

6-3. In a region of space, a particle has a wave function given by  $\psi(x) = Ae^{-x^2/2L^2}$  and energy  $\hbar^2/2mL^2$ , where  $L$  is some length. (a) Find the potential energy as a function of  $x$ , and sketch  $V$  versus  $x$ . (b) What is the classical potential that has this dependence?

6-16. The wavelength of light emitted by a ruby laser is 694.3 nm. Assuming that the emission of a photon of this wavelength accompanies the transition of an electron from the  $n = 2$  level to the  $n = 1$  level of an infinite square well, compute  $L$  for the well.

6-33. Find  $\sigma_x = \sqrt{\langle x^2 \rangle - \langle x \rangle^2}$ ,  $\sigma_p = \sqrt{\langle p^2 \rangle - \langle p \rangle^2}$ , and  $\sigma_x \sigma_p$  for the ground-state wave function of an infinite square well. (Use the fact that  $\langle p \rangle = 0$  by symmetry and  $\langle p^2 \rangle = \langle 2mE \rangle$  from Problem 6-32.)

6-47. In a particular semiconductor device an oxide layer forms a barrier 0.6 nm wide and 9 eV high between two conducting wires. Electrons accelerated through 4 V approach the barrier. (a) What fraction of the incident electrons will tunnel through the barrier? (b) Through what potential difference should the electrons be accelerated in order to increase the tunneling fraction by a factor of 2?

6-53. A particle is in the ground state of an infinite square well potential given by Equation 6-21. Calculate the probability that the particle will be found in the region (a)  $0 < x < \frac{1}{2}L$ , (b)  $0 < x < \frac{1}{3}L$ , and (c)  $0 < x < \frac{3}{4}L$ .