

## 1 Quantum Practice for Midterm 2

**(Based on Q4B.1 from textbook)** Red light emitted by a standard helium-neon laser has a wavelength of about 633 nm. What is the frequency of the electromagnetic wave? Give your answer in Hz.

**(Based on Example Q11.1 in the textbook)** Suppose an electron is trapped in a box whose length is  $L = 1.2$  nm. This is a coarse-grained model for an electron in a small molecule like cyanine (see Example Q11.1 in the textbook). If we solve the Schrodinger equation for such a system (the PDE describing the electron matter wave), the electron wavefunctions that satisfy the boundary conditions have discrete frequencies that can be indexed by an interger  $n = 1, 2, 3, \dots$

The frequencies are given by

$$f_n = 0.63 \times 10^{14} n^2 \quad (1)$$

- (a) Draw a frequency-level diagram for the wavefunctions with  $n = 1, 2, 3, 4, 5, 6$ .
- (b) Make a list of the visible frequencies of light that this system could adsorb or emit (i.e. electromagnetic waves that are visible to the human eye).