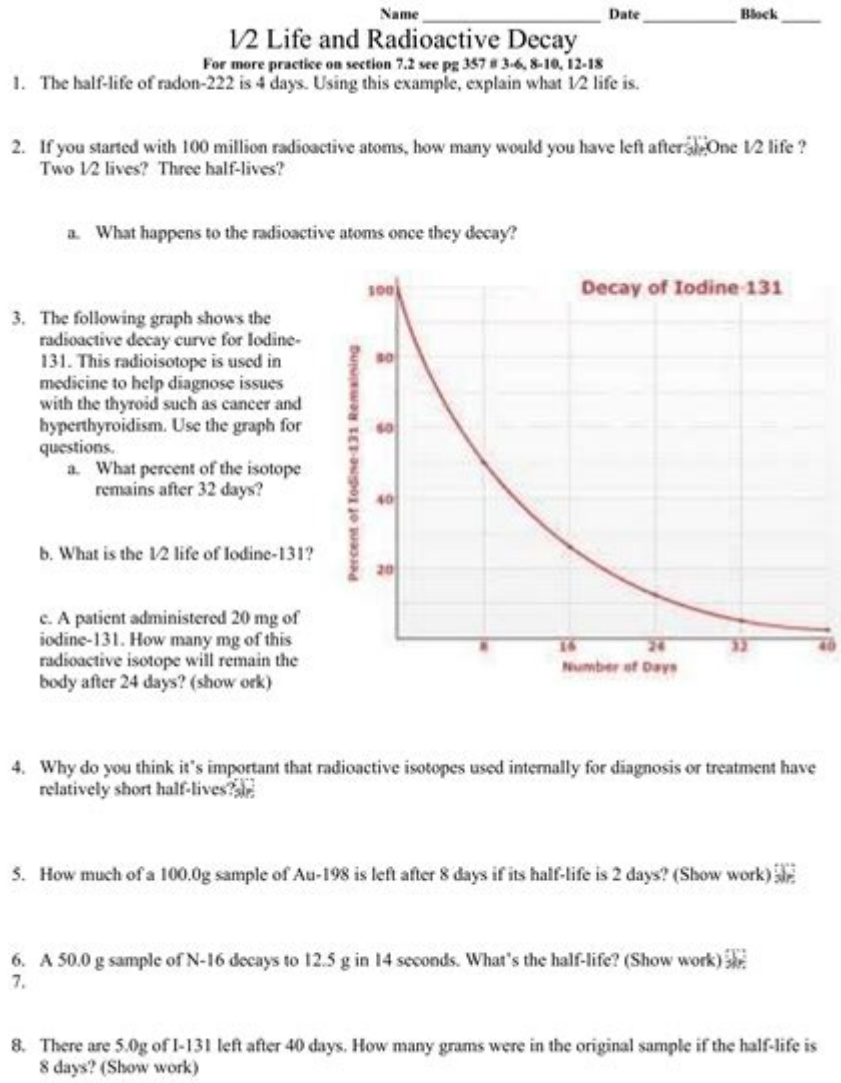
Half Life Of Radioactive Isotopes Worksheet Answers



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1/2 Life and Radioactive Decay

For more practice on section 7.2 see pg 357 # 3-6, 8-10, 12-18

1. The half-life of radon-222 is 4 days. Using this example, explain what 1/2 life is.

2. If you started with 100 million radioactive atoms, how many would you have left after: One 1/2 life ? Two 1/2 lives? Three half-lives?

   a. What happens to the radioactive atoms once they decay?

3. The following graph shows the radioactive decay curve for Iodine-131. This radioisotope is used in medicine to help diagnose issues with the thyroid such as cancer and hyperthyroidism. Use the graph for questions.

   a. What percent of the isotope remains after 32 days?

   b. What is the 1/2 life of Iodine-131?

   c. A patient administered 20 mg of iodine-131. How many mg of this radioactive isotope will remain the body after 24 days? (show ork)

4. Why do you think it's important that radioactive isotopes used internally for diagnosis or treatment have relatively short half-lives?

5. How much of a 100.0g sample of Au-198 is left after 8 days if its half-life is 2 days? (Show work)

6. A 50.0 g sample of N-16 decays to 12.5 g in 14 seconds. What's the half-life? (Show work)
7.

8. There are 5.0g of I-131 left after 40 days. How many grams were in the original sample if the half-life is 8 days? (Show work)

Half life of radioactive isotopes worksheet answers are a crucial aspect of understanding nuclear chemistry and radioactivity. For students studying these concepts, worksheets provide practical scenarios that require calculations and applications of the half-life concept. This article will explore the fundamentals of half-life, how to solve worksheet problems, and detailed answers to common exercises found in these worksheets.

Understanding Half-Life

Half-life is the time required for half of the radioactive isotopes in a sample to decay. This concept is vital in various fields, including medicine, archaeology, and nuclear physics. To grasp the

significance of half-life, consider the following:

- **Radioactive Decay:** Radioactive isotopes decay at a predictable rate, characterized by their half-lives.
- **Application:** Half-lives help in dating archaeological finds, determining the age of fossils, and managing nuclear waste.
- **Fixed Rate:** Each isotope has a unique half-life, which remains constant regardless of the amount of material present.

