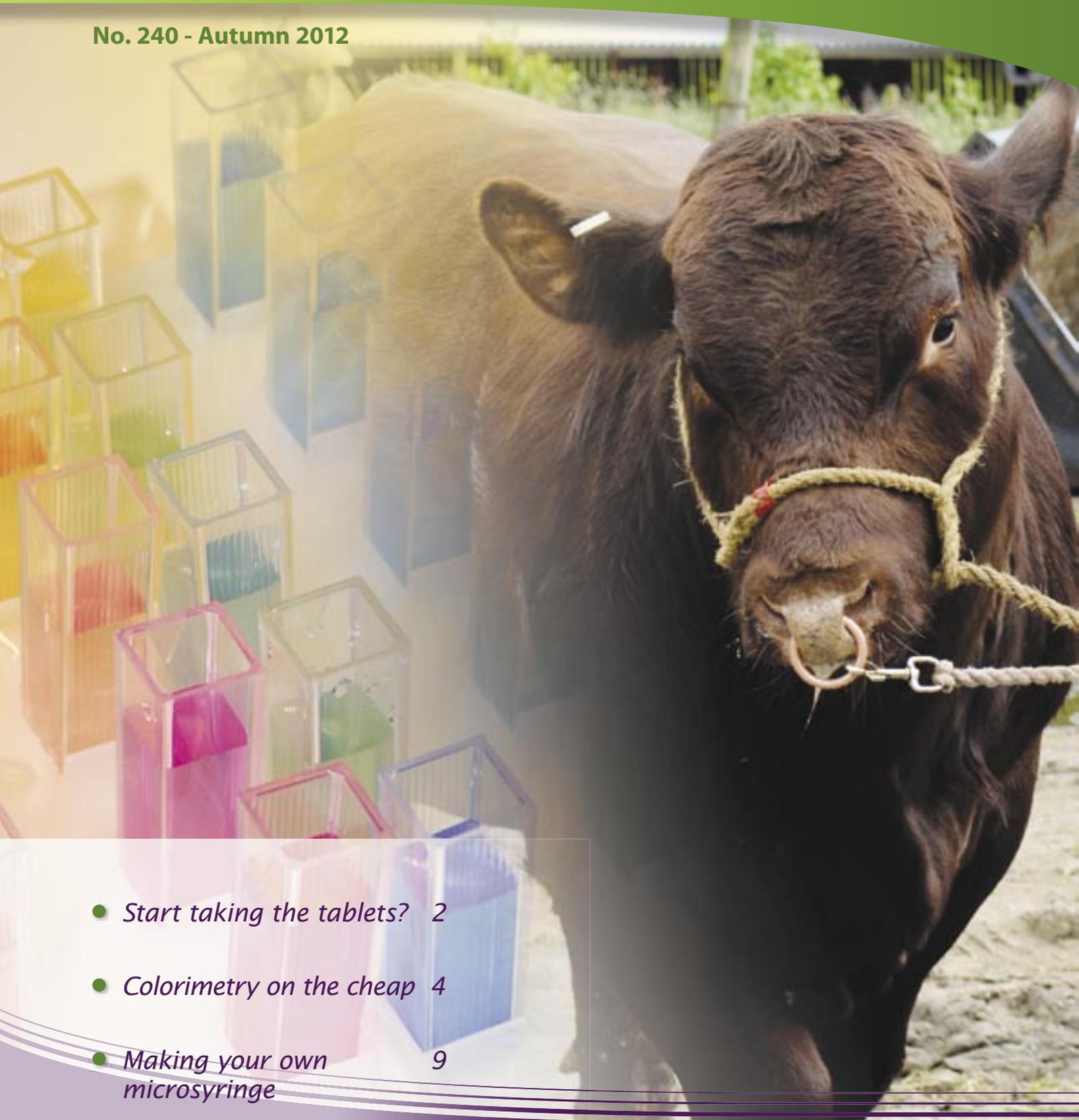


SSERC *Bulletin*



Ideas and inspiration supporting science and technology for all Local Authorities

No. 240 - Autumn 2012



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Start taking the tablets?

Many teachers, and indeed students, own smartphones and tablets. Here we look at some interfacing and analysis applications from two companies associated with datalogging hardware and software.



Figure 1 - iPad and iCelsius Pro temperature probe.

iCelsius temperature probe

The iCelsius is a temperature probe that plugs into the Apple iPhone or iPad. With the help of a free app, the phone or tablet becomes a thermometer with logging and alarm facilities. Our model was the iCelsius Pro, which has a range of -30°C to 150°C , with a claimed accuracy of $\pm 0.2^{\circ}\text{C}$ at 25°C and a data capture rate of 2 Hz. As of summer 2012, this cost £45 before VAT. For £5 less, a base model is available but it cannot read beyond 70°C . (Figure 1)

What you see on the screen when you run the app depends on whether you have an iPad or iPhone. Figures 2 and 3 show, respectively, the readout and graphing screens for the phone. These are combined into a single screen for the pad.

The graph can be scrolled and zoomed in the usual manner for iOS applications. It is also possible to set an alarm to sound if the temperature falls outwith a certain range (Figure 4). Indeed, with the iPhone, you can make it call another phone should this happen. We are struggling to find a laboratory use for this beyond “because we can”.

