INTRODUCTION TO RADIATION

Introduction:

This experiment is designed to allow you to use a nuclear scalar to collect data for three sealed sources. The scalar contains a Geiger-Muller tube (G-M tube) that detects radiation emitted from atoms. After you have collected the data, you will analyze it to determine what effects, if any, each variable has on the number of counts.

Purpose:

The purpose of this experiment is to collect data for three radioactive sources and describe the effects of time, distance, and shielding.

Student Outcomes:

1. Use a scalar and G-M tube to collect data for radioactive sources.
2. Analyze data to describe the effects of time, distance and shielding on the number of counts per unit time.

Equipment/Materials:

sealed sources (alpha, beta, and gamma)
scalar and G-M tube
materials forceps

Safety:

- This experiment presents no unusual safety hazards. It is good technique to handle all radioactive sources with forceps.

Procedure

Part I: *TIME*

1. Plug in the scalar and press the POWER button if this has not already been done. Press STOP and RESET to clear the display. Set the voltage to 775.

2. Obtain a sealed alpha source and place it on the second shelf of the sample holder, paper side down. Remember to use forceps when handling the sources.

3. Set the timer to 30 seconds. Push the COUNT button and record the value when the STOP light goes on. Press the RESET button, set the timer to 60 seconds, and take another reading. Repeat, taking a 90 second reading.

4. Repeat steps 2 & 3 for a beta source and a gamma source.

Part II - *DISTANCE*

1. Place a sealed alpha source on the top shelf of the sample compartment (paper side down) and take a 60 second reading. Lower the source to the next shelf and take another one minute reading. Remember to record your data and to reset the scalar between measurements. Continue until readings are taken on all the shelves.

2. Repeat the procedure in Step 1 with the beta and gamma sources. The order in which they are used does not matter.

Part III - *SHIELDING*

1. Take a 60 second reading with no sample in the sample compartment.

   This will serve as the *background* reading.

2. Place a sealed alpha source, paper side down, on shelf 2. It will remain on this shelf for the entire experiment. Take a one minute reading.

3. Place the index card over the sealed source sample and take another one minute reading. Repeat the procedure with the other materials indicated on the data sheet.

4. Repeat Step 2 and 3 for the beta and gamma sealed sources.

5. Take another one minute background reading.

Name _____

Introduction to Radiation
Data Sheet

Part I – TIME

	Alpha (Po-210)	Beta (Sr-90)	Gamma (Co-60)
30 second count			
60 second count			
90 second count			

Part II – DISTANCE

Alpha (Po-210)		Beta (Sr-90)		Gamma (Co-60)	
Shelf 1		Shelf 1		Shelf 1	
Shelf 2		Shelf 2		Shelf 2	
Shelf 3		Shelf 3		Shelf 3	
Shelf 4		Shelf 4		Shelf 4	
Shelf 5		Shelf 5		Shelf 5	
Shelf 6		Shelf 6		Shelf 6	

Part III – SHIELDING

Background (before) _____ **Background** (after) _____

Alpha (Po-210)		Beta (Sr-90)		Gamma (Co-60)	
Air		Air		Air	
Paper		Paper		Paper	
Al. Foil		Al. Foil		Al. Foil	
Al. Metal		Al. Metal		Al. Metal	
Lead		Lead		Lead	

Questions:

1 . What were the three independent variables studied in this experiment?

2. Describe the relationship you observed between count rate and time in Part I.

3. a. Describe the relationship you observed between distance and count rate in part II.
b. What term is used to describe this relationship?.

4. Were there any differences between the sealed sources in Part II? What does this tell you about the ability of different forms of radiation to travel through air?

5. What happened when the distance between the beta source and the detector doubled?

6. How do you know if a shielding material has completely stopped a particular type of radiation?

7. From your data, what substance would be required to stop each of the three types of radiation?