Physics 402
Spring 2019
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Discussion Worksheet for March 27, 2019

1. Let us consider a system composed of a particle of mass m in an infinite quantum well of width a. The particle is initially in the ground state. Its wavefunction is

$\psi_{n=1}(x) = \sqrt{\frac{2}{a}} \sin\frac{\pi x}{a}$ and its energy is $E_{n=1} = \frac{\hbar^2 \pi^2}{2ma^2}$. At time $t = 0$ a brick is dropped

in the well, and then removed at time $t = T$. We can model the effect of the brick using the following potential:

$$V(x) = \begin{cases} V_0; 0 < x < \dfrac{a}{2} \\ 0; \dfrac{a}{2} < x < a \end{cases}$$

What is the probability that the system is now found in its first excited state, with

wavefunction $\psi_{n=2}(x) = \sqrt{\frac{2}{a}} \sin\frac{2\pi x}{a}$ and energy $E_{n=2} = \frac{4\hbar^2 \pi^2}{2ma^2}$?

Useful integral: $\int_0^{\pi/2} \sin(y) \sin(2y)\, dy = \frac{2}{3}$