



SSERC Bulletin

Number 225 Summer 2008

Ideas and Inspiration supporting Science & Technology for all Local Authorities

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From early October 2007 until the end of March 2008, the new SSERC premises in Dunfermline proved their worth and buzzed with even more life than normal. As part of the Scottish Government supported project 'Support for Scottish Science Education through CPD', new (albeit temporary) staff were busy helping develop resources and associated