**. "What is the Schrödinger Equation? Purpose:** The Schrödinger equation is a fundamental equation in quantum physics that describes how particles behave, especially predicting where an electron will be. It is the quantum equivalent of Newton's laws of motion.

* **Energy Conservation:** The equation represents the conservation of energy in a quantum system, where the sum of the **kinetic energy** and **potential energy** operators equals the total energy of the system.
* **Wave Functions:** It is designed to work with **wave functions (ψ)**, which are mathematical functions that describe the quantum state of a particle. The square of the wave function's norm (∣ψ∣2) represents the **probability density** of finding the particle at a specific location.

**2. "How To Derive The Schrödinger Equation"**

* **Derivation:** The video explains how to derive the equation by analyzing the time evolution of a quantum state.
* **Time Evolution Operator:** A **time evolution operator (U)** is used to describe how a particle's state changes over time. This operator must be **unitary** to ensure that the total probability of a quantum state is conserved.
* **Hamiltonian:** The derivation shows that the time evolution of a quantum state is governed by the **Hamiltonian operator**, which is the **energy operator** of the system.

**3. "The Schrödinger Equation**

* **Origins:** The video credits **Erwin Schrödinger** with developing the equation in 1926, inspired by **Louis de Broglie's** theory of wave-particle duality.
* **Solutions:** Solving the Schrödinger equation provides the wave function for a particle. For a simple system like a particle in a box, the solution reveals that the particle's energy is **quantized**—it can only exist at specific, discrete energy levels.
* **Stationary vs. Non-stationary States:** The video differentiates between **stationary states** (where the probability density doesn't change over time) and **non-stationary states** (where it oscillates).

**4. "What is the Schrödinger Equation? A visual introduction to the most famous equation in quantum mechanics."**

* **Wave Function Collapse:** This video introduces the concept of **wave function collapse**. When you measure a particle's position, its wave function collapses from a range of probabilities into a single spike at the measured location.
* **Indeterminacy:** Unlike in classical physics, where you can predict a particle's exact position and momentum, quantum mechanics only allows you to determine the **probability** of finding a particle in a certain region. Quantities like position and momentum are **indeterminate** until they are measured.