

a

b

Fig. 11.1. (a) Solutions $R_\ell(k, r)$ of the radial Schrödinger equation for a potential that is negative in region I, $V_I < 0$; is positive and larger than the particle energy in region II, $V_{II} > E$; and vanishes in region III. The shape of the potential $V(r)$ is indicated by the long-dash line, the particle energy E by the short-dash line. The short-dash lines also serve as zero lines for the functions $R_\ell(k, r)$. The energy is kept constant. The various curves correspond to different angular-momentum quantum numbers ℓ . (b) The situation is the same as that in part a except that the potential is zero everywhere, $V(r) \equiv 0$. Here the solutions $R_\ell(k, r)$ are identical to the spherical Bessel functions $j_\ell(kr)$, $k = \sqrt{2ME}/\hbar$.

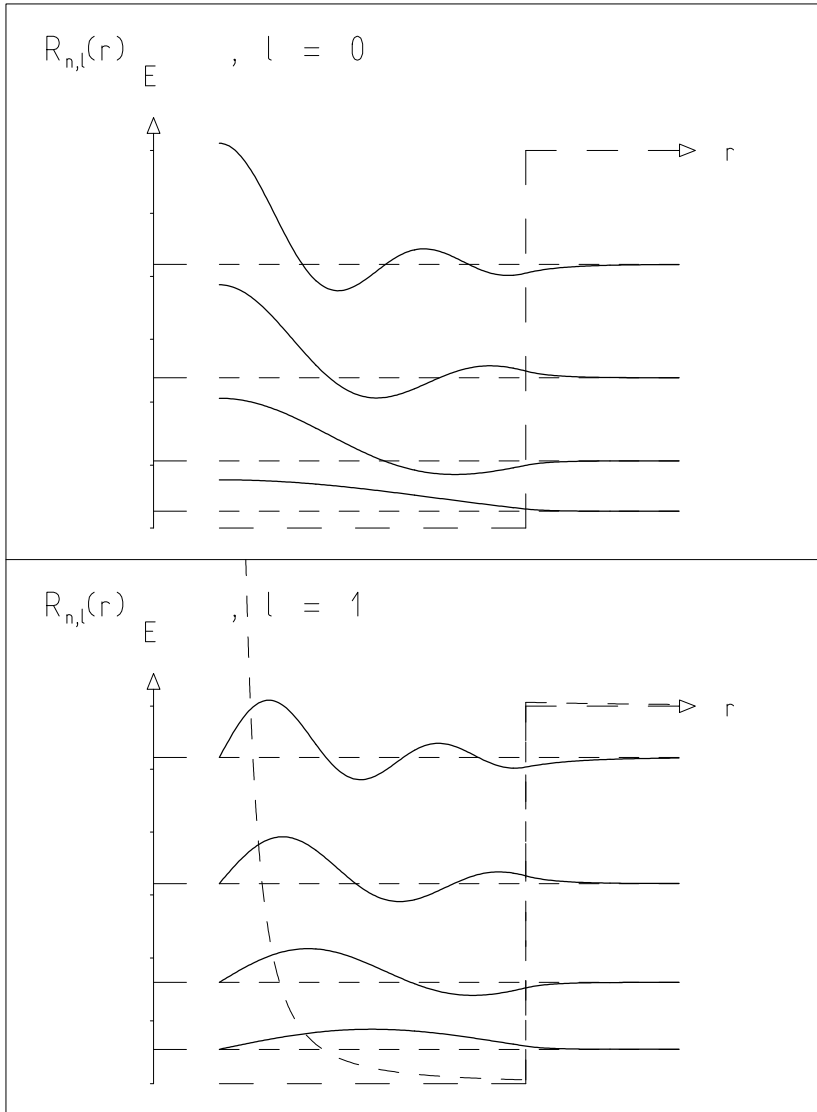


Fig. 11.2. Bound-state solutions $R_{n\ell}(r)$ of the radial Schrödinger equation for a square-well potential for two angular-momentum values, $\ell = 0$, $\ell = 1$. The form of the potential $V(r)$ is indicated by the long-dash line. On the left side an energy scale is drawn, and to the right of it the energies E_n of the bound states are indicated by horizontal lines. These lines are repeated as short-dash lines on the right. They serve as zero lines for the solutions $R_{n\ell}(r)$. For $\ell \neq 0$ the radial dependence of the “effective potential” $V_\ell^{\text{eff}}(r)$ shown as a short-dash curve indicates the influence of angular momentum (see Section 13.1).