Introduction to Nuclear Chemistry

TO SUMMARIZE:
- Beta particles are electrons emitted from nuclei when a neutron changes into a proton
- Beta particles have the symbol $\beta$ or $e$
- Beta particles have lower ionizing power than alpha particles
- Beta particles have greater penetrating power than alpha particles

3. Gamma Emission
- Because photons have no mass and no charge, the emission of gamma rays does not change the atomic number or mass number of a nucleus

TO SUMMARIZE:
- Gamma rays are electromagnetic radiation—high-energy, short-wavelength photons
- Gamma rays have the symbol $\gamma$
- Gamma rays have low ionizing power
- Gamma rays have high penetrating powers

4. Positron Emission
- a radioactive decay process that involves the emission of a positron from a nucleus
  - positron - a particle with the same mass as an electron but carries a positive charge
  - symbol for positron: $0^+e$
- a proton in the nucleus is converted into a neutron and a positron, and then the positron is emitted
- When an atom emits a positron, its atomic number decreases by 1 because it has one less proton

5. Electron Capture
- occurs when the nucleus of an atom draws in a surrounding electron, usually one from the lowest energy level
  - This captured electron combines with a proton to form a neutron
- As a consequence of electron capture, the atomic number of the nucleus decreases by 1
- The formation of the neutron also results in an X-ray photon being emitted

<table>
<thead>
<tr>
<th>Radioactive Decay</th>
<th>Particle Emitted</th>
<th>Change in Mass #</th>
<th>Change in Atomic #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha Decay</td>
<td>Helium Nuclei</td>
<td>decreases by 4</td>
<td>decreases by 2</td>
</tr>
<tr>
<td>Beta Decay</td>
<td>Beta particle</td>
<td>no change</td>
<td>increases by 1</td>
</tr>
<tr>
<td>Positron Emission</td>
<td>Positron</td>
<td>no change</td>
<td>decreases by 1</td>
</tr>
<tr>
<td>Electron Capture</td>
<td>X-ray photon</td>
<td>no change</td>
<td>decreases by 1</td>
</tr>
<tr>
<td>Gamma Emission</td>
<td>Energy</td>
<td>no change</td>
<td>no change</td>
</tr>
</tbody>
</table>

RADIOACTIVE SERIES:
- a series of nuclear reactions that begins with an unstable nucleus and results in the formation of a stable nucleus
- decay reactions continue until a stable nucleus is formed

![Radioactive Decay Diagram]