Name: Key Date: _____

Half - Life Practice

1. What is meant by half-life?

The amount of time it takes for half of the radioactive atoms to become stable.

2. If you have 100 grams of a radioactive isotope with a half-life of 10 years:

a. How much of the isotope will you have left after 10 years?

50 grams

b. How much of the isotope will you have left after 20 years?

25 grams

c. How many half-lives will occur in 40 years?

4 half-lives

3. The half-life of plutonium-239 is 24,300 years. If a nuclear bomb released 8 kg of this isotope, how many years would pass before the amount is reduced to 1 kg?

$8 \rightarrow 4 \rightarrow 2 \rightarrow 1$ (3 half-lives)

(24,300 yrs/half life)(3 half-lives) = 72,900 years

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

$\frac{15.2 \text{ days}}{3.8 \text{ days/half life}} = 4$ half lives

$y = 100(0.5)^4$

$y = 6.25$ grams

5. Carbon-14 has a half-life of 5,730 years. If a sample contained 70 mg originally, how much is left after 17,190 years?

$\frac{17,190}{5,730} = 3$ half lives

$y = 70(0.5)^3$

$= 8.75$ mg

There will be 8.75mg left after 17,190 years.

6. The half-life of cobalt-60 is 5.26 years. If 50 grams are left after 15.78 years, how many grams were in the original sample?

$\frac{15.78}{5.26} = 3$

$\frac{50}{0.5^3} = \frac{a(0.5)^3}{0.5^3}$

$400 = a$

Started with 400 grams

7. The half-life of I-137 is 8.07 days. If 25 grams are left after 40.35 days, how many grams were in the original sample?

$\frac{40.35}{8.07} = 5$ half lives

$\frac{25}{0.5^5} = \frac{a(0.5)^5}{0.5^5}$ $\quad a = 800$

Started with 800 grams

8. If 100 grams of Au-198 decays to 6.25 grams in 10.8 days, what is the half-life of Au-198?

$100 \rightarrow 50 \rightarrow 25 \rightarrow 12.5 \rightarrow 6.25$

4 half lives

$\frac{10.8 \text{ days}}{4 \text{ half lives}} = \frac{2.7 \text{ Days}}{\text{half life}}$

9. The half-life of radon-222 is 3.8 days. If 3.54 grams remain after 17.1 days, how many grams were in the original sample?

$\frac{17.1}{3.8} = 4.5$ half lives

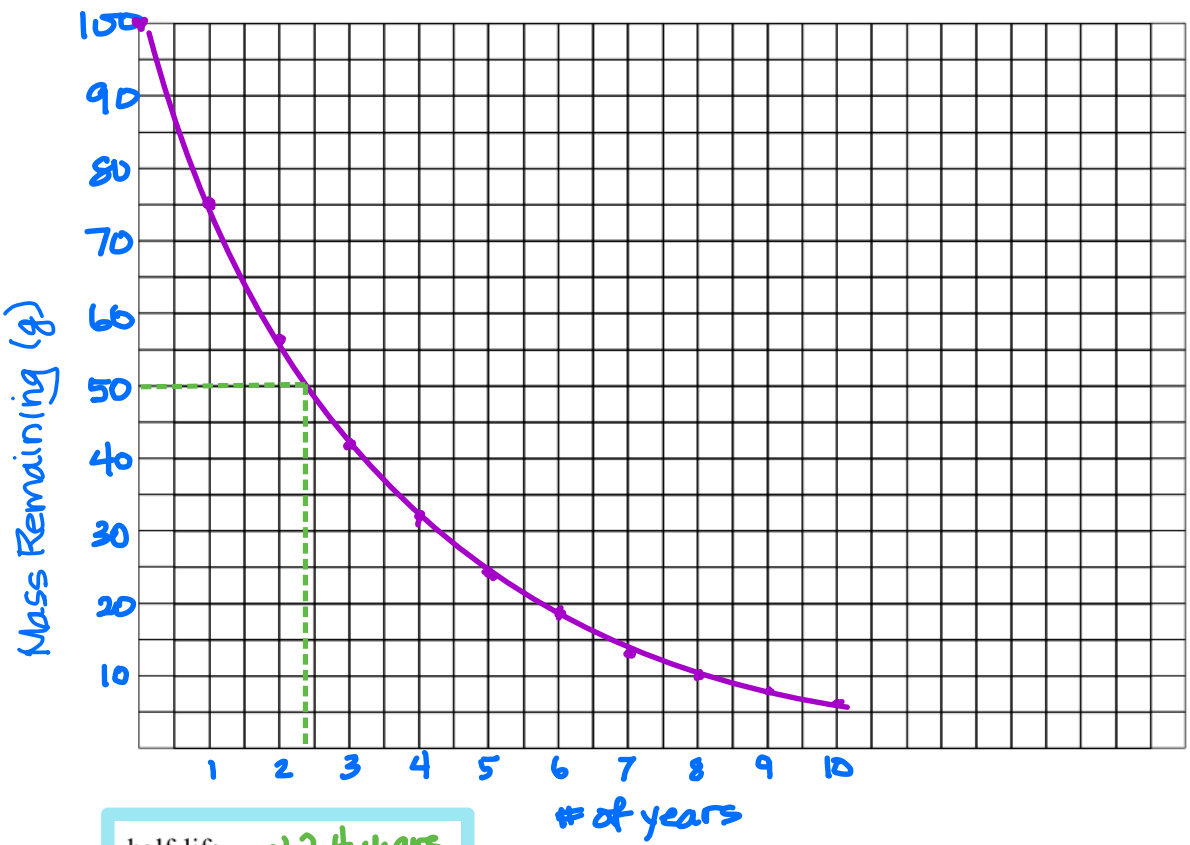
$\frac{3.54}{0.5^{4.5}} = \frac{a(0.5)^{4.5}}{0.5^{4.5}}$

$80.1 = a$

80.1 grams

10. 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 = ≈ 2.4 years