P10-6 GAMMA RADIATION

Figure 10-4 shows a typical case of gamma emission from the fission fragment krypton 90. Rubidium 90 is sometimes formed directly in the fission process and is sometimes a daughter of krypton 90. Twenty-nine percent of the time krypton 90 emits one beta group to the ground state of rubidium 90, but 63 percent of the time the beta emission is to an excited state of rubidium 90. This state subsequently decays by emitting several gamma rays. The major decay is by a series of gamma rays that are emitted sequentially as the rubidium 90 nucleus deexcites from the nuclear level at 1.780 MeV, to another at 0.661 MeV, to another at 0.122 MeV, and finally to the ground state.

The gamma rays that are given off have energies that are equal to the difference in the nuclear energy levels, namely, 1.119, 0.539, and 0.122 MeV. There is also an appreciable gamma radiation of 1.780 MeV that corresponds to a transition directly from the 1.780-MeV level to the ground level of ^{90}Rb, which in turn beta-decays (half-life = 153 s) to the bone-seeker ^{90}Sr.

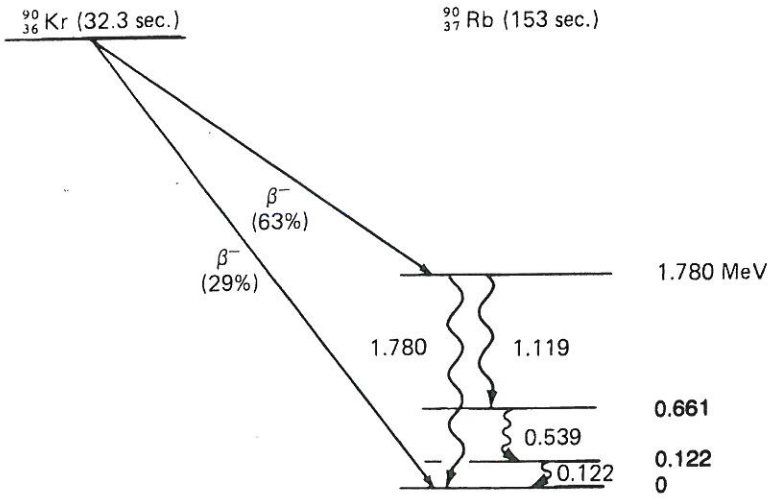

FIGURE 10-4
Formation of gamma rays by nuclear deexcitation. In the figure two groups of beta particles are emitted by the radioactive nucleus, ^{90}Kr. One group (29 percent of the time) goes directly to the ground state of the daughter nucleus, ^{90}Rb. The second group (63 percent of the time) populates an excited nuclear state in ^{90}Rb. This excited state very quickly (1×10^{-12} seconds) deexcites itself to the ground state of ^{90}Rb, emitting several gamma rays.