Harmonic Oscillator Wavefuntions and Probability Densities

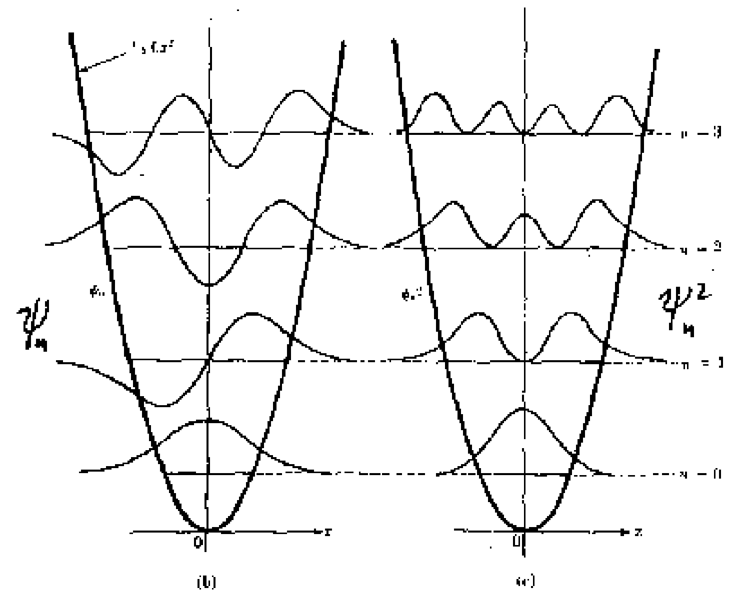


Fig. 2.20. Harmonic oscillator. **(a)** Ground-state wave function ψ_0 and probability density ψ_0^2; **(b)** potential-energy function $\frac{1}{2}kx^2$, wave functions ψ_n, and energy levels E_n; **(c)** probability densities ψ_n^2 and energy levels E_n.

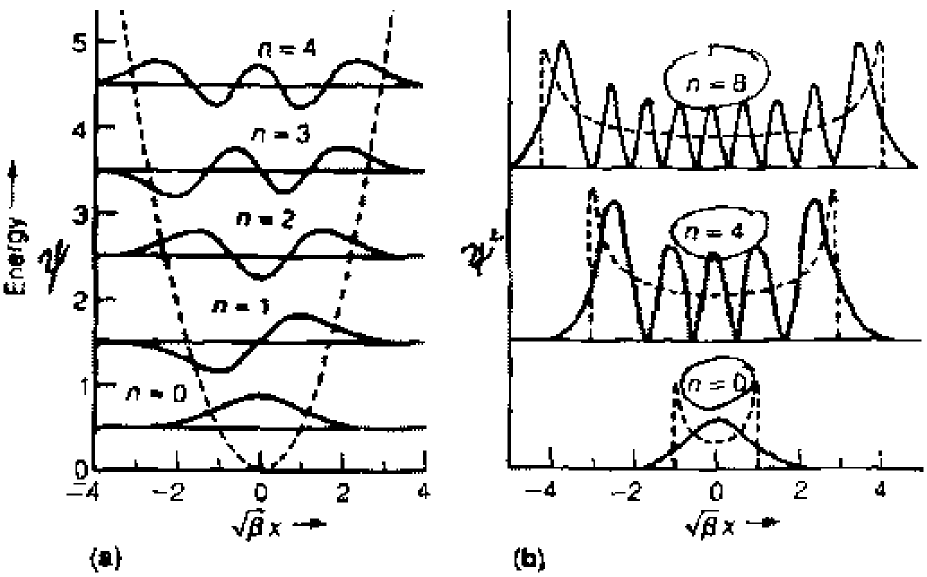
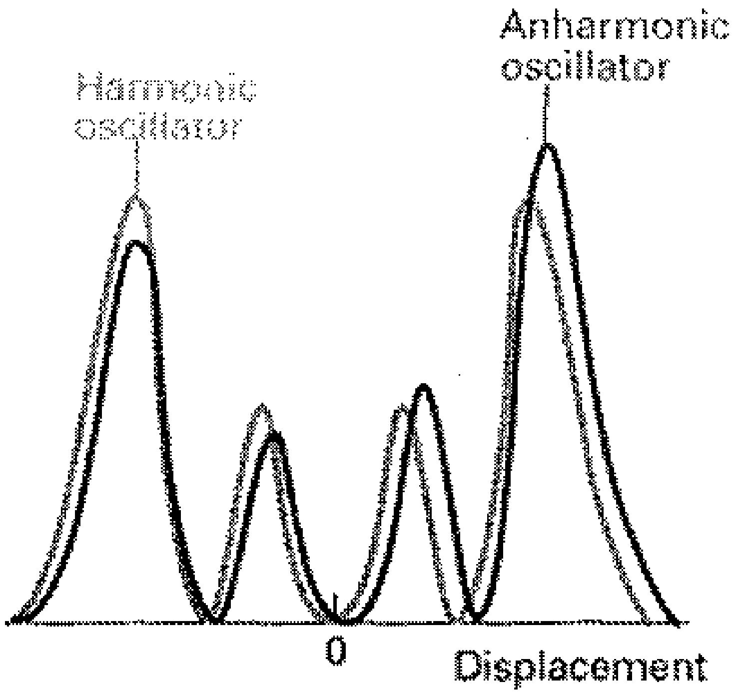


FIGURE 10-13

Wave functions for the harmonic oscillator. **(a)** The horizontal lines show the energy levels in units of $h\nu$. Superimposed on each line is the wave function for that level. The dashed line shows the potential-energy function. Note that the energy for level 0 is not zero. **(b)** Probability functions for levels $n = 0$, 4, and 8. The solid lines show the quantum mechanical probability distributions, ϕ_n^2. The dashed lines show the classical probability distributions computed from Equation 10-45, for the same energy E. (Reproduced from Kauzmann, 1957.)

Probability Distribution for Anharmonic Oscillator
as Compared to Harmonic Oscillator



16.36 The probability distribution (ψ^2) of a slightly anharmonic oscillator compared with the probability distribution of a harmonic oscillator (in each case for $v = 3$). The anharmonic oscillator (for a typical diatomic molecule) is more likely to be found at large extensions and less likely to found significantly compressed than is a harmonic oscillator.

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pp. 572