

1.5.2: Nuclear Bombardment Reactions

Positron Emission

There is another type of nuclear emission that results in a very unusual particle, a "positron" or a positively charged electron! This particle is a form of antimatter and almost immediately combines with a normal electron in the environment to produce gamma radiation. During positron emission, a proton in the nucleus converts to a neutron and a positron. The neutron stays in the nucleus but the positron is emitted. Writing the positron as shown below ensures that the atomic numbers and mass numbers are balanced.



Gamma Emission

The previous types of nuclear reaction, alpha emission, beta emission, and positron emission, all involve a single radioactive atom splitting into two pieces. One of the pieces is very small, so you can picture it as a nucleus emitting a small particle. The nucleus changes identity as a result.

Sometimes, a nucleus does not emit a particle at all, but only changes from an energetic unstable state (metastable) to a more stable state while emitting energy in the form of gamma radiation. This type of nuclear equation can be written this way.



Nuclear Bombardment

Another type of nuclear reaction occurs when scientists purposefully launch two types of nuclei together, or launch a small particle at a nucleus. These reactions have two things written on the left side of the arrow and two or more written on the right.



As in our previous equations, the sum of the atomic numbers on the left has to equal the sum on the right ($92 + 0 = 56 + 36 + 0$). The sum of the mass numbers on the left has to equal the sum of the mass numbers on the right ($235 + 1 = 141 + 92 + 3$).

These reactions sometimes result in new heavy elements, and is the way the elements beyond uranium were created. One of the most recent elements to be created this way is Mc:



Exercise 1.5.2.1

What is the missing isotope in the reaction below?



Answer

