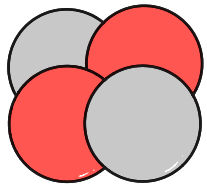
alpha
α



$^{4}_{2}\alpha$

particle of 2 protons and 2 neutrons

(helium nucleus)

emitted from nucleus

lowest penetration



absorbed by a thin layer of paper

beta
β

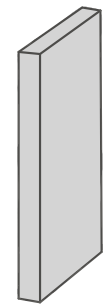


$^{0}_{-1}\beta$

high-speed electron

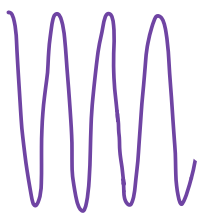
emitted from nucleus

medium penetration



absorbed by a few mm of aluminium

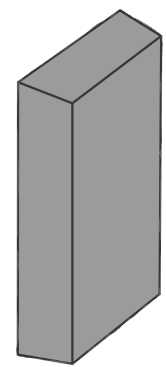
gamma
γ



electromagnetic radiation

emitted from nucleus

highest penetration

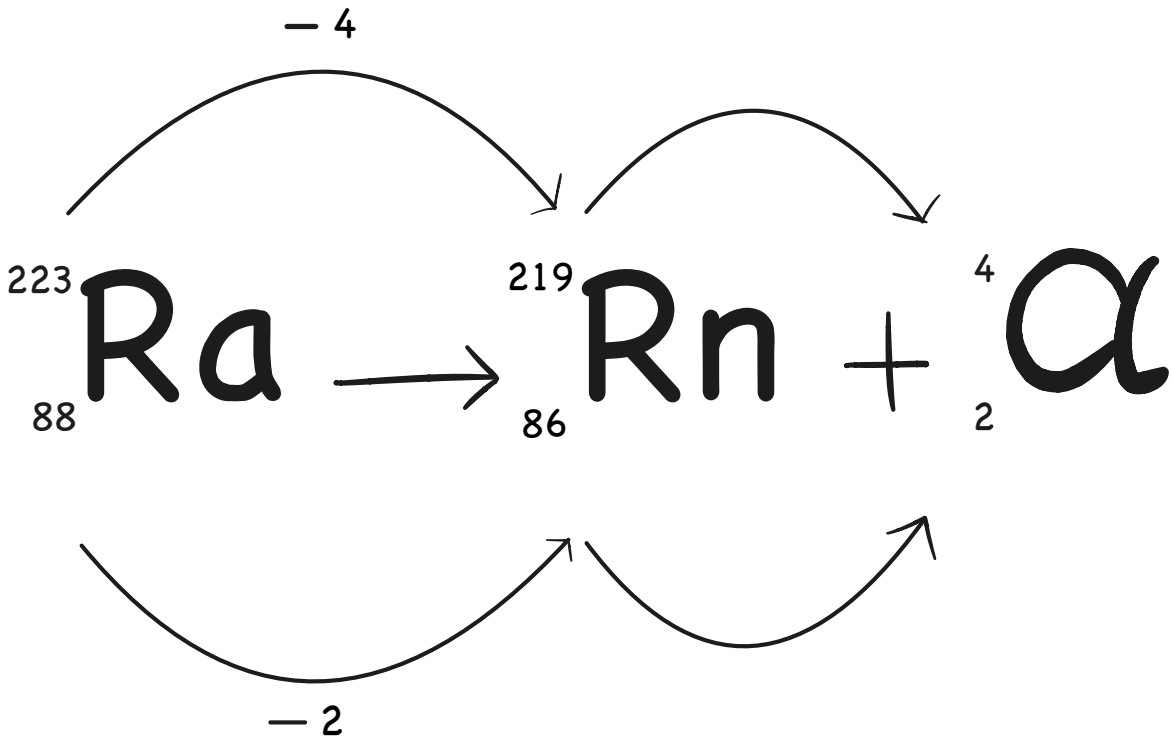


absorbed by a few cm of lead

(or concrete)

