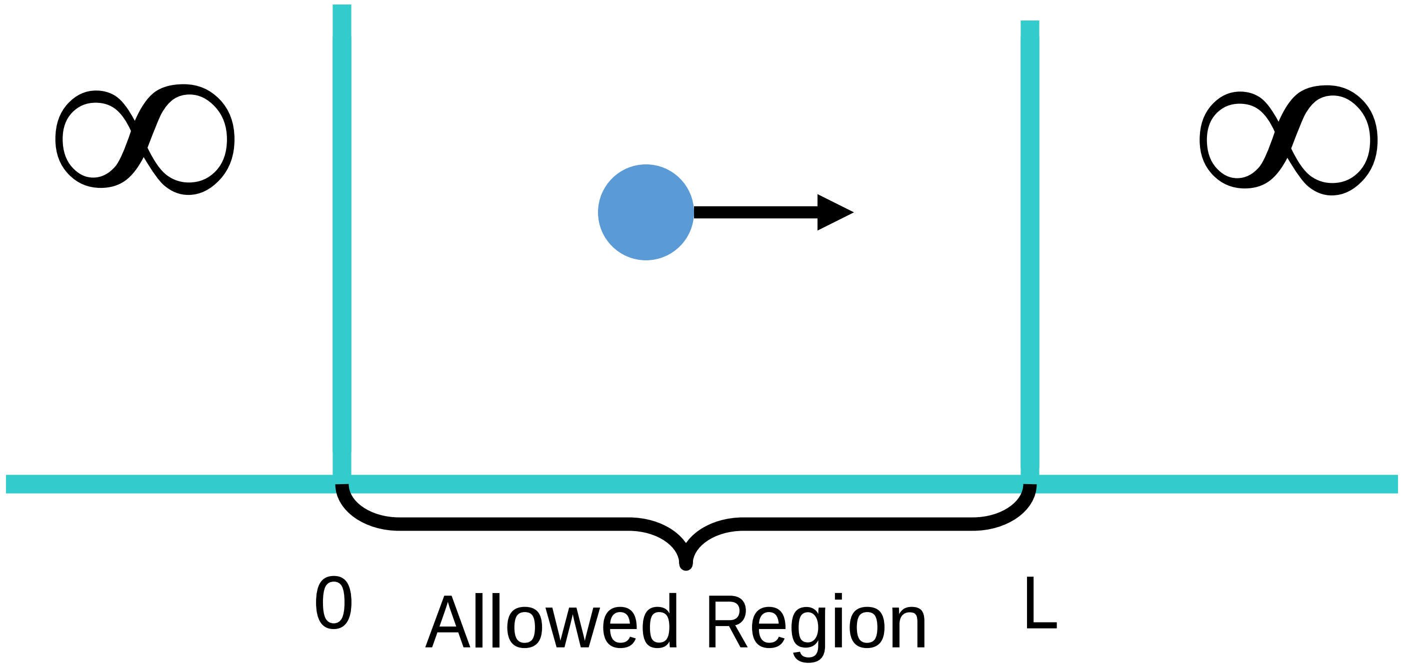
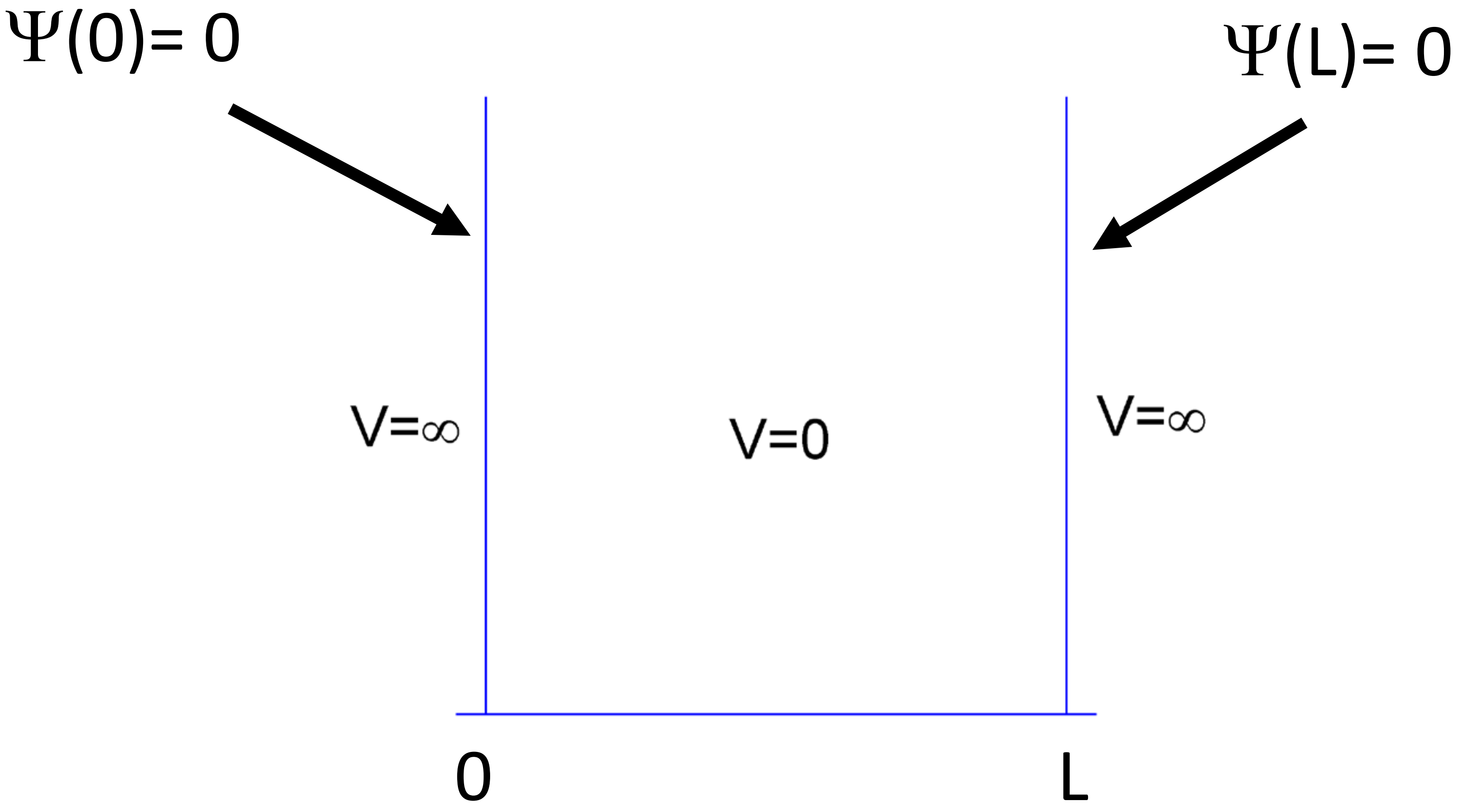
Schrödinger equation with boundary conditions

