Q: Infinite Quantum Well

New Boundary conditions.

4(01=0,4(9)=0

from last slide: solution to S.E.

V=0

E=0

= 4(0) = A+13 @4(a)=Aerka+Beika

A =-B

=0

sub

Aeika Ap-ika = 0

A70 → .. What was the main point?

A: I'd be glad to explain the concepts related to the infinite quantum well and the new boundary conditions you provided:

Infinite Quantum Well

In quantum mechanics, an infinite quantum well (also known as a particle in a box or an infinite square well) is a theoretical model that describes a particle confined within a one-dimensional region by infinitely high potential barriers. The particle is free to move within the well (where the potential energy is zero), but its wave function vanishes outside the well (where the potential energy is infinite).

New Boundary Conditions

The new boundary conditions you presented are:

- `ψ(0) = 0` (wave function at `x = 0` is zero)

- `ψ'(a/4) = 0` (derivative of the wave function at `x = a/4` is zero)

These boundary conditions indicate that the wave function must be zero at `x = 0` and its slope must be zero at `x = a/4` (where a is the width of the well). This implies a specific standing wave pattern within the well.

Solving the Schrödinger Equation (SE)

The Schrödinger Equation (SE) is a fundamental equation in quantum mechanics that relates the wave function (`ψ`) of a particle to its total energy (`E`). In this case, we could solve the SE for the infinite quantum well with the given boundary conditions to obtain the allowed energy levels (eigenvalues) and corresponding wave functions (eigenfunctions) of the particle.

However, the provided snippet seems to be showing a specific step in the solution process, not the complete solution. Here's a breakdown of that step:

1. **Separation of Variables:** The SE is typically separated into variables, resulting in two ordinary differential equations (ODEs) –one for the spatial part (`ψ(x)`) and one for the energy part (`E`).

2. **Solving for Spatial Part:** For the infinite quantum well with zero potential energy inside the well (`V = 0`), the solution for the spatial part typically involves trigonometric functions like sine or cosine, depending on the specific boundary conditions.

3. **Applying Boundary Conditions:** The boundary conditions are then applied to the solution for the spatial part. This step helps determine the allowed values of the wave number (k) or other constants involved in the solution.

In the snippet you provided:

- The equation `ψ(0) = A + B` likely comes from applying the boundary condition `ψ(0) = 0`, where A and B are constants to be determined.

- The equation `ψ'(a/4) = A ika + B(-ika)` results from applying the other boundary condition $\psi'(a/4) = 0$ and using the relationship between the wave function and its derivative in terms of the wave number (k).

- Solving these equations together (along with any other conditions from the SE) helps determine the values of A and B, which can then be used to construct the complete wave function for the particle within the well.

Key Points Discussed

- The concept of an infinite quantum well and its basic properties.

- The role of boundary conditions in determining the allowed wave functions and energy levels.

- A glimpse into the solution process using the Schrödinger Equation, including separation of variables and application of boundary conditions.

I hope this explanation clarifies the concepts involved in the given snippet about the infinite quantum well with the new boundary conditions!