1. Chapter 4, Problem 1 (page 120).

2. Chapter 4, Problem 2 (page 120).

3. Chapter 4, Problem 38 (page 122).

4. Chapter 5, Problem 2 (page 169).

5. Chapter 5, Problem 15 (page 171).

6. **20 points extra credit:** Use Mathematica to solve the following differential equation for the harmonic oscillator:

$$\frac{d^2\psi(x)}{dx^2} = \frac{2m}{\hbar^2}\left[\frac{1}{2}Cx^2 - E\right]\psi(x)$$

Make the assumption that

$$\frac{(Cm)^{1/4}}{\hbar^{1/2}} = 1$$

It is found that the energy E is quantized and can only take on the following values:

$$E_n = \left(n + \frac{1}{2}\right)\hbar\sqrt{\frac{C}{m}} \quad \text{where } n = 0,1,2,3,.....$$

Calculate and show the probability density function for n = 0, 13, and 50. Compare these distributions with the classical distribution shown in 5-3.

In order to receive the extra credit, you should create a Mathematica Notebook, showing on the relevant calculations and graphs, and submit it electronically to Prof. Wolfs at wolfs@pas.rochester.edu. The name of the file should be hw04p06XXYYYYYYYY.nb where XX are your initials and YYYYYYYY is your student id number. The subject of the email should start with hw04p06XXYYYYYYYY.