

The Half-Life of Ba-137m

Part I: Open the Lab

In your web browser (mobile phones not recommended), navigate to www.gigaphysics.com, then click **Virtual Labs** in the heading bar and **Geiger-Müller Tube** from the list of labs. If you're using a computer that someone else just used for this lab, then also click the **New Experiment** button to obtain your own random source.

Part II: Determine the Background Radiation Counts

To account for the radiation that is in the air, building materials, etc. rather than in your radioactive source, start by setting the **Radiation source** to none (background), the **Type of barrier** to none, and the **Duration of count** to 10 seconds. Then click the **Start Count** button to begin counting the number of background radiation particles that strike the counter in 10 seconds. Record your answer below.

Background: _____ counts/10 seconds

Part III: Collect the Data

Please read the directions for all of part III now, because you will need to be ready to take some measurements just seconds apart. It's best if you know what you will need to do ahead of time.

From the **Radiation source** menu, select Ba-137m. Ba-137m is a radioactive isotope whose half-life is short enough that you can measure it in just a few minutes. If there has been any significant delay since you started the lab, you should probably click **New Ba-137m Source** as well in case the Ba-137m source has become depleted. Leave the **Type of barrier** and **Duration of count** settings at none and 10 seconds, respectively.

Click the **Show Timer** button to begin the clock for this experiment. Immediately thereafter, click the **Start count** button to find the number of counts in 10 seconds, and enter your result in the "Counts per 10 seconds" column in the first row of the chart that starts at the top of the next page. Leave the timer running for the entire experiment.

Repeat this measurement every thirty seconds for the next eight minutes, filling in each successive row of the chart as you go. [**Important:** Be sure that the **starts** of each count are thirty seconds apart, meaning that you click the **Start Count** button when the timer shows 0:30, 1:00, 1:30, etc. Do not wait until thirty seconds have passed since the end of the previous count.] Add your data to the table as you go.

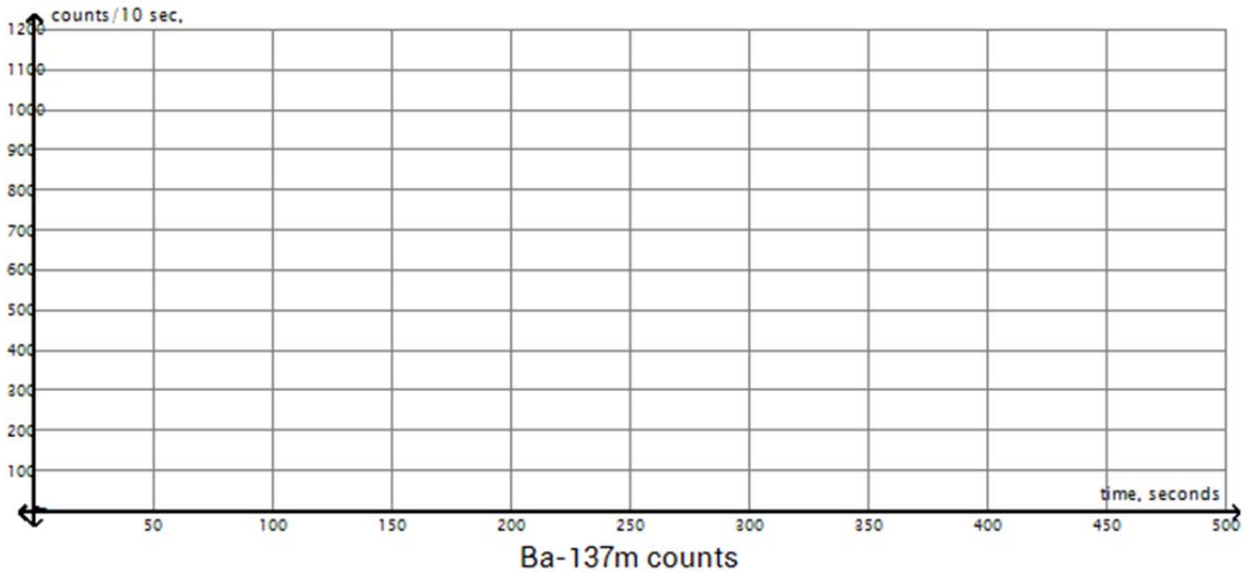
Remember, however, that some of the counts you just measured were from the background, not the Ba-137m source. Therefore, you must subtract the background count that you found in part II from your count in order to determine the number of counts resulting solely from the Ba-137m source. As you perform the subtraction for each row of your data, enter your results in the column labeled "Counts per 10 seconds (excluding background)." If the subtraction yields a negative result, just enter zero instead of the negative number. This can happen sometimes since the rate of background counts is somewhat random.

Continued on the next page...

Elapsed time (in seconds)	Counts in 10 seconds	Counts in 10 seconds (excluding background)
0		
30		
60		
90		
120		
150		
180		
210		
240		
270		
300		
330		
360		
390		
420		
450		
480		

Part IV: Graph Your Data

Graph the Ba-137m counts per minute (excluding the background) vs. the elapsed time on the graph below. Draw the curve as smoothly as you can to represent the shape or trend of the points; don't just connect the dots!



Continued on the next page...

Part V: Determine the Half-Life

Now use the graph you just drew to answer the following questions as accurately as you can.

At what time were there 400 counts in 10 seconds from the Ba-137m source? _____

At what time were there 200 counts in 10 seconds from the Ba-137m source? _____

What is the half-life of Ba-137m, or in other words, how long did it take for the activity of Ba-137m to drop by half (from 400 to 200)? _____

If you had measured the time to drop from 600 to 300 counts in 10 seconds instead, should your value for the half-life have been much different? Explain.

Now suppose that you had a much larger source Ba-137m, and it started out producing 16,000 counts in 10 seconds. Based on your data from this lab, how long would it be until that source produced only 2,000 counts every 10 seconds? Explain how you arrived at your answer.

Need help with physics? Try the tutorials at www.gigaphysics.com.