Lab 09: Radioactive Decay

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1 Introduction

The purpose of this lab is to determine the decay constant of a sample of ^{137}Ba.

2 Procedure

2.1 Setup

The setup for this lab consisted of a Geiger-Müller tube, a power supply, and a frequency counter.

2.2 Lab

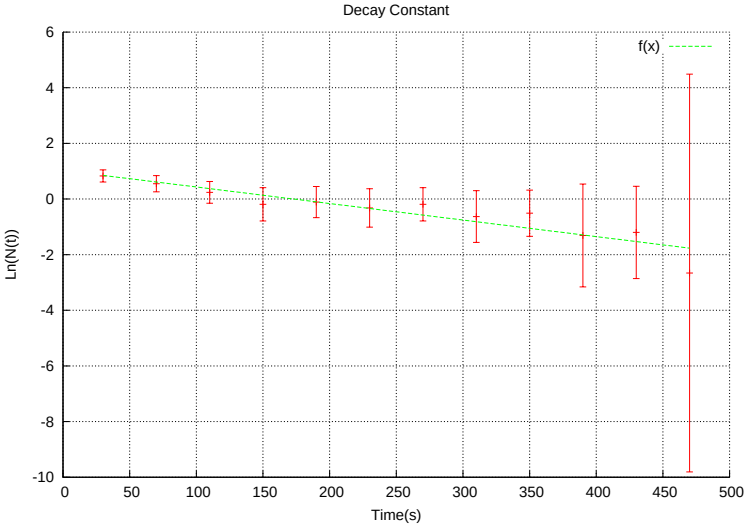
There are two main parts of this lab, in the first part we found the background noise of the room to normalize our data. We set the counter to count for 10 minutes then divided that result by 20 to see how much background noise we got per 30 seconds. The second part of the lab we would take 30 second counts with 10 second intervals in between. This data is what we use to determine the decay constant of the sample.

3 Data

Table 1: Lab Data

Time Elapsed (s)	Normalized data[1]	N/Second	Ln(N/s)
0-30	69	2.3	.832
40-70	52	1.7	.55
80-110	38	1.26	.236
120-150	25	.833	-.1823
160-190	27	.9	-.105
200-230	22	.733	-.31
240-270	25	.83	-.19
280-310	16	.53	-.63
320-350	18	.60	-.51
360-390	8	.27	-1.31
400-430	10	.3	-1.2
440-470	-2	.07	-2.66

With $t^{1/2}$ being 156 second we can find the activity to be .0044 using formula 3 Using this value we can compute this to our data



In our graph we have a slope of -.00595 which is fairly close to our expected value of -.0044

4 Formulas

$$N(t) = N_o e^{\lambda t} \quad (1)$$

$$ln[N(t)] = -\lambda t + ln[N_o] \quad (2)$$

$$\lambda = \frac{ln[.5]}{t^{1/2}} \quad (3)$$

4.0.1 Sample Lab Calculations

Here we have a sample calculation for finding the expect lambda

$$\begin{aligned} \lambda &= \frac{ln[.5]}{t^{1/2}} \\ \lambda &= \frac{ln[.5]}{156} \\ \lambda &= -.0044 \end{aligned}$$

5 Error

Error in the lab can be defined by deviation in the expected value of the natural log of N.

$$\Delta ln(N) = \frac{\Delta N}{N}$$

Each value is calculated and included as the y error bars in the graph.

6 Analysis & Conclusion

The lab was overall successful we got a value which was relatively close to the expected, given the spontaneity of the lab, our error wasn't off the charts. The biggest problem with the lab was assuring good timing and not hindering results by being too late or early. The biggest change to this lab would be making it more automated, but seeing this is a 200 level lab, i don't think that is a major concern. Overall the lab was successful and we yielded some good results