



videos

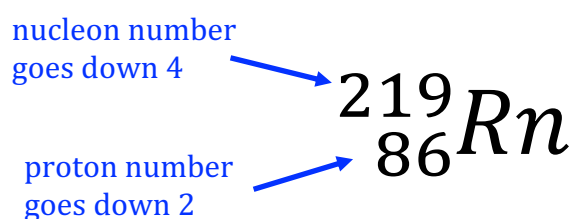
4.4.2 Nuclear equations

We have seen, in section 4.4.1, that alpha and beta emissions result in changes to the nucleus. To describe these changes, we use nuclear equations.

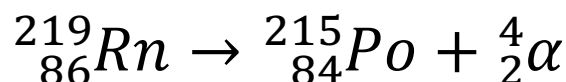
Alpha emission

When a nucleus 'decays' by emitting an alpha particle, it loses 2 protons and 2 neutrons. This means its proton number (or 'atomic number') decreases by two, and its nucleon number (or 'atomic mass') decreases by 4.

Consider the decay of radon-219:

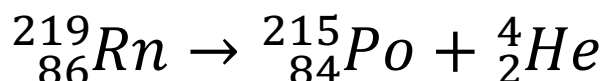


The nuclear equation for this is:



Radon-219 decays into polonium-215 by emitting an alpha particle. The arrow signifies that a change (decay) has occurred.

This is also sometimes written:



This is because an alpha particle (consisting of 2 protons and 2 neutrons) is actually a helium nucleus.

(1) *In the nuclear equation (above), what do you notice about the numbers on the top line on either side of the arrow?*

(2) *In the nuclear equation (above), what do you notice about the numbers on the bottom line on either side of the arrow?*

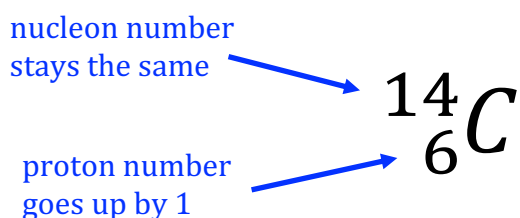
(3) *Uranium-238 decays to thorium-234 by emitting an alpha particle. Write a nuclear equation for this. (atomic number for U=92, atomic number for Th=90)*

(4) *Bismuth-209 decays by emitting an alpha particle. Write a nuclear equation for this. (Hint: You will need to use a periodic table to find out the element symbols for bismuth and what it decays into.)*

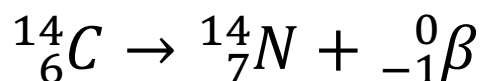
Beta emission

When a nucleus decays by emitting a beta particle, a neutron changes to a proton (in the nucleus), and a high-speed electron is emitted. The high-speed electron is the beta particle.

Consider the decay of carbon-14:

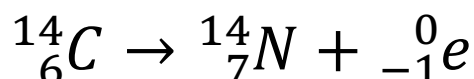


The nuclear equation for this is:



Carbon-14 decays into nitrogen-14 by emitting a beta particle.

This is also sometimes written:



This is because an alpha particle consists of an electron (with symbol 'e').

(5) *In the nuclear equation (above), what do you notice about the numbers on the top line on either side of the arrow?*

(6) *In the nuclear equation (above), what do you notice about the numbers on the bottom line on either side of the arrow?*

(7) *Phosphorus-32 decays to sulphur-32 by emitting a beta particle. Write a nuclear equation for this. (atomic number for P=15, atomic number for S=16)*

(8) *Strontium-90 decays by emitting a beta particle. Write a nuclear equation for this. (Hint: You will need to use a periodic table to find out the element symbols for strontium and what it decays into.)*

Gamma emission

Gamma emission does not result in changes to the atomic number or mass number.