Marwari college Darbhanga

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Radioactivity

Radioactivity is the spontaneous emission of radiation in the form of particles or high energy photons resulting from a nuclear reaction. It is also known as radioactive decay, nuclear decay, nuclear disintegration, or radioactive disintegration. While there are many forms of electromagnetic radiation, they are not always produced by radioactivity. For example, a light bulb may emit radiation in the forms of heat and light, yet it is not radioactive. A

substance that contains unstable atomic nuclei is considered to be radioactive

Radioactive decay is a random or stochastic process that occurs at the level of individual atoms. While it is impossible to predict exactly when a single unstable nucleus will decay, the rate of decay of a group of atoms may be predicted based on decay constants or half-lives. A half-life is the time required for half of the sample of matter to undergo radioactive decay.

Units

The International System of Units (SI) uses the becquerel (Bq) as the standard unit of radioactivity. The unit is named in honor of the discoverer of radioactivity, French scientists Henri Becquerel. One becquerel is defined to be one decay or disintegration per second.

The curie (Ci) is another common unit of radioactivity. It is defined as 3.7×10^{10}disintegrations per second. One curie equals 3.7×10^{10} bequerels.

Ionizing radiation is often expressed in units of grays (Gy) or sieverts (Sv). A gray is the absorption of one joule of radiation energy per kilogram of mass.

Types of Radioactive Decay

The first three types of radioactive decay to be discovered were alpha, beta, and gamma decay. These modes of decay were named by their ability to penetrate matter. Alpha decay penetrates the shortest distance, while gamma decay penetrates the greatest distance. Eventually, the processes involved in alpha, beta, and gamma decay were better understood and additional types of decay were discovered.
Decay modes include (A is atomic mass or number of protons plus neutrons, Z is atomic number or number of protons):

(1) * **Alpha decay:** An alpha particle (A =4, Z=2) is emitted from the nucleus, resulting in a daughter nucleus (A -4, Z - 2).
(2) * **Proton emission:** The parent nucleus emits a proton, resulting in a daughter nucleus (A -1, Z - 1).
(3) * **Neutron emission:** The parent nucleus ejects a neutron, resulting in a daughter nucleus (A - 1, Z).
(4) * **Spontaneous fission:** An unstable nucleus disintegrates into two or more small nuclei.
(5) * **Beta minus (β^-) decay:** A nucleus emits an electron and electron antineutrino to yield a daughter with A, Z + 1.
(6) * **Beta plus (β^+) decay:** A nucleus emits a positron and electron neutrino to yield a daughter with A, Z - 1.
(7) * **Electron capture:** A nucleus captures an electron and emits a neutrino, resulting in a daughter that is unstable and excited.
(8) * **Isomeric transition (IT):** An excited nucleus releases a gamma ray resulting in a daughter with the same atomic mass and atomic number (A, Z),