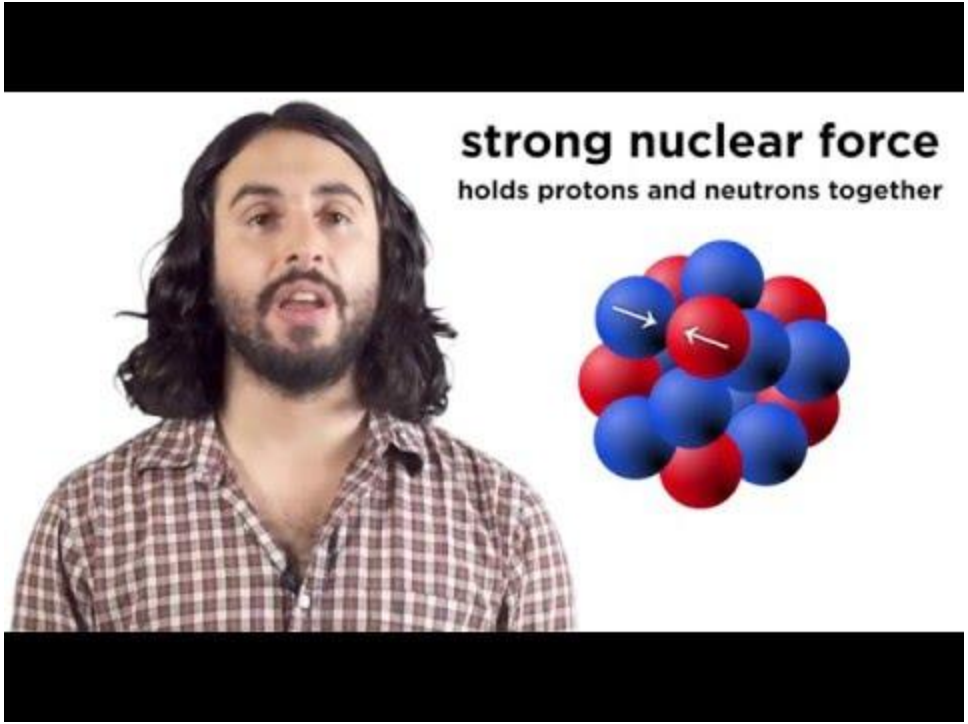
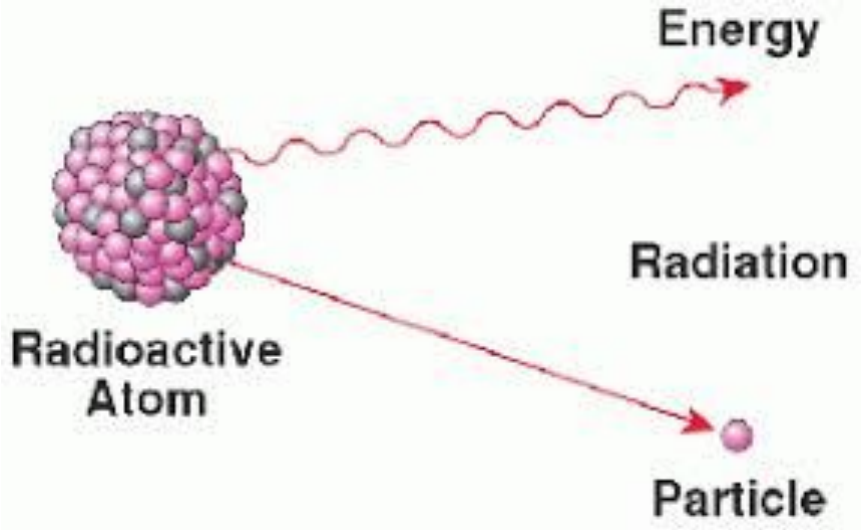
Nuclear Processes


strong nuclear force
holds protons and neutrons together

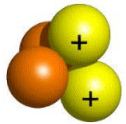
The nuclei of some atoms are **unstable** and naturally **decay** (break apart).

This is called **radioactive** decay.



The three most common types of radiation from radioactive decay are:

- Alpha (α) particles (Helium nuclei)
- Beta (β) particles (electrons)
- Gamma (γ) radiation (high-energy photons)



(see textbook page 861 for properties of these types)

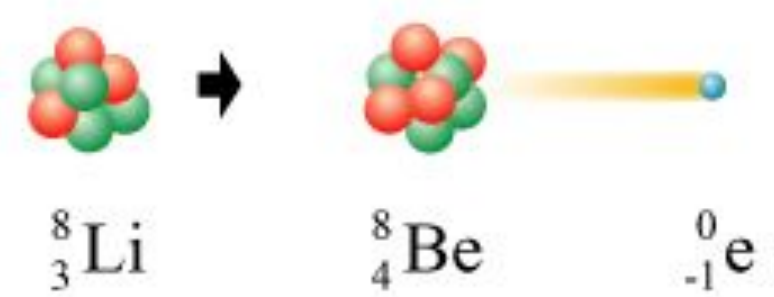
In any nuclear process,
the total number of protons and neutrons does not change.

But...
A neutron could turn into a proton!!

Beta decay

Lighter elements sometimes have too many neutrons. Then they may release a β particle from a neutron, which makes it turn into a proton!
(Gamma rays are usually released, also).

Example:



Protons and neutrons have **nearly** the same mass.
Electrons are much less massive.

