Name: _____ Per__

Half-Life Lab Simulation of "Pennyum"

Activity

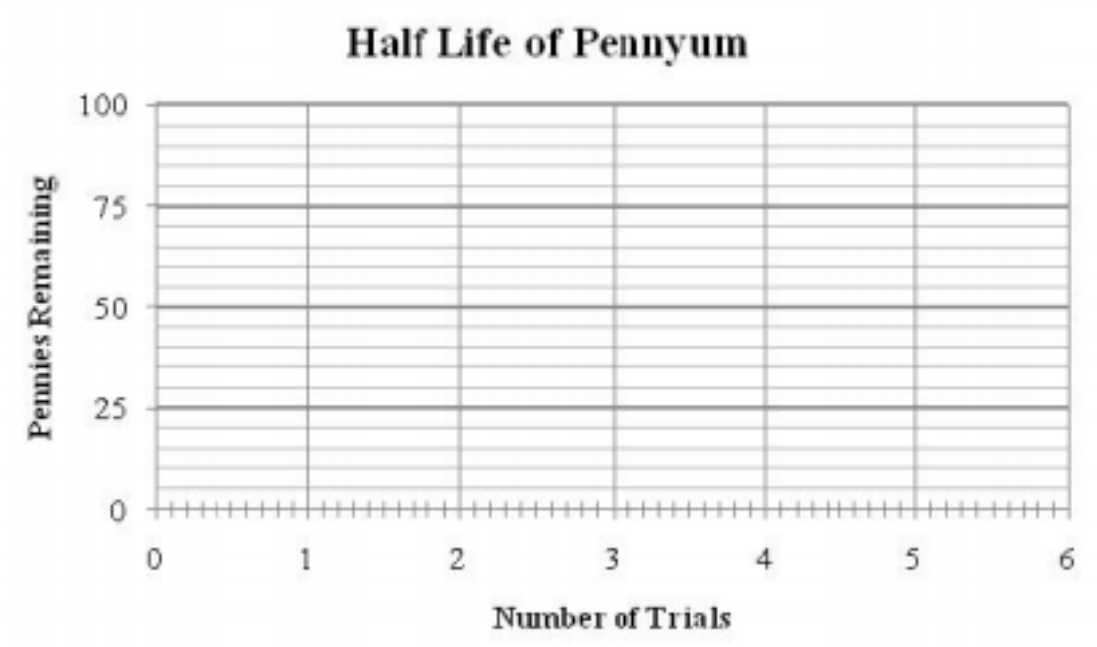
Purpose: To simulate the radioactive decay of the element "Pennyum"

Procedure:

1. Obtain a container with 100 pennies.
2. Shake the container and empty it onto the lab counter. Some of the pennies will land on heads, the others will land on tails. The pennies that land on heads represent decayed atoms of "Pennyum". Remove the pennies that landed on heads and set them aside. The pennies that landed on tails represent atoms of "Pennyum" that have not decayed. Count the number of pennies remaining and record in the table below.
3. Repeat this process five more times for a total of six times. (If all of the pennies are removed before the process is repeated six times, the remaining trials are not necessary.)
4. Return all pennies to the container.

Observations:

1. Graph the data below. Draw a smooth curve through the data.



2. Suppose the each trial represents 1000 years.
   a. From the graph, approximately how many years would it take for the number of remaining pennies to be 30?

   b. From the graph, approximately how many pennies would remain after 4,500 years?

3. A. How many pennies would remain after one half life has passed?

   B. Using the graph, estimate the half-life of the element "Pennyum"

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Use the following information to answer questions 4, 5, and 6.

Element	**Symbol**	**Atomic Number**
Dollarium	Do	124
Moneyum	My	125
Pennyum	Pe	126

4. Answer the following questions about Pennyum
    a. Give the Symbol for an alpha particle _____
    b. An atom of Pennyum-300 gives off an alpha particle

        _____ → _____ + _____

5. Answer the following questions about Moneyum
    a. Give the symbol for a beta particle _____
    b. An atom of Moneyum-298 emits a beta particle

        _____ → _____ + _____

6. Answer the following questions about Dollarium
    a. Give the symbol for a gamma ray _____
    b. An excited atom of Dollarium-295 gives off a gamma ray

        _____ → _____ + _____

Conclusion: State the definition of half-life and describe uses of half-life. Are there any limitations to using radioisotopes to determine an unknown age? If so, describe.

