## CHEM 352: Homework for chapter 6.

1. Consider a diatomic molecule and denote the equilibrium bond lengths for the ground and excited electronic states by  $R_e$  and  $R'_e$ . Given the force constants for both states are equal, calculate the 0-0 transition Franck-Condon factor and show that this transition is most intense when  $R_e = R'_e$ .

2. Consider a pulsed laser that operates at 532 nm wavelength, which has 0.10 J energy per pulse and 3.0 ns pulse length. What is the average power and the number of photons in one pulse?

3.  $N_2$  molecules are irradiated with 58.43 nm wavelength electromagnetic radiation and it was observed tat the photoelectrons ejected had a kinetic energy of 5.63 eV. What was the ionization energy for these electrons? How does this compare with the ionization energy of  $N_2$  and what does it say about the orbital from which the photoelectrons came from?

4. Consider vibrationally resolved electronic spectrum of a diatomic molecule. What does the Franck-Condon principle say about the relative bond lengths between the excited and ground electronic states if there is: a) just one line, b) one line with a pattern of decaying lower intensity lines, or c) line pattern that first increases in intensity and then decays.