CHEM106: Assignment 8

Hydrogen Atom

1. For the hydrogen-like atoms, the solution of the Schrödinger equation leads to the quantized energy .

A. Calculate the energy (in eV) for the hydrogen atom at various values of n, and plot the energy levels.

B. Calculate the absorption frequency in wavenumbers (cm–1) for an electron in the hydrogen atom undergoing a transition from the n = 2 level to the n = 5 level.

C. Determine the ionization energy (in eV) for the hydrogen atom.

2. The solution of the Schrödinger equation for the hydrogen atom produces three quantum numbers n, l, and ml.

1. Name the three quantum numbers, and describe how they are related.
2. For the n = 3 energy level of the hydrogen atom, what are the allowed quantum states?
3. For the n = 3 energy level of the hydrogen atom, what is the degeneracy?

3. The solution of the Schrödinger equation for the hydrogen atom results in the wavefunction for the 1s state .

1. Calculate the probability of finding the electron within a distance of 3a0 from the nucleus.
2. Is there a node in the wavefunction for the 1s orbital?

4. What is the meaning of the atomic term symbol 3F?