Data captured can be e-mailed for analysis using a package such as Microsoft Excel. We wonder

if this heralds a range of probes for tablets and smartphones. The makers of the iCelsius, a company called Aginova, seem to deal only in temperature measurement. Indeed, the iPad app has a barbecue mode. Were it not for the data export and graphing facilities, an iCelsius linked to an iPhone would be in danger of falling into the “extremely expensive thermometer” trap. The device is available from Instruments Direct Services [1], who are more often associated with Vernier systems and Logger Pro software.

Vernier Video Physics

Vernier Video Physics is an application for the iPhone, iPod Touch or iPad that lets the user

analyse video footage of a moving object. The app is available from the Apple App Store and costs £1.99 at the time of writing. Objects captured on video playable on these mobile devices can be tracked and corresponding motion graphs plotted (Figures 5 and 6). These graphs are limited to a y versus x displacement plot, x displacement versus time, y displacement versus time and x or y velocity versus time. There is a facility to set axes and to use an object of known length to scale the plots. Whilst it is not possible to zoom or scale the graphs, or to remove the join-the-dots effect loathed by physicists, files can be exported to LoggerPro. LoggerPro is extremely versatile.



Figure 2 - iCelsius readout screen (iPhone).

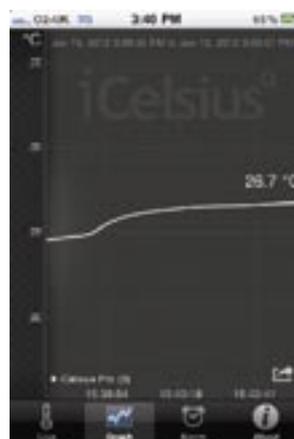


Figure 3 - iCelsius graphing screen (iPhone).



Figure 4 - Alarm facility.

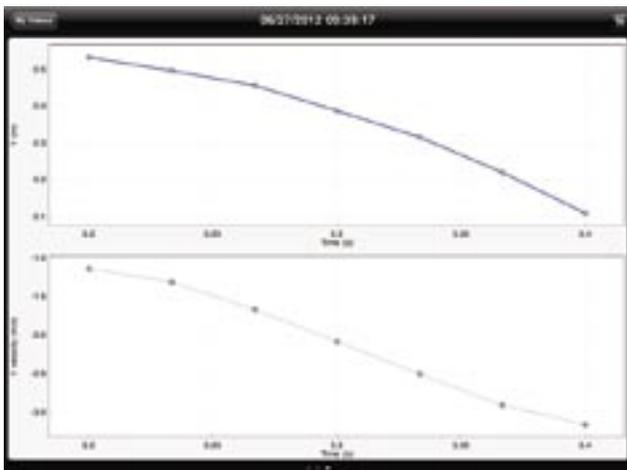


Figure 6 - Graphs that physicists will simultaneously love and hate.



Figure 8 - Sparkvue screen (iPad).



Figure 5 - a ball being tracked using Video Physics.

loggers, or with a USB link to a computer. The Airlink replaces this USB connection with a wireless Bluetooth link. The Sparkvue app is available as a free download, letting an Airlink pair with a single mobile device. Once this has taken place data can be transferred wirelessly at a rate of 100 Hz. Even if you don't have an Airlink, you might like to download the app as it can use the iPhone's accelerometers as sensors. We had fun (carefully) attaching an iPhone to a spring then logging acceleration during simple harmonic motion.

The Sparkvue app allows a user to specify the sensor, measurement units, capture rate and duration of an experiment. Data can be displayed on a graph (Figure 8) or on an analogue or digital readout. Helpfully, it can be exported via e-mail as a CSV file. Though we tried the Airlink with a force sensor, we think that it would be particularly useful when used with accelerometers or with sensors that measure breathing rate, pulse and so on. The Airlink currently costs £169.15 ex VAT.

Note that Pasco equipment is now distributed by Scientific and Chemical [2] in the UK.

Coming soon...

Just as we were about to go to press, we had a call from Instruments Direct, offering to send us a Vernier Labquest 2 for test. This device has built-in Bluetooth and Wifi, promising to allow users to "Collect, analyze, and share sensor data wirelessly on any device with a web browser". We hope to test this in the near future.

Whilst Video Physics is nowhere near as powerful as the motion analysis facilities in LoggerPro, or indeed as those in the quite wonderful free Tracker package (see SSERC Bulletin 225), it is still a very useful app. Given that iPhones and other idevices generally have the ability to shoot video, it is certainly worth a look at the price.

Pasco Airlink

The Pasco Airlink 2 (figure 7) is not designed solely to operate with iPads and so forth but that will be our focus. The company's Passport sensors are generally used with either the Spark or Xplorer data



Figure 7 - The Pasco Airlink 2 and a force sensor.

References

- [1] www.indis.co.uk
- [2] www.scichem.com

Colorimetry on the cheap

Colorimetry is simply the measurement of colour. Simple visual colorimetry is familiar to anyone who has been involved with maintenance of a swimming pool and use of the human eye to determine the intensity of a coloured solution is much more accurate than is generally thought: that said, it is not possible to get a really *accurate* measurement of just how intense a colour is or how cloudy a solution may be.

