

The Half-Life of Ba-137m

Part I: Introduction

In this simulation you will use a Geiger-Müller tube to measure the half-life of Ba-137m, an isotope with a half-life short enough that you can easily watch it decay over multiple half-lives in a single class period.

To begin, go to www.gigaphysics.com in your web browser, then to the **Geiger-Müller tube** lab. Then click the tab for **Half-life of Ba-137**.

Part II: Measure the Background Radiation

There is always radiation around us, from sources in the air, building materials, etc., and this simulation takes this background radiation into account. To measure the background radiation, set both the **Radiation Source** and the **Kind of Barrier** to **None**. Then click the **Start Count** button. Every few seconds, you will see the readout on the G-M apparatus increase, meaning that a background decay has been detected. The count will stop automatically after ten seconds; you can watch the countdown timer on the **Stop Count** button so you know when it is finished. (The **Stop Count** button is just so you can stop and restart quickly if you make a mistake.) Record your background counts below. (The is some natural random variation in counts, so consider taking more than one measurement and averaging the values.)

Background: _____ counts per 10 seconds

Part III: Data Collection

Please read the directions for all of part III before you begin. You will have to take measurements just seconds apart, so it's best to know what you will do ahead of time.

Just before you are ready to start collecting data, click the **Milk New Ba-137 Source** button. This will simulate the procedure known as "milking" a Cs-137 source that is used in a traditional lab to obtain a fresh Ba-137 source. When you do this, you will see a timer appear on the screen to help you keep track of the time during this experiment.

At each time in the chart (on the next page), click the **Start Count** button and record the number of counts in the ten second interval. Then subtract the background counts to obtain the number of counts due solely to the Ba-137 source and record those as well.

Elapsed time (s)	Counts	Counts (excl. background)
0		
30		
60		
90		
120		
150		
210		
240		
270		
300		
330		
330		
360		
390		
420		
450		
480		

Part IV: Graph the Data

On the grid below, graph the Ba-137m counts per 10-second interval versus the elapsed time. Draw a curve as smoothly as you can to represent the shape or trend of the data points.



Part V: Determine the Half-Life

Now use the graph above to answer the following questions as accurately as you can. Be sure to answer them according to the smooth curve that you drew, not the numbers on your data table.

At what time were there 20 counts per 10 seconds? _____

At what time were there 10 counts per 10 seconds? _____?

What is the half-life of Ba-137m, or in other words, how long did it take the number of counts to drop by half (from 20 to 10)? _____

If you had calculated the drop from 15 to 7.5 counts per interval instead of 20 to 10, should the resulting half-life be much different? Explain.

Now suppose that you had a much larger Ba-137 source that produced 800 counts per 10 seconds. Based on your data from this lab, how long should it be until there are only 100 counts per 10 seconds? Explain how you arrived at your answer.
