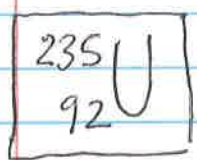


Half-Life

The amount of time it takes for half of the atoms (or nuclei) in a sample of radioactive isotopes to decay.

All elements with more than 83 protons (Polonium #84 and up) are radioactive.



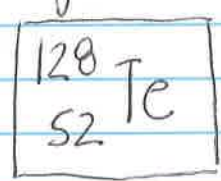
Half-life = 7.04×10^8 years

704,000,000

Uranium-235

Uranium-238 - half life 4.5 billion years

Longest Half Life



Half-Life = 2.2×10^{24} years

2.2 trillion, trillion years

tellerium-128

Shortest Half-Life



23×10^{-24} seconds

or 23 yoctoseconds

hydrogen-7

I ♥ THE HALF-LIFE WORKSHEET



1. What is radioactivity?
 process of nuclear decay in which nuclei break apart and emit particles and energy.

2. What is half-life?
 amount of time it takes for half of the radioactive isotope to decay.

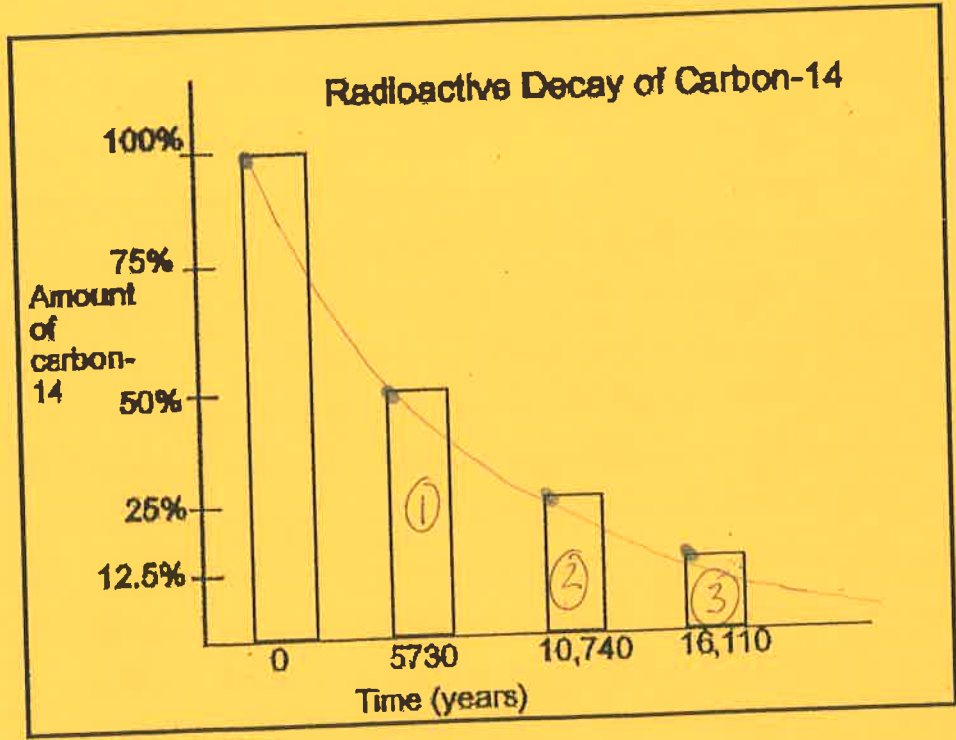
3. If we start with 400 atoms of a radioactive substance, how many would remain after one half-life? 200 after two half-lives? 100
 after three half-lives? 50 after four half-lives? 25

4. If we start with 48 atoms of a radioactive substance, how many would remain after one half-life? 24 after two half-lives? 12
 after three half-lives? 6 after four half-lives? 3

5. If we start with 16 grams of a radioactive substance, how much will remain after three half-lives? 2
 16 → 8 → 4 → 2

6. If we start with 120 atoms of a radioactive substance, how many will remain after three half-lives? 15

Use the following graph to answer questions 7-10.



7. How long is a half-life for carbon-14? 5,730 years

8. If only 25% of the carbon-14 remains, how old is the material containing the carbon-14? 10,740 yrs

9. If a sample originally had 120 atoms of carbon-14, how many atoms will remain after 16,110 years? 15 atoms

10. If a sample known to be about 10,740 years old has 400 carbon-14 atoms, how many atoms were in the sample when the organism died? 1600 atoms

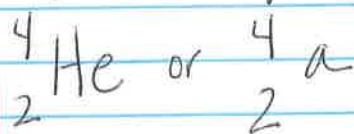
Radioactive Decay

Three types: All release energy.

	# of protons	# of n	atomic mass
1) alpha decay	-2	-2	-4
2) beta decay	+1	-1	∅
3) gamma decay	∅	∅	∅

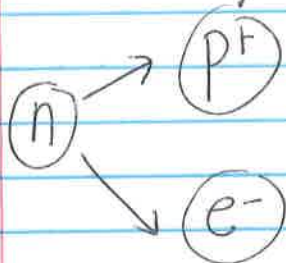
changes in atom when decaying

Alpha Decay



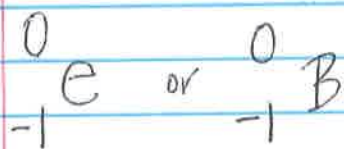
loses 2 protons
loses 2 neutrons
loses 4 a.m.u

Beta Decay



Neutron decays into a proton + electron.

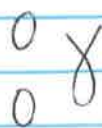
Proton stays in the nucleus while the electron is ejected.



p↑ n↓ atomic mass stays the same

p↑ atomic number increases by one.

Gamma Decay



No change in element but energy is emitted.