Modern Physics

Start reading chapter 6 by Friday, November 9. (Remember that November 12th is a holiday.) The important sections are 1-5 and 7-8.

Homework Assignment 7: Due Friday, November 16.

1. For an electron of kinetic energy 10eV, what is the de Broglie wavelength?
2. A neutron has a de Broglie wavelength of 0.01nm
   a) What is its kinetic energy in eV?
   b) What is its speed?
3. What is the de Broglie wavelength of a 0.1g mass with speed of 10 μm/s? (For this problem you may want to use "normal" MKS units.)
4. An electromagnetic pulse of "frequency" 10^{12}Hz has a duration of 10^{-8}s. What range of frequencies, Δf, is in the pulse?
5. **If** the n=2 level in hydrogen has a lifetime of 10^{-9}s (I'm making up this number.),
   a) What would be the uncertainty in the energy of that level, ΔE, in electron volts?
   b) How does that compare to the energy of the photon emitted when the electron in the n=2 level goes to the n=1 level?
6. What would the "minimum" KE of an electron be if it were confined in a region 0.2nm in length? Again, find it in eV. (Treat this as a one-dimensional problem.)
7. What is the minimum KE, in eV or MeV, of a proton confined in a nucleus of dimension 2×10^{-15}m? (Treat this as a one-dimensional problem.)
8. A system has four energy levels, $E_0 = -9.0$eV, $E_1 = -4.0$eV and $E_2 = -2.0$eV and finally $E_3 = -0.80$eV. What wavelengths of electromagnetic radiation would you expect to see coming from this system if it had been excited out of the ground state E_0 to the higher levels?
9. A certain system emits electromagnetic radiation of wavelengths $\lambda_1 = 310$nm, $\lambda_2 = 207$nm and $\lambda_3 = 124$nm. If the ground state is – 12eV, what are the other energy levels? (Assume these are the only wavelengths it emits.)