# Problems

1- An electron is described by the wave function

$$\Psi(x) = \begin{cases} 0 & x < 0 \\ Ae^{-x}(1-e^{-x}) & x > 0 \end{cases}$$

where x is in nm and A is a constant.

a- Determine the value of A that normalizes $\Psi(x)$.

b- Where is the electron most likely to be found ? That is, for what value of x is the probability of finding the electron the largest?

c- Calculate the average position <x> for the electron. Compare this result with the most likely position, and comment on the difference.

2- A particle is in the n*th* energy state $\Psi_n(x)$ of an infinite square well potential with width L.

a- Determine the probability $P_n(L/a)$ that the particle is confined to the first L/a of the width of the well.

b- Comment on the n-dependence of $P_n(L/a)$.

3- a particle in infinite one-dimensional Box describe by the wave function at t=0 as

$$\Psi(x,0) = A[\psi_1(x) + \psi_2(x)]$$

Determine

a- The normalization constant A.

b- The general form of the wave function at any time t.

c- The expectation value of x.

d- The expectation value of the momentum.

e- The expectation value of the energy.

4- A particle in an infinite square well of width L has an initial wave function describe by the equation $\Psi(x,0) = Ax(L-x)$

a- Determine the value of A.

b- Plot this wave function. Which of the eigenstates of the system does this initial wave function most closely resemble ? based on this observation, estimate the expectation value of the energy of this wave function.

c- Compute the expectation value of H at t=0, compare the value of , <H> to the estimated value you obtained in part b.