

# Laboo

Information and guidelines for accompanying teachers

In this workshop, pupils in the fifth and sixth year of secondary education will have the unique opportunity to conduct a number of experiments with radioactive sources. They will get acquainted with how to measure ionizing radiation and learn how to use radioactive sources safely. They will then investigate a number of concepts autonomously, such as penetrating and ionizing capacity, half-life and half-value layer.

## Practical information

A workshop in Laboo lasts for 2 hours. A maximum of 32 pupils, working in pairs, can participate. At least one accompanying teacher should attend the workshop which is run by guides from Tabloo.

The workshop takes place in the Tabloo laboratory (Gravenstraat 3, 2480 Dessel). This can be combined with a visit to our exhibition, a repository walk or the Disposal Expert game. More info and reservations on [www.tabloo.com](http://www.tabloo.com).

## Before your visit

### Prior knowledge

For many pupils, the material presented is quite complex. In our experience, the tests run best when pupils have some prior knowledge of the subject.

### Practical preparation

A little preparation beforehand ensures that your visit to Laboo will go smoothly.

Decide on pairs before the workshop. If you come with an uneven number of pupils, one group will work in a three. To maximise efficiency when moving through the different experiments, it is best to pair pupils with a similar working rhythm at the same table.

During the workshop, the pupils also need to provide the e-mail address of one teacher. This teacher will receive the responses from all participants. Check beforehand to which teacher the results should be sent. Give the e-mail address(es) to the accompanying teacher if required.

## Workshop structure

### Introduction

At the start of the workshop, the pupils will watch a presentation. We will give a short introduction in which we explain a number of essential elements. We see this introduction as a first acquaintance or short reminder of the following concepts:

- Stability of a nucleus
- Ionizing radiation: alpha, beta-, beta+ and gamma
- Penetrating and ionizing capacity of radiation
- Background radiation
- Half-life



We also pay the necessary attention to safety during the experiments. Which safety principles are necessary to protect ourselves from ionizing radiation? How do we use the radioactive sources during the experiments? How does a pulse counter work?

Then, pupils will set to work in pairs. On a tablet, they will read the instructions for each experiment

and record their measurements and analysis results. There are four tables, each with four different experiments. Therefore, by rotating, they will each conduct a total of four experiments.

### Experiment 1 – Determine the radiation from an unknown source

In this arrangement, the pupils are given an unknown source X: a gamma or beta source. Using distance and plates placed between the source and the Geiger counter, and with the recorded radiation, they must determine the type of source.

### Experiment 2 - Determine the half-life of Ba-137m

The pupils will extract Ba-137m from a Cs-137 source using salt water. The salt solution is placed under a Geiger counter and they must record the number of pulses per 10 seconds. With this data, the program makes a graph of the half-life and the pupils can use it to determine the half-life.

### Experiment 3 - The ionizing impact of radiation

This is a qualitative observation experiment. The pupils will set up an arrangement with a power source and electroscope. Subsequently, they will use a radioactive source to demonstrate the electrical conduction when the radiation source ionizes the air between the plates. In a second arrangement, they will connect the power source with a spark chamber and observe electrical sparks when approaching the chamber with a radioactive source. Finally, they will observe the traces of ionisation in a cloud chamber.

### Experiment 4 - Inverse-square law with a v-shaped radioactive source

The pupils will examine the inverse-square law with a v-shaped radioactive source. This source will gradually be taken further from the Geiger counter, and the radiation will be measured with each step. Using the graph and calculation, it is demonstrated that the radiation intensity is inversely proportional to the square of the distance.

## After your visit

During the workshop, the pupils will enter their measurements and analysis results on the tablet. At the end of the workshop, their answers will be sent to the pupils and a teacher. The e-mail addresses are entered by the pupils at the start of the workshop.

They can use these results later in the class. You will receive them in an Excel file and can easily use them for further analysis: pairs can compare their answers, the different results can be studied or the file can be used to explore certain educational topics in more depth.

Since the results are also sent to a teacher, this teacher can evaluate the answers too, if desired.