**Homework Assignment #3**  
*From Modern Physics by Frank Blatt*  
*Physics 225*

**Reading:** Read Sections 4.1, 4.2 (not necessarily 4.2a) and 4.4 from Chapter 4 of Blatt's book. Read sections 5.1, 5.4, 5.5, and 5.7 of chapter 5. Read all of chapter 6 (it isn't very long and it is important).

**From the text (Blatt): Chapter 4**

**Problems:** 4.1, 4.9, 4.11, 4.17, 4.19

**Hints:**

5.13) This one requires some thinking. Some things carry over from the Bohr model. The circumference of the orbit must be equal a whole number of waves \(2\pi r = n \lambda\). The deBroglie relation for momentum still applies \((p\lambda = h)\) and the conserved quantity is angular momentum \(L = mvr\). Combine those three to find quantization of angular momentum. Now the force has the same form as a Hooke's law force which determines centripetal acceleration \(F = -kr = -m\omega^2/r\) and the form of potential energy \(U = \left(\frac{1}{2}\right)kr^2\). The quantity that Blatt defines as \(\omega\) is the angular velocity of the electron around the nucleus \((v = r\omega)\). The centripetal acceleration equation should give you quantization of the radius. Adding the potential energy to kinetic energy should give you quantization of energy.

5.28) The energy here is the electron charge \(e\) times the voltage. You need to think about how many energies of absorption there will be if there are two excited states (the answer is not two), and you need to remember that the resonant energy will be the difference between two energies of the atom. Finally, think about what we see at resonance: will that be a maximum of the energy or a minimum?

**From the text (Blatt): Chapter 5**

**Problems:** 5.13, 5.19, 5.23, 5.28

**Hints:**

6.7) You are estimating here, so your answer may differ from Blatt's by a factor of 2 or so. I started with the ground state kinetic energy of the hydrogen atom in the Bohr model \((13.6 \text{ eV})\). I set that equal to \(p^2/(2m)\) and solved for \(p\). That's the absolute value of \(p\) so the uncertainty in momentum will be about twice that big. Then I solved for the minimum uncertainty in position. That will be an estimate of the minimum size of a hydrogen atom.