HW Set #4 Due 09/30/10 (at the beginning of class)

Problems from Chapter 4

4, 6, 14, 16, 20, 24, 26, 32, 36, 38, 54, 60

Go to this website to play with the photoelectric effect Java applet http://phet.colorado.edu/en/simulation/photoelectric (there is a link on the course homepage as well)

Run the program.

For Sodium see what happens as you change the frequency and intensity of the radiation. What happens when you change the potential on the battery?

Use the applet to determine the workfunction of sodium. The workfunction is the energy required to get an electron off the metal. It is like the ionization energy of the solid metal.

Describe how you figured it out?

Which has a higher work function: sodium or copper? Does that make sense?

Another way to arrive at the DeBroglie wavelength is think about the momentum of a photon. The momentum is its mass times its velocity. However, we don't know the mass of a photon. However we have two ideas that relate its energy. Using the notion from relativity that $E = mc^2$ and the $E = hv$ show that momentum (mc) = h/lambda.

Other problems from Dr. Vanden Bout for the particle in a box problem.

1. What is the probability of finding the particle in the box between x=0 and x=L/2 for the n=1 state? Show your math explicitly

What about the n=3 state? You can simply reason this one if you like.

2. For the n=4 state at what distance is the probability of finding the particle the largest? At what distance are the nodes?

3. If you redefined the edges of the particle in the box such that is started at x=-L/2 and ended and x=L/2, what would the lowest energy wavefunction look like?

4. What is the zero point energy for a 3-dimensional particle in box whose size are L_x = 1 Å, L_y = 2Å, and L_z = 1Å?

5. For a three dimensional particle in a box with equal sides, what is the degeneracy of the energy state that is 6 times the lowest energy state?