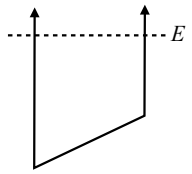
Physics 370 Homework #7

5 problems

Due by Monday, October 17

▷ **1.**

Consider a particle bound in an infinite well where the potential inside isn't constant, as shown in the picture. Suppose the particle is in a fairly high energy state, so that its wave function stretches across the entire well and its wavenumber is fairly high. Decide how, if at all, the particle's wavelength should vary across the potential, and sketch a plausible wavefunction.



▷ **2.**

Show that $\psi(x) = Ae^{ikx} + Be^{-ikx}$ is a solution to the infinite-well Schrodinger equation, find the relationship between A and B, and show that the energy $E = \frac{\hbar^2 k^2}{2m}$ is quantized as usual.

▷ **3.**

An electron in the $n = 4$ state of a 5 nm wide infinite well makes a transition to the ground state, giving off energy in the form of a photon. What is the photon's wavelength?

▷ **4.**

What is the probability that a particle in the first excited ($n = 2$) state of an infinite well would be found in the middle third of the well? How does this compare with your classical expectation?

▷ **5.**

A tiny 1 μg particle is in a 1 cm wide enclosure and takes a year to bounce from one end to the other and back.

(a) How many nodes are there in its enclosure?

(b) How would your answer change if the particle were more massive, or moving faster?