1. Problem 1.9 in Rowley.

2. (a) A hydrogen molecule is confined inside a zeolite pore. Assuming the pore is cubical with a dimension of 4 Å, calculate (in J) the spacing between the $n_x = 1$ and the $n_x = 2$ translational energy levels assuming $n_y = n_z = 1$; (b) Spectroscopists use the wavenumber ($\tilde{\nu}$) with units of cm$^{-1}$ as a unit of frequency, where $\tilde{\nu} \times c = \nu$ (s$^{-1}$). Calculate the wavenumber associated with the $n_x = 1$ to $n_x = 2$ transition.

3. Calculate the expectation value of $E = p^2/2m$, designated $\langle E \rangle$, for a particle in a 1-dimensional box where $n = 3$. Also compute $\langle p \rangle$ and explain your finding for the average momentum.

4. Computer problem: Consider the H$_2$ molecule as a quantum harmonic oscillator with spring constant $k = 1108$ N/m. Compute the ground state and first two excited state wavefunctions and the probability densities (square of the wavefunctions) and make plots of these. Hint, use the reduced mass for H$_2$ in your calculations to reduce the problem from 2-body to 1-body.