Transmutation Encyclopedia Article

Transmutation

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Transmutation

Transmutation is the transformation of one element into another. This notion originated in **alchemy** but continues today as an important research area of physics and **chemistry**. The principal goal of alchemists was the conversion or transmutation of base **metals** like **lead** into **gold**. The alchemists searched from the Middle Ages to the sixteenth century, in one manner or another, for the "philosopher's stone," which was thought to be the vital ingredient needed to transmute lead to gold. The search for the means to transmute was considered a noble occupation; even Isaac Newton (1642-1727) devoted much of his time to alchemy. This hope of converting one element into another using alchemical means was almost wholly abandoned by the late eighteenth century because it was regarded as foolish trickery.

The goal of transmutation was finally realized in the early twentieth century in **radioactivity**. In 1903, **Ernest Rutherford** and **Frederick Soddy** made the astonishing discovery that natural radioactivity involves transmutation. Radioactivity involves the change of atoms of one chemical element into atoms of another element. The change, known as radioactive decay, occurs when an unstable **nucleus** spits out one or more particles and transforms to a new nucleus. This new nucleus--that of a different element--may be stable, or also unstable and so capable of undergoing another transmutation. There are two types of radioactive decay, alpha decay (ejection of a nucleus of **helium**, two protons and two neutrons tightly bound together) and beta decay (ejection of an electron). Both of these transmute an original radioactive nucleus into the nucleus of another element. Through radioactivity, it is indeed possible to transmute **uranium** to lead. The alchemists of today are those nuclear chemists who routinely transmute uranium to **plutonium** by bombarding uranium with neutrons.