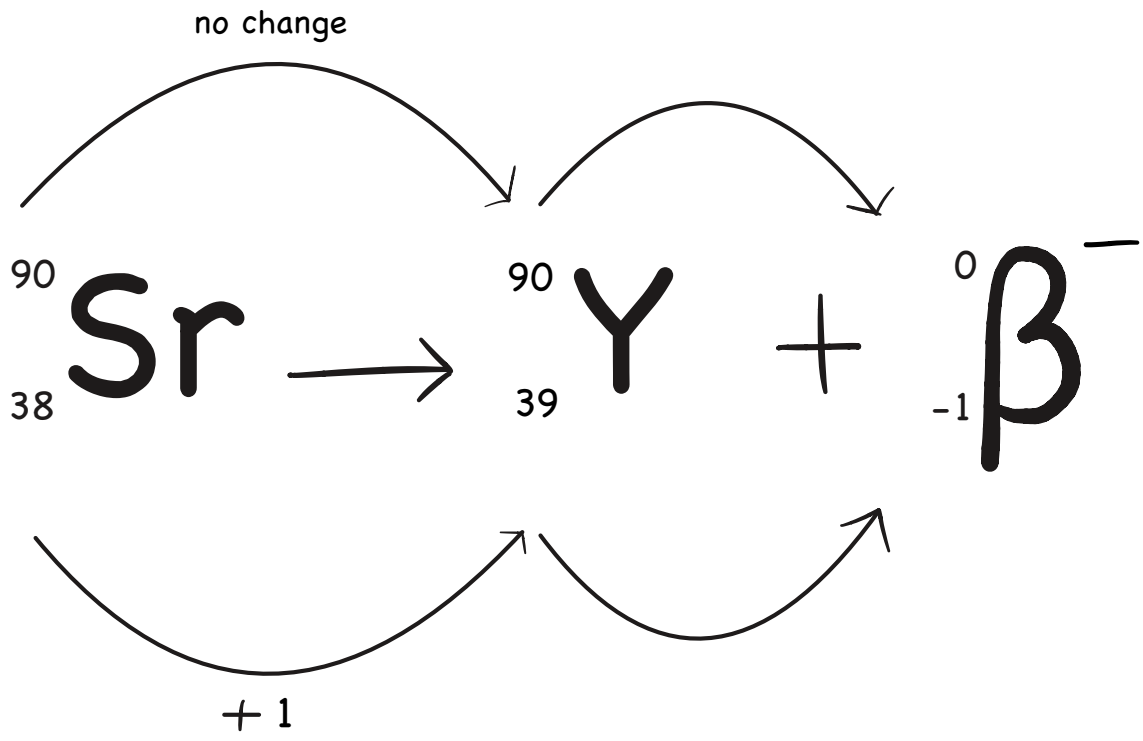
© Luciola

Emission of alpha particles



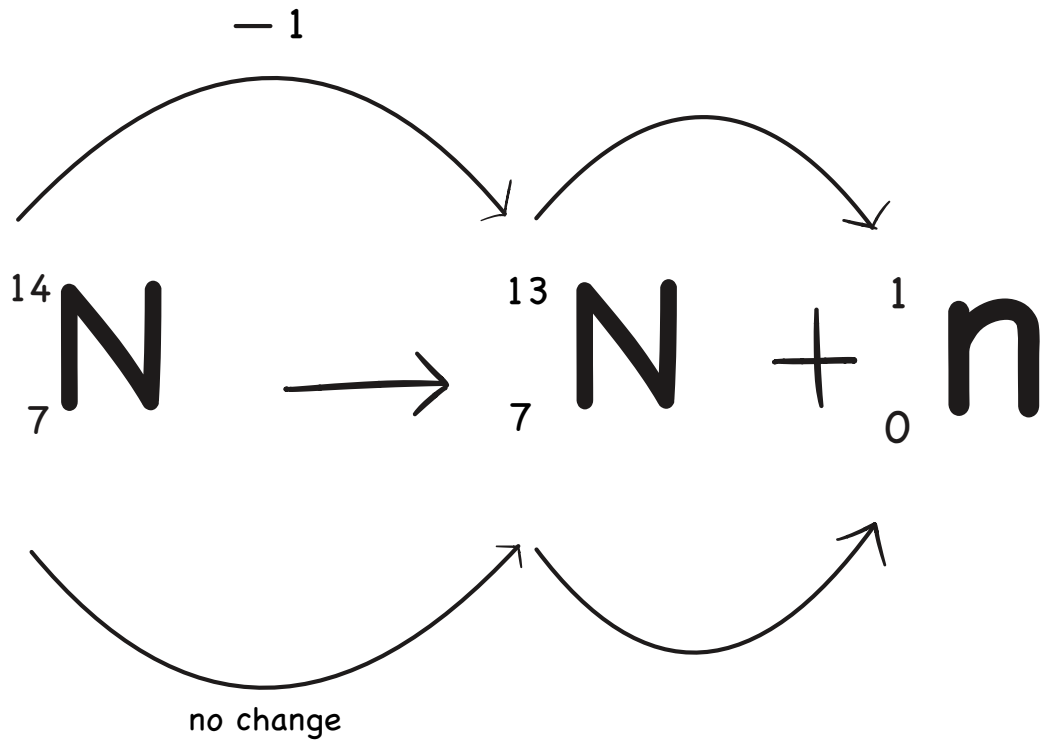
© Luciola

Emission of beta particles



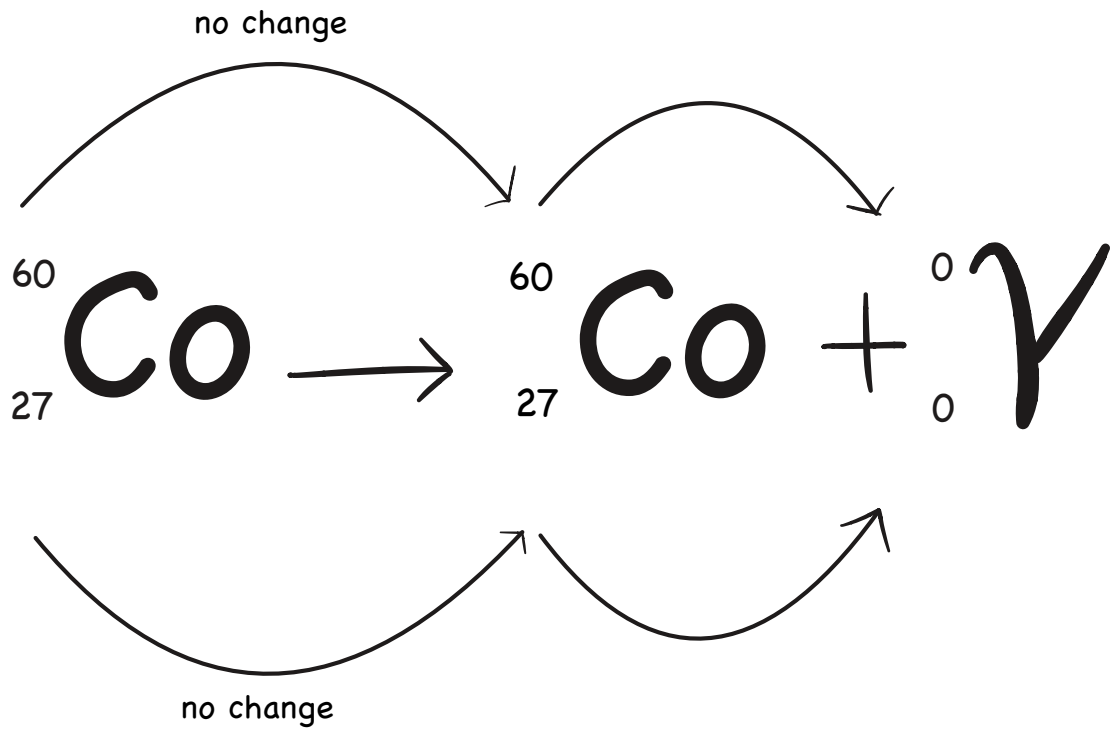
© Luciola

Neutron decay



© Luciola

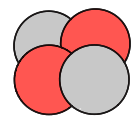
Emission of gamma radiation



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Alpha decay

unstable nucleus → emits an alpha particle → mass number decreases by 4
atomic number decreases by 2



