LO: Students will be able to describe radiation and nuclear decay.

DOL: Students will be able to correctly answer questions about nuclear decay at least 4/5 times.

Radiation: the emission of energy as electromagnetic waves or as moving subatomic particles, especially high-energy particles which cause ionization.

Nuclear Radiation refers to the particles and photons emitted during reactions that involve the nucleus of an atom.

When the nucleus of an atom is unstable, it emits particles and energy in order to become more stable. Atoms must have the correct ratio of protons to neutrons in the nucleus to be stable.

3 different types of radiation:

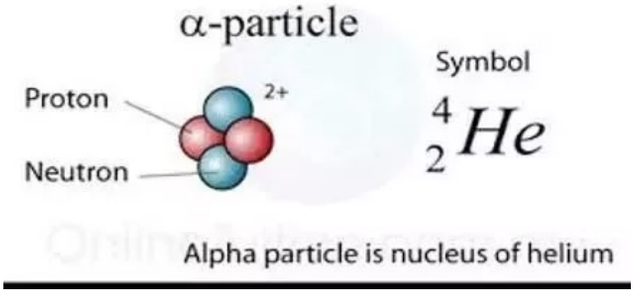
Alpha α

Beta β

Gamma γ

Alpha Particles:

2 protons, 2 neutrons, 0 electrons

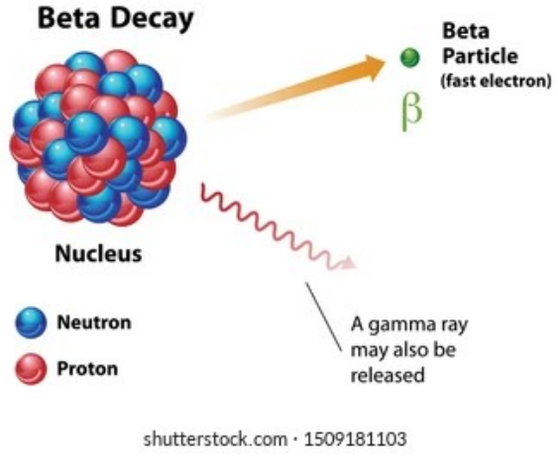


$$ß\,(\text{beta particle}) = e^{0}_{-1}$$

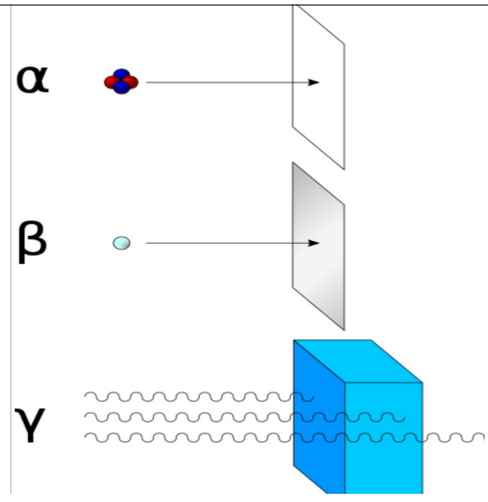
Beta particles have essentially no mass (1/2000th of that of a proton) and a negative charge, beta particles are electrons.

beta particles are created when a neutron decides to become a proton.

Neutrons have the same mass as a proton (1 amu), but they have no charge. In order to "gain" a positive charge and become a proton, they must get rid of a negative charge (an electron)



Gamma radiation is a wave, not a particle and is very high energy (we discussed this earlier this year when looking at the electromagnetic spectrum).



alpha can be stopped by a piece of paper

beta require something like aluminum to stop them

gamma require something like lead to stop them.

Chemical Equations for Nuclear Decay

alpha

$$^{226}_{88}\mathrm{Ra} \longrightarrow {}^{222}_{86}\mathrm{Rn} + {}^{4}_{2}\mathrm{He}$$

beta

$$^{131}_{53}\mathbf{I} \rightarrow {}^{131}_{54}\mathbf{Xe} + {}^{0}_{-1}\mathbf{e}$$

Decay Type	Radiation Emitted	Generic Equation	Model
Alpha decay	$^{4}_{2}\alpha$	$^{A}_{Z}X \longrightarrow {}^{A-4}_{Z-2}X' + {}^{4}_{2}\alpha$	Parent → Daughter + Alpha Particle
Beta decay	$^{0}_{-1}\beta$	$^{A}_{Z}X \longrightarrow {}^{A}_{Z+1}X' + {}^{0}_{-1}\beta$	Parent → Daughter + Beta Particle
Gamma emission	$^{0}_{0}\gamma$	$^{A}_{Z}X^{*} \xrightarrow{\text{Relaxation}} {}^{A}_{Z}X' + {}^{0}_{0}\gamma$	Parent (excited nuclear state) → Daughter + Gamma ray