

Answer on Question #85010, Physics / Quantum Mechanics

Question:

The wavefunction for a particle is defined by:

$$\psi(x) = \begin{cases} N \cos(2\pi x/L) & \text{for } -L/4 \leq x \leq L/4 \\ 0 & \text{otherwise} \end{cases}$$

0 otherwise

Determine

i) the normalization constant N , and

ii) the probability that the particle will be found between $x = 0$ and $x = L/8$. (5+5)

Solution:

By entering $t = 2x + 0.5L$, we get its range $[0;L]$ and the wavefunction $\psi(t) = N \sin(\pi t/L)$. In this case

$N = \sqrt{\frac{2}{L}}$ and the probability

$$p = \frac{0.75L - 0.5L}{L} - \frac{\sin 2\pi \cdot 0.75 - \sin 2\pi \cdot 0.5}{6.28} = 0.25 + 0.16 = 0.41$$

The answer:

The normalization constant $N = \sqrt{\frac{2}{L}}$

The probability $p = 0.41$

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