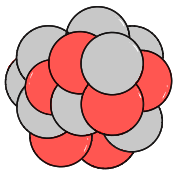
$$^{4}_{2}\alpha$$

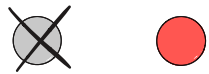
$$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}\alpha$$

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Beta decay

unstable nucleus → a neutron changes to a proton → emits a beta particle → mass number is unchanged; atomic number increaseses by 1





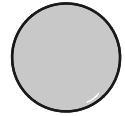


$$^{14}_{6}C \longrightarrow {}^{14}_{7}N + {}^{0}_{-1}\beta^{-}$$

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Neutron decay

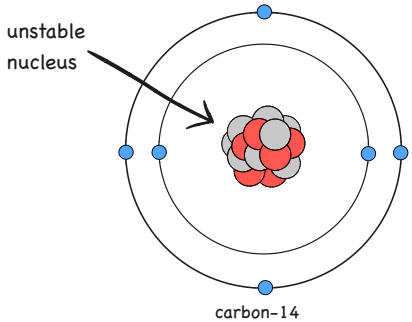
unstable nucleus → emits a neutron → mass number decreases by 1
atomic number is unchanged



$$^{9}_{3}\mathrm{Li} \rightarrow {}^{8}_{3}\mathrm{Li} + {}^{1}_{0}\mathrm{n}$$

© Luciola

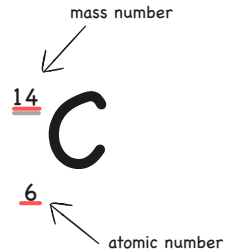
Beta radiation



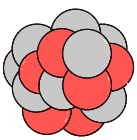
proton (6)

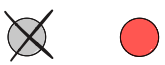
electron (6)

neutron (8)

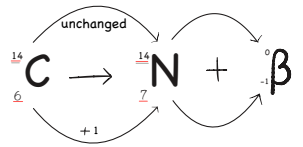


unstable nucleus → a neutron changes to a proton → emits a beta particle → mass number is unchanged, atomic number increaseses by 1



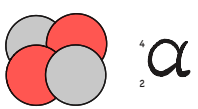


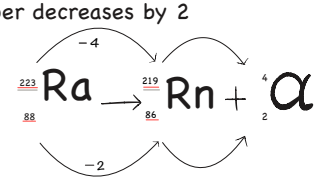
high-speed electron



Alpha radiation

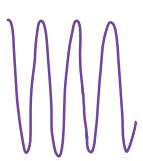
unstable nucleus → emits an alpha particle → mass number decreases by 4, atomic number decreases by 2

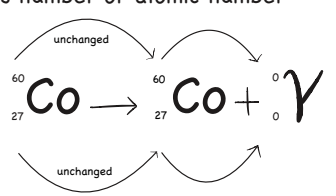




Gamma radiation

unstable nucleus → emits gamma radiation → no change in mass number or atomic number

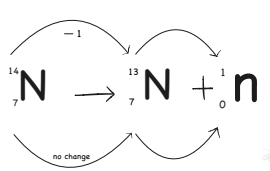




Neutron radiation

unstable nucleus → emits a neutron → mass number decreases by 1, atomic number is unchanged





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Radiation

Some atomic nuclei are unstable. The nucleus gives out radiation as it changes to become more stable. This is a **random** process called radioactive decay.