As a technique of huge importance in chemistry, colorimetry is one of the most widely used methods for quantitative chemical analysis. Unfortunately, it is not used as widely in schools as it should be, largely due to cost. In this article, we will show you how to construct a workable colorimeter for use throughout the school for the cost of only a few pence.



Figure 1 - Visual Colorimetry.

A colorimeter is a device that passes light of a particular wavelength through a sample. Using a detector, the colorimeter can measure how much of the light passes through the sample. We can then calculate the amount of light absorbed by the sample and this is related to the concentration of the chemical of interest. This way it is possible to obtain numerical values for the amount of light transmitted and, given such data, there is much more that can be done.

Why bother making one?

- 1) **Cost** - Even with a cheap model, a class set is the best part of £1,000. If it is possible to make a working colorimeter for a few pounds then it means that this important technique can be used more often.
- 2) **Access** - Making a colorimeter for a few pounds means that it is possible for each pupil to use one and thus everyone gets to use and understand the technology.
- 3) **Understanding** - If you can make something, you are likely to have a clearer understanding of how it works. It ceases to be some sort of 'magic box' that just mysteriously gives you the answer.

The basics

At its most basic, a colorimeter needs a light source that shines through a cuvette and some way of measuring the intensity of the light that passes through.

- For our light source, we are using an LED.
- For the light detector, we are using a light dependent resistor (LDR)
- And the housing for these is simply a block of polystyrene, cut to shape and size with appropriate holes made using a cork-borer.

Making your colorimeter

You will need: A piece of polystyrene, 1 x rubber bung, a Cork borer (no 7 or 8 depending on the diameter of the bung), 1 x LDR, 1 x white 5 mm LED, 1 x 180 ohm resistor, 1 short piece of insulated wire.

- 1) Cut a piece of the polystyrene to approximately 5 cm x 5 cm. A hot knife is the most effective method for this as it provides a firm, non crumbly edge.

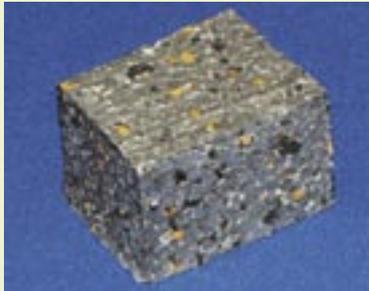


Figure 2 - Cut block of Jablite board.

- 2) Select a rubber bung/cork-borer combination that allows the bung to fit in the hole made by the borer.
- 3) Cut the length of the bung in half, with a knife or scalpel, and keep the narrower end.



Figure 3 - Cut bung and LED.

- 4) Use the cork-borer to make a hole horizontally completely through the block. Take care to keep it as horizontal as possible.



Figure 4 - Horizontal hole for LED and LDR.

- 5) Use the borer again to make a hole vertically down from the top, taking care to make sure it crosses the line of your first hole. Don't take this hole all the way through to the bottom.



Figure 5 - Vertical hole for cuvette.

- 6) Check the size with a cuvette - you may need to press on the sides of the hole with a spatula. The idea is that it is a snug fit and the cuvette does not rotate (Using a warm spatula will help square off the hole).



Figure 6 - Sizing for the cuvette.

- 7) Insert the LED into the hole in the bung. Push it into the hole in the block to make sure it fits.



Figure 7 - Testing the fit of the LED.

- 8) Repeat with the LDR.

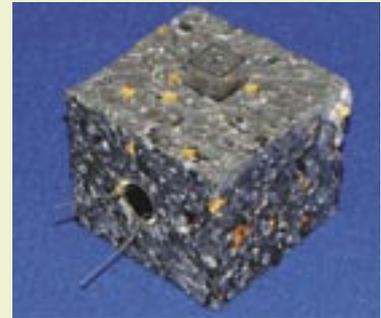


Figure 8 - Testing the fit of the LDR.

- 9) Use a hot knife or spatula to cut a slit for a filter.



Figure 9 - Cut a slit for the filter.

- 10) Cover the whole block with one or two layers of aluminium foil (to lightproof it). Pierce where the holes are with a screwdriver or pencil and push the foil in.



Figure 10 - Wrap in aluminium foil.

- 11) Bend the arms of the resistor 90 degrees.

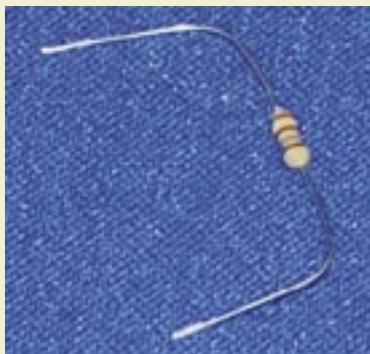


Figure 11 - Bend the arms of the resistor.

- 12) Take the insulated wire and use it to connect the positive arm of the LED (the longer one) to one arm of the resistor.
- 13) Gently push the bung into one of the holes on the side of the block.
- 14) Push the arms of the resistor into the polystyrene block.



Figure 12 - Push the resistor into the block and connect to the LED with wire.

