Half-Life

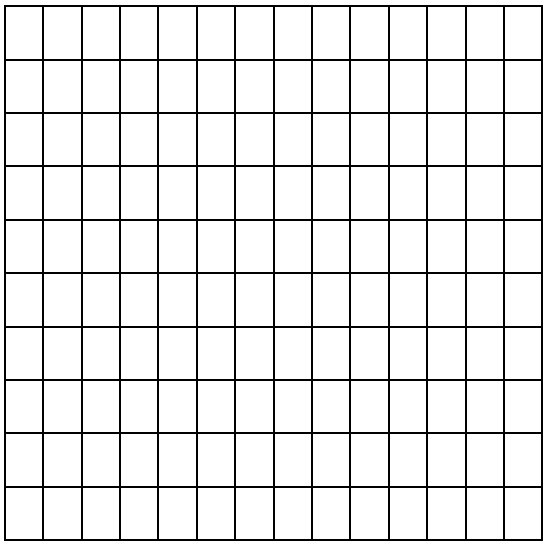
Spontaneous breakdown of nucleus releasing energy and matter	occurs when atoms are unstable, meaning there is not enough	Amount of energy required to hold nucleus together

➔ Not all atoms in a sample decay at the same time, but there is a predictable decay that is specific for the particular isotope
➔ Cannot say specifically:
➔ Can reliable predict:

Paste flipbook here

Activity: Modeling Radioactive Decay with M&Ms

Time (Half-lives)	**# of Parent Atom**	**# of Daughter Atom**	**Percent Radioactive Isotopes Remaining**
0		0	100%
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



1. At the end of two half-lives, how many candies were still "radioactive"?

2. Scientists found a fossilized bone from an organism in a deep layer of rock. When they took the bone back to the lab they realized that the bone had only 12.5% of the total **Carbon $_{14}$** left. Based on the amount of Carbon $_{14}$ left in the bone how old is the bone?

Half-lives

Carbon $_{14}$ ------ 5730 years

Uranium $_{235}$---- 713 million years

Potassium $_{40}$---- 1.3 billion years

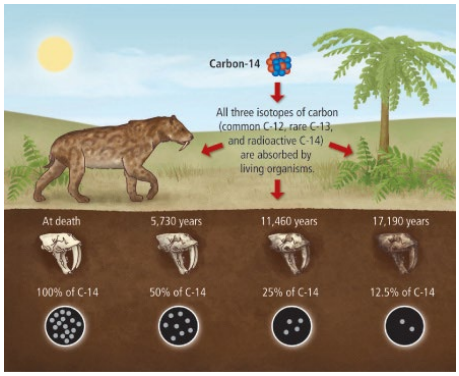
3. If a rock was determined to be around 2.6 billion years old what percentage of the original amount of **Potassium $_{40}$** would be left in the rock sample?

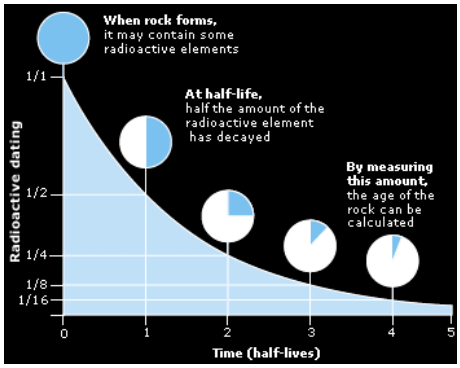
4. A radioactive material has a half-life of 30 days. You begin with 4 grams of radioactive material.
   a. How much of the original is left unchanged after 120 days?

   b. After 180 days?

