CEM 483/881 Problem Set 8 Fall 2017
(due Friday, November 10)

1. Show that the function $\left(\frac{r}{a_o}\right)e^{-r/2a_o}$ is a solution of the following differential equation for l = 1,

$$-\frac{\hbar^2}{2m_e r^2}\frac{d}{dr}\left[r^2\frac{dR(r)}{dr}\right]+\left[\frac{\hbar^2 l(l+1)}{2m_e r^2}-\frac{e^2}{4\pi\varepsilon_o r}\right]R(r)=ER(r)\ .$$

What is the eigenvalue? Using this result, what is the principle quantum number *n* for this function?

2. Calculate the expectation value for the potential energy of the hydrogen atom with the electron in the 1s orbital. Compare your result with the total energy.

3. Calculate the probability that the 1s electron for hydrogen will be found between r = a_o and r = $2a_0$.

4. Calculate the expectation value of the radius, $\langle r\rangle$, at which you would find the electron if the H atom wave function is ψ_{100} .