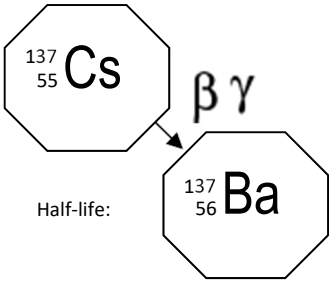
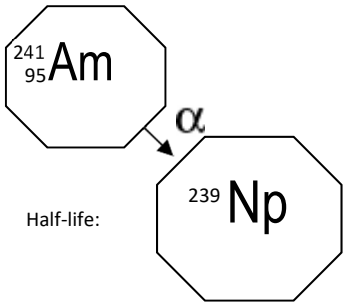
Decay Chain Examples-Teacher Answer Key

Cesium (Cs)



Cesium–137 is an isotope of cesium that is produced when uranium and plutonium absorb neutrons and undergo fission (the splitting of a nucleus into at least two other nuclei and the release of a relatively large amount of energy; used to generate nuclear power).

Americium (Am)



Americium–241 is produced in the same process as Cesium- 137; it is an isotope of americium that is used in ionizing smoke detectors and nuclear gauges.

The number of years listed in the example is the half-life for each element. Half-life is the amount of time it takes for approximately one-half of the radioactive atoms to decay.

Radioactive elements decay at different rates (e.g., cesium has a half-life of 30.17 years and americium–241 has a half-life of 432.7 years).

1. What forms of radiation are released when cesium (Cs) converts to barium (Ba)?
   Beta particle and gamma rays.

2. What change occurs in the atomic properties of cesium (Cs) when it converts to barium (Ba)? Why?
   The number of protons increases by one and cesium (55) becomes barium (56) because before a beta particle is released a neutron changes into a proton and an electron. The proton stays in the nucleus and the electron is ejected from the nucleus in the form of beta particles. The release of a beta particle decreases the number of neutrons by one and *increases the number of protons by one*.

3. What form of radiation is released when americium (Am) converts to neptunium (Np)?
   Alpha particle.

4. What change occurs in the atomic properties of americium (Am) when it converts to neptunium (Np)? Why?
   An alpha particle is made up of two protons (+2) and two neutrons from the atom's nucleus. When the ratio of neutrons to protons in the nucleus is too low, certain atoms restore the balance by emitting alpha particles. This *reduces the number of protons by two*, changing americium (95) to neptunium (93).