Name _____ Date _____ Period _____

Identifying an Unknown Radiation Source

Objective: Identify an unknown radiation source as alpha, beta, or gamma.

Find the Lab

- Click this link [Geiger Muller Tube](#) or in your web browser, go to www.gigaphysics.com, then click Virtual Labs, and then Geiger-Müller Tube.

- Click New Experiment. This will ensure that you have your own random sources for the experiment, and if you ever need to completely start over, click New Experiment to reset.

Part I: Measure the Background Radiation

1. First we need to account for the radiation in the air, building materials, etc.—things other than the radioactive sources. (Yes, the lab is programmed to simulate these background sources.)

2. To measure the background radiation, set the **Radiation source** to none (background), the Type of Barrier to none, and the **Count duration** to 10 seconds.

3. Click **Start Count** to begin counting the number of background particles that hit the counter in 10 seconds. After the count has completed, record your answer below. You only need to do this one time for the entire experiment.

   Background: _____ counts in 10 seconds

Part II: Alpha Radiation

1. You need to know how each type of radiation is affected by barriers such as cardboard, lead, etc. To start these tests, change the Radiation source to alpha. Set the **Type of Barrier** to **None**. Set **Count Duration** to 10 seconds.

2. Click **Start Count** to obtain your count, then enter it in the first line of the data table at the top of the next page. This count goes in the **"Including Background"** column since you have not yet removed the background counts that you measured in part I.

3. To determine the counts from just the alpha source, subtract the number of background counts you measured in part I from the count you just measured. Record this figure in the "excluding background" column of the table.

4. To find out how a cardboard barrier affects alpha radiation, change the **Type of Barrier** to **Cardboard** and the **Number of Barriers** to **One**. Click **Start Count** again to obtain the count with one cardboard barrier between the alpha source and the detector. Record the data in the Alpha Test data table..

5. Continue with the rest of the rows for Alpha radiation in the table - changing the type of barrier and number of barriers. Sometimes the alpha count may be less than the background. This happens because this simulation is programmed to randomly vary the counts, just as in the real world. If this happens, write zero for the counts excluding the background.

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Alpha Radiation Test Data

Type of barrier	Number of barriers	**Alpha** counts/10 seconds (including background)	**Alpha** counts/10 seconds (excluding background)
None	---		
Cardboard	1		
Cardboard	3		
Cardboard	5		
Plastic	1		
Plastic	3		
Plastic	5		
Lead	1		
Lead	3		
Lead	5		

1. Based on your data, how hard is it to block alpha radiation? Which barriers are more effective? Which are less effective? (LIST YOUR ANSWERS)

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Part III: Beta Radiation. Change the Radiation source to beta and repeat the previous experiment.

Type of barrier	Number of barriers	**Beta** counts/10 seconds (including background)	**Beta** counts/10 seconds (excluding background)
None	---		
Cardboard	1		
Cardboard	3		
Cardboard	5		
Plastic	1		
Plastic	3		
Plastic	5		
Lead	1		
Lead	3		
Lead	5		

2. Based on your data, how hard is it to block beta radiation? Which barriers are more effective? Which are less effective?(LIST YOUR ANSWERS)

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Part IV: Gamma Radiation. Change the Radiation source to gamma and repeat the previous experiment.

Type of barrier	Number of barriers	**Gamma** counts/10 sec (including background)	**Gamma** counts/10 sec (excluding background)
None	---		
Cardboard	1		
Cardboard	3		
Cardboard	5		
Plastic	1		
Plastic	3		
Plastic	5		
Lead	1		
Lead	3		
Lead	5		

3. Based on your data, how hard is it to block gamma radiation? Which barriers are more effective? Which are less effective? (LIST YOUR ANSWERS)

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Part V: Identify the Unknown Source

1. Now that you know how each type of radiation is affected by different types of barriers, you can use this knowledge to identify an unknown source. Change the Radiation source to the **Unknown** source.

2. Use what you learned in the previous parts to decide what tests will be most effective at helping you determine whether your unknown source is alpha, beta or gamma. You may or may not need to use all ten lines of the table.

Type of barrier	Number of barriers	**Unknown** Counts/10 seconds (including background)	**Unknown** Counts/10 seconds (excluding background)
None	---		

1. Compare the results for your unknown source to your results for alpha, beta, and gamma radiation. Based on these data, what type of source is your unknown most likely to be?

2. Clearly explain your reasoning.

Part VI: Apply Your Knowledge

1. Many smoke detectors contain a small amount of the isotope Americium-241, which emits alpha radiation. Should a person walking under such a smoke detector be concerned about being hit by the alpha particles? Explain your answer using something you learned in this lab.

2. In the medical imaging procedure known as a PET scan (Positron Emission Tomography), positrons from a radioactive tracer strike electrons in the body's tissues. This produces radiation, and this radiation is then observed using a detector outside the body. Based on this information, do you think the positron-electron collisions create alpha, beta, or gamma radiation? Explain your answer using something you learned in this lab.