- Takes advantage of radioactive decay of naturally abundant radioactive isotopes (such as ____ and ____)

- At death (or in the case of rocks after formation) new isotopes are no longer added and thus any existing radioactivity will decrease over time





Radiometric Dating

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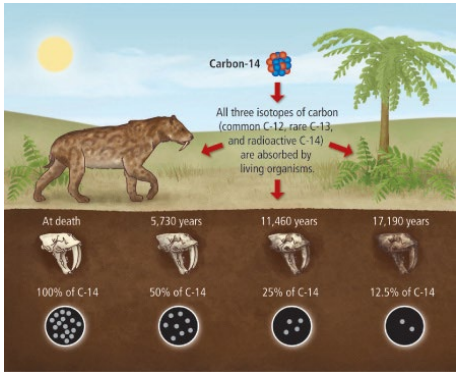
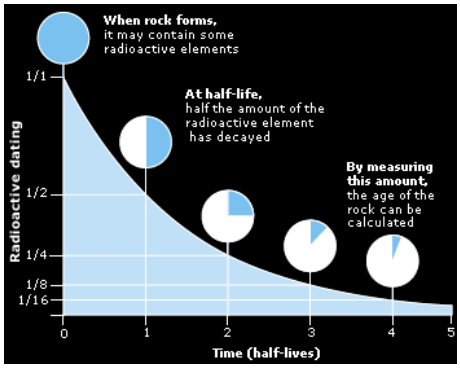
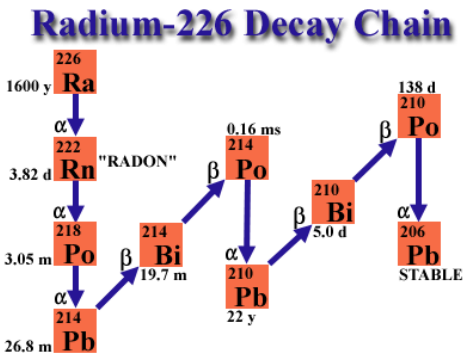




Radiometric Dating

- Not all materials decay to a stable isotope after the first decay
- Many go through one or more additional decays until they reach a stable state
- Parent isotope:

- Daughter isotope:



Decay Chain

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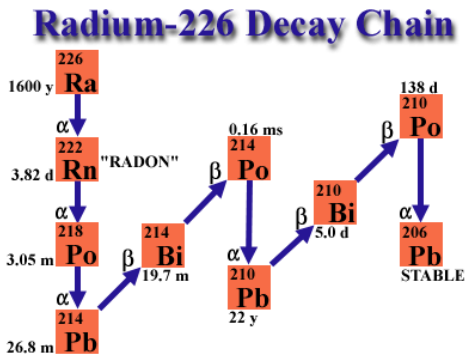
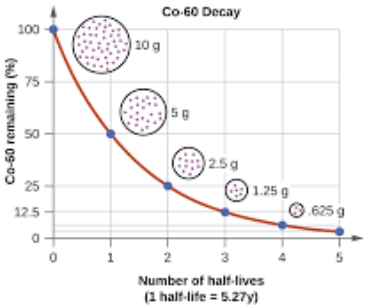


Decay Chain

Half-Life

➔ The amount of time required for:



Values vary widely and depend on specific isotope

The half-lives of some radioactive isotopes

Radioactive isotope	Half-life
Uranium-238, $^{238}_{92}U$	4.5×10^9 years
Carbon-14, $^{14}_{6}C$	5.7×10^3 years
Radium-226, $^{226}_{88}Ra$	1.6×10^3 years
Strontium-90 $^{90}_{38}Sr$	28 years
Iodine-131, $^{131}_{53}I$	8.1 days
Bismuth-214, $^{214}_{83}Bi$	19.7 minutes
Polonium-214, $^{214}_{84}Po$	1.5×10^{-4} seconds

Half-Life

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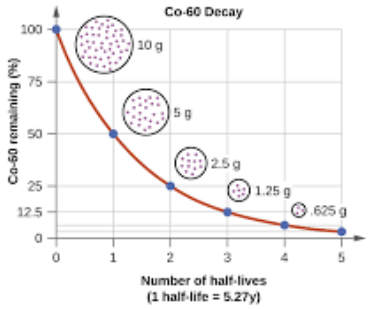

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