- 15) Connect the positive terminal of the power supply to the resistor and the negative to the LED and switch on briefly to make sure it lights up.
- 16) Gently push the LDR into the hole opposite the LED.
- 17) Connect the arms of the LDR to the Multimeter and select resistance - pick the range that gives you a good value (20 k Ω usually on the ones we are using here. (Figure 13)

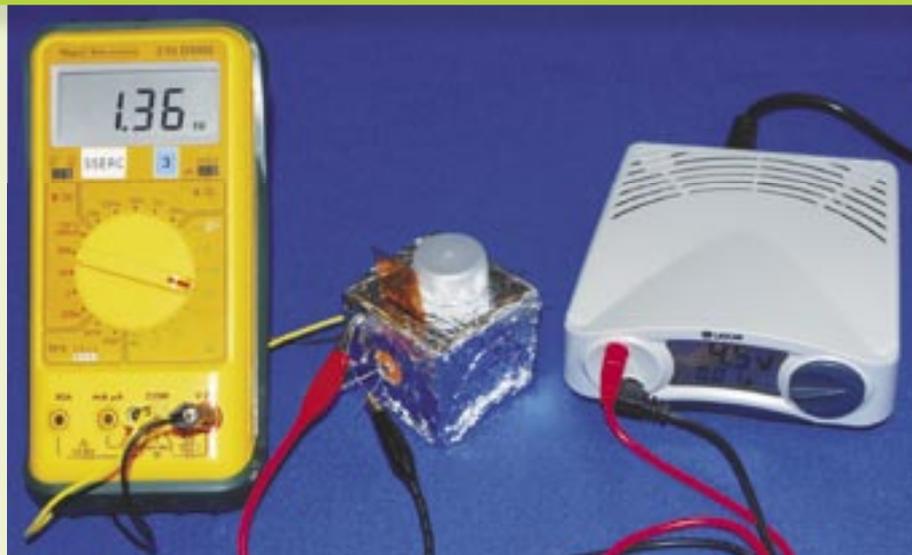


Figure 13 - The finished device.

Using your colorimeter

- 1) Put your sample in a cuvette.
- 2) Place it in the hole in the top.
- 3) Take a lid from a drinks bottle and use that as a cap over the cuvette to prevent stray light entering.
- 4) Switch on the LED and the multimeter.
- 5) Take the reading on the multimeter.

The detector in your colorimeter is a Light Dependent Resistor (LDR). When a light shines on it, the resistance is reduced. You are using a multimeter to measure the resistance of the LDR. Commercial colorimeters give you a choice of measuring either transmittance or absorbance.

- **Transmittance** is a measure of how much light passes through; the highest value is when a blank cuvette is used.
- **Absorbance** is a measurement of how much light is absorbed and

in this case the blank cuvette will give a low reading. In this colorimeter, the more light gets through (the more transparent the solution) the lower the reading. Thus it is measuring absorption rather than transmittance.

You can use this simple device in much the same way as a 'proper' colorimeter for instance:

- a) Plotting a standard curve and using it to work out concentrations.
- b) Following the course of a reaction to determine its rate.

Colour Adjustment

While many experiments can be carried out quite satisfactorily using white light, many are much better using a more restricted colour range. There are two simple ways to adjust the design to allow for this.

- 1) Filters - Use a heated knife to melt a narrow slit in the foam block

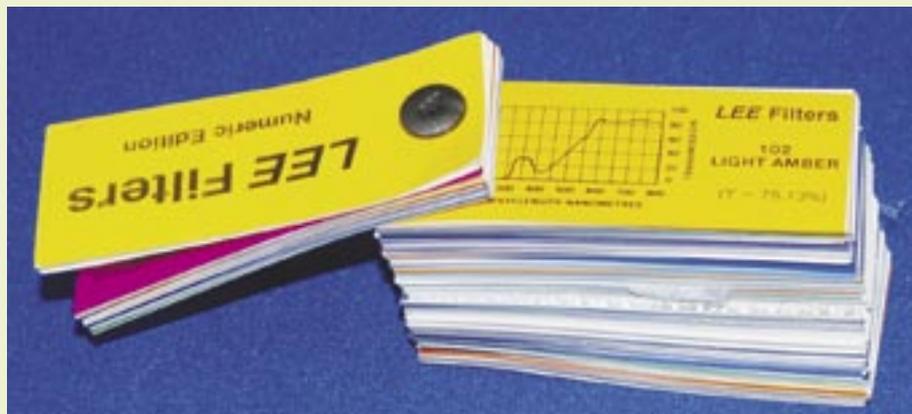


Figure 14 - Filters.

between the LED and the cuvette. You can then insert filters in here. If you are near a large-ish centre of population, then find a theatrical lighting supplier and you can pick up free swatch books of lighting gel filters. (The two main suppliers are Lee and Rosco) (You may have some of these filters already that you can cut up). Any coloured filters, cellophane for instance, will work. The advantage of the lighting gels is that each sample is on a backing card that gives you its absorption spectrum. An advantage this gives over the cheaper commercial colorimeters is that you have a far wider range of colours to choose from. (Figure 14)

There are two methods for choosing a suitable filter to use:

- a) Examine the absorption spectrum and use a filter of a wavelength that is absorbed most.

To measure the concentration of carotenoids, the best filter would be one around 500 nm, which gives absorption by carotenoids and low by chlorophyll. (Figure 15)

- b) A simpler method that will work for many coloured compounds is to use a colour wheel. This helps you determine the colour that is absorbed most from the colour you are seeing. Simply look at where the colour of your solution lies on the wheel and use a filter of the colour opposite it.



