

ACTIVITY 3: RADIOACTIVE CARBON DATING SIMULATION



The purpose of this activity is to help students understand how radio carbon dating works by teaching the fundamentals of radioactive decay* and the principles underlying radiometric dating. This is achieved through modeling radioactive elements with pennies and observing their decay over multiple 'half-lives.'

Materials:

- Pennies (100 per group)
- Flat-bottomed container with a lid
- Half-Life of a Penny Handouts
- Writing utensils
- Chart paper or large whiteboard and markers

First, inform students that they will be modeling radioactive decay and the principles of radio carbon dating using pennies.

Then, review what a linear model / line graph is and how to generate one by graphing data points, emphasizing the importance of drawing the curve that best represents their data set. Make sure to discourage them from simply connecting the dots, and instead drawing the curve that best represents their data set once all data has been plotted, e.g., use a line of best fit. Go through a couple of sets of sample data to demonstrate how to do this with students.

Next, have them partner up with another student and obtain the supplies needed for the activity. Provide each team with 100 pennies and a flat-bottomed container with a lid. Instruct students to begin with all pennies facing "heads up," representing unstable radioactive isotope of an element, for example: Carbon.

***Teaching Tip:** *If pennies are not available, you can use any small two-sided object, for example: Skittles candies.*

Have them go through the following procedural steps:

1. Put all the pennies "heads up" in the container and cover the lid.
2. Shake the container well to cause some of the pennies to flip.
3. Remove the pennies from the container and separate the "heads" from the "tails."
4. Record the number of "heads" pennies on the Half-Life of a Penny data table and set aside the "tails" pennies.
5. Repeat this procedure until all pennies have landed on their "tails" side, tallying the "heads" and removing the "tails" each round.
6. Plot your data on the graph provided in the handout and determine a line of best fit.
7. Transfer your graph to the large whiteboard or chart paper to show classmates during the debrief of this activity.

Facilitate a class discussion about the significance of the graph's shape and encourage comparisons between groups' data. Discuss the concept of radioactive decay, inviting students to use their data to explain the concept. Review that half-life represents the average time for half of a radioactive isotope sample to decay. Highlight how the consistent rate of decay allows scientists to determine object ages using radiometric dating.

*Radioactive Decay Lab Notes:

1. As an optional extension, students can record and graph both the number of "heads" pennies and "tails" pennies after each shake during the activity. Graph each line in different colors so that you can discuss how they compare and connect as well as what they each mean about the situation.
2. Depending on the experience of your students, you may need to guide them in plotting their data on the provided graph.
3. Teams may not need all the rows in the data table for the activity; or they may need more.
4. While there's a 50:50 chance of a coin landing on "heads" or "tails," it's unlikely for any group's coin number to be exactly halved with each shake.