

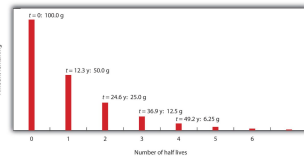
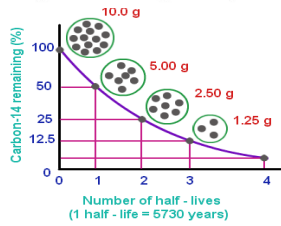
### Half-Life

**def:** The time it takes for half of the radioactive material found in a nucleus to decay.

**Info:**

- Could be short, as little as 0.16 seconds to decay or long, 1 300 000 years.
- Each radioactive element has its own half-life, it is characteristic.

	Half-Life	Time unit	Emitter
Uranium-238	4,468	billion of years	alpha
Thorium-234	24,10	days	beta -
Protactinium-234	6,70	hours	beta -
Uranium-234	245 500	years	alpha
Thorium-230	75380	years	alpha
Radium-226	1 600	years	alpha
Radon-222	3,8235	days	alpha
Polonium-218	3,10	minutes	alpha
Plomb-214	26,8	minutes	beta -
Bismuth-214	19,9	minutes	beta -
Polonium-214	164,3	microseconds	alpha
Plomb-210	22,3	years	beta
Bismuth-210	5,015	years	beta
Polonium-210	138,376	days	alpha
Plomb-206	Stable		



HL	Day	Time	% In system
Half 1	Friday	2pm	100
Half 2	Sat	8pm	50
Half 3	Monday	2am	25
Half 4	Tuesday	8am	12,5
Half 5	Wednesday	2pm	6,25
Half 6	Thursday	8pm	3,125
Half 7	Saturday	2am	1,5625
Half 8	Sunday	8am	0,78125

*30 hour half life*

Carbon Dating 14.mp4  
 How Does Radiocarbon Dating Work\_ - Instant Egghead #28.mp4

What is best to use when want to eliminate quickly out of the body?

What is best to use when have a very old substance to date?

## Example 1- Determining length of half life

Using the chart below, determine the half life of the substance.

HL	Day	Time	% In system
Half 1	Friday	2pm	100
Half 2	Sat	8pm	50
Half 3	Monday	2am	25
Half 4	Tuesday	8am	12.5
Half 5	Wednesday	2pm	6.25
Half 6	Thursday	8pm	3.125
Half 7	Saturday	2am	1.5625
Half 8	Sunday	8am	0.78125

**Example 2-**

Te 130's half life is 7 days. How long would it take to have less than 1 g of Te left if you start with 35.0 g. What percentage of Te would be left?

	1/2 life(Days)	Mass (g)	Percent (%)
	0	35.0g	100%
1 <sup>st</sup> half-life	7	17.5g	50%
2 <sup>nd</sup>	14	8.75g	25%
3 <sup>rd</sup>	21	4.4g	12.5%
4	28	2.2g	6.25%
5	35	1.1g	3.1%
6	42	.55g	1.6%

42 days > 1g 1.6%

**Example 3**

Polonium's half-life is 0.16 s. You have 10.0 g, how long would it take you to have less than 2 g? What % will be left?

	half life (s)	Mass (g)	Percent (%)
	0	10g	100%
1.	0.16s	5g	50%
2.	0.32s	2.5g	25%
3.	0.48s	1.25g	12.5%

0.48s 12.5%

**Example 4**

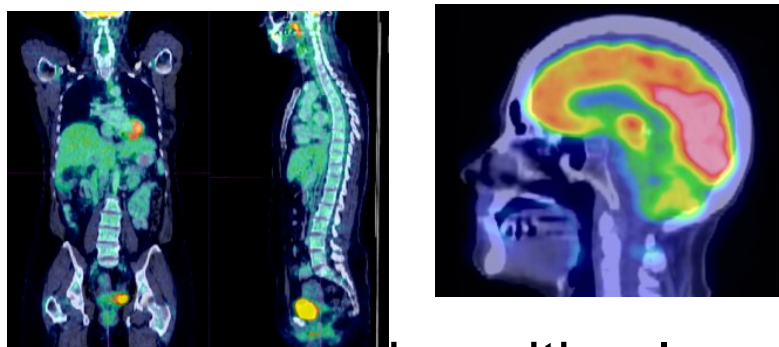
You found 7.0 g of a radioactive substance you think is 70 000 years old. Would it be better to use carbon-14 which has a half-life of 5 770 years or plutonium with a half-life of 24 000 years to date the object?

Carbon 14		Plutonium	
1/2 life	mass	%	1/2 life
0	7	100	0
1 5770	3.5	50	24 000 1
2 11 540	1.8	25	48 000 2
3 17 310	.9	12.5	72 000 3
	23 080	.45	6.3
	28 850	.23	3.1
	34 620	.12	1.6
	40 390	.060	.78
	46 160	.030	.39
	51 930	.0015	.20

Plutonium is better because when you reach 72 000 years you still have almost 1 gram left and 12.5%. Carbon at 72 000 years has virtually nothing left of substance.

When is it best to use something with a short half life?

When the radioactive substance is being used for medical purposes (nuclear medicine). You do not want radiation to stay in the body for a long time. Eliminate quickly





When is best to use something with a long half life?

When you are "dating" something very old (fossil)



## Attachments

---

-  Carbon\_Dating\_14.mp4
-  How\_Does\_Radiocarbon\_Dating\_Work\_-\_Instant\_Egghead\_#28.mp4