The relative masses are:

Neutron = 1

Proton = 0.99862349

Electron = 0.00054386734

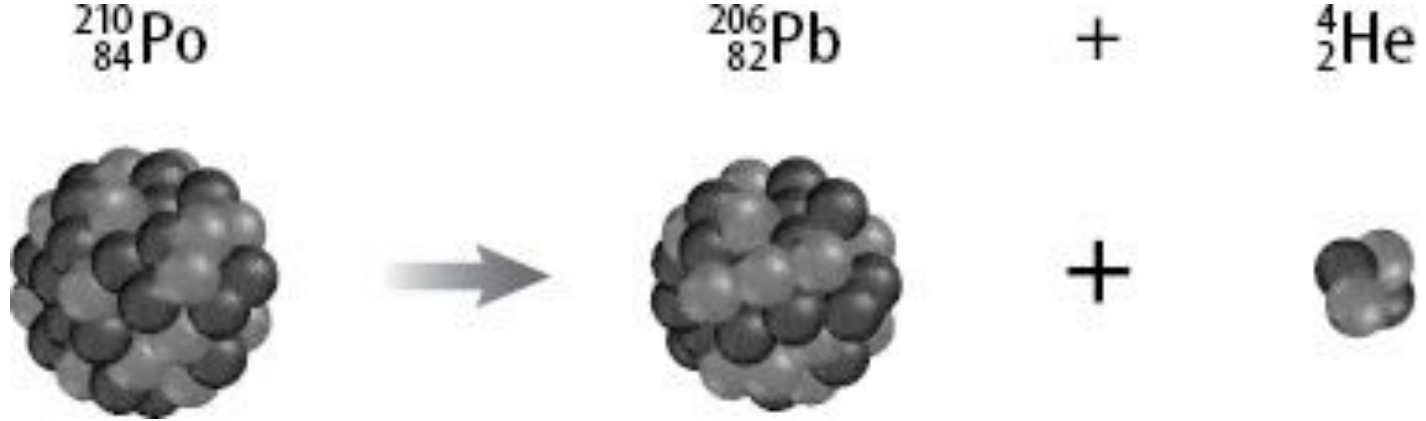
Said another way, protons are 99.86% as massive as neutrons.

Source: https://education.jlab.org/qa/particlemass_02.html

Alpha decay

All atoms with more than 82 protons are radioactive!
These heavy elements often emit α particles
(as well as gamma radiation).

Example:

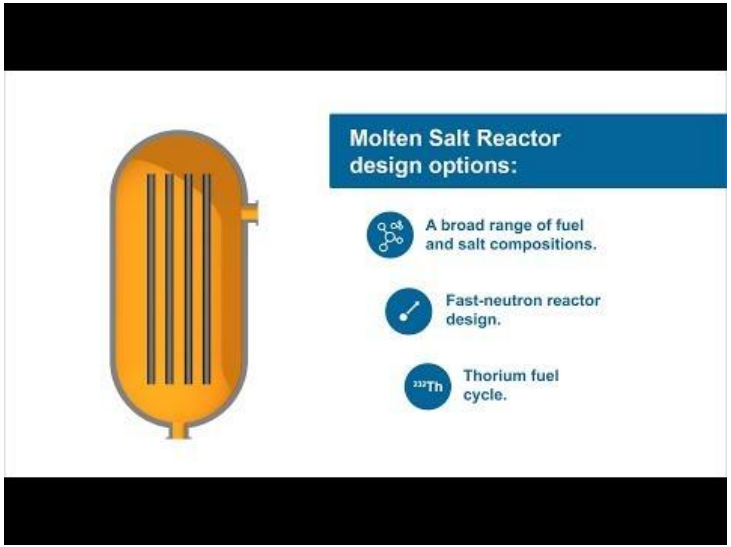


What is Nuclear Fusion?

Nuclear Fission:

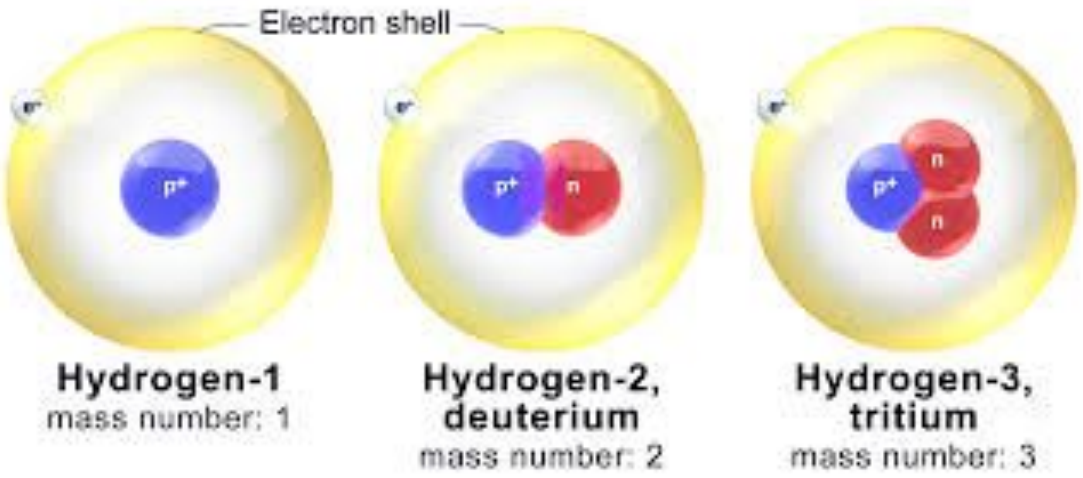
See textbook page 879.

Animation:



Isotopes are:

Atoms of the same element (equal number of protons) having different mass
(due to different numbers of neutrons).



Some isotopes decay in several steps before becoming a stable isotope.