

Chapter 11 and 12 – Optional Exercise

20 points possible

DUE: Monday, February 26 at 10:00 a.m. (*no later!*)

(**NO** late assignments will be accepted!)

** If you would like to turn in the assignment early, this is fine!*

* It is recommended that you work through these exercises on your own and use this as a study opportunity, as this will help you reinforce what you do know (and perhaps what you may need to work a bit on). It is also recommended that you take the time to put #2 and #3 in a format that will be useful to you as a study guide for your final exam preparation as well as for use of the material in later chapters. (Yes, far in the future, but this will save some time for you later in the semester!)

1. Identify which of the following wavefunctions are “acceptable” wavefunctions. (If the wavefunction is not acceptable, state all of the reasons why it is not acceptable.)
 - (a) $\psi(x) = \pm x^2$
 - (b) $\psi(x) = Ax^2$ where A is a constant
 - (c) $\psi(\theta) = \cos \theta$
 - (d) $\psi(x) = \exp(-ax)$ where “a” is a constant
 2. Make a table which includes the following information for translational (1-D), vibrational, and rotational motion:
 - (a) the general formulas for the energy and wavefunction
 - (b) the possible quantum numbers
 - (c) the zero-point energy
 - (d) is the wavefunction normalized?
 - (e) formula for the spacing between energy levels (for translational and vibrational motions)
 - (f) energy level diagrams (with appropriate labels – ZPE, energy levels, . . .) for translational and vibrational motions
 - (g) are there degeneracies for the energy levels? If so, what are they?
 3. Make a table of the following operators and provide the operation they perform: momentum, position, kinetic energy, potential energy.
 4. What are the most probable and least probable locations in a box of length L in the n=6 state? For credit, clearly explain your rationale for each step you take to reach an answer.
 5. Write the general form for the Schrödinger equation.
 6. What is the significance of boundary conditions?
- Complete the following exercises and explain your rationale for each step you reach in solving the problem.
7. Exercise 11.19 (b).
 8. Exercise 12.6 (b)
 9. Exercise 12.8 (b)
 10. Exercise 12.16 (b)