

Complete the edpuzzle in
your classroom!



Jan 17-8:15 AM

TOC 71-72 Half Life

half life

* the time it takes for half a substance to decay *

time that has passed

mass after decay

$$A = A_0 * \left(\frac{1}{2}\right)^{\frac{t}{t}}$$

mass you start with

half life

Detailed description: This is a handwritten diagram on lined paper explaining the half-life formula. At the top, the words 'half life' are written in a bubbly, decorative font. Below this, the formula $A = A_0 * \left(\frac{1}{2}\right)^{\frac{t}{t}}$ is written. Several boxes with arrows point to parts of the formula: a blue box labeled 'mass after decay' points to 'A'; a green box labeled 'mass you start with' points to 'A_0'; a red box labeled 'half life' points to the denominator 't' in the exponent; and another box labeled 'time that has passed' points to the numerator 't' in the exponent. A note at the top right explains the asterisk: '* the time it takes for half a substance to decay *'.

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TOC 71-72 Half Life

* if you are asked to find:

A or A₀

Ex: How much of a 100g sample of Rn-222 is left after 15.2 days if its half life is 3.8 days?

$$A = A_0 \cdot \left(\frac{1}{2}\right)^{\frac{t}{t_{1/2}}}$$

$$A = 100g \left(\frac{1}{2}\right)^{\frac{15.2}{3.8}}$$

$$A = 6.25g$$

$$A = ?$$

$$A_0 = 100g$$

$$n = 15.2$$

$$t = 3.8$$

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TOC 71-72 Half Life

* if you are asked to find:

n or t

Ex: How long will it take a 78g sample to decay to 4.875g if the half life is 4.5hrs?

$$A = A_0 \cdot \left(\frac{1}{2}\right)^{\frac{n}{t_{1/2}}}$$

$$\frac{4.875}{78} = \frac{78}{78} \left(\frac{1}{2}\right)^{\frac{n}{4.5}}$$

$$0.0625 = \frac{1}{2}^{\frac{n}{4.5}}$$

$$A = 4.875g$$

$$A_0 = 78g$$

$$n = ?$$

$$t = 4.5hrs$$

$$\frac{\ln(0.0625)}{\ln(0.5)} = \frac{n}{4.5}$$

$$4 \leftarrow \frac{n}{4.5}$$

$$18hrs = n$$

Jan 17-8:51 AM

1. An isotope of cesium (cesium-137) has a half-life of 30 years. If 1.0 g of cesium-137 disintegrates over a period of 90 years, how many g of cesium-137 would remain?

$$A = ?$$

$$A_0 = 1g$$

$$n = 90 \text{ yrs}$$

$$t = 30 \text{ yrs}$$

$$A = A_0 \cdot \left(\frac{1}{2}\right)^{\frac{n}{t}}$$

$$A = 1g \cdot \frac{1}{2}^{\frac{90}{30}}$$

$$A = 0.125g$$

$1 \rightarrow 0.5 \rightarrow 0.25 \rightarrow 0.125$

2. Actinium-226 has a half-life of 29 hours. If 100 mg of actinium-226 disintegrates over a period of 58 hours, how many mg of actinium-226 will remain?

3. Sodium-25 was to be used in an experiment, but it took 3.0 minutes to get the sodium from the reactor to the laboratory. If 5.0 mg of sodium-25 was removed from the reactor, how many mg of sodium-25 were placed in the reaction vessel 3.0 minutes later if the half-life of sodium-25 is 60 seconds?

$$5 = A_0 \left(\frac{1}{2}\right)^{\frac{180}{60}}$$

$$A = 5 \text{ mg}$$

$$A_0 = ?$$

$$n = 180 \text{ s}$$

$$t = 60 \text{ s}$$

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4. The half-life of isotope X is 2.0 years. How many years would it take for a 4.0 mg sample of X to decay and have only 0.50 mg of it remain?

5. Selenium-83 has a half-life of 25.0 minutes. How many minutes would it take for a 10.0 mg sample to decay and have only 1.25 mg of it remain?

$$A = 1.25 \text{ mg}$$

$$A_0 = 10 \text{ mg}$$

$$n = ?$$

$$t = 25 \text{ min}$$

$$A = A_0 \cdot \left(\frac{1}{2}\right)^{\frac{n}{t}}$$

$$\frac{1.25}{10} = \frac{10}{10} \cdot \frac{1}{2}^{\frac{n}{25}}$$

$$0.125 = \frac{1}{2}^{\frac{n}{25}}$$

$$\frac{\ln(0.125)}{\ln(0.5)} = 3 \leftarrow \frac{n}{25}$$

$$n = 75 \text{ min}$$

6. The half-life of Po-218 is three minutes. How much of a 2.0 gram sample remains after 15 minutes? Suppose you wanted to buy some of this isotope, and it required half an hour for it reach you. How much should you order if you need to use 0.10 gram of this material?

Jan 17-9:45 AM

1 How long does it take a 100.00g sample of As-81 to decay to 6.25g?

2. How long does it take a 180g sample of Au-198 to decay to 1/8 its original mass?

3. What percent of a sample of As-81 remains un-decayed after 43.2 seconds?

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4. What is the half-life of a radioactive isotope if a 500.0g sample decays to 62.5g in 24.3 hours?

5. How old is a bone if it presently contains 0.3125g of C-14, but it was estimated to have originally contained 80.000g of C-14?

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