Due January 28, 1999

1. Confirm that xe^{-ax^2} is a solution of the Schröenger Equation for the harmonic oscillator and find a.

2. Calculate $\langle x^2 \rangle$ for the ground state of a harmonic oscillator. (See Table 12.1)

3. Show that for a harmonic oscillator the selection rule for IR transitions is $\Delta V = \pm 1$.

4. Consider the particle-on-a-ring problem. What is the z-component of the angular momentum if $\psi = e^{3i\phi}$, if $\psi = ae^{i\phi} + be^{-i\phi}$?

5. Problem 12.21 from text.

6. Consider the H atom. Is the electron further from the nucleus on average when it is in a 2p or 2s orbital?

7. Show that $\hat{\ell}^2$ and $\hat{\ell}_z$ commute with one another. Show also that they commute with $\hat{H}$ for the H atom. Why is this important?