We define a region of space with no potential energy (V = 0). The Schrödinger equation in that region is the same as the free particle. Outside of that region we assume that the potential energy is infinite.



The particle in a box has boundary conditions



The boundary conditions determine the values for the constants C and D

$$C = -D = \frac{1}{2i}$$

$$\Psi = sin(kx)$$

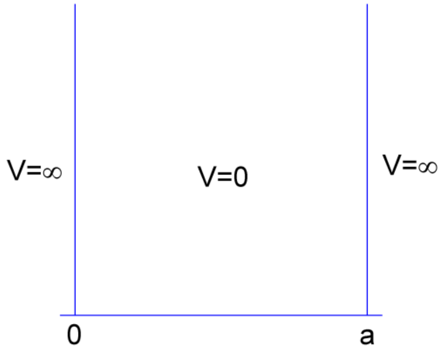
sin(kx) will vanish at 0 since x = 0 and sin(0) = 0.

sin(kL) will vanish at a if kL = nπ.

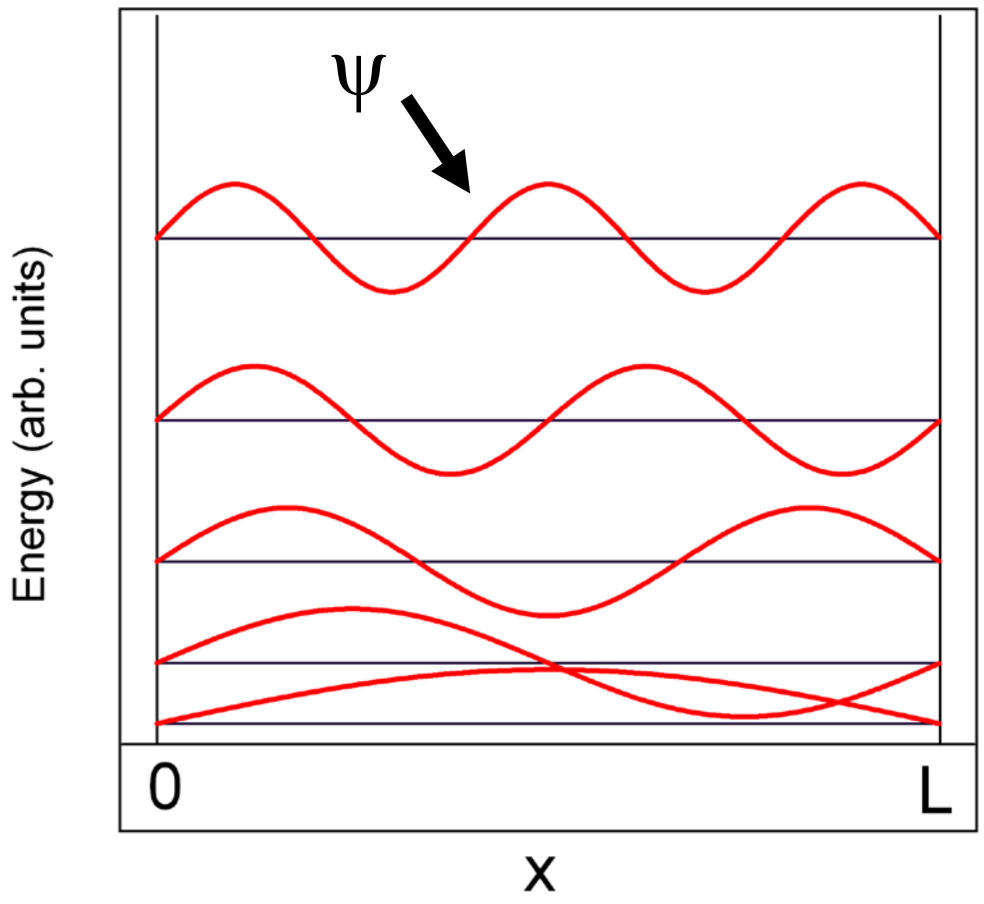
Therefore, k = nπ/L.

$$\Psi = \sin\left(\frac{n\pi x}{L}\right)$$

Not Normalized !



The solutions to the particle in a box



The solutions have increasing numbers of nodes as the quantum number n increases. The lowest solution has no nodes. It is constrained at either end like a guitar string. The lowest solution is like the fundamental of a guitar string.