Figure 16 - A simple colour wheel.

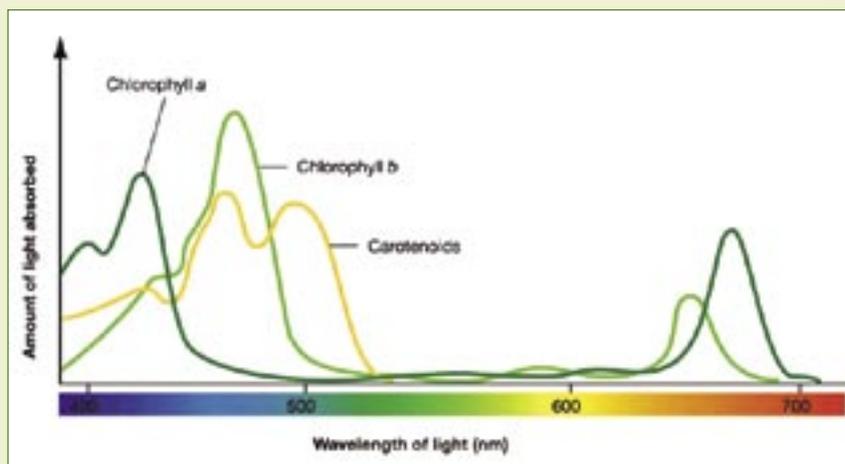


Figure 15 - Absorption spectrum of chlorophyll and carotenoids.

For instance, to measure the absorption by a copper sulphate solution you should use a yellow filter.

- 2) Alternatively, you can simply replace the LED with one of a different colour. This is the method used in several of the cheaper commercial colorimeters, you have a choice of Red, Green or Blue and your choice determines which LED is selected. It also highlights one of the advantages your new, home-made colorimeter has over all but the most expensive commercial ones. You have a much wider range. As well as visible light, it is possible to purchase LEDs that give out either Infra Red or Ultra Violet - both of which have been successfully tested. Standard cuvettes are still transparent in the near UV, down to about 340 nm so are quite suitable for this use.

Interpreting the data

In most cases, the figures for resistance can simply be used as they are. For instance, when determining concentration against a reference graph, a simple plot of resistance against concentration will be quite usable and enable you to read the resistance of an unknown off the scale.

The graph will often look neater if it starts from zero - in which case simply take the blank, calibration

reading (which you should do anyway) and subtract this from each of the other readings - Excel or any other spreadsheet makes this a very easy task.

There are times when you might want to try to get more accurate data, in this case you will need to convert your resistance reading into the actual absorbance. From the Beer-Lambert Law, it is possible to work out that

$$A = \log_{10} \left(\frac{I_0}{I} \right)$$

Where I_0 is the intensity of light passing through the blank and I is the intensity of light passing through the sample. Once again, Excel can come to the rescue and make the calculation quite straightforward. Once you have this value, you can use the Beer-Lambert law to work out other information you may need.

$$A = \epsilon l c$$

Where

ϵ = the molar absorption coefficient of the substance (at that wavelength)

l = the length of the path through the solution (1 cm in a standard cuvette)

c = the concentration of the solution in mol dm⁻³.



It is possible to link up the LDR to a datalogger and get it to automatically record the results but in the spirit of parsimony and participation, we have assumed that not many schools will have access to 20 dataloggers and so have concentrated on the simpler approach.

A more detailed treatment on interpreting the data will be appearing on our website.

Evaluation

This colorimeter is not quite as accurate as a commercial one but considering the difference in price that is perhaps to be expected. Nonetheless, quite good results can be obtained with a small amount of care.

- Be careful in the construction to make sure the LED and LDR are aligned.
- It is best to make sure that a single experiment/investigation is only carried out on one device as they may give slightly different results.
- Similarly, as the brightness of the LED obviously varies with

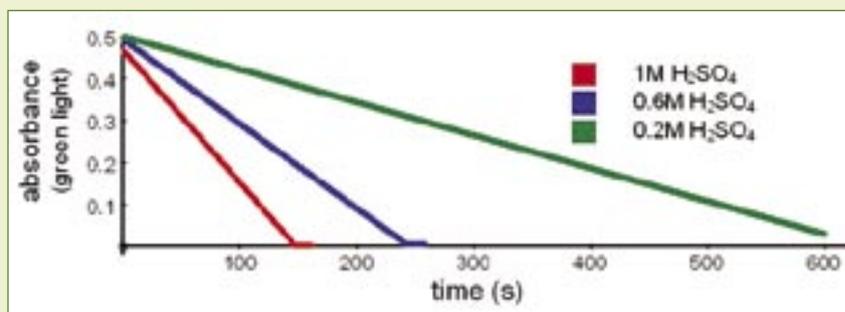


Figure 17 - Iodination of propanone 1 (graph taken from Mystrica website).

the input voltage you will need to make sure the same voltage is being used each time the colorimeter is used. If there is an ongoing investigation, it might be an idea to put a voltmeter into the circuit with the light.

Here are some results obtained for the rate of reaction of the iodination of propanone with varying concentrations of acid.

