

Educational Exercises

The following radiation lab practical is designed to take ~30 minutes (5 minutes per table with 6 table experiments total.) Kids can work in teams. Demonstrate to the whole class first how alpha and beta/gamma survey meters work and how to read the scales.

Table #1 BACKGROUND RADIATION

TASK: Measure alpha and beta/gamma radiation background fields in the room with the 2 different survey meters. Record the values for background. Answer the question “ Where is background radiation coming from?”

Supplies: 1 alpha air proportional survey meter
1 beta/gamma GM survey meter

Table #2 TIME AND RADIATION EXPOSURE

TASK: Your Grandfather just gave you a old compass that contains radium paint (unknown to him). Measure the radiation field at 5 inches from the compass. Record the value. You place the compass on your headboard 5 inches from your pillow on your bed. If you leave it there for 1 year (365 days) and we assume that you sleep in your bed 8 hours every night, what will be the radiation dose to your head after 1 year?

Radiation Dose (mrem)=365 days/yr x 8 hrs/day sleep x _____mR/hr

(at 5” off the compass)= _____ mrem to your head!

Supplies: 1 beta/gamma GM survey meter
uranium compass
ruler
calculator

Table #3 DISTANCE AND RADIATION EXPOSURE

TASK: Measure the beta/gamma radiation from a piece of pottery with radioactive glaze (Fiestaware) at 2 inches, 6 inches and 12 inches from the pottery. Record the values. Answer the question “How does distance affect radiation?”

Supplies: 1 beta/gamma GM survey meter
1 Fiestaware pottery
ruler

Table #4 SHIELDING FOR ALPHA RADIATION

TASK: Measure the alpha radiation from the surface of a Coleman lantern mantel. Record the value. Put a piece of paper over the lantern mantel and measure the alpha radiation field. Repeat with Plexiglas and then a piece of lead. Record the values. Answer the question “How did the different types of shielding change the radiation field?”

Supplies: 1 alpha air proportional survey meter
1 Coleman lantern mantel
1 piece paper, Plexiglas and lead

Table #5 SHIELDING FOR BETA/GAMMA RADIATION

TASK: Measure the beta/gamma radiation from the surface of a radium dial watch. Record the value. Put a piece of paper over the watch and measure the beta/gamma radiation field. Repeat with Plexiglas and then a piece of lead. Record the values. Answer the question “How did the different types of shielding change the radiation field?”

Supplies: 1 beta/gamma GM survey meter
1 radium dial watch

1 piece paper, Plexiglas and lead

Table #6 WHICH ITEMS ARE RADIOACTIVE?

TASK: Using a beta/gamma GM survey meter, determine which numbered items are radioactive and which aren't. Record the numbers of the items that are radioactive.

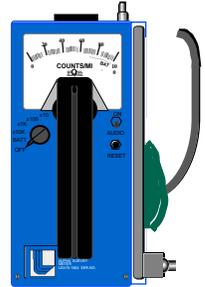
Supplies: 1 beta/gamma GM survey meter
14 numbered items (natural forms of radiation, consumer products and non-radioactive items)

Date: _____

Name(s): _____

Table #1 Background Radiation

1. Use a Blue Alpha survey meter to measure the alpha background radiation in counts per minute (cpm). Background = _____ cpm



2. Use a Beta/Gamma GM survey meter to measure the background radiation in counts per minute (cpm).
Background = _____ cpm

Where is this radiation coming from? Is it your teacher?

Table #2 Time and Radiation Exposure

Your Grandfather gave you an old compass that contains radium paint (unknown to him). You place the compass on your headboard 5 inches from your pillow on your bed. If you leave it there for 1 year (365 days) and we assume that you sleep in your bed 8 hours every night, what will be the radiation dose to your head after 1 year?

Measure the radiation field at 5 inches from the compass. Record the value.
_____mR/hr at 5"

Calculate: Radiation Dose (mrem)=365 days/yr x 8 hrs/day sleep x _____mR/hr
(at 5" off the compass)= _____ mrem to your head!

Table #3 Distance and Radiation Exposure

DISTANCE	RADIATION READING
2 inch	
6 inches	
12 inches	

What effect does distance have on the radiation emitted from the piece of pottery?

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Table #4 Shielding for Alpha Radiation

1. Using the Blue Alpha survey meter measure the radiation at the surface of the Coleman lantern mantle.
_____cpm
2. Place a piece of **paper** over the Coleman lantern mantle and measure the radiation level at the surface of the lantern mantle through the paper
_____cpm
3. Place a piece of **Plexiglas** over the Coleman lantern mantle and measure the radiation level at the surface the lantern mantle thorough the Plexiglas.
_____cpm
4. Place a piece of **lead** over the Coleman lantern mantle and measure the radiation level at the surface the lantern mantle through the lead.
_____cpm

Question: How did the different types of shielding affect the radiation field?

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Table #5 Shielding for Beta/Gamma Radiation

1. Using the GM survey meter to measure the radiation at the surface of the radium dial watch.
_____cpm
2. Place a piece of **paper** over the radium dial watch and measure the radiation level at the surface of the radium dial watch through the paper. _____cpm
3. Place a piece of **Plexiglas** over the radium dial watch and measure the radiation level at the surface of the radium dial watch through the Plexiglas.
_____cpm
4. Place a piece of **lead** over the radium dial watch and measure the radiation level at the surface of the radium dial watch through the lead.
_____cpm

Question: How did the different types of shielding affect the radiation field?

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Table #6 Which Items are Radioactive?

Use a GM Survey meter and find which items are radioactive on the table and record the number below.

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