PH 105 – Quantum Mechanics

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84)

$\partial^2\psi/\partial x^2 + [2m(E_1-V)\psi]/\hbar^2 = 0$ ---(1)

Substitute $x\psi$ into Schrodingers Equation

$x\partial^2\psi/\partial x^2 + 2\partial\psi/\partial x + [2m(E_2-V)\psi x]/\hbar^2 = 0$ ---(2)

Multiply (1) by x and subtract from (2)

$2\partial\psi/\psi = [2m(E_1- E_2)/\hbar^2]xdx$

$a=2m(E_1- E_2)/\hbar^2$

Integrating,

$\psi = Cexp(ax^2/4)$ ---(3)

Substitute (3) in (1)

$a\psi(ax^2/4+1/2) + 2m(E_1-V)\psi/\hbar^2 = 0$

Simplifying

$V(x) = (E_1- E_2)(ax^2/4+1/2) + E_1$ ---(4)

Given , $V(0) = 0$

$E_2/E_1 = 3$

Simplifying (4)

$V(x) = [(E_1- E_2)^2mx^2]/2\hbar^2 + (3E_1- E_2)/2$