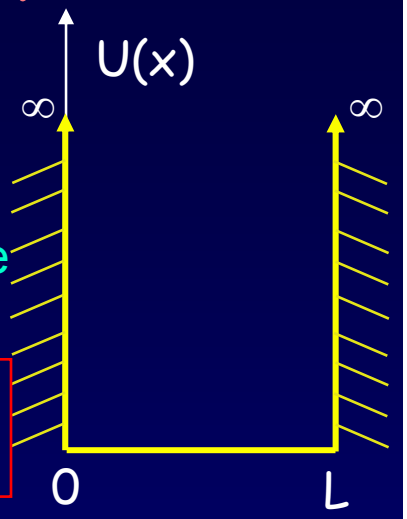
Example: "Particle in a Box"

As a specific important example, consider a quantum particle confined to a region, $0 < x < L$, by infinite potential walls. We call this a "one-dimensional (1D) box".

$U = 0$ for $0 < x < L$

$U = \infty$ everywhere else



We already know the form of ψ when $U = 0$: sin(kx) or cos(kx). However, we can constrain ψ more than this.

The waves have exactly the same form as standing waves on a string, sound waves in a pipe, etc.

The wavelength is determined by the condition that it fits in the box.

On a string the wave is a displacement y(x) and the square is the intensity, etc. The discrete set of allowed wavelengths results in a discrete set of tones that the string can produce.

In a quantum box, the wave is the probability amplitude $\psi(x)$ ond the square $|\psi(x)|^2$ is the probability of finding the electron near point x. The discrete set of allowed wavelengths results in a discrete set of allowed energies that the particle can have.