Radioactivity

Chemistry – Leaving Cert

Quick Notes

Radioactivity

Henri Becquerel, Pierre Curie and Marie Curie were the scientists responsible for discovering radioactivity and radioactive elements such as polonium and radium. Radioactivity is the spontaneous breaking up of spontaneous nuclei with the emission of one or more types of radiation. Radiation from radioactive substances is of three types – alpha particles, beta particles and gamma radiation. Alpha particles consist of two protons plus two neutrons being emitted from a larger nucleus e.g. Americium-241. Alpha particles are stopped by a sheet of paper and they have uses in smoke detectors. A Beta particle is released when a neutron breaks down into a proton and an electron, and the electron leaves the atom at high speed e.g. Carbon-14. Beta particles may be stopped by 5mm of aluminium and they may be used in dating archaeological artefacts. Gamma rays are high-energy electromagnetic radiation e.g. Cobalt-60. Gamma rays may be stopped by a thick block of lead and they are used in radiation or food irradation. A radioisotope is an isotope of an element that is radioactive. Transmutation is the formation of a new element when either alpha or beta particles are released. This does not occur when gamma radiation is emitted because there is no change in the number of protons or neutrons in the nucleus. Alpha radiation results in the loss of two protons and two neutrons whereas beta emission causes a neutron to become a proton and an electron. A nuclear reaction may involve the formation of a new element but in a chemical reaction a new element cannot be formed. The half-life of an element is the time taken for half of the nuclei in any given sample to decay e.g. Carbon-14 has a half-life of about 5700 years, and this allows the age of ancient materials to be determined in Carbon-14 dating. There is always a certain level of background radiation in the environment. This may be naturally occurring e.g. radon or it may be man-made e.g. from medical uses.