Chemistry H

Exercise 21.2b

Half-Lives

Name: _____

Date: _____ Per: _____

A nuclear half-life represents the amount of time required for one-half of a radioactive isotope (radionuclide) to decay. The decay that occurs in each half-life results in a characteristic pattern representing the remaining amount – 1/2,1/4, 1/8, 1/16, 1/32, 1/64, etc. Amounts may be found using a table or using the formula:

$$\textit{amount remaining} = \textit{starting amount} \bullet (1/2)^{n}$$

where n = the number of half-lives

Sample:

If you start with 200 g of element Y (half-life 150 years), how many grams will be present 600 years from now?

$A_R = 200g \bullet (1/2)^4 = 12.5g$

(n = 4 because 600 years represents 4 150 year half-lives.)

or

Half-Lives	*Time (years)*	*Amount Remaining*
0	*Now*	*200 g*
1	*150 years from now*	*100 g*
2	*300 years from now*	*50 g*
3	*450 years from now*	*25 g*
4	*600 years from now*	*12.5 g*

DIRECTIONS: Solve the following in the space provided:

1. Solve the half-life formula for *n.*

2. Solve the half-life formula for "*starting amount*".

3. If you currently have 20. g of element *X* (half-life 300 years), how many grams would have been present 1500 years ago?

4. The half-life of plutonium-239 is 24300 years. If a nuclear bomb released 8 kg of this isotope, how many years would pass before the amount is reduced to 1 kg?

5. The half-life of radon-222 is 3.8 days. How much of a 100. gram sample is left after 15.2 days?

6. Carbon-14 has a half-life of 5730 years. If a sample contained 70.0 mg originally, how much is left after 17190 years?

7. The half-life of cobalt-60 is 5.26 years. If 50.0 grams are left after 15.78 years, how many grams were in the original sample?

Answers: 3) 640 g 4) 72900 years 5) 6.25 g 6) 8.75 mg 7) 400 g 8) 2 hours

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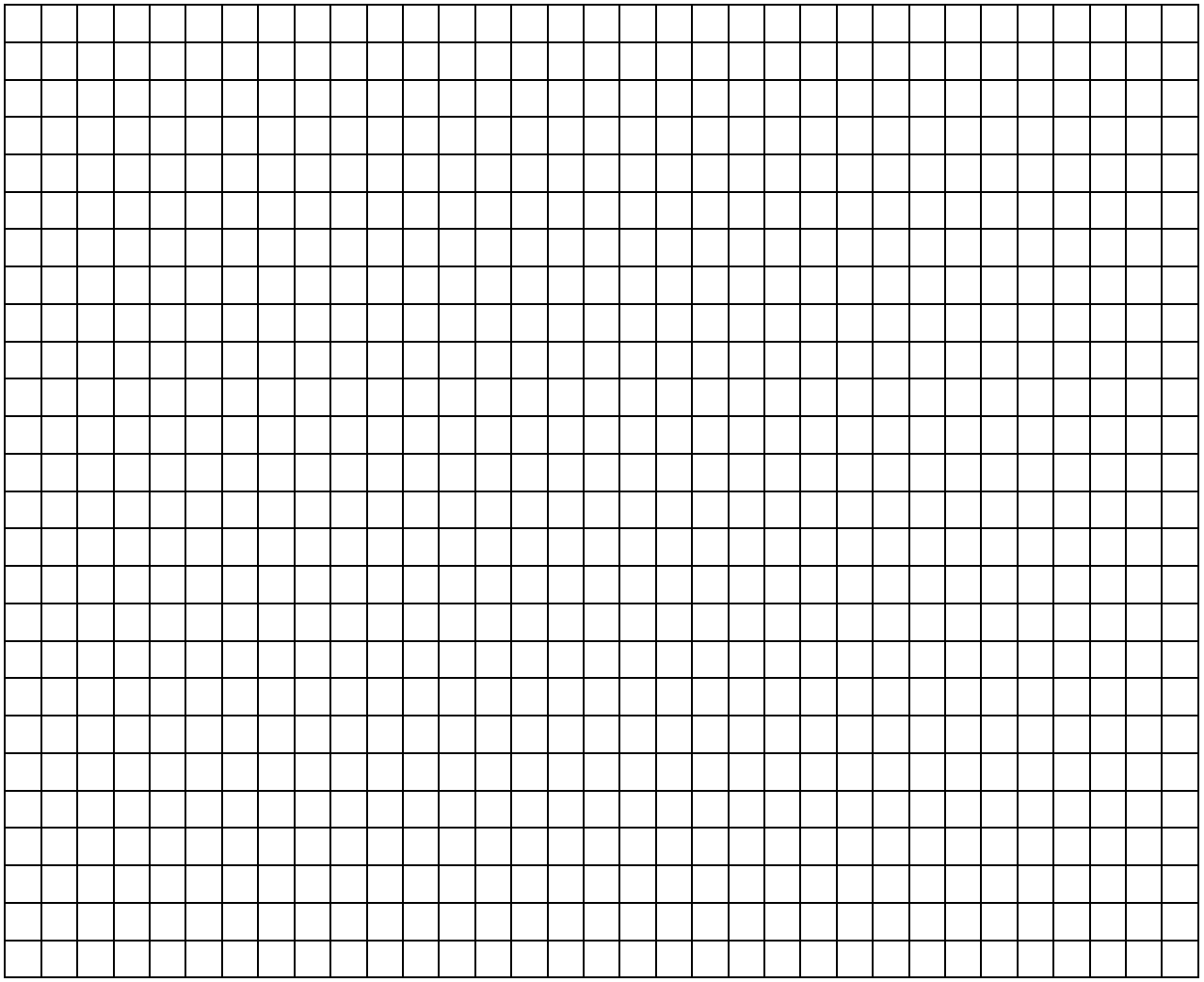
8. If you have 200. g of radioactive element *Z* at 12:00noon and have only 12.5g left at 8:00pm that same day, what is the half-life of this element?

9. Graph the following data on the graph, then use the graph to determine the half-life of this isotope.

Time (years)	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***
Mass Remaining (grams)	***100***	***75***	***56***	***42***	***32***	***24***	***18***	***13***	***10***	***8***	***6***



Half-life = _____

DIRECTIONS: Answer the following in the space provided.

10. How are fission & fusion alike: _____

11. How are fission & fusion different: _____

12. What does $E=mc^2$ really mean to us? _____

Answers: 3) 640 g 4) 72900 years 5) 6.25 g 6) 8.75 mg 7) 400 g 8) 2 hours