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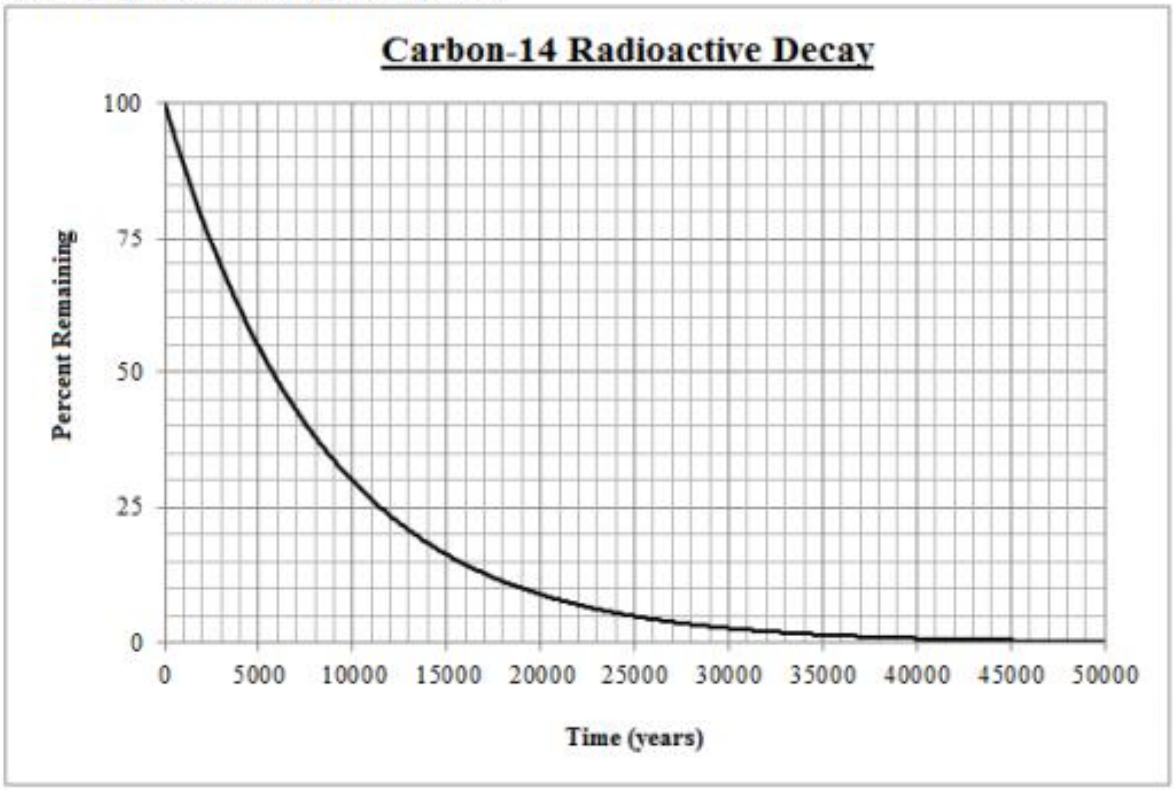
Additional Questions

Use the graph to answer the questions below.



(1) The half-life of carbon-14 is 5730 years.
(a) What mass of a 1.0 g sample will remain after 5730 years?
(b) What percentage of a 1.0 g sample will remain after 11 460 years?

(2) Use the graph to estimate the approximate age of each sample.
(a) A bone that has 50% of the original carbon-14 remaining
(b) A shark's tooth that has 20% of the original carbon-14 remaining
(c) A fragment of paper with 70% of the original carbon-14 remaining

(3) Use the graph to determine the approximate percentage of the carbon-14 that would remain in each sample.
(a) A piece of wood that is 12500 years old
(b) A shell that is 30000 years old
(c) A piece of silk that is 5000 years old.

(4) How long would it take for a 50.0 g sample to have 12.5 g of carbon-14 remaining?

(5) What mass of carbon-14 would remain in a 2.00 g sample after 22920 years?