

Elements and the Periodic Table ▪ Section Summary

Radioactive Elements

Key Concepts

- How was radioactivity discovered?
- What types of particles and energy can radioactive decay produce?
- In what ways are radioactive isotopes useful?

Remember that atoms with the same number of protons and different numbers of neutrons are called isotopes. Some isotopes are unstable. In a process called **radioactive decay**, the atomic nuclei of unstable isotopes release fast-moving particles and energy. **In 1896, the French scientist Henri Becquerel discovered radioactive decay quite by accident while studying a mineral containing uranium.** Becquerel presented his findings to Marie Curie and her husband, Pierre. The Curies concluded that a reaction was taking place with the uranium nuclei. **Radioactivity** is the name that Marie gave to this spontaneous emission of radiation by an unstable atomic nucleus.

Natural radioactive decay can produce alpha particles, beta particles, and gamma rays. The particles and energy produced during radioactive decay are forms of nuclear radiation. An **alpha particle** consists of two protons and two neutrons and is positively charged. It is the same as a helium nucleus. Alpha radiation can cause an injury much like a bad burn. A **beta particle** is a fast-moving electron given off by a nucleus during radioactive decay. Beta particles can travel into the body and cause cell damage. Alpha and beta decay are almost always accompanied by gamma radiation. **Gamma radiation** is high-energy waves. Gamma rays can pass right through the human body, causing severe cell damage.

The decay of radioactive isotopes makes them useful in many ways. **Uses include tracing the steps of chemical reactions and industrial processes, and diagnosing and treating disease.** These uses are possible because radioactive isotopes give off detectable radiation. **Tracers** are radioactive isotopes that can be followed through the steps of a chemical reaction or an industrial process. Tracers may be used by biologists studying plants, engineers surveying flaws in metal, and doctors detecting medical problems. In addition, the radiation given off by certain radioactive isotopes can be used to destroy unhealthy cells in the body, such as those in cancer tumors.