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*) $0 < x < \frac{3}{4}L$.