

Half Life:**Calculating half-life Sample Problem #1**

If 100.0 g of carbon-14 decays until only 25.0 g of carbon is left after 11,460 y, what is the half-life of carbon-14?

- Analyze the data:
 - If you started with 100.0 g and now have 25 g, how many half-lives must have passed?
 - (1 h.l.) (2 h.l.)
 - 100.0 ----→ 50.0 ----→ 25.0
- Two half-lives have passed.
 - If a total of 11,460 years is TWO half-lives, then $11,460/2$ is the half-life: 5,730 years.
- Answer: The half-life of Carbon-14 is 5,730 years

Sample Problem#2

Thallium-208 has a half-life of 3.053 min. How long will it take for 120.0 g to decay to 7.50 g?

- Analyze the data:
 - You are starting with 120.0 g and ending with 7.50 g
 - Half of 120.0 is 60.0. Half of that is 30.0. Half of that is 15.0 g. Half of that is 7.5 g.
 - Therefore the sample has halved 4 times, or gone through 4 half-lives.
- If 4 half-lives have passes and you know that the time for a half-life is 3.053 min, then...
 - $4 \times 3.053 = 12.21$ min
- Answer: It will take 12.21 min for 1250.0 g of Tl-208 to decay to 7.50g

Sample Problem #3

Gold-198 has a half-life of 2.7 days. How much of a 96 g sample of gold-198 will be left after 8.1 days?

- Analyze the data:
 - The half-life is 2.7 days. The time it has been left to decay is 8.1 days. 2.7 goes into 8.1 three times. This means that 3 half-lives have passed.
- If you are starting with 96 g and three half-lives have passed, then...
 - (1 h.l.) (2 h.l.) (3 h.l.)
 - 96 ---→ 48 ---→ 24 ---→ 12
- That means that 12 grams of the 96 grams are left.

Your Turn to Think...

1. Define half-life:
2. If we start with 400 atoms of a radioactive substance, how many atoms would remain after one half-life? _____
After two half-lives? _____; after three half-lives? _____; after four half-lives? _____
3. If we start with 48 atoms of a radioactive substance, how many would remain after one half-life? _____
After two half-lives? _____; after three half-lives? _____; after four half-lives? _____

4. If the half-life of iodine-131 is 8 days, how long will it take a 50.00 g sample to decay to 6.25 g?

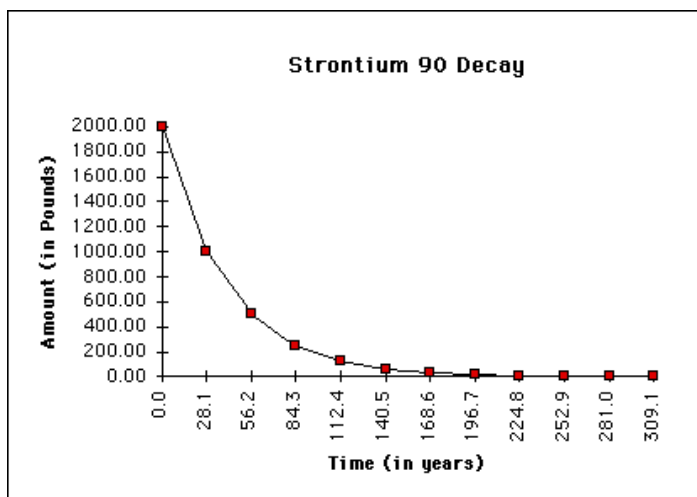
5. The half-life of hafnium-156 is 0.025 s. How long will it take a 560 g sample to decay to one-fourth its original mass?

6. If we start with 8000 grams of radium-226, how much would remain after 3,200 years? The half-life of Ra-226 is 1600 years
 - a. How much would have decayed in that amount of time? _____

7. How many years would have to pass for a 75% of a 400 grams sample of Uranium-238 to decay? The half-life of U-238 is 4.47×10^9 years)

8. How much time would it take for a 500 gram sample of Iodine-131 to decay to 31.25 grams? The half-life of I-131 is 8 days
 - b. How many half-lives is that?

Use the following graph of the decay of Strontium-90 to answer the following questions:



18. How long is a half-life for Sr-90?

19. If only 25% of the Sr-90 remains, how many years have passed? _____

20. If a sample originally contained 100 grams of Sr-90, how many grams of Sr-90 would *remain* after 112.4 years?
 - a. How many grams of the Sr-90 would *have been decayed* after 112.4 years?

21. If a sample known to be about 140.5 years old has 400 grams of Sr-90 in it, how many grams of Sr-90 were in the sample 140.5 years ago?