Time Dependence in Quantum Mechanics Pretest

University of Colorado

Please type your name in the form: Last, First:

Required.

NOTE!! Please type in your CU userid (that's the username you use to log in to CULearn. We do NOT want your password. It probably looks like your last name, perhaps with a few extra characters. Note that it is definitely NOT your numerical (9 digit) student ID!!
This script cannot "error check", you have to be sure you type it in correctly! Thanks

Please type your CU userid:

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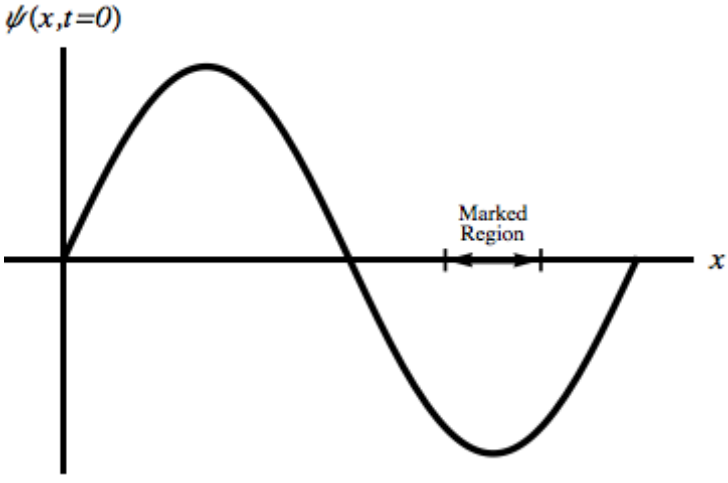
Q1: Suppose a system consists of a particle in an infinite square well potential of width a. The wave function for the system at time t = 0 is shown at right. This state satisfies the eigenvalue equation $\hat{H}\psi = E_2\psi$, where $\mathrm{E}_2 = \frac{4\pi^2\hbar^2}{ma^2}$.

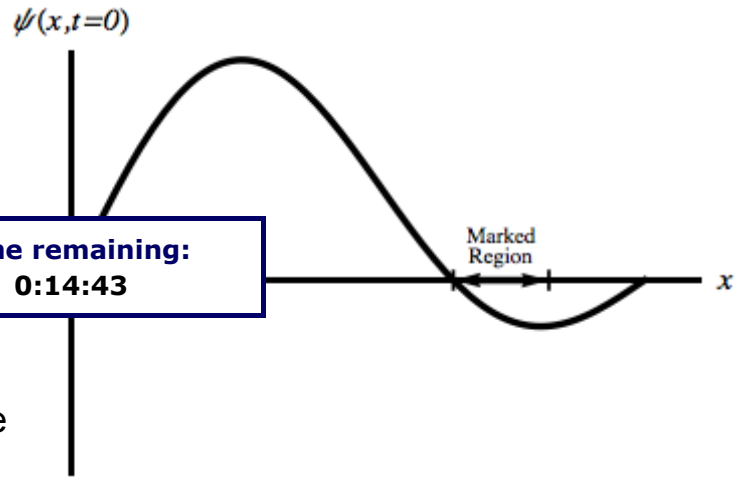


Consider the marked region along the x-axis. Rank from greatest to least the probabilities of finding the particle within the marked region at the following five times: $\mathrm{t}_0 = 0$, $\mathrm{t}_1 = \frac{\pi\hbar}{2E_2}$, $\mathrm{t}_2 = \frac{\pi\hbar}{E_2}$, $\mathrm{t}_3 = \frac{3\pi\hbar}{E_2}$, and $t_4 = \lim_{t\to\infty} t$. Use $\mathrm{P}_0,\ P_1,\ P_2,\ P_3,$ and P_4 as symbols for your probabilities.

Explain your ranking.

Required.

Q2: Another system consisting of a particle in an infinite square well potential of width a is initially prepared such that its wave function at time t = 0 is $\Psi(x,t=0) = \sqrt{\frac{1}{2}}\left(\psi_1(x) + \psi_2(\right.$ shown at right. ψ_1 and ψ_2 satisfy the eigenvalue equation $\hat{H}\psi_n = E_n\psi_n$. Here $\mathrm{E}_n = \frac{n^2\pi^2\hbar^2}{2ma^2}$. Consider the marked region along the x-axis. Rank the probabilities of finding the particle within the marked region at the following five times: $\mathrm{t}_0 = 0$, $\mathrm{t}_1 = \frac{2\hbar\pi}{E_2}$, $\mathrm{t}_2 = \frac{4\hbar\pi}{E_2}$, $\mathrm{t}_3 = \frac{6\hbar\pi}{E_2}$, and $\mathrm{t}_4 = \frac{8\hbar\pi}{E_2}$. Use $\mathrm{P}_0,\ P_1,\ P_2,\ P_3,$ and P_4 as symbols for your probabilities. Explain your ranking.



Time remaining: 0:14:43

Required.

Submit responses

Questions or Comments?
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