



## SSERC Support for practical science (Secondary school pupils)

### ***Spectrophotometer***

This easy to use spectrophotometer, in combination with the LabQuest 2, allows the ***analysis of rates of reactions*** or the ***calculation of concentrations of a compound in an unknown sample***. It does this by measuring the absorbance or percentage transmittance of solutions. It measures how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through a sample solution into a detector. If the light beam's intensity is reduced upon reaching the detector, then the sample has absorbed some of the light. Different compounds will absorb different amounts of light.

The machine can also be used as a fluorometer with excitation wavelengths of 405 nm or 500 nm. Fluorescent molecules are compounds that absorb light of one wavelength, then re-emit light at a longer wavelength. This emitted light can be quantified using fluorescence spectroscopy. Molecular and cellular biologists use fluorescent compounds to label proteins, gels, and even cellular organelles.

Examples of experiments that can be carried out in the chemistry or biology classroom such as ***Determination of Chlorophyll in Olive Oil***, ***Determining the Concentration of a Solution: Beer's Law*** and ***Determining the Quantity of Iron in a Vitamin Tablet*** using the spectrophotometer provided by SSERC in partnership with Aberdeen Science Centre can be found here:

<http://www.vernier.com/products/sensors/spectrometers/visible-range/svis-pl/>

### ***Fibre-optic probe***

Giving the spectrophotometer even more uses is the fibre-optic probe. It allows analysis of emitted radiation, i.e. the intensity of emissions from a light source. This probe extends the usability of the spectrophotometer into more areas of chemistry, Advanced Higher in particular, and into physics.

### ***Mystrica Colorimeters***

Colorimetry is a valuable analytical technique in many areas of biology and chemistry. Colorimetry can be used by any age group, but is of most use from National 4/5 and above. The machines are robust and easy to use, and can be connected to PCs, iPhones and iPads (free app available to download). Detailed suggestions for practical activities can be found at [www.mystrica.com](http://www.mystrica.com) and include:

- Rates of chemical reactions, determination of rate order
- Investigations with enzymes
- Quantitative determination of biological molecules

- Quantitative determination of inorganic ions
- Population growth of micro-organisms

### ***Cloud Chamber***

Radioactivity is part of both the chemistry and physics Senior Phases courses. Particle Physics has been introduced at Higher and Advanced Higher. One piece of equipment that really engages learners with these topics is the cloud chamber. Invented by Scottish Nobel Prize-winning physicist CTR Wilson, this beautiful apparatus shows tracks left by radiation and cosmic rays as vapour trails. The device is electronically cooled, and comes with a piece of mildly radioactive welding rod which requires no special storage or transport provision. Add a small amount of isopropyl alcohol, switch on the chamber in a darkened room, and particle tracks appear in minutes.

### **Infrared (IR) Thermal Imaging Camera**

This IR Thermal Imaging Camera allows detection of infrared energy (heat) within the range of  $-20^{\circ}\text{C}$  to  $250^{\circ}\text{C}$ , and can accurately measure temperatures within  $\pm 2^{\circ}\text{C}$  with its on-screen center spotmeter. Again, this equipment can be used by any age group, but is of most use from National 4/5 and above. This equipment allows for exploration of the subject of heat transfer, insulation, radiation and convection. For example, it could be used to detect heat loss from buildings, body temperatures, heat transfer from one object to another, and the temperature of exothermic chemical reactions. Images can be captured and saved as JPEGs and then transferred to be stored on to PCs.