### Parent Information

The nucleus of an atom contains positively charged protons and neutral neutrons. The force holding these particles together is called the Strong Nuclear Force. It is the strongest force in the universe. (Imagine trying to push the positive ends of two batteries together) When the nucleus of an atom breaks apart, or combines with another, a tremendous amount of energy is released. Isotopes are atoms whose mass number (see week 1 lesson) has changed because neutrons have been added or removed. Often, these atoms nuclei are unstable, and will try to “kick out” particles and energy to stabilize. This is nuclear decay. There are three types: alpha, beta and gamma, named for the type of energy (radiation) they emit, and the leftover atom.

### Benchmark

SC.912.P.10.11 Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.

### Objective

Student will be able to describe nuclear reactions, the kinds of energy being released and the potential dangers associated with each.

### Duration

1-2 hours.

### Materials

1. Research Books (or internet access)

### Procedures

1. Examine the diagram of an atom and the table explaining nuclear reactions.
2. Use your research materials to learn about fusion and fission.

**Discussion Questions:**

1. What kind of radiation is the most dangerous to living things?
2. Gamma rays have extremely short wavelengths. Where would you expect to find them on the electromagnetic spectrum?
3. Which process produces nuclear power; fusion or fission?
4. What are some of the dangers of nuclear power?
5. Where does fusion happen most frequently?

### FCAT Practice

1. Uranium-238 is a form of uranium that is used in nuclear-power generators. Which of the following makes uranium-238 ideal for use in nuclear-power generators?
   A. It is unstable and releases large amounts of energy when it decays.
   B. It is unstable but releases only a small amount of energy when it decays.
   C. It is stable until it is heated so can be safely used.
   D. It is stable and produces large amounts of energy without decaying.
   
   **Answer:** A

### Extra Help

[http://reactor.engr.wisc.edu/tour/fission.htm](http://reactor.engr.wisc.edu/tour/fission.htm)
## 9th Grade Science Summer Activity

<table>
<thead>
<tr>
<th>Type of Reaction</th>
<th>Atomic Number</th>
<th>Mass Number</th>
<th>Particle Emitted</th>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha Decay</td>
<td>Down 2</td>
<td>Down 4</td>
<td>A helium nucleus with a mass of 4. (no electrons)</td>
<td>Alpha particles are not usually dangerous; they can be blocked by skin or paper.</td>
</tr>
<tr>
<td>Beta Decay</td>
<td>Same</td>
<td>Up 1</td>
<td>An electron</td>
<td>Beta particles are much more penetrating than alpha particles, but much less than gamma particles.</td>
</tr>
<tr>
<td>Gamma Decay</td>
<td>Same</td>
<td>Same</td>
<td>A single, high energy photon.</td>
<td>Gamma rays are very penetrating; they can be most efficiently absorbed by a relatively thick layer of high-density material such as lead.</td>
</tr>
</tbody>
</table>