c. Calculate the minimum energy (based on creating new surface) to form 1 liter of pure water drops of sizes 10 mm, 0.1 mm and 0.001 mm diameter.