Notes: Radiometric Dating

pg 156-158 - Early ideas of age of ⊕

radioactive isotopes - unstable nucleus (parent) so, in time, it decays changing into a different nucleus that is stable (daughter)

[produces heat - believed to provide the heat that has kept ⊕ molten inside providing energy for plate tectonics]

radiation of decay
- alpha particles (He nuclei = 2p+2n) (α)
- beta particles (electrons, e^-, β)
- gamma rays (electromagnetic radiation, strongest energy)

ex carbon14 (parent) decays by ejecting beta particles (e^-) and forms Nitrogen14 (daughter)

C14 (8n 6p) ⟶ N14 (7n 7p)

↳ one n becomes one p + one e^- ↘ ejected

radioactive decay obeys the laws of probability:

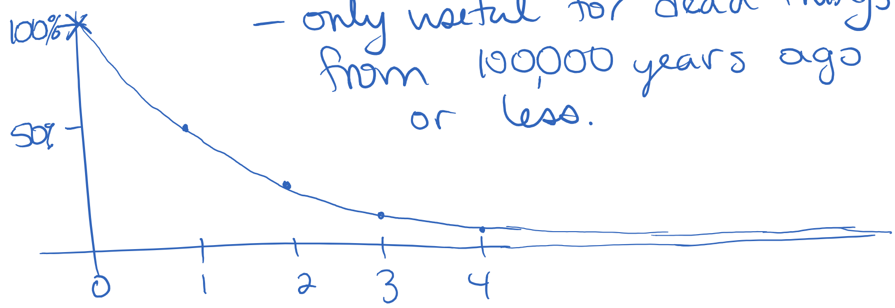
half-life - length of time required for half of a given initial # of parent atoms to decay into the daughter isotope

half-life is constant for each element

☆ C14 h.l. = 5730 year

↑ can only be used for dead things

(not rocks) (used to be alive)



- only useful for dead things from 100,000 years ago or less.

K-40 $\xrightarrow{1.25\ b.y.}$ Ar 40 gas

* U 238 $\xrightarrow{4.5\ b.y.}$ Pb 206

U 235 $\xrightarrow{704\ m.y.}$ Pb 207

ex Dead tree sample has 16 Carbon 14 atoms and 48 Nitrogen 14 atoms. How long has tree been dead? h.l. = 5730 yrs

16+48 = 64 atom of C14 when tree died

64P $\xrightarrow{1\ hl}$ 32P 32d $\xrightarrow{1\ h.l.}$ 16P 48d ∴ 2 h.l.

$$\text{Age} = \left(\#\text{ of h.l.}\right)\left(\text{length of h.l.}\right)$$

$= (2)(5730\,y)$

$= 11{,}460$ years since tree died

Possible Problems

- may have been some daughter present to start with (make rock look older)
- may not be a closed system - for ex. K-Ar, argon is a gas that can escape making rock look younger

Choice of Isotope

- parent was/is abundant in sample
- h.l. appropriate to age being dated
- what are you dating?
  dead thing - use C14 up to 100,000 y old
  rock - any method, except C14
  meta. rock - K-Ar since Ar escapes in meta processes, resetting the K-Ar clock

Absolute Age - numerical age from radiometric dating, counting tree ring, counting varves (layers at bottom of glacial lake)

We use a combination of relative and absolute dating methods.