GET OUT YOUR CALCULATORS!

Turn your phone into the pockets on wall - get calculator based on your seat #

Half Life Calculations

$\alpha \ \beta \ \gamma$

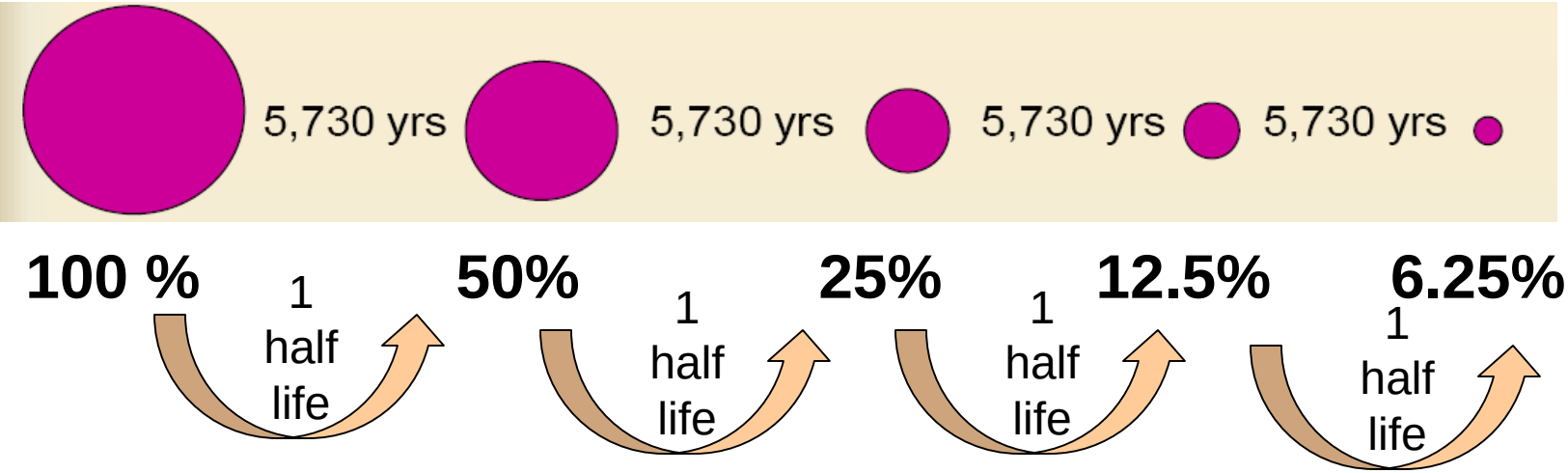
Rates of Decay & Half Life

- Atoms are radioactive when too many neutrons. Strong force cant hold nucleus together.
- **Radioactive elements** have different stabilities and decay at ***different rates.***

Half Life

- The length of time it takes for 50% of the material to have undergone radioactive decay.
- Example: Carbon-14, half life = 5,730 years

Half Life


5,730 yrs
5,730 yrs
5,730 yrs
5,730 yrs
100 %
1 half life
50%
1 half life
25%
1 half life
12.5%
1 half life
6.25%

Oetzi, the “ice man” was found by hikers in the Alps between Switzerland and Italy. He was carbon dated to 5,300 yrs old! One of the oldest frozen humans ever found – and the best preserved.

How much is left?

- If I start with 20 grams of Carbon-14 and the half life is 5,730 years…how many grams am I left with after 5,730 years?

5,730 years = 1 half life

20 grams/2 = 10 grams

But what if the problem is harder??? What if you started with 17.4 grams, and 12,901 years went by? How much would you be left with???

We have a handy-dandy equation we can use!!!

$$A_E = A_S \times 0.5^{\left(\frac{t}{h}\right)}$$

\# of half lives

A_E = amount ending with

A_S = amount starting with

t = time gone by (time elapsed)

h = length of the half life

Let's give it a try!

- You start with 157 grams of carbon-14 and the half-life of carbon-14 is 5730 years. How much would be left after 2000 years?

A_E = amount ending with = ???

A_S = amount starting with = 157 grams

t = time gone by = 2000 years

h = half life = 5730 years

A_E = amount ending with = ???

A_S = amount starting with = 157 grams

t = time gone by = 2000 years

h = half life = 5730 years

$$A_E = 157 \times 0.5^{\left(\frac{2000}{5730}\right)} = 123.26 \text{ grams}$$

$$A_E = A_S \times 0.5^{\left(\frac{t}{h}\right)}$$

is still radioactive!

How much is stabilized?

157 g radioactive to start − 123.26 grams still radioactive =

33.74 g has stabilized – no longer radioactive

Fraction left over?

Percent left over?

$$\frac{A_F}{A_S} = 0.5^{\left(\frac{t}{h}\right)}$$

Fraction Left Over

$$0.5^{\frac{\left(\frac{t}{h_E}\right)}{A_S}} \times 100 = \text{\% left over}$$