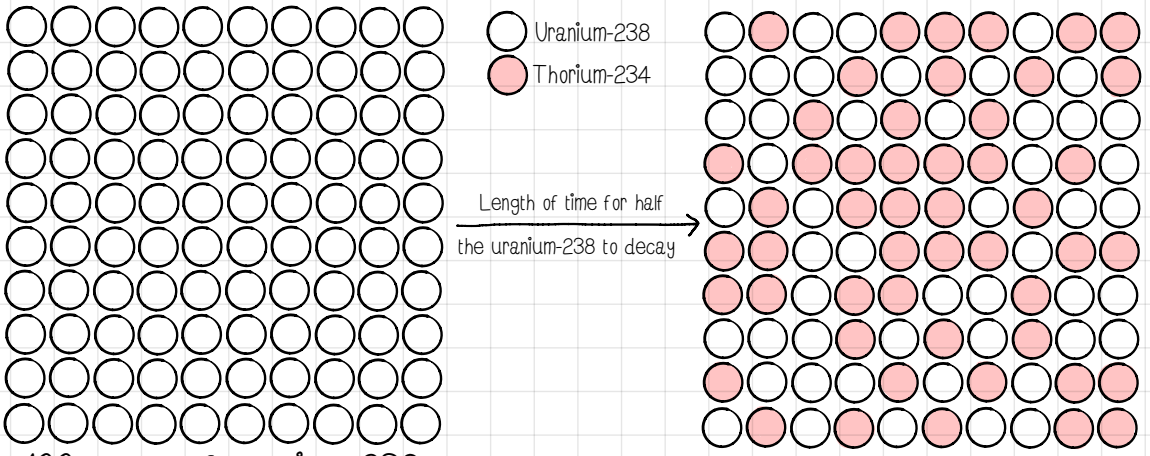
Half life

Review

- Radioactive isotopes emit radiation from the nucleus of their atoms because they are unstable.
- Nuclear decay is a random process. You cannot predict when an individual atom will decay.

Half-life

- The half life of a radioactive isotope is the time it takes for the number of nuclei in a sample to halve.

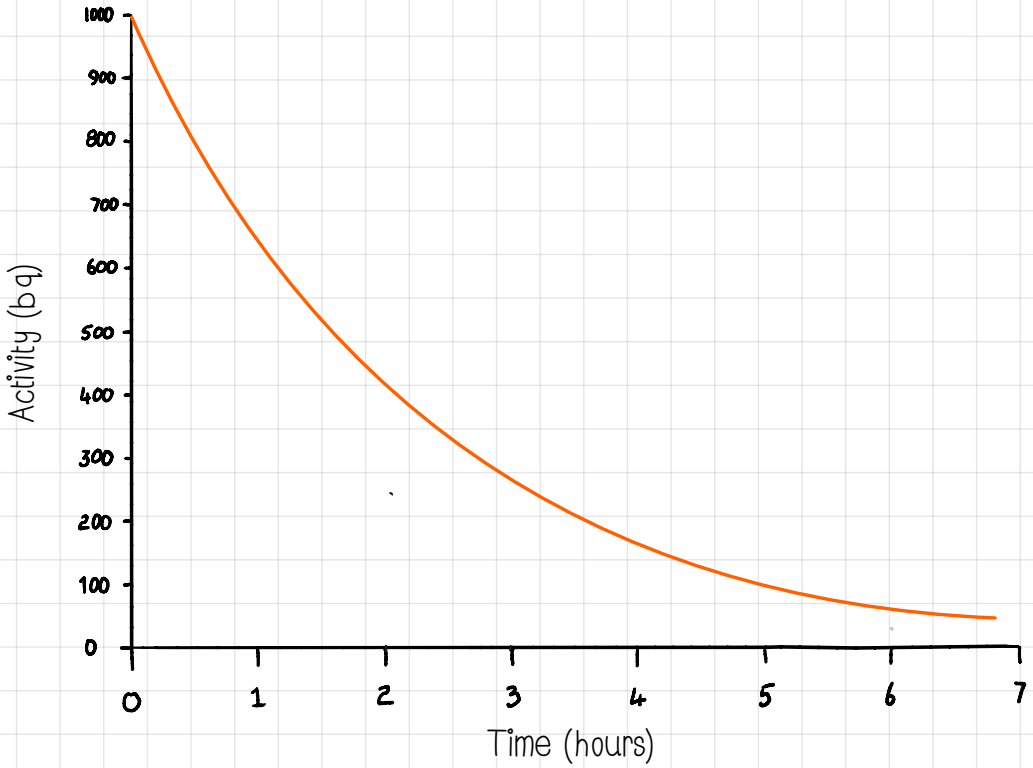


100 atoms of uranium-238

50 atoms of uranium-238 and
50 atoms of thorium 234

- The half-life of different isotopes varies. Some have short half-lives so they will decay quickly. Other isotopes have long half lives and decay slowly.
- Radium-226 has a half-life of 1600 years, while iodine-131 has a half life of 8 days.
- The half-life of a radioactive isotope can also be calculated from the time it takes for the count rate (or activity) from a sample containing the isotope to fall to half its initial level. For example it would take a sample of Radium - 226 with a count rate of 60 000 becquerels, 1600 years to fall to a count rate of 30 000 becquerels.
- The count rate is the number of decays measured per second using a detector such as a Geiger - Muller tube. The number of decays per second is measured in becquerels (Bq).

Half life...



To find the half-life of an isotope from a graph, divide the initial activity by 2. Then draw a line horizontally until you intersect the line. At this point draw a line down and read the time from where the line intersects the axis.

You can also use half-life to calculate the activity of an isotope.

Example question

For each half life the activity will drop by half.
A radioactive isotope of iodine-131 has a half-life of 8 days and an initial count rate of 600 counts per minute (cpm). Calculate the count rate after 24 days.

Initial count rate = 600 cpm. After 8 days (1 half-life) = 300 cpm. After 16 days (2 half-life) = 150 cpm. After 24 days (3 half-life) = 75 cpm

Practice question #1

Polonium-218 has a half-life of 3 minutes and an final count rate of 225 counts per second after 9 minutes. Calculate the initial count rate.

After 9 minutes = 225 counts per second. After 6 minutes = 550 counts per second. After 3 minutes = 1100 counts per second. Initial activity = 2200 counts per second.

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