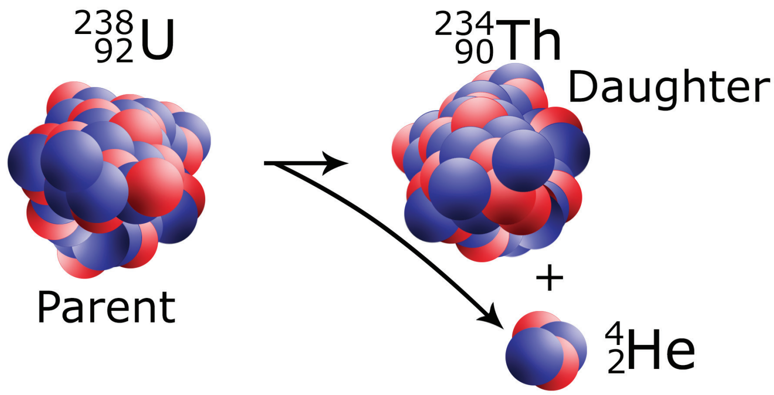
Let's look closer at the part of the last three graphics called "Accounting of mass and particles." Since nuclear decay equations are written like chemical reactions, it makes it easy to balance them. Using the notation showing the atomic mass in the superscript —^{238}U—and the protons in the subscript—$_{92}$U—makes it easy to "track the mass and particles" because the numbers in the superscripts must equal each other on both sides of the reaction, as must the subscripts. We can see at a glance that the atomic masses are balanced since the atomic mass of Th (234) plus the atomic mass of the α particle (4) add up to the atomic mass of U (238). As well, we can follow the proton numbers in the subscripts and see they also balance since the 2 of the α particle plus the 90 of Th adds up to the 92 of U.



Whenever an isotope undergoes alpha decay, it always loses 4 atomic mass units. Also, since it always loses 2 protons, the new element that is formed after the α particle is ejected from the nucleus is 2 columns to left of the starting one (check that out for calcium-argon, lead-mercury and uranium-thorium on our Periodic Table to make sure I did it right).

Notice that I slipped "parent" in under the ^{238}U and "daughter" next to the ^{234}Th. This is yet more terminology we should know when discussing nuclear decay. The **parent**, or **parent isotope**, is the isotope that undergoes the decay and changes, and the **daughter**, or **daughter isotope**, is the isotope that results from the decay process. For this equation, we'd say ^{238}U is the parent and it decays into ^{234}Th, the daughter. For the calcium-argon decay, the ^{46}Ca is the parent and ^{42}Ar is the daughter and for the lead-mercury decay cycle, ^{208}Pb the parent and ^{204}Hg the daughter.

13.7 BETA DECAY (BETA RADIATION)

Beta decay, also called "**beta radiation**," is a type of nuclear radiation that carries energy out of the nucleus via a **beta particle**. A beta particle is an electron. Wait, what? I thought we were talking about nuclear decay, and electrons are not in the nucleus. Well, stick with me on this one. During beta decay, a neutron changes into a proton (how cool is that), an electron is formed in the nucleus, and then is ejected out. Yes, the electron comes from the nucleus. How did an electron come out of the nucleus, you might ask? Great question! I don't mean to disappoint with the answer, but, for our purposes, the answer is, "Because that's what happens when a neutron gets converted into a proton during beta decay. An electron is formed in, and ejected from, the nucleus." Basically, it happens because it happens. Nothing fancier than that is necessary (at least at this point in your young nuclear chemistry career).

In the nuclear decay equation, the symbol for the beta particle can either be the Greek letter for beta—β—or it can be written as $^{0}_{-1}$e and here's why: