

Experiment 6 Natural Radiation

In this experiment, you will examine the soil sample of your choice. Your goal is

1. to determine how much potassium, by weight, that is in the soil. You should express your answer in percent by weight.
2. to determine the activity of Th^{232} , and hence the Thorium series, in in the soil.
3. to determine the activity of U^{238} , and hence the Uranium series, in the soil.
4. to check if there are any other isotopes in the soil sample (e.g. Cs^{137}). If there are, determine the activity of these isotopes in your sample.

Energy Calibration and resolution of the Ge detector

To determine the energy/(channel number) we will use our normal standards:

Isotope	Energy (KeV)
Cs^{137}	661.657
Na^{22}	511.0034
	1274.53
Mn^{54}	834.848
Co^{60}	1173.237
	1332.501

Analysis of Environmental Sample

We will record data from at least three samples: a background, a soil or other environmental sample, and a KCl sample with the same detector source geometry as the soils. You can use the program fit8000s to find the channel numbers and areas of the photopeaks. From this data, you should be able to determine the isotope content in the sample. A useful quantity to plot is the **(counts/yield)** for each peak in the decay series. Remember to subtract the background counts from the photopeaks.

Laboratory Write-up

You should turn in the following:

1. (2 points) An energy calibration graph, with calibration equation, from the standards. Your calculation of the resolution of the detector for the 662KeV photopeak of Cs^{137} .
2. (2 points) Your calculation for determining the efficiency of the detector for an energy of 1460 KeV for the geometry of the KCl sample.
3. (3 points) A table which lists the channel numbers of the peaks you measured, the energies of the gamma radiation, the yield of the radiation, and the counts/yield. You should use Excel, and can turn in the Excel spreadsheet.
4. (2 points) A graph of (counts/yield) as a function of energy for the sample.
5. (3 points) Your calculations for determining the relative (or absolute) activities of the Thorium and Uranium series in your sample as well as the potassium content.