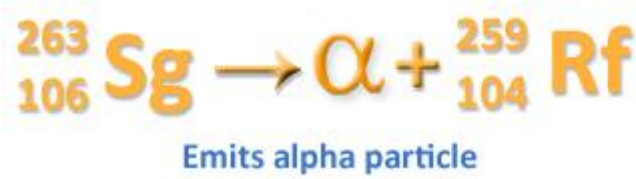
α Alpha Decay

When an atom experiences an alpha decay, it gives off an alpha particle made up of two protons and two neutrons which come directly from its nucleus. The alpha particle is the equivalent to the nucleus of the helium atom and has a mass number of 4, two protons and two neutrons.

An example of alpha decay would be seaborgium-263 which is an unstable radioactive isotope. An atom of seaborgium-263 will at some point go through an alpha decay and give off a particle and transmute or change into rutherfordium-259 in an attempt to become stable.



Note the mass number of rutherfordium-259 is 4 less than seaborgium-263 because the alpha particle which has just been given off has an atomic number of 2 and a mass number of 4.

Radioactive decays can be written as equations similar to those used in chemistry for expressing chemical reactions.

As a general rule of thumb, you can find the progeny isotope which has just experienced an alpha decay by finding the element or isotope which has a mass number which is 4 less than the parent radioactive isotope and has an atomic number that is 2 less than the parent radioactive isotope.

Here's another example. Look on the periodic table and find astatine (atomic mass # is 210). A radioactive isotope of astatine is astatine-211. It will decay and give off an alpha particle. Now look back two spaces on the periodic table. You will find that the element bismuth. Subtract 4 from the mass number of astatine-211 and 2 from its atomic number progeny isotope is bismuth-207.

Again the equation:

α Alpha Decay

Name: _____ Period: _____ Date: _____

Read the information found in the "Alpha Decay" section in the *What is Radiation?* module on the **Nuclear Technology: Exploring Possibilities Website**, then answer the following questions.

What subatomic particles make up an alpha particle?

_____

An alpha particle is the equivalent to the nucleus of what atom?

_____

What is the atomic mass of an alpha particle?

_____

As a general rule of thumb, how can you find the progeny isotope which has just experienced alpha decay using the periodic table?

_____

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Using the periodic table, solve the following alpha decay equations.

1. $^{238}_{92}U \rightarrow \_\_\_\_ + ^{4}_{2}He^{2+}$
2. $^{222}_{88}U \rightarrow \_\_\_\_ + ^{4}_{2}He^{2+}$
3. $\_\_\_\_ \rightarrow ^{204}_{82}Pb + ^{4}_{2}He^{2+}$
4. $^{256}_{103}Lr \rightarrow ^{252}_{101}Md + \_\_\_\_$
5. $\_\_\_\_ \rightarrow ^{227}_{89}Ac + ^{4}_{2}He^{2+}$
6. $^{225}_{89}Ac \rightarrow \_\_\_\_ + ^{4}_{2}He^{2+}$
7. $\_\_\_\_ \rightarrow ^{207}_{85}At + ^{4}_{2}He^{2+}$
8. $\_\_\_\_ \rightarrow ^{181}_{77}Ir + ^{4}_{2}He^{2+}$
9. $^{149}_{64}Gd \rightarrow ^{145}_{62}Sm + \_\_\_\_$
10. $^{175}_{78}Pt \rightarrow \_\_\_\_ + ^{4}_{2}He^{2+}$