

IONIZING RADIATION AND RADIOACTIVITY

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The term “**radioactive atoms**” describes atoms, whose nuclei are not stable. Over time they can spontaneously transform into different nuclei. The transformed nuclei can be either stable or radioactive. The transformation of unstable nuclei (containing excessive energy) can be accompanied by emission of a particle, electromagnetic radiation quantum, or by capturing an electron originating in the electron cloud. The ultimate goal of the radioactive transformation is to reach a state of atomic stability. These processes take place in the atomic nucleus and physical or chemical processes cannot influence the speed of a nuclear transformation. The type of radionuclide emitted by this radiation determines the properties of the ionizing radiation. Temperature, type of the atom’s chemical bond, or the presence of an external electric or magnetic field does not influence the nuclear processes. Ionizing radiation changes the chemical nature of the radioactive atoms due to emission of nuclear particles.

Ionizing radiation is characterised as a stream of particles that possess the ability to ionize other atoms in their vicinity. Electromagnetic radiation is characterized as a stream of photons that possess the ability to excite other atoms in their vicinity. The ionizing radiation originates as a side effect of nuclear reactions. When speaking of X-radiation, the resulting radiation is generated through processes in the atomic electron cloud. During these reactions the atomic nucleus enters an excited state and becomes energetically unstable. In order to retain energetic stability the atom emits the excessive energy in the form of charged particles, or as electromagnetic radiation (photons).

Corpuscular ionizing radiation is characterised by the presence of **electric charge, mass, and by kinetic energy**. According to their mass, particles can be classified as **heavy** (α radiation, protons, and neutrons), **medium-weight** (mesons) and **light** (electrons, positrons).

Photonic ionizing radiation has a dual character. This type of radiation holds both the properties of electromagnetic wave motion and properties of particles characterised by zero mass. There are two types of radiation that come under this category; **gamma (γ) and X-radiation**. Physically speaking, both of these types are basically the same. The **only difference is their wavelength and their origin**. **Gamma radiation is produced in the atomic nucleus**, either as natural or artificial radioactivity. **X-radiation originates within the atomic electron cloud**, and can be produced in X-ray generators, betatrons, and linear particle accelerators.

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