Radioactivity

While conducting this experiment, you will be assessed for CPAC3: Working safely.

The Aim of the Experiment

Radioactivity is often used in industry for measuring the thickness or uniformity of a material. The purpose of this experiment is that you should investigate the feasibility of using a beta source to count sheets of paper.

The College's radioactive sources are not strong and if treated with care will not harm you.
It is a Health and Safety requirement that a <u>*lab coat*</u> *be worn whenever you are working with a radioactive source. You will be required to log out the source and to sign for its return.This experiment is to be conducted on the side bench away from other students.*

Before starting, write below 3 safety precautions you should adopt while working with the sources.

Having used the source you should wash your hands thoroughly.

Apparatus

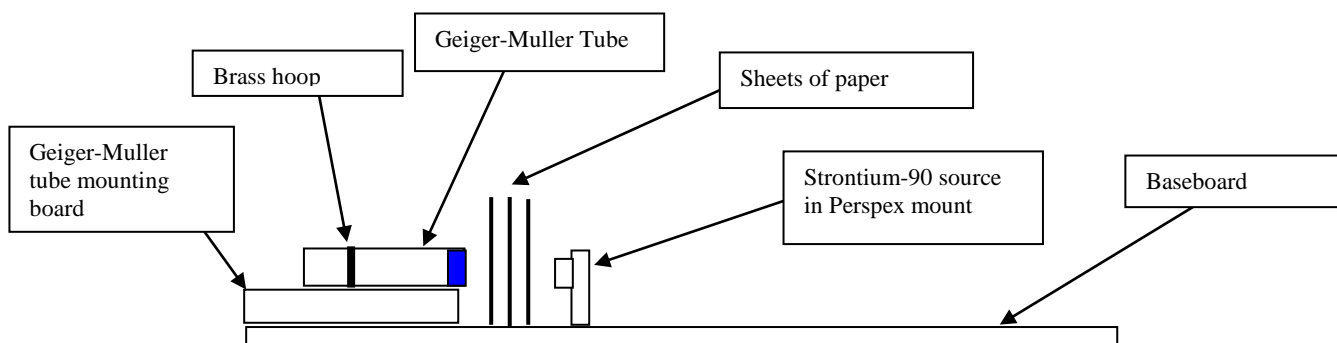|	
Scalar timer	Scalar to Geiger-Muller tube connector
Strontium-90 source	Geiger-Muller tube holder with brass hoop
Baseboard	Rubber tipped tongs
Geiger-Muller tube (HANDLE WITH CARE)	Sheets of paper

Method

- Keep the distance between the source and the detector *small* and *constant.*

- Use the counter in "frequency rate" mode such that it records the average count rate (in counts s^{-1}) over 10 second intervals.

- Record the average count rate as you increase the number of sheets of paper.

- Repeat each reading *at least* once, and obtain lots of readings – go up to 30 sheets of paper. Radioactive decay is a random process, so random errors are unavoidable.

- Remember that "background radiation" is always present, so your readings will never become zero.

- **Before dismantling the equipment,** place an 'unknown' number of sheets of paper within the range tested in front of the source, and record your readings as before. Do this twice. Once for a low number and once for a high number. Count the number of sheets to check your results!

Record a table of the count rate readings for each number of sheets of paper used and calculate the average count rate for each number of sheets.

Plot a graph of *Counts s⁻¹* (y-axis), against *No. of sheets* (x-axis) and draw a best fit smooth curve.

From the average count rate readings for the 'unknown' samples, use your graph to estimate the number of sheets in each sample.

Discussion and Conclusion

Comment on the shape of your graph of average count rate against number of sheets of paper. Is there a linear relationship between these quantities?

Compare the predicted number of sheets in the 'unknown' samples with the actual number used.

Discuss how accurately it is possible to count the number of sheets. Is it better at counting a large or a small number of sheets?

Finally write a conclusion as to whether or not it is feasible to use a beta source to count sheets of paper.

Radioactivity Equipment

Scalar Timer

Geiger tube Connection

Geiger Tube Box

Geiger tube

Geiger tube Mounting Board

Base Board