19.4: Artificially Induced Nuclear Reactions

In 1919 Rutherford performed the first artificial nuclear reaction. He was able to demonstrate that when α particles are introduced into a closed sample of N_2 gas, an occasional collision led to the formation of an isotope of O and the release of a proton:

$$^{4}_{2}\text{He} + ^{14}_{7}\text{N} \longrightarrow ^{17}_{8}\text{O} + ^{1}_{1}\text{H} \tag{19.4.1}$$

Since then many thousands of nuclear reactions have been studied, most of them produced by the bombardment of stable forms of matter with a beam of nucleons or light nuclei as projectiles. Particles which have been used for this purpose include protons, neutrons, deuterons ($^{2}_{1}\text{H}$) , α particles, and B, C, N, and O nuclei.