

CHM102
Assignment 3 (31-1-2017)

1. Calculate the probability that a particle in a one-dimension box of length 'L' is found in the first one-third of the box in its ground state. Repeat the calculation for level $n=20$. Compare the two numbers that you have obtained.
2. Find a state (n_1, n_2) for a particle in a rectangular box with sides of length $L_x=L$ and $L_y=2L$ that is accidentally degenerate with the state (4,4).
3. Calculate the energy separation in joules and electron volts between levels $n=2$ and $n=1$ of an electron in a box of length 1.0 nm.
4. Check the orthogonality of the wavefunctions of the $n=1$ and $n=2$ level of a particle in a box of length 'L'.
5. Consider the particle in a cubic box. What is the degeneracy of the level that has an energy three times that of the lowest level?
6. An electron is confined to a potential of length 'L'. What should be the length of the box such that the zero-point energy of the electron is equal to its rest mass, $m_e c^2$?

Preparation tips:

I would like you to go through the following sections from JP Lowe:

Sections 1-6, 1-7, 1-8, 1-9, 1-10, 1-11.

Sections 2-1, 2-2A, 2-2B, 2-2D, 2-7

Sections 6-1, 6-3, 6-5, 6-10, 6-11

As I mentioned in class, you are allowed one sheet of A4 paper, in the examination hall, on which you may write anything, you feel will be useful in answering questions on the topics covered. You may write on ONLY one side of the A4 sheet and NOT on both sides. You have to rely on only your sheet and you will not be allowed to exchange sheets with others. Such exchange of sheets will be considered as academic misdemeanour.