A) Using a Mystrica colorimeter

(<http://mystrica.com/Colorimeter.aspx>)
(see Figure 17)

B) Using a home-made colorimeter (see Figure 18)

Note - the value for the 1M acid is roughly twice as long as for the Mystrica graph - but we used HCl, not H₂SO₄ so the top graph has twice the concentration of hydrogen ions.

Conclusion

This colorimeter is probably not accurate enough for use in an Advanced Higher project, though the construction and evaluation of such a device could be a possibility, but it will give an easy and cheap entry in to the very important topic of colorimetry and allow, we hope, for its much wider use in schools.

Supplies

Any LDR/LED combination should work. The ones we used (all were from RS components (<http://uk.rs-online.com>)) were:

LDR	NORPS-12 TO18	£1.36
LED	5 mm White, Water Clear, 15deg	£0.32
Resistor	CFR16 carbon film resistor, 180R 0.25 W	£0.16 for 10

Polystyrene from any waste packaging can be used quite happily but we used Jablite insulation board from B&Q as it is dark grey and so there is less reflected light. (£15.98 for a board 50 x 1200 x 2400 mm)

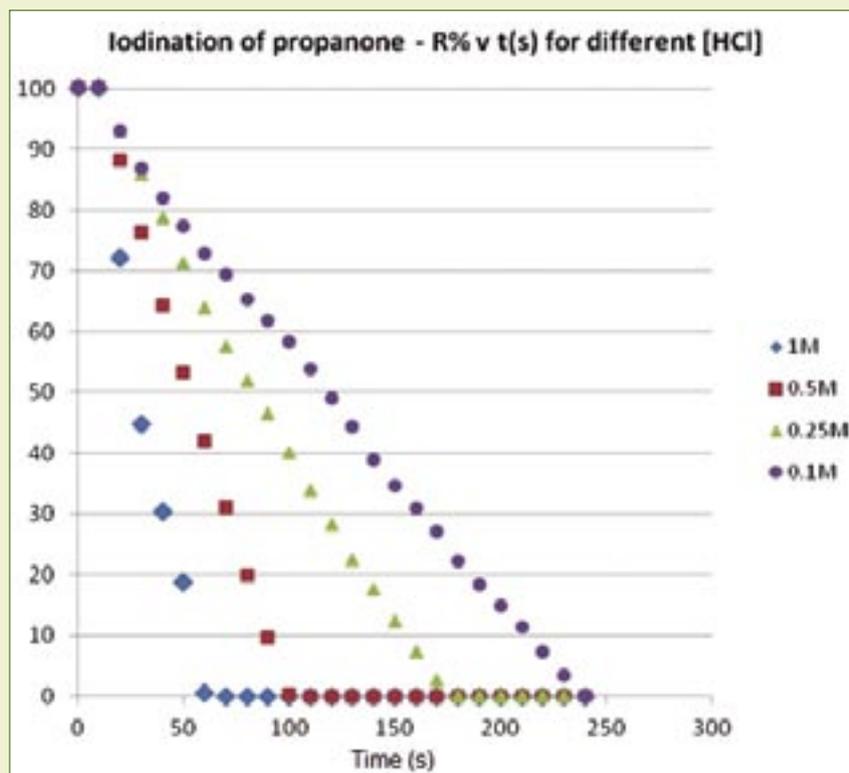


Figure 18 - Iodination of propan-2-one (graph generated by Excel).

Making your own microsyringe

Background

The Arrangements Documents for the Revised and *CfE* Highers in Biology [1, 2] and Human Biology [3, 4] as well as the Revised Advanced Higher in Biology [5] recommend a variety of practical work that will require the measurement of small volumes of samples. Microsyringes are available from a range of suppliers and can vary in both price and complexity. For measurement of single volumes, we find the range of Volac Minipipets from NCBE [6] is particularly useful - allowing reliable measurement of volumes of 5 μL , 10 μL , 20 μL , 25 μL , 50 μL and 100 μL , although at a price of £16 per syringe class sets might be difficult to obtain. NCBE also provide packs of microsyringes which are suitable for measuring volumes as small as 2 μL and 5 μL when using graduated tips.

In this short paper we wish to show you how you can make your own perfectly serviceable microsyringe capable of measuring volumes from 10 μL to 200 μL in 10 μL increments; the cost of 10 such syringes is approximately £2.00.

The equipment

To make your microsyringe you need 3 pieces of equipment (see Figure 1):

- a disposable 1 cm^3 syringe;
- a small (ca. 1 cm) length of plastic tube;
- a graduated pipette tip.

The first 2 items in the above list are available from a number of suppliers at low cost (for example

packs of 200 disposable 1 cm^3 syringes (catalogue number OU-07940-99) are available from Cole-Parmer (www.coleparmer.co.uk) at a cost of £21; Scientific and Chemical (www.scichem.com/) supply rolls (10 m) of silicone tubing (catalogue number TSR-020-090) for £28.20. The graduated pipette tips (catalogue number FR0250) are available from Alpha Laboratories (www.alphalabs.co.uk) at a cost (May 2012) of £20.00 for 960 tips.

Construction of the syringe is straightforward. Simply cut a piece of silicone tubing and connect the pieces as shown in Figure 2.

What is not immediately obvious from the images in Figures 1 and 2 is that the pipette tip is graduated with markings at 10 μL , 20 μL , 50 μL , 100 μL and 200 μL . These graduations are shown more clearly in Figure 3 although in our experience the graduation is sometimes difficult to see especially the one at 200 μL .

Operation

The syringe is relatively straightforward to use provided the following simple steps are followed:

- 1) Before drawing liquid into the pipette tip make sure that a small volume of air has been drawn into the barrel of the syringe. When expelling the contents of the tip this volume of air will ensure that no liquid remains in the syringe.
- 2) Make sure that a maximum of 200 μL of liquid is drawn into the tip. Volumes much greater



Figure 1 - The 3 items of equipment needed.

than this will lead to liquid being drawn into the tubing and possibly the barrel of the syringe leading to contamination. Whilst all of the elements of the syringe are of low cost careful adherence to this aspect will mean that only tips need to be changed/discarded.

- 3) When drawing liquid into the syringe take up a slightly larger volume than is required and use the air in the syringe to slowly expel the excess until the graduation mark is reached. Remove any excess liquid (present as a small droplet) from the end of the syringe tip by gently touching against a surface.
- 4) Slowly expel the desired volume into the receiving vessel.
- 5) Some volumes (e.g. 50 μL) are straightforward to measure and require a single manipulation whereas others (e.g. 40 μL) may require two or more manipulations.

How reliable are the measurements using the syringe?

With practice we find that the 'homemade' syringe performs pretty well. Delegates at a recent (June 2012) Summer School for Biology teachers were invited to make a syringe and test its reliability. Delegates were asked to measure 50 μL or 100 μL aliquots of



Figure 2 - A syringe in its constructed form.

distilled water into a weighing boat of known mass. The experiments were carried out using distilled water at a temperature of 18° C and the density of pure water under those conditions is reported to be 0.9986 g cm⁻³ [7]. Once 10 such aliquots had been added to the weighing boat, the mass of water present was recorded and the data gathered in the table shown.

The variation between the recorded masses is small; in fact the data in each row of the table shown were obtained using different balances (all of which read to 2 decimal places). No attempt to undertake statistical analysis has been made, although the results lend themselves to such an approach especially if class data sets were available.

Using a balance capable of measuring to 3 decimal places, we obtained the data in the lower part of the tables for 10 µl and 20 µl aliquots of water.

Mass of distilled water (g) recorded from the combination of 10 aliquots each of 100 µl.	Mass of distilled water (g) recorded from the combination of 10 aliquots each of 50 µl.
1.03	0.51
1.00	0.48
1.03	0.50
0.94	0.51
1.02	0.46
0.98	0.50
0.99	0.49
0.95	0.48
1.00	0.48
0.97	0.50

Mass of distilled water (g) recorded from the combination of 10 aliquots each of 10 µl.	Mass of distilled water (g) recorded from the combination of 5 aliquots each of 20 µl.
0.095	0.098
0.101	0.100
0.097	0.099
0.996	0.101
0.102	0.100

From the data in both the above tables it can be seen that the syringes yield results very close to the predicted mass and

consequently with practice they could be used with confidence when measuring small volumes of liquids. Their cost and ease of replacement, if necessary, should make them a useful addition to the range of equipment available in schools.

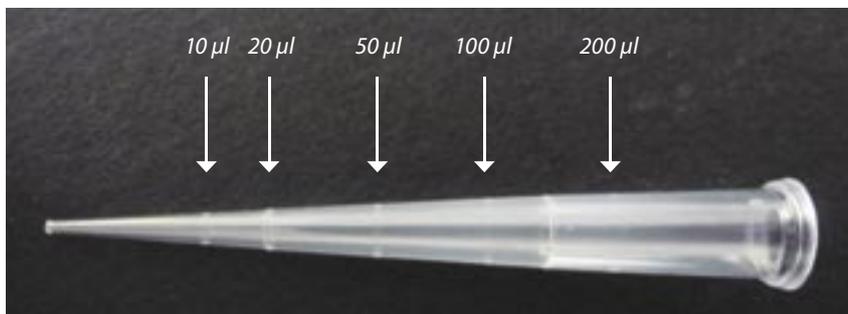


Figure 3 - Syringe tip showing graduation marks.

Acknowledgements

The original idea for this device has its origins in the mists of time but we are pretty sure that both Rodger McAndrew and Kirsty Menzies during their time working with SAPS Scotland will have been involved at some point and so our thanks go to them!

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- [7] Mass, Weight, Density or Specific Gravity of water at various temperatures C and thermal coefficient of expansion of water - see http://www.simetric.co.uk/si_water.htm (accessed 24th April 2012).

Dissecting bulls' eyes

Within SSERC we have received a number of enquiries recently about health and safety concerns about the dissection of animal materials both in terms of what is permissible and where such materials can be sourced. In particular we regularly receive enquiries about dissection of bulls' eyes. Information on complying with legislation that includes the dissection of bulls' eyes in schools is contained within the document *Materials of Living Origin* which can be accessed from the SSERC website (www.sserc.org.uk). As a result of recent changes in legislation the Code of Practice *Materials of Living Origin* has been reviewed and updated copies will be sent to all Member schools in the autumn term of 2012.



