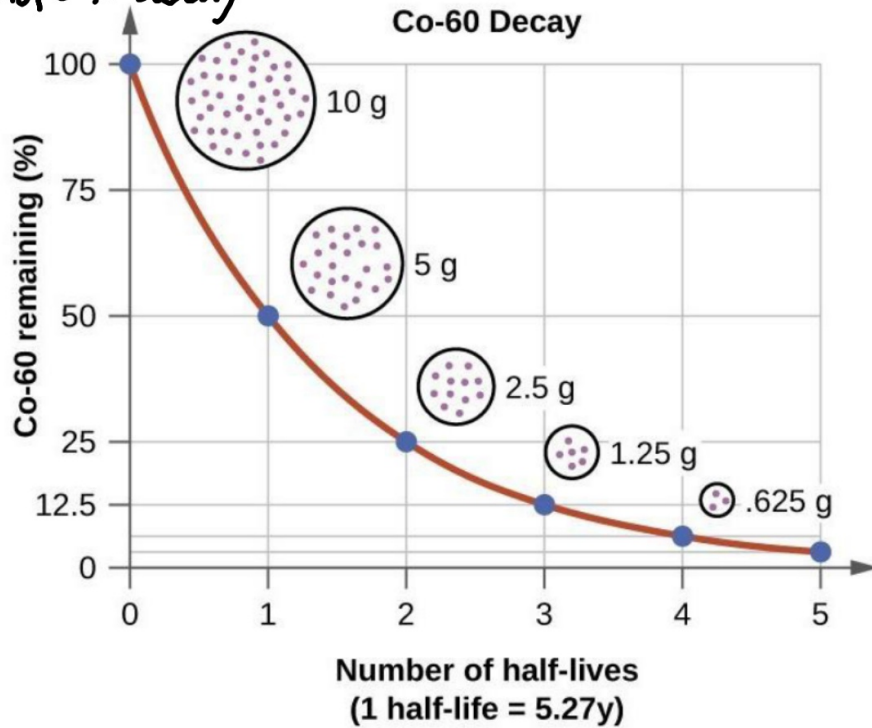


Half-life Notes & Examples

Half-life: amount of time it takes for half of a radioactive isotope to decay



1. How many half-lives will have occurred when 25% of the original Cobalt-60 sample remains?

2 half-lives

2. How many half-lives will it take for 75% of a Cobalt-60 sample to decay?

2 half-lives

3. How many half-lives will it take for a 60. g sample of Cobalt-60 to decay to a mass of 15 g?

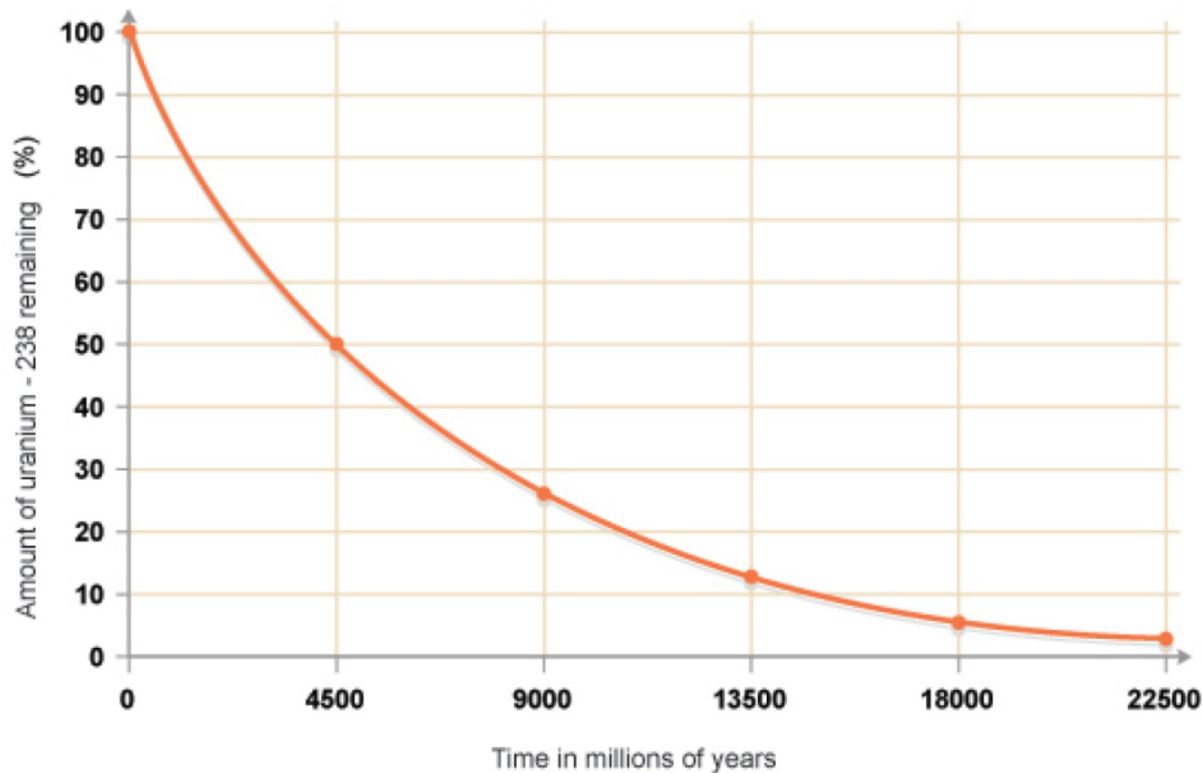
$$60 \text{ g} \xrightarrow{\textcircled{1}} 30 \text{ g} \xrightarrow{\textcircled{2}} 15 \text{ g}$$

2 half-lives

4. How many years will it take to undergo the decay in Question 3?

$$(5.27 \text{ yrs})(2) = 10.54 \text{ yrs}$$

Decay of Uranium-238



5. What is the half-life of Uranium-238?

$$t_{1/2} = 4500 \text{ million yrs.}$$

6. How long will it take for Uranium-238 to undergo four half-lives?

$$(4500 \text{ million yrs})(4) = 18000 \text{ million yrs}$$

7. How many grams of a 75 g sample of Uranium-238 will remain after 13500 million years?

$$\frac{13500 \text{ million yrs}}{4500 \text{ million yrs}} = 3 \text{ half-lives}$$

$$75 \text{ g} \xrightarrow{\textcircled{1}} 37.5 \text{ g} \xrightarrow{\textcircled{2}} 18.75 \text{ g} \xrightarrow{\textcircled{3}} 9.375 \text{ g}$$

Practice Problems

Problem #1: How much of a 100 g sample of ^{198}Au is left over 8.10 days if its half-life is 2.70 ^{$t_{1/2}$} days

$$\frac{\text{total time}}{t_{1/2}} = \frac{8.10 \text{ days}}{2.70 \text{ days}} = 3 \text{ half-lives}$$

$$100 \text{ g} \xrightarrow{\textcircled{1}} 50 \text{ g} \xrightarrow{\textcircled{2}} 25 \text{ g} \xrightarrow{\textcircled{3}} 12.5 \text{ g}$$

Problem #2: A 50.0 g sample of ^{16}N decays to 12.5g in 14.4 seconds. What is the half-life?

$$50 \text{ g} \xrightarrow{\textcircled{1}} 25 \text{ g} \xrightarrow{\textcircled{2}} 12.5 \text{ g}$$

$$\frac{14.4 \text{ s}}{2} = 7.2 \text{ s} = t_{1/2}$$