

Interactive Classroom

Glencoe Science

CHEMISTRY

MATTER AND CHANGE

Chapter 4

The Structure of the Atom

**Mc
Graw
Hill** **Glencoe**

Click the mouse button or press the Space Bar to continue.

Section 4.4 Unstable Nuclei and Radioactive Decay

Objectives

- **Explain** the relationship between unstable nuclei and radioactive decay.
- **Characterize** alpha, beta, and gamma radiation in terms of mass and charge.

Review Vocabulary

element: a pure substance that cannot be broken down into simpler substances by physical or chemical means



Section 4.4 Unstable Nuclei and Radioactive Decay (cont.)

New Vocabulary

radioactivity

radiation

nuclear reaction

radioactive decay

alpha radiation

alpha particle

nuclear equation

beta radiation

beta particle

gamma rays



Unstable atoms emit radiation to gain stability.



Radioactivity

- Nuclear reactions can change one element into another element.
- In the late 1890s, scientists noticed some substances spontaneously emitted radiation, a process they called radioactivity.
- The rays and particles emitted are called radiation.
- A reaction that involves a change in an atom's nucleus is called a nuclear reaction.



Radioactive Decay

- Unstable nuclei lose energy by emitting radiation in a spontaneous process called radioactive decay.
- Unstable radioactive elements undergo radioactive decay thus forming stable nonradioactive elements.



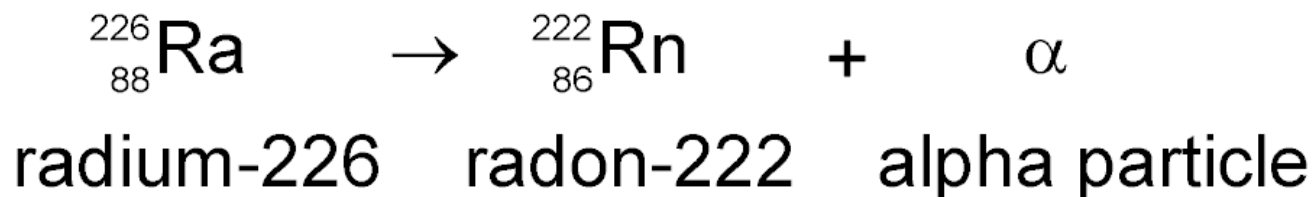
Radioactive Decay (cont.)

- Alpha radiation is made up of positively charged particles called alpha particles.
- Each alpha particle contains two protons and two neutrons and has a 2^+ charge.



Radioactive Decay (cont.)

- The figure shown below is a nuclear equation showing the radioactive decay of radium-226 to radon-222.

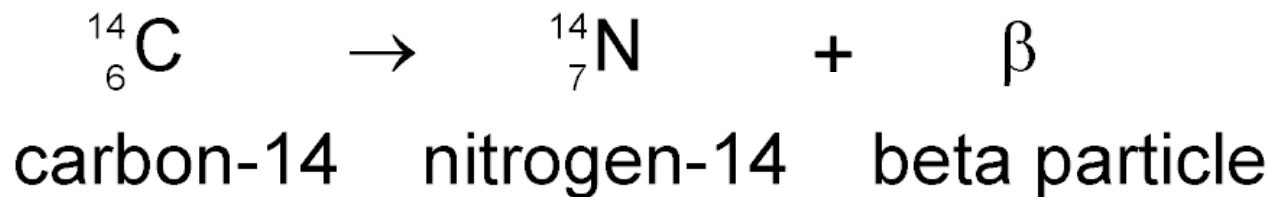


- The mass is conserved in nuclear equations.

