Homework #5; Phys 122; Due Monday 3/9

1. An atom has (bound) electron energy levels at -7.3eV, -4.3eV, and -2.8eV. Show a calculation of all wavelengths that will be emitted if a collection of these atoms are excited. Hint: there will be more than 2.

2. Electromagenetic radiation of wavelength 100nm is incident upon a ground-state Hydrogen atom. What is the highest state to which the electron might be excited?

3. Use Bohr-model-like logic (deBroglies's version) to deduce the allowed energy states of an electron that is forced to travel in a square path with a side-length of "L". There is no potential energy, only kinetic energy. (Give answer in terms of a quantum number "n", some integer that must be 1 or greater.)

4. Minimize the total energy (kinetic + potential) of a particle with mass m that is oscillating on a spring of spring constant k, subject to the uncertainty principle. (The distance from equilibrium can't be smaller than the position uncertainty, and the momentum can't be smaller than the momentum uncertainty.)

5. Very short laser pulses can be produced, on the order of a few femtoseconds. (look it up.) If a laser has a center wavelength of 800nm, and lasts for 20 femtoseconds, what spread of wavelengths must it have to be compatible with the time-energy uncertainty principle?