Calculating Half-Life

Understanding how to calculate half-life is essential for solving problems on worksheets. The basic formula for half-life calculations can be expressed as:

$$ N(t) = N_0 \left(\frac{1}{2} \right)^{\frac{t}{T_{1/2}}} $$

Where:
- $ N(t) $ = the remaining quantity of the substance after time $ t $
- $ N_0 $ = the initial quantity of the substance
- $ T_{1/2} $ = the half-life of the substance
- $ t $ = total time elapsed

Steps to Solve Half-Life Problems

When faced with half-life problems on worksheets, follow these steps:

1. **Identify the Isotope:** Know the isotope and its half-life.
2. **Determine Initial Amount:** Find the initial quantity of the radioactive material.
3. **Calculate Time:** Establish the total time for which the isotope has been decaying.
4. **Use the Formula:** Insert the values into the half-life formula to solve for the remaining quantity or to find how many half-lives have passed.

Common Radioactive Isotopes and Their Half-Lives

A variety of isotopes are studied in chemistry, each with unique half-lives. Here are some commonly encountered isotopes and their respective half-lives:

- **Carbon-14:** 5,730 years - used in radiocarbon dating.
- **Uranium-238:** 4.5 billion years - used in dating rocks and geological formations.
- **Radon-222:** 3.8 days - a concern in indoor air quality due to its radioactive properties.
- **Iodine-131:** 8 days - used in medical treatments, particularly for thyroid issues.
- **Cesium-137:** 30 years - often found in nuclear waste and medical applications.

Sample Problems and Answers

To further illustrate how to tackle half-life problems, let’s walk through a couple of sample worksheet problems and their solutions.

Problem 1: Carbon-14 Dating

Question: If a sample originally contained 100 grams of Carbon-14, how much will remain after 17,190 years?

Solution:
1. Identify the half-life of Carbon-14, which is 5,730 years.
2. Determine how many half-lives fit into 17,190 years:
$$
\text{Number of half-lives} = \frac{17,190}{5,730} \approx 3
$$
3. Use the half-life formula:
$$
N(t) = 100 \left(\frac{1}{2} \right)^{3} = 100 \times \frac{1}{8} = 12.5 \text{ grams}
$$
Thus, 12.5 grams of Carbon-14 will remain after 17,190 years.

Problem 2: Iodine-131 Medical Usage

Question: An Iodine-131 sample has an initial amount of 80 mg. How much remains after 32 days?

Solution:
1. The half-life of Iodine-131 is 8 days.
2. Calculate the number of half-lives in 32 days:

$$
\text{Number of half-lives} = \frac{32}{8} = 4
$$
3. Apply the half-life formula:
$$
N(t) = 80 \left(\frac{1}{2} \right)^{4} = 80 \times \frac{1}{16} = 5 \text{ mg}
$$
Therefore, 5 mg of Iodine-131 will remain after 32 days.

Practical Applications of Half-Life Knowledge

Understanding the half-life of radioactive isotopes has several practical applications, including:

- **Medical Treatments:** Radioactive isotopes are used in cancer treatments and diagnostic imaging.
- **Archaeological Dating:** Carbon dating allows scientists to date ancient artifacts and fossils.
- **Nuclear Energy:** Knowledge of isotopes helps in managing nuclear fuel and waste.
- **Environmental Monitoring:** Tracking radioactive contamination in ecosystems.

Conclusion

In conclusion, the study of the half-life of radioactive isotopes is an essential part of nuclear chemistry and has significant implications across various fields. By mastering the calculations and understanding the applications, students can effectively tackle problems related to half-life on worksheets. This foundational knowledge not only aids in academic success but also prepares students for real-world applications in science and technology.

Frequently Asked Questions

What is the half-life of a radioactive isotope?

The half-life of a radioactive isotope is the time required for half of the isotope's atoms to decay into a more stable form.

How do you calculate the remaining quantity of a radioactive isotope after a certain number of half-lives?

To calculate the remaining quantity, use the formula: remaining quantity = initial quantity ×

(1/2)^(number of half-lives).

What factors influence the half-life of a radioactive isotope?

The half-life of a radioactive isotope is a characteristic property that is primarily determined by the nature of the isotope itself and is not influenced by external factors like temperature or pressure.

How can half-life be used in carbon dating?

In carbon dating, scientists measure the remaining amount of carbon-14 in a sample to estimate its age, using the known half-life of carbon-14, which is about 5,730 years.

What are some common radioactive isotopes and their half-lives?

Common radioactive isotopes include Uranium-238 (half-life of about 4.5 billion years), Radon-222 (half-life of about 3.8 days), and Iodine-131 (half-life of about 8 days).

Why is understanding half-life important in fields like medicine and environmental science?

Understanding half-life is crucial in medicine for determining the dosage and timing of radioactive treatments, and in environmental science for assessing the longevity and impact of radioactive waste.

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Unlock the secrets of radioactive isotopes with our comprehensive worksheet answers. Master the half-life concept today! Learn more for detailed insights.

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