

Laboratory Investigation

CHAPTER 5 ■ Radioactive Elements

The Half-Life of a Sugar Cube

Problem

How can the half-life of a large sample of sugar cubes be determined?

Materials (per group)

250 sugar cubes large bowl
 food coloring medicine dropper

Procedure ▲

1. Place a small drop of food coloring on one side of each sugar cube.
2. Put all the sugar cubes in a bowl. Then gently spill them out on the table. Move any cubes that are on top of other cubes.
3. Remove all the sugar cubes that have the colored side facing up. If you have room on the table, arrange in a vertical column the sugar cubes that you removed. Put the rest of the cubes back in the bowl.
4. Repeat step 3 several more times until five or fewer sugar cubes remain.
5. On a chart similar to the one shown, record the number of tosses (times you spilled the sugar cubes), the number of sugar cubes removed each time, and the number of sugar cubes remaining. For example, suppose after the first toss you removed 40 sugar cubes. The number of tosses would be 1, the number of cubes removed would be 40, and the number of cubes remaining would be 210 (250-40).

Observations

1. Make a full-page graph of tosses versus cubes remaining. Place the number of tosses on the X (horizontal) axis and the number of cubes remaining on the Y (vertical) axis. Start at zero tosses with all 250 cubes remaining.
2. Determine the half-life of the decaying sugar cubes in the following way. Find the point on the graph that corresponds to one half of the original sugar cubes (125). Move vertically down from this point until you reach the horizontal axis. Your answer will be the number of tosses.

Tosses	Sugar Cubes Removed	Sugar Cubes Remaining
0	0	250
1	40	210
2		
3		

Analysis and Conclusions

1. What is the shape of your graph?

2. How many tosses are required to remove one half of the sugar cubes?

3. How many tosses are required to remove one fourth of the sugar cubes?

4. Assuming tosses are equal to years, what is the half-life of the sugar cubes?

5. Using your answer to question 4, how many sugar cubes should remain after 8 years? After 12 years? Do these numbers agree with your observations?

6. What factor(s) could account for the differences in your observed results and those calculated?

~~7. On Your Own Repeat the experiment with a larger number of sugar cubes. Predict whether the determined half-life will be different. Is it?~~