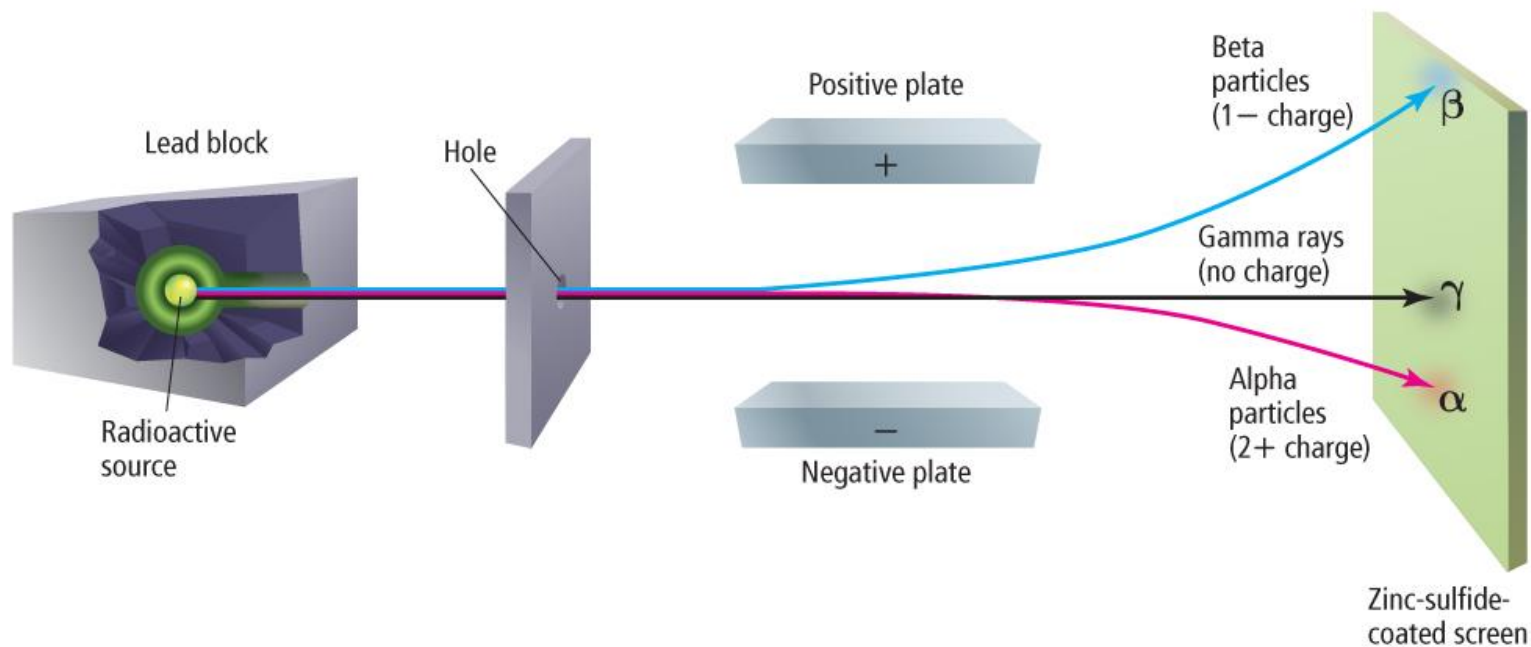


Radioactive Decay (cont.)

- **Beta radiation** is radiation that has a negative charge and emits beta particles.
- Each **beta particle** is an electron with a 1– charge.



Radioactive Decay (cont.)



Radioactive Decay (cont.)

- **Gamma rays** are high-energy radiation with no mass and are neutral.
- Gamma rays account for most of the energy lost during radioactive decay.

Table 4.5	Characteristics of Radiation		
	Alpha	Beta	Gamma
Symbol	${}^4_2\text{He}$ or α	e^- or β	γ
Mass (amu)	4	$\frac{1}{1840}$	0
Mass (kg)	6.65×10^{-27}	9.11×10^{-31}	0
Charge	2+	1-	0



Radioactive Decay (cont.)

- Atoms that contain too many or too few neutrons are unstable and lose energy through radioactive decay to form a stable nucleus.
- Few exist in nature—most have already decayed to stable forms.

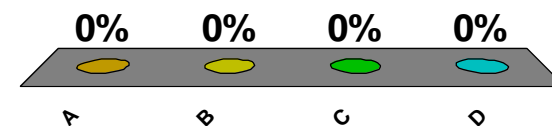


Section 4.4 Assessment



A reaction that changes one element into another is called what?

- A. chemical reaction
- B. beta radiation
- C. nuclear reaction**
- D. physical reaction



Section 4.4 Assessment



Why are radioactive elements rare in nature?

- A.** They do not occur on Earth.
- B.** Most have already decayed to a stable form.
- C.** They take a long time to form.
- D.** They are too hard to detect.

