

# Unit 6 • Radioactivity—What is the Nucleus Like?

## STUDY LIST

### Who Discovered Radioactivity?

I can...

- tell the story of how Henri Becquerel accidentally discovered radioactivity
- describe some of the important contributions of Marie (and Pierre) Curie to the understanding of radioactivity [<http://www.aip.org/history/curie/>]
- state that x-rays and uranium rays (Becquerel rays) were discovered about the same time. Marie Curie decided to take “the road less traveled” and studied the weaker uranium rays

### How Do We Know Radioactivity Exists?

I can...

- list four ways we know radioactivity exists (Geiger counter, cloud chamber, causes air to be a conductor, makes people ill)
- build a cloud chamber, tell the difference between an alpha track and a beta track, and explain the existence of tracks in terms of ionized air particles and fog

### What Is Radioactivity?

I can...

- list and describe three kinds of Becquerel rays that fly out of the nucleus

alpha, $\alpha$	beta, $\beta$	gamma, $\gamma$
$2\text{ p}^+ 2\text{ n}^0$	high NRG $\text{e}^-$	high NRG light
${}^4_2\text{He}$	${}^0_{-1}\text{e}$	${}^0_0\gamma$

- describe radioactive elements as elements with unbalanced numbers of protons and neutrons (the band of stability)
- state the changes that occur in a nucleus when each type of radioactivity is observed
  - alpha ( $2\text{ p}^+$ 's and  $2\text{ n}^0$ 's are emitted)
  - beta ( $\text{n}^0 \rightarrow \text{p}^+ + \beta^-$ )
  - positron ( $\text{p}^+ \rightarrow \text{n}^0 + \beta^+$ )
  - gamma (nucleus changes from high energy to lower energy state and emits a photon of high energy light)

### Is Radioactivity Dangerous?

I can...

- state that nuclear radiation can be dangerous because “fast moving photons (gamma rays), electrons (beta rays) and helium nuclei (alpha particles) can crash into other molecules and change their structure. If this happens to a DNA molecule, it can damage the genetic information, and sometimes turn a cell cancerous. Radiation also causes burns, much like sunburn, in large doses over short amounts of time.”\*
- state that since alpha particles are the most easily stopped, they are the least dangerous. Gamma radiation is more penetrating, but interacts with matter less frequently. Explain that even though radioactivity can damage tissue, it also has great benefits

### Does Radioactivity Go Away?

I can...

- explain that radioactive nuclei decay randomly, but follow simple mathematical rules when considered collectively
- graph undecayed atoms vs time and determine the half-life of an element from this graph
- use Mr. Groves’ “scoopy method” to state the amount of radioactive element left over time

### What Can Radioactivity Be Used For?

I can...

- list at least 5 uses for radioactivity [<http://www.darvill.clara.net/nucrad/uses.htm>]
- describe nuclear fission, fusion, and energy [binding energy, mass defect,  $E=mc^2$ , etc.]
- roughly explain how nuclear power plants work [<http://people.howstuffworks.com/nuclear-power.htm>]

\*Good Link About Uses and Dangers of Radioactivity:  
On Google: “uses radioactivity” resulted in...  
[http://van.hep.uiuc.edu/van/qa/section/Everything\\_Else/Hard\\_to\\_Categorize/20030223104346.htm](http://van.hep.uiuc.edu/van/qa/section/Everything_Else/Hard_to_Categorize/20030223104346.htm)