

Chapter 19 Radioactivity and Nuclear Energy

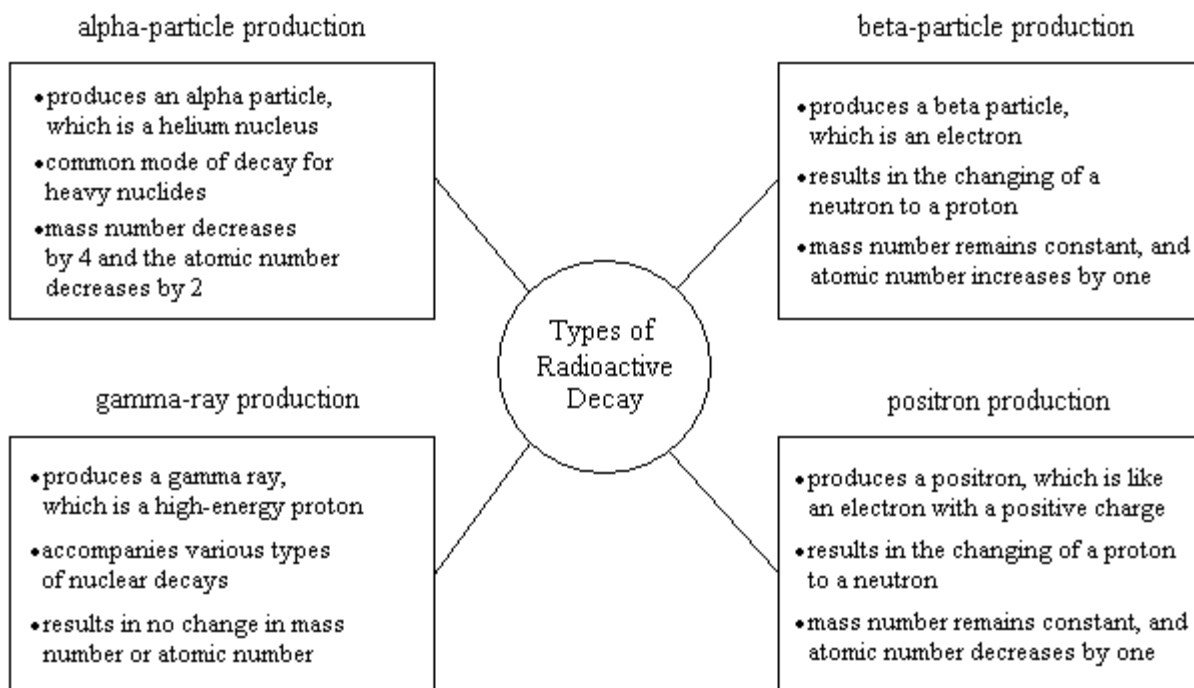
19.1 Radioactivity

Key Terms

nucleons (protons and neutrons)	atomic number (Z)	mass number (A)
isotopes	nuclide	radioactive
beta particle	nuclear equation	alpha particles
alpha-particle production	beta-particle production	gamma ray
positron	positron production	electron capture
decay series	nuclear transformation	transuranium elements
Gieger-Muller counter	scintillation counter	half-life

Summary

Many nuclei are *radioactive*; that is, they naturally decay (break down), forming a different nucleus and producing one or more particles. There are several types of radioactive decay.



Nuclear transformation is the change of one element into another. This change is achieved by bombarding a *nuclide* (an atom) with nuclei, such as *alpha particles* or neutrons, which penetrate the atom and break it apart. In order to overcome the natural tendency of particles of the same charge to repel each other, the bombarding particle must be traveling at a very high speed.

The most familiar instrument for measuring radioactivity is the *Geiger-Muller counter*.

The high-energy particles produced by radioactive elements are potentially harmful to living things. Energy transferred to cells can break chemical bonds and cause the cell systems to malfunction. Radiation damage can cause sickness or death. Exposure to radiation also can damage the genetic structures in cells, creating problems in the offspring of the organism.

Additional Active Reading Questions

1. What is *nuclear transformation*?
2. Define *half-life*.
3. What is the half-life of carbon-14?
4. Where might radiotracers be used?
5. Name and define the two types of nuclear energy processes.
6. What is another term for a self-sustaining nuclear reaction?
7. How do fission reactions inside a reactor core produce electricity?
8. Place the following three reactions in order from the one that produces the least energy to the one that produces the most: fission, chemical reaction, fusion.
9. How do stars produce energy?
10. How can radiation harm living things?