Name Period Date

CHAPTER 12 | CHAPTER INVESTIGATION

Radioactive Decay

Through the process of radiometric or radioactive decay, scientists are able to measure the age of ancient fossils and minerals. All radioactive atoms decay, or change over time, from their original form to become a more stable atom. The time it takes for half of the atoms present in a given material to decay is called its half-life and is measured by scientists to determine the age of a material. In this lab, you will model how scientists determine the age of a fossil by modeling the decay of a fictitious radioactive isotope called "tailsium."

MATERIALS

- 10 pennies
- graph paper
- 3 pencils of different colors

PROCESS SKILLS

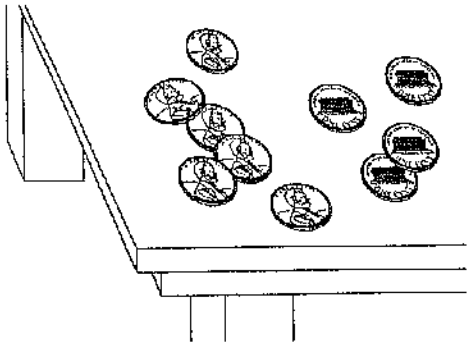
- Analyzing
- Interpreting Data
- Modeling

Problem

How is the half-life of an unstable isotope used to determine the age of a material?

Procedure

1. Arrange your pennies so that they are all tails-side-up. These pennies represent 10 atoms of "tailsium," a radioactive isotope.
2. Pick up all ten tailsium atoms and drop them on the table. The pennies that fall heads-side-up represent atoms of a more stable element, "headsium." Put the headsium atoms off to the side. Count the number of tailsium atoms. Record that value in table below, under toss 1.



3. Pick up only the tailsium atoms and drop them again. Put the newly formed headsium atoms off to the side with the other headsium atoms. Count the number of tailsium atoms and record this value in your table.
4. Repeat step 3 until there is no more tailsium, or until you have run 10 tosses.
5. Share your results with your class. Using the class data, determine the average number of tailsium atoms that remained after each toss. Record the data in Table 1.

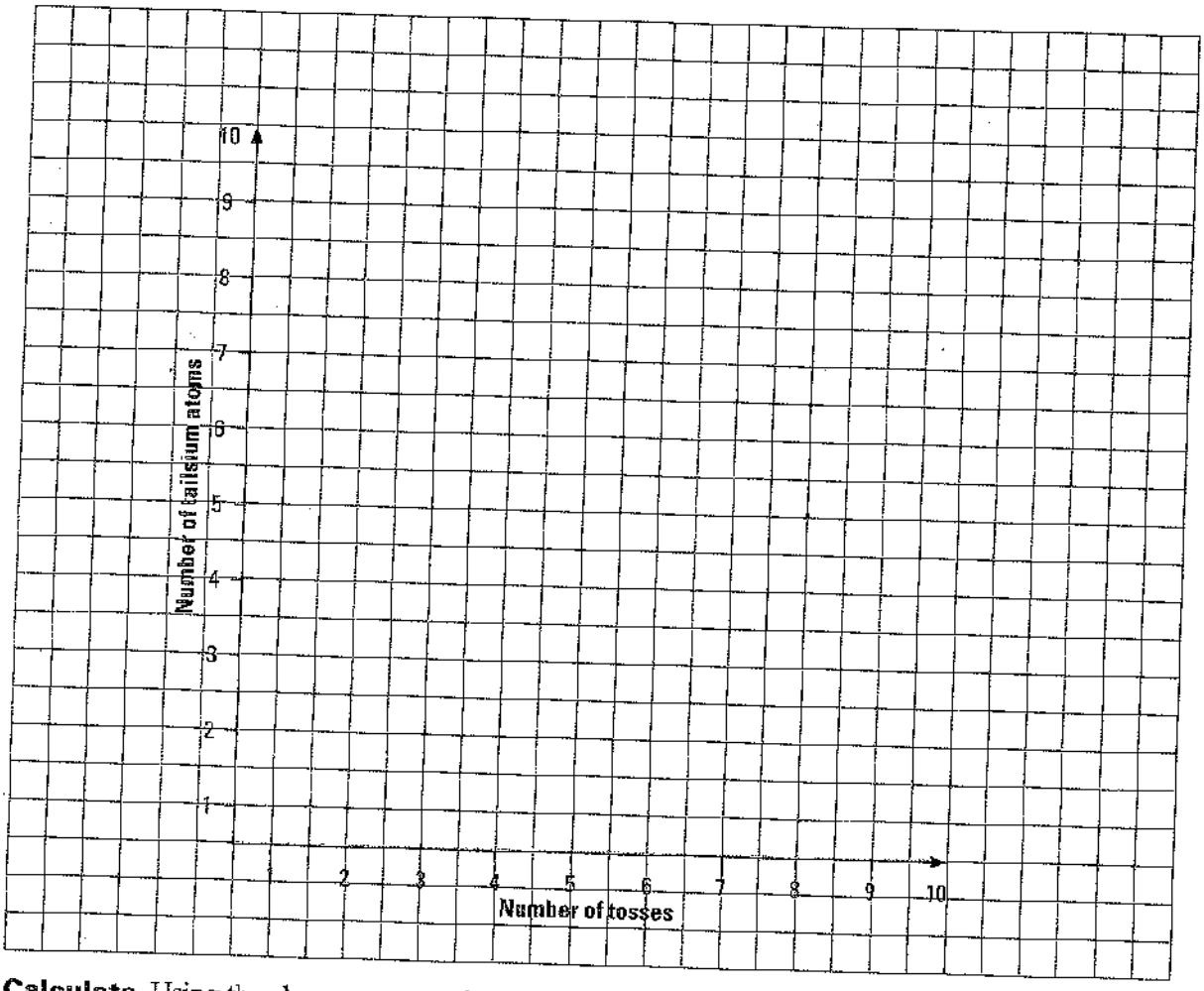
TABLE 1. TAILSIUM DECAY

Toss #	1	2	3	4	5	6	7	8	9	10
# of tailsium atoms										
class:average # of tailsium atoms										

Name Period Date

Analyze and Conclude

1. **Graph Data** Graph your group results along with the average for the class on the graph paper below. The number of tosses should be on the *x*-axis and the number of tailsium atoms remaining should be on the *y*-axis.



2. **Calculate** Using the class average, calculate an average half-life for tailsium. This is the number of tosses it took for half of the pennies to decay to headsium.

$$\text{average} = \frac{\text{sum of the half-lives of all the groups}}{\text{number of groups}}$$

Name Period Date

3. **Interpret** Below is the ideal rate of decay for tailsium. Graph this data on the same axes as your other graphs, using a different colored pencil to differentiate between the data sets. Which data set was closer to the ideal rate of decay, your group's data or the class average? Explain.

TABLE 2. IDEAL RATE OF TAILSIUM DECAY

Time	Start	1	2	3	4	5	6	7	8	9	10
# tailsium atoms	10	5	2.5	1.25	0.625	0.313	0.156	0.078	0.039	0.019	0

4. **Apply** Assume that there are 20 years between tosses. According to your data from the penny lab, how old would a material be that had 3 tailsium atoms and 7 headsium atoms? How old would it be according to the class data?