HW # 6 Chem 2430

1. Consider a diatomic molecule with the atoms carrying charges of +Q and -Q and described by the harmonic potential $0.5 kx^2$.
   Use 2nd order PT to calculate the energy of the first two vibration levels of this system in the presence of a uniform electric field in the x direction of strength ε.
   Compare the energy difference between the two vibrational levels with and without the field. Explain your result.
   Do the frequencies really shift? Think of what happens to the potential in the electric field.
   Do your PT corrections include $\hbar$? Again, discuss your result.

2. Consider two coupled Drude oscillators aligned along the x-axis. The individual uncoupled Drude oscillators have the Hamiltonians
   $-0.5 d^2/dx_i^2 + 0.5kx_i^2$, where i = 1 or 2.
   The coupling term is of the form $-2x_1x_2/R^3$, where R is the distance between the two oscillators
   Use 2nd order PT to calculate the energy change in the two oscillator system due to the above perturbation.