CHEM 1410 **Homework Set #1** **(Chapters 11,12)**

Due: 9/14/99

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1. Normalize the following wavefunctions

   a) $\psi = \cos\left(\frac{2\pi x}{L}\right)$ on (0,L)

   b) $\psi = x^2$ on (-a,a)

   c) $\psi = e^{-x^2+y^2}$ for $-\infty \le x \le \infty$, $-\infty \le y \le \infty$.

2. Consider the wavefunction $\psi = \sin\left(\frac{\pi x}{L}\right)$ for a particle in a box of length L ($0 \le x \le L$). What is the probability of finding the particle between x = L/4 and L/2. (Note: The given wavefunction is not normalized.)

3. Consider a particle described by the wavefunction $\psi = \sin kx$. What is the momentum? Would multiple measurements of the momentum give the same value? Why or why not?

4. Consider the wavefunction $\psi = ae^{2ikx} + be^{-3ikx}$. What is the momentum? Would multiple measurements of the momentum give the save value? Why or why not?

5. Consider a conjugated polyene containing 8 C atoms. If you model the π electron of this system with a one dimensional particle in the box, the ground state would place two electrons in each of the eight lowest energy orbitals. What is the energy gap (in eV) between the 4th and 5th orbitals? What is the frequency of the transition between these two energy levels.