739.

Problem 50.37 (RHK)

We have to find the points of (a) *maximum and* (b) *minimum probability for a particle trapped in an infinitely deep well of length L if the particle is in the state n.*

Solution:

The wave functions of a particle that is trapped in an infinitely deep well of length L are

$$\psi_n(x) = A\sin\left(\frac{n\pi x}{L}\right), \; n = 1, 2, 3...$$

Note that

$$\psi_n(0) = \psi_n(L) = 0.$$

The probability density is proportional to

$$P_n(x) \propto \sin^2\left(\frac{n\pi x}{L}\right).$$

(a)

Therefore, the points where the probability will be a maximum will be determined by the condition

$$\frac{n\pi x}{L} = (m+1/2)\pi, \ m = 0,1,2,.. \quad ,(n-1),$$

or

$$x_{max} = \left\{ \frac{(m+1/2)L}{n}, \ m = 0,1,2,.. \quad ,(n-1) \right\}.$$

(b)

The points where the probability will be a minimum will be determined by the condition

$$\frac{n\pi x}{L} = m\pi, \ m = 0,1,2,.. \quad ,n,$$

or

$$x_{min} = \left\{ \frac{m}{n}L, \ m = 0,1,2,.. \quad ,n \right\}.$$