



CAEN Educational Handbook

Nuclear and Particle Physics Experiments



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SP5660 - ROCKYRAD

Difficulty



Execution Time



Purpose of the experiment

The objective of the experiment is to analyze and compare the detected counts originating from rocks of different origins.

Fundamentals

The radioactivity of rocks varies significantly depending on their geological origin, with different types of rocks contributing distinctively to the overall radiation background. The composition of the Earth's crust contains various radioactive elements, and the concentration of these elements in rocks can vary based on factors such as the rock type and the geological processes that formed them.

Granitic rocks, for example, often exhibit higher concentrations of radioactive elements such as uranium, thorium, and potassium. These rocks contribute to elevated levels of ionizing radiation due to the decay of these

radioactive isotopes. On the other hand, sedimentary rocks like limestone may have lower concentrations of these radioactive elements, resulting in comparatively lower radioactivity.

The different contributions of rocks to radioactivity are crucial in understanding natural background radiation and its variations across geological regions. This knowledge not only has implications for scientific studies but also plays a role in applications such as radiological assessments, mineral exploration, and environmental monitoring. Additionally, it underscores the importance of considering the geological context when interpreting measurements from radiation detection experiments, as the types of rocks present can influence the observed radiation levels.

Requirements

No other tools or instruments are needed.

Carrying out the experiment

The experiment involves several data-taking sessions, depending on the number of rocks under investigation. Begin by placing the GM detector on the desk and powering on the system. The GM detector will immediately initiate measurements and record data every minute during acquisition. Background counts, essential for calibration, should be obtained in the absence of samples, specifically with the GM tube window uncovered. It is advisable to conduct an acquisition for a minimum of 2 hours.

Upon completing the background measurement, place the first rock sample in the middle of the open window of the GM detector. Start the new acquisition, maintaining the same acquisition time to facilitate straightforward background subtraction. Repeat the procedure by using the other rock samples.



Experimental setup.

Results

The primary aim of this experiment is to investigate the variations in ionizing radiation levels exhibited by several geological samples. Furthermore, it not only serves as a practical application of radiation detection principles but also encourages participants to apply scientific methods in data analysis and interpretation. The experiment opens avenues for discussions on the geological factors influencing radioactivity, contributing to a broader understanding of the complex interplay between rocks and ionizing radiation.

	Background	Leucitic Tephrite	Granite	Porphyry	Trachyte
<i>Max</i>	37.0	47.0	40.0	40.0	33.0
<i>Min</i>	11.0	20.0	15.0	15.0	15.0
<i>Mean</i>	22.0	33.6	25.4	25.4	24.8
<i>STAT</i>	0.1	0.4	0.9	0.9	0.9
<i>STD</i>	4.5	5.6	5.4	5.4	4.6
<i>Live Time [m]</i>	197	197	121	35	28