Absorption of Radioactive Radiation

Goals: You know how different types of radioactive radiation can be absorbed.

Preparation: **Background radiation**

Device:
- Geiger-Müller counter

Measurement: Each team measures three times the number of events in 100 s. Write your measurements into the floor plan on the blackboard.

Analysis: Calculate the average background radiation in the lab room and the standard deviation. Discuss any variations between the different lab stations.

Experiment 1: **Absorption of β radiation**

Devices:
- Radioactive source: Na-22 (β^+) or Sr-90 (β^-)
- Geiger-Müller counter

Measurements:

A Place the source at a distance to the counter tube that allows for a reasonable count rate (at least ten times the background radiation).

B For different materials determine the range of the β radiation, i.e. the thickness that reduces the count rate to a value below twice background radiation.

Analysis:

1. Present your results in a table. Compare the values to the ones calculated with the empirical formula.
2. For one of the measurements calculate the probability that the measured count rate was in fact lower than the background radiation.

Experiment 2: **Absorption of γ radiation**

Devices:
- Radioactive source: Co-60 and Cs-137 (β^-, γ)
- Geiger-Müller counter

Measurements:

A Measure the count rates (interval 100 s) while you insert an increasingly thicker layer of lead between the source and the counter tube until the count rate drops below the background radiation.

B Repeat A for the second source.

Analysis:

1. Plot the net count rates (i.e. without the background) vs. the thickness of the lead plates in a semi-logarithmic diagram (for both sources). Determine the half thicknesses from this diagram.
2. Explain why there is a sudden drop in the count rate for the first lead plate.
3. Calculate the half thicknesses for the energies of the γ radiation in the two sources with the help of the diagram in "Formeln, Tabellen, Begriffe" (p. 201).

Requirements: For a short report, work at least on exercise 1 of experiment 1 and on exercise 1 of experiment 2. The complete interpretation is required for a full report.

Hand in your report and the lab notes by the first lab of the new semester.