1. Read Griffiths section 5-4. Did you read all the pages?

2. For each of the following systems, find a formula for E_n in terms of fundamental constants, find E_1 numerically in eV, find the Bohr radius in terms of constants and numerically, and find the wavelength of the $n = 2$ to $n = 1$ photon (the analog of the Lyman-alpha line in hydrogen).

   (a) positronium (positron and electron)

   (b) muonium (μ^+ and an electron)

   (c) $^{12}C^{+++++}$ (carbon-12 nucleus and one electron)

   (d) antihydrogen (antiproton and positron)

   (e) an anti-alpha particle and a ^{12}C nucleus (ignore the strong nuclear force interaction).

3. In step one, the square of the orbital angular momentum of a particle L^2 is measured and found to have the value 20 $\hbar^2$.

   (a) If L_z were then measured in step 2, what values could possibly result?

   (b) If instead of L_z, L_x were measured in step 2, what values could possibly result?

   (c) Suppose that in step 2, L_z is measured and the value zero is obtained. Now in step 3, L^2 is measured. What values can result and with what probabilities?

   (d) In step 4, L_z is measured. What values can result and with what probabilities?

Bonus:

1. For $\ell = 1$, construct the 3 by 3 matrices for L_+ and L_-.

   (a) What is $(L_+)^2$?

   (b) What is $(L_+)^3$?

   (c) What is L_+L_-?

   (d) What are the eigenvalues and eigenvectors of L_+