As a result of the Animal By-Products (Scotland) Regulations 2011 the position is now as follows:

- Eyes from cattle, sheep and goats less than 12 months old at slaughter may be supplied and used for educational purposes such as dissection. Previously the restriction was for cattle less than 6 months old at slaughter. Such materials may be disposed of in the normal way for animal (food) waste. Eyes from other species (e.g. from pigs or fish) may be used in the same way.
- Abattoirs may now also supply eyes from cattle, sheep and goats that are more than 12 months old at slaughter. The brain and spinal chord (including eyes) of these animals are designated as SRM (specific risk materials). The risk here is of transmission of TSEs (transmissible spongiform encephalopathies such as BSE and nvCJD) although the risk of such animals carrying the infective agent for TSEs is now considered to be low. The legislation is designed to control the risk of such materials entering the food chain. Previous cases of TSEs were considered to be

due to including these waste animal tissues in animal feed. The risk of transmission in dissecting eyes is low and is effectively controlled by normal laboratory practice. However, SRM materials must be disposed of by incineration. The supplying abattoir will provide the school with a simple form to complete to obtain permission for the abattoir to supply the material. This form requires the school to make arrangements for the incineration of the materials after use. The abattoir or the local authority environmental health service should be able to advise on suitable premises for incineration. The school should keep a record of the material obtained and of its disposal.

Although eye dissection lends itself to learning about structure and function, eyes more generally provide a rich source of other practical work that can be used to develop scientific skills of experimental design and data analysis making for more integrated and connected learning rather than an isolated one off experience. In a subsequent issue of the Bulletin we will publish some hints and tips on successful eye dissection. ◀

Health & Safety

Radioactive sources - gaunnae no dae that?

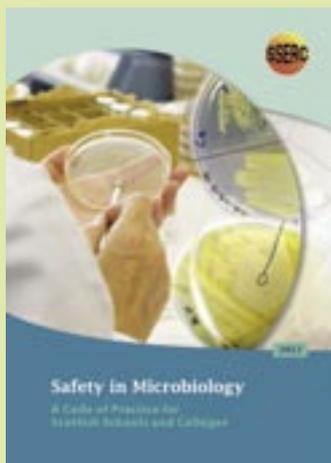
Not only do we sometimes speak differently here in Scotland, the law governing the purchase of radioactive sources is different too. In England, if you wish to buy a radioactive source, no letter of approval from the government is required. This is not the case north of the border, though some equipment suppliers have been telling buyers otherwise.

As a consequence, a small number of schools are holding sources that they should not have.

The bottom line: do not buy a radioactive source without first obtaining a letter of approval from the Scottish Government. Contact SSERC for guidance on the full process.

Third editions of Codes of Practice published

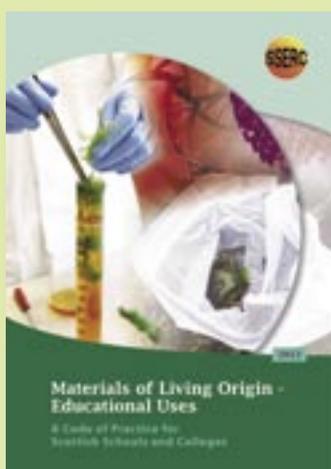
Safety in Microbiology



Since working with micro-organisms is covered by the Control of Substances Hazardous to Health (COSHH) regulations, it is necessary to have suitable and sufficient control measures in place which have been developed as a result of assessing the risks involved. In the late 1980s, the then Strathclyde Regional Council published

the original edition of the Code of Practice in Safety in Microbiology to support the implementation of the biotechnology content of the recently introduced Standard Grade Biology. The Code of Practice also addressed COSHH legislation that was first enacted in 1988.

Materials of Living Origin - Educational Uses



The 1st edition of Materials of Living Origin was also published by Strathclyde Regional Council. Along with the belief that the use of material of living origin in schools can considerably enhance children's educational experience, there was and remains a strong conviction that for any educational application of living materials to

be justifiable, it has to bring with it strong and positive educational benefits. The 3rd edition, as with previous editions, therefore introduces each section of the Code of Practice with an educational rationale and, where appropriate, includes the social relevance of such activities.

Both of the original Codes of Practice were the result of the deliberations of working groups convened by Strathclyde Regional Council. The members of the working groups included practising teachers and Education Officers from Strathclyde Regional Council, representatives from Further and Higher Education and John Richardson, who was Executive Director of SSERC at that time. Where practical activities in microbiology or using materials of living origin fall within the relevant Code of Practice, no additional risk assessment is required. Work that falls outwith the Codes of Practice must be accompanied by a risk assessment.

SSERC would like to acknowledge the contribution of Jim Stafford who has played a key role in updating both the Code of Practice in Safety in Microbiology and the Code of Practice in Materials of Living Origin - Educational Uses. Jim chaired the working groups that produced the original Codes of Practice and these current editions stem from the original publications. These 3rd editions of the Codes of Practice also highlight the relationship between good science practice and *CfE*.

Both the Code of Practice for Safety in Microbiology and the Code of Practice for Materials of Living Origin - Educational Uses are available through the SSERC website (www.sserc.org.uk). Watch out for hard copies coming into school during the autumn term. ◀

