Electrons in a Box - Quantization

\[ V(z) \uparrow \]

\[ V = \infty \quad V = 0 \quad V = \infty \]

0 \quad L \quad \rightarrow z

This time we have boundary conditions
\[ \psi(0) = \psi(L) = 0 \]

\[ \therefore \text{the solution to the S. eqn. is: } V = 0 \text{ in } \]
\[ \psi_n = A_n \sin \left( \frac{n \pi z}{L} \right) \quad n = 1, 2, 3, \ldots \]

\[ E_n = \frac{n^2 \hbar^2}{8mL^2} \]

\[ \text{note that } k = \frac{2\pi}{\lambda} = \frac{n\pi}{L} \]

\[ \therefore n = k \frac{L}{\pi} \]

The wavefunctions look like this:

\[ U \]

\[ \mid \psi \mid^2 \]

\[ n = 1 \quad n = 2 \quad n = 3 \quad n = 4 \]

\[ \text{The lowest allowed energy is } \frac{\hbar^2}{8mL^2} \text{ in the ground state } (n = 1) \text{ - it is not possible to have zero energy!} \]

An electron can be moved between energy levels by a photon whose energy is equal to the energy difference between the levels.

\[ E_{ph} = h\nu = \Delta E = E_i - E_f = \frac{\hbar^2}{8mL^2} (n_i^2 - n_f^2) \]

Problem 8.7, p.149