

Spectroscopy in an Envelope, V0.5 kit guide

If you are reading this, then you are in receipt of the “Spectroscopy in an Envelope” kit, version 0.5.

This kit should contain:

- Two individual bagged colourimeters with instructions
- Two laser-cut cuvette racks
- A voltmeter and set of leads

This kit contains no hazardous chemical reagents. It is not a toy, and contains batteries and small parts which are not suitable for young children. If you have received this kit in error, please contact our team at the email address below if you are unable to forward it on to the correct recipient.

The colourimeters in this kit can be used for any classroom activity, project investigation, or after-school science club that would normally rely on a conventional colourimeter, and there is specific advice overleaf on how to use this kit as a drop-in replacement for a more comprehensive device.

This kit requires some setup before first use, which could itself be a job for more able and independent pupils. The voltmeter may need the battery fitted, the laser-cut cuvette racks will need to be assembled using wood-compatible glue, and detector bricks should be checked to make sure the wires are bent apart. This should only be done **once**, since metal fatigue otherwise damages the wires over time. There is a video “unboxing” guide on our website, with all of this in detail.

To use both spectrometers at the same time, you will need to use an extra voltmeter. If you don’t have one, get in touch as we may have a small number of spares available.

Most of our information, advice, and support will run through our project website:

<https://www.strath.ac.uk/science/chemistry/teachers/SpectroscopyInAnEnvelope/>



This website contains several useful resources, including:

- A video of the kit being opened and set up for first use
- A video of the spectrometer being built and used to collect data
- Blank and sample filled-in paper worksheets for pupils
- An excel spreadsheet which can process data and handle calculations and graphs

This is only an indicative list – check the website for full details of the available support!

This project was made possible due to funding by the Royal Society of Chemistry. We will ask you to complete a survey after first using the kit with your pupils – please let us know your thoughts, as future improvements and resources will depend on the lessons learned from this first pilot project!

Best wishes,

Patrick Thomson, Spectroscopy in an Envelope Principal Investigator. patrick.thomson@strath.ac.uk

- Version 0.5 of the “Spectroscopy in an Envelope” insert, March 2026 by the University of Strathclyde, department of Pure & Applied Chemistry. <https://www.strath.ac.uk/science/chemistry/teachers/SpectroscopyInAnEnvelope/>
- For technical support, contact chemistry-teacherscpd@strath.ac.uk or patrick.thomson@strath.ac.uk
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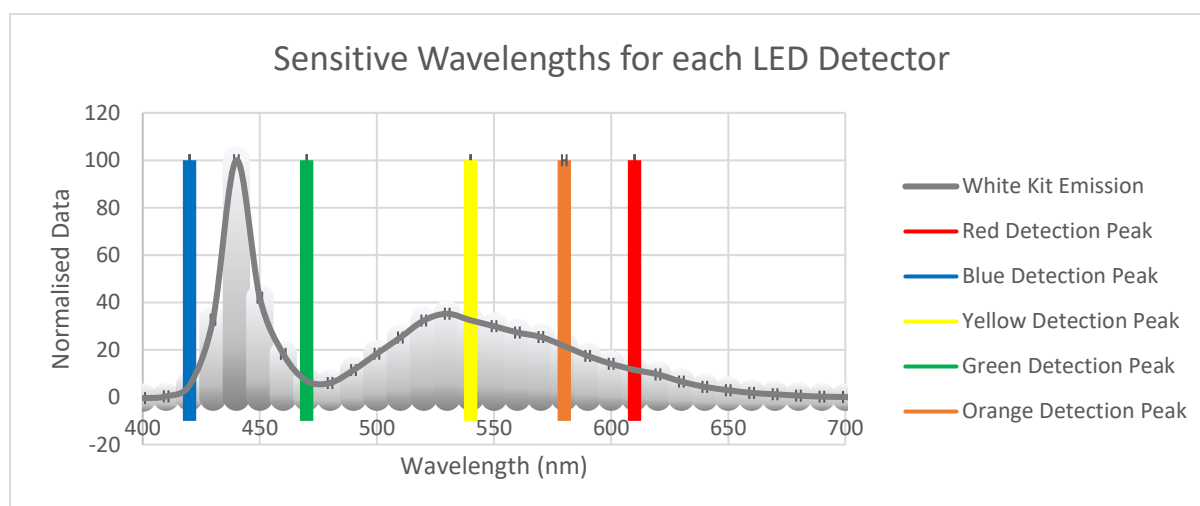
How to use this kit as a replacement for a conventional colourimeter

The SIAE spectrometer (this kit!) works similarly to any conventional colourimeter that uses a set number of wavelengths, usually *via* colour filters. There are some specific quirks, but this guide (and the user instructions in each kit) will enable you to use SIAE to measure any common colourimetry experiment, including (but not limited to) manganese, copper or iron content determination.

SIAE is not a full experiment in its own right – just an accessible instrument. Suitable experiments can be found via the RSC, SSERC, CLEAPSS, or the Strathclyde Advanced Higher Project Database.

Choosing a wavelength for the SIAE spectrometer

The wavelength selection of this kit is done by choosing a specific LED detector brick during construction. Specifically, there are 5 colours of detector, sensitive to light of that colour: blue (420 nm), green (470 nm), yellow (540 nm), orange (570 nm), and red (610 nm). Use colour theory to select the appropriate match for your experiment. For example, a red solution allows red light to pass unchanged, so the red detector will not be insensitive to changes. Instead, select the blue detector, since the red solution strongly absorbs blue light.



For some experiments, multiple detectors could be suitable. Each detector has a different overall sensitivity, and therefore a different maximum mV reading (independent of colour match). Higher maximum mV readings don't correlate to absorbance, and in many cases, the best wavelength match may not give the highest maximum mV reading.

You can also determine the best matched detector by experimental investigation. For each wavelength, measure a cuvette of water and a cuvette of analyte. Calculate the %T for each detector; the detector that has the lowest %T for a fixed concentration of analyte is the most responsive, and will be the best choice even if it doesn't have high values of mV readings.

Interpreting results from the SIAE spectrometer

To keep costs down and make the device fully repairable by you, the SIAE spectrometer cannot provide absorbance (Abs) data directly. Instead, each millivolt reading is used as the incident light parameter (" I ") in a Beer-Lambert law calculation. This means that converting data into Abs requires a little bit of extra maths, including base-10 logarithms. The user instructions with each individual spectrometer detail these calculations, and there are also helper spreadsheets and pupil paper worksheets available on the project website. The SIAE spectrometer cannot subtract a non-zero background, which must be done by hand using absorbance values.