RADIOACTIVITY A DEADLY ENEMY OR INVALUABLE HELPER

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What is an atom?

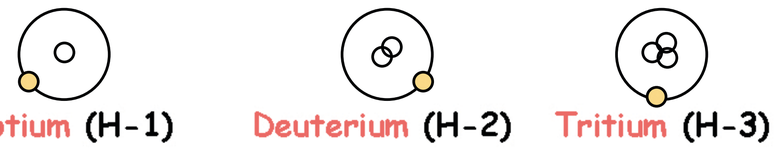
The main constructive particle - the atom is a nucleus with **equal** quantity of neutrons and protons, surrounded by an electron shell made of electrons.

What happens when protons and neutrons are not equal?

When we have the **same** amount of protons, but **more** or **less** neutrons, it's called **isotope**. An isotope can be **stable** or **unstable**.

Stable and unstable isotopes and their difference

Stable isotopes have stable nuclei, so they don't undergo radioactive decay. Hydrogen istopoes are perfect example:



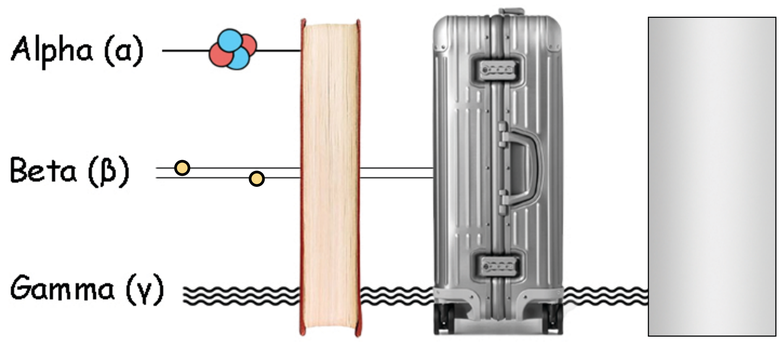
Unlike the stable isotopes, unstable ones do undergo radioactive decay, which means that the nucleus emits particles or **electro-magnetic radiation**. Usually isotopes with higher atomic number are unstable and radioactive.

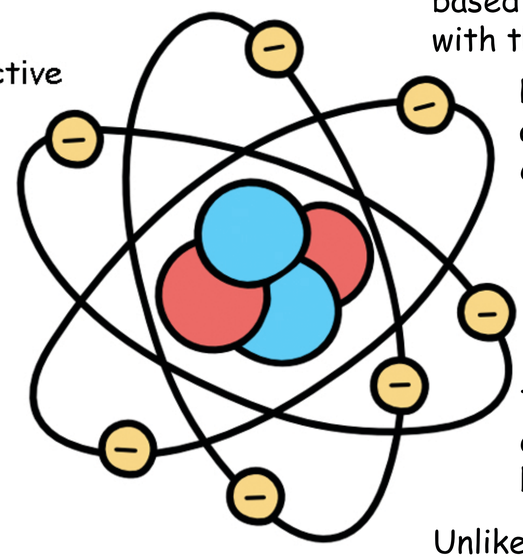
Radioactive decays

Radioactive decays are classified as:

The differences between the decays are as follows:

- In alpha decay, the nucleus loses two protons and two neutrons
- In beta decay, the nucleus emits an electron and antineutrino or a positron and neutrino
- In gamma no change in proton numbers occurs, so the atom does not become a different element but there is a loss in energy





Is radioactivity an invaluable helper?

Despite the enormous danger of radioactivity, it is also of extraordinary help in familiar medicine. It's used for a variety of purposes, including diagnosis and treatment of diseases, which is our main object.

Radioactivity is widely known with its contribution to the fight against cancer and tumors.

Proton therapy

The method used mainly for cancer treatment is **radiotherapy**, it is based on using high doses of radiation, directed to the abnormal cell, with the aim of damaging or killing it.

Radiotherapy is divided into different types of treatment, according to the used beams and their particles. The most common types of radiotherapy are:

- External beam radiation therapy
- Proton therapy
- Brachytherapy

The majority of types of treatment doesn't have the potential to damage the abnormal cell more effectively, without harming the healthy surrounding cells, except one - **Proton therapy**.

Unlike the common radiotherapy, which uses X-ray beam(electromagnetic particles), the proton therapy is a beam of positively charged protons, which are capable of delivering higher energy directly into the targeted cell, minimizing exposure to the surrounding healthy tissues.

Proton therapy, leaves healthy tissue undisturbed. This distinct advantage comes from the unique behavior of protons as they move through the body. Demonstrated on the Bragg Curve, protons reach a peak near the end of their path. The absorbed dose of radiation increases very gradually with greater depth, rising to its peak when the protons are stopped.