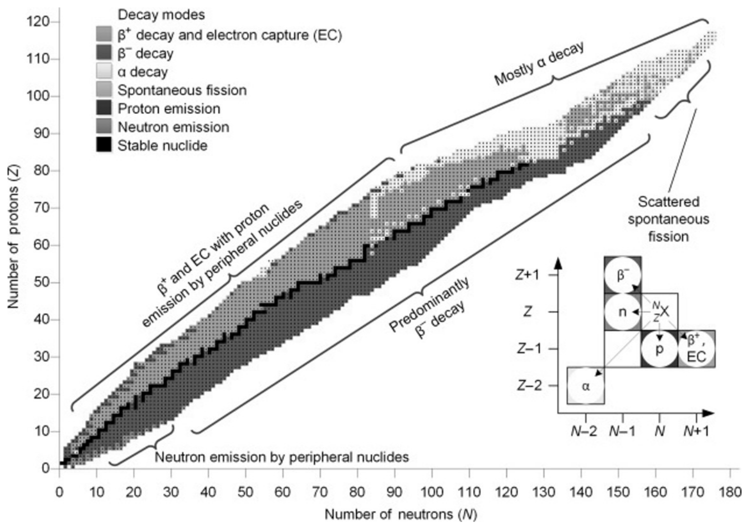
Nuclear Isotope Stability



Isotope stability is based on the z-ratio (p^+:n^o) of the atom

The band of stability (*shown in black*) is the thin group of elements that are considered *stable.* Other isotopes will undergo nuclear decay

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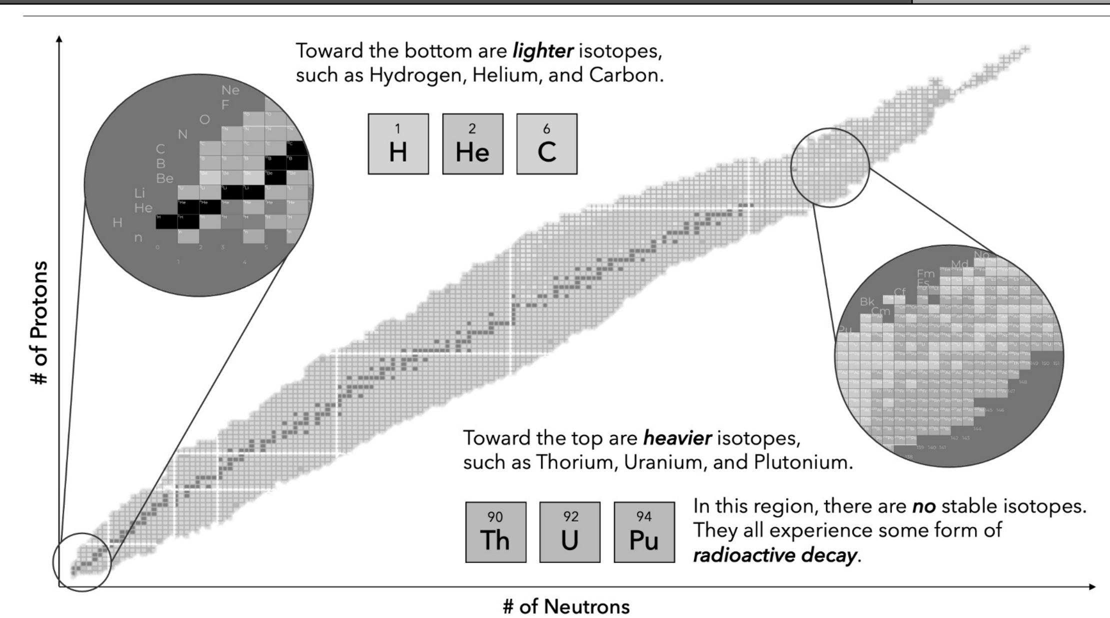

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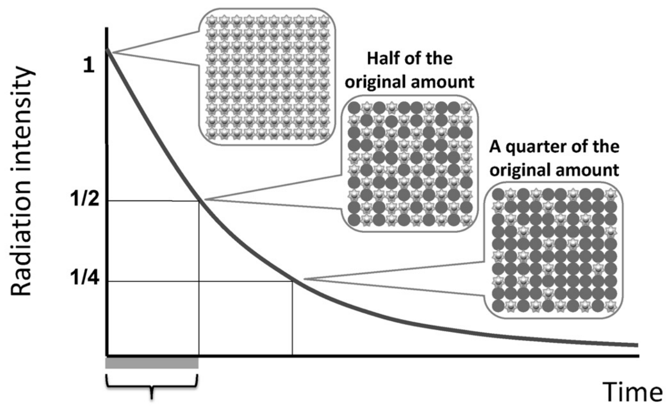
Nuclear Decay Rate

Based on the stability each isotope of an atom has a chance to decay every moment of time.



Each isotope will decay over time, the rate starting fast (*more particles can decay*) then slowing down (*less particles to decay*) over time as the sample decays

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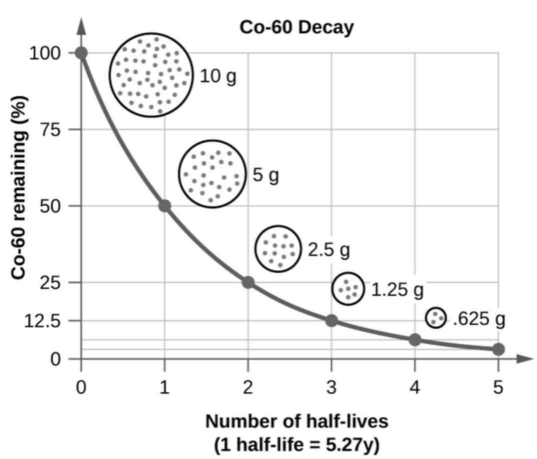
Nuclear Half Life

The time for particles to decay is based on the stability of particles



The **Half-Life** of a particle is the time it takes for half (50%) of the particles to decay from the original isotope state.

More Stable = Longer Half Life
Less Stable = Shorter Half Life

Nuclear Decay is an *inverse function* with a negative slope

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Solving for Half-Life

The following are equations to solve for particles at given half-life

$$N(t) = \frac{N_0}{2^n} \qquad N(t) = N_0 \left(\frac{1}{2}\right)^{\frac{t}{t_{1/2}}}$$

$n =$ number of HL

t = elapsed time

$t_{1/2}$ = half-life of the substance

$N(t)$ = quantity remaining

N_0 = initial quantity

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