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= $-\varepsilon \sin(\pi x/L)$.
- 2. Use the trial function $\varphi(x) = (1 + \alpha x^2)\exp(-\alpha x^2/2)$, 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: $1s^{2}2s^{2}2p^{2}$