PHY 3106, Fall 2017, Homework #8

due Wednesday, Nov. 22, by 5 pm (e.g., before Thanksgiving)

1.) Take a particle moving in a one-dimensional gox with walls at $x = \pm\frac{L}{2}$. A) Write the wavefunctions and probability densities for the lowest 3 states. B) Normalize these lowest three states. C) Find the probability that the particle is in the region $-\frac{L}{4} < x < 0$ for the ground state wavefunction.

2.) An electron is in an infinite well, with the wavefunction in the lowest state. It has an energy of 0.10 eV. A) Find the well's length, L. B) What is the probability that the electron will be found in the left-hand third of the well? C) What would be the next higher allowed energy? D) if the well was "roomier", i.e, L=1.0 mm, while the energy remained 0.10 eV, what would be the probability of finding it in the well's left hand third and what would be the minimum possible **fractional** increase in its enegy?

3.) A 50 eV electron is trapped in between electrostatic walls 200 eV high (e.g., in a finite well). How far does the wave function extend beyond the walls?

4.) A particle in the infinite square well is in the initial state $\Psi(x,0) = Ax(a-x)$, where $0 \le x \le a$ and A is a constant. a) Normalize the wave function. b) Use the Hamiltonian operator ($\hat{H} = \frac{-\hbar^2}{2m}\frac{\partial^2}{\partial x^2} + V(x)$) to find the expectation value of H: $\langle H \rangle = \int \Psi^*(x,0)\hat{H}\,\Psi(x,0)dx$.

5.) Determine the probability of finding a particle of mass m between x=0 and x=$a/10$ if it is in the n=3 state of an infinite well of width a.