
Physics 321, hw 2 additional problem

Suppose that, at one instant, a particle of mass m in an infinite square well of width L is in the state

$$\Psi(x) = \frac{1}{2} \phi_1(x) + \frac{1}{3} e^{i\pi/2} \phi_3(x) + \frac{1}{2} e^{i\pi} \phi_4(x) + \sqrt{\frac{7}{18}} e^{i\pi/2} \phi_6(x)$$

where $\phi_n(x)$ are the energy eigenstates (just the generic sin basis:w:wq functions if we haven't used that term yet)

A) Suppose that the energy of a single particle in this state is measured. What are the possible outcomes of this measurement?

B) Is it possible that the energy measurement yields $E = 5 \frac{\hbar^2 \pi^2}{2mL^2}$?

C) What are the probabilities with which the various outcomes of the energy measurement occur?

D) Suppose that 10000 identical particles are each prepared in the this state and that the energy of each is measured. List the outcomes of this measurement and the number of times that you expect to get each outcome.

E) Determine the expectation value of the energy and the uncertainty in the energy.