ENVIRONMENTAL ASPECTS

**Energy and efficiency calibration**

Data has been collected with a calibrated Marinelli beaker source. Using this data measure the absolute efficiency of the γ-ray system as a function of gamma-ray energy.

Notes for carrying out your own data collection:

* Collect a spectrum for a few minutes and store it for analysis.
* First, check the energy calibration. Record the results.

# Source used: Counting time = sec

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| --- | --- | --- | --- | --- |
| Nuclide | Channel number | Calibrated energy(keV) | Tabulated energy(keV) | Net peak area± error |
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Now carry out an efficiency calibration. This is best done using a spreadsheet (EXCEL). Remember to include the error on the efficiency.

where *N*peak = net peak area, τ is the live time and *A*γ is the gamma activity (= source activity × gamma branching ratio).

The gamma activity can be found from the calibration information for the source. Remember to correct for the decay of the source since the calibration date. This correction can be done conveniently using a spreadsheet.

Note that, in this practical, you assume that there is no significant peak in the background to be subtracted from *N*peak. This assumption will not be made in the next practical

* Plot efficiency versus gamma-ray energy. This best done on a log(efficiency) versus log(energy) scale.

Practical: **Activity Calculations**

**Measurement of the gamma-ray spectra**

Please use the data provided for a Marinelli beaker. If taking the measurements yourself you would count for at least a six-hour period.

Report the results below. Enter a sample description as a title.

Investigate the possible nuclides from the energies given

Sample 1:

Counting time = sec

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| --- | --- | --- | --- |
|  Eγ (keV) |  Net peak area ±error | Count rate ± error (Hz) | Possible nuclide |
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**Determination of the activity**

Having identified the various nuclides the next task is to calculate their activities per unit mass of sample. In order to do this you will have to correct for (1) a possible peak in the background, (2) the γ-ray branching ratio and (3) the detector efficiency.



This is probably best done using a **spreadshee**t.

Remember to include errors.

Summarise the results below for each sample for various nuclides - by averaging if there is more than one value for a particular nuclide.

Before taking an average, study the results to decide whether they agree within the error given.

Sample 1

|  |  |  |  |
| --- | --- | --- | --- |
| Nuclide |  γ-ray energy  (keV) |  Activity (Bq/kg) |  Average activity (Bq/kg) (for a nuclide) |
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Sample 2

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| --- | --- | --- | --- |
|  Nuclide |  γ-ray energy  (keV) |  Activity (Bq/kg) |  Average activity (Bq/kg) (for a nuclide) |
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