CHM102
Assignment
April 9, 2017

1. Calculate the first order correction to the ground state energy for a particle in a box , whose potential is of the form V= -ε sin (πx/L).

2. Use the trial function $\varphi(x) = (1 + c\alpha x^2)\exp(-\alpha x^2/2)$, where $\alpha = (k\mu/\hbar^2)^{1/2}$. In this function, 'c' is a variational parameter. If you use this function for calculation of the ground state energy of the harmonic oscillator, what would the value of 'c' and E_{min} be? Why?

3. Use the trial function $\varphi(x) = c_1\exp(-\alpha r) + c_2\exp(-\alpha r^2)$ to carry out a variational calculation for the ground state of the hydrogen atom, what would be the value of the variational parameters c_1 and c_2? What would be the value of α and E_{min}?

4. Derive term states for the following electronic configurations and identify the gound state among the states you have derived.
   A) He: $1s^1 2p^1$
   B) B: $1s^2 2s^2 2p^1$
   C) C: $1s^2 2s^2 2p^1 3p^1$
   D) F: $1s^2 2s^2 2p^5$
   E) Ne: B: $1s^2 2s^2 2p^6$
   F) C: B: $1s^2 2s^2 2p^2$