

**Phys 402**  
**Spring 2009**  
**Homework 3**  
**Due Friday, February 20, 2009 @ 9 AM**

1. Griffiths, 2<sup>nd</sup> Edition, Problem 6.1
2. Griffiths, 2<sup>nd</sup> Edition, Problem 6.4 (a) only
3. Griffiths, 2<sup>nd</sup> Edition, Problem 6.5 (a) only
4. Griffiths, 2<sup>nd</sup> Edition, Problem 6.11

**Extra Credit #4**

**The Stark Effect in Hydrogen.** In 1913 Stark observed a splitting of the Hydrogen Balmer series lines by applying an electric field  $E = 100,000$  V/cm.

- a) Write down the perturbing Hamiltonian  $H'$  for the electron. Neglect spin in this problem.
- b) Calculate the change in energy of the ground state of Hydrogen to first order.
- c) Consider the  $n=2$  states of Hydrogen. Find the new energies to first order.
- d) Calculate the new  $n=2$  eigenfunctions.
- e) Roughly calculate the resulting splitting of the Balmer series  $H_\alpha$  line in an electric field of  $100,000$  V/cm.

