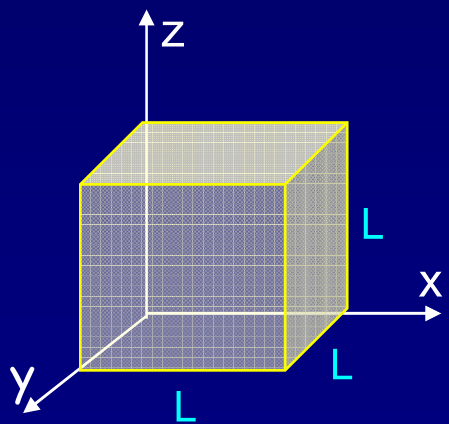
Particle in a 3D Box (1)

The extension of the Schrödinger Equation (SEQ) to 3D is straightforward in Cartesian (x,y,z) coordinates:

$$-\frac{\hbar^2}{2m}\left(\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}\right)+U(x,y,z)\psi = E\psi \qquad \text{where} \quad \psi \equiv \psi(x,y,z)$$

Kinetic energy term: $\frac{1}{2m}\left(p_x^2+p_y^2+p_z^2\right)$

Let's solve this SEQ for the particle in a 3D cubical box:



$$U(x,y,z) = \begin{cases} \infty & \text{outside box, } \; x \text{ or } y \text{ or } z < 0 \\ 0 & \text{inside box} \\ \infty & \text{outside box, } \; x \text{ or } y \text{ or } z > L \end{cases}$$

This U(x,y,z) can be "separated":
U(x,y,z) = U(x) + U(y) + U(z)

U = ∞ if any of the three terms = ∞.