

Experiment 1: Geiger Counter Experiments

In this introductory lab on the Geiger Counter, we will do two different experiments: determining the proper operating voltage and the efficiency of the detector. Record your data on a separate piece of paper and turn it in with your report.

1. Operating Voltage of the Geiger Counter

First, we will measure the Geiger counter's response as a function of applied voltage.

- a) Place a source under the Geiger counter tube.
- b) Set the timer to count for ten minutes or longer.
- c) Set the voltage to zero first, then slowly turn up the voltage until the counter starts to record counts. This is the "starting voltage".
- d) Take 1 minute readings, increasing the voltage by about 10 or 20 volts each time. Make a table of your data.

Note: to prevent damaging the tube, **do not increase the voltage more than 150 volts beyond the starting voltage, and certainly not more than 1000 volts.**

- e) Graph your results using Excel or on linear graph paper. Label on your graph the starting voltage and the plateau region. Also label the proper operating voltage on the graph. From your graph, do you think your Geiger counter tube is operating properly? Why or why not?

2. Efficiency of the Geiger Counter

In this part, you will estimate the efficiency of the Geiger-Mueller tube for a particular source. The efficiency of the Geiger counter will depend on the sample, so be sure to record the sample used. From the activity written on the source, use the half-life formula to determine the activity in decays/sec of your source today. Place your source as close to the tube as you can, and count for 2 minutes. Estimate the distance the source is away from the tube. Determine the efficiency of the Geiger-Mueller tube for this positioning of the source. We will define the efficiency ϵ as:

$$\epsilon \equiv \frac{\textit{particles detected}}{\textit{particles emitted}} \quad (1)$$

This is not a measure of the efficiency of the tube itself, but also includes the distance the source is from the detector (geometry factor).

Report for Experiment 1

1. (8 points) Make a table and graph of Counts vs. voltage for your Geiger counter tube. Label on your graph the starting voltage, operating voltage, and the plateau region.
2. (4 points) Show your data and calculations for determining the efficiency of your Geiger counter for counting geometry of your experiment.