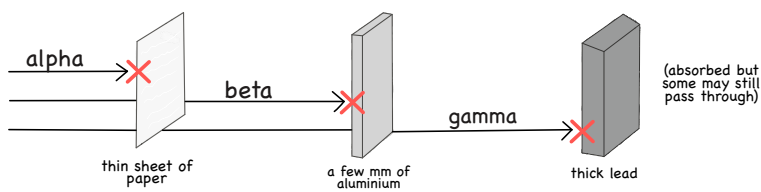


alpha	beta	gamma
α	β	γ
		
$^{4}_{2}He$	$^{0}_{-1}e$	
particle of 2 protons and 2 neutrons	high-speed electron	electromagnetic radiation
emitted from nucleus	emitted from nucleus	emitted from nucleus
highest ionising power	medium ionising power	lowest ionising power
lowest penetration	medium penetration	highest penetration
short range in air	medium range in air	long range in air

neutron → emits a neutron  mass number decreases by 1, atomic number is unchanged $^{1}_{0}n$

* random - it is not possible to predict when an individual nucleus will decay

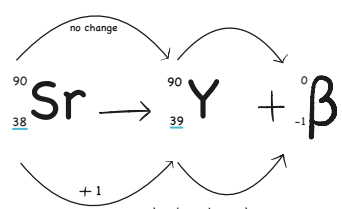
* ionising - can cause atoms to lose electrons and form ions



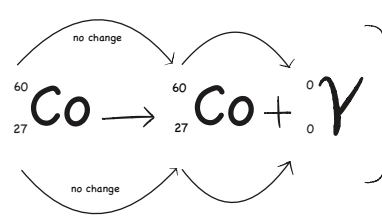
$^{238}_{92}U \rightarrow ^{234}_{90}Th + ^{4}_{2}\alpha$

mass number decreases by 4
atomic number decreases by 2

alpha equation



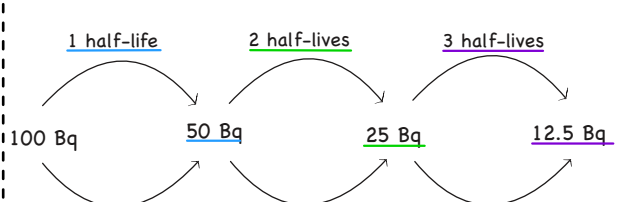
beta equation



gamma equation

half-life

the time taken for the number of radioactive nuclei in a sample to halve



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Radiation

Some atomic nuclei are unstable. The nucleus gives out radiation as it changes to become more stable. This is a **random** process called radioactive decay.





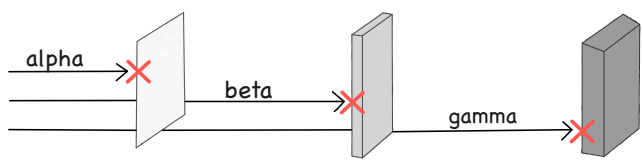




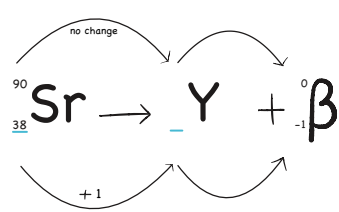
neutron → emits a neutron  mass number decreases by 1, atomic number is unchanged — n

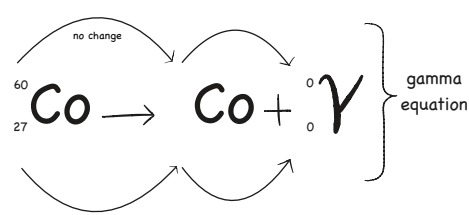
* random –

* ionising –



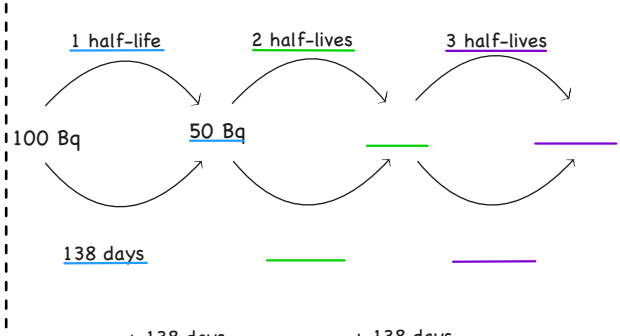
$^{238}_{92}U \rightarrow {}^{\ }_{\ }Th + {}^{4}_{2}\alpha$ — alpha equation





half-life

the time taken for the number of radioactive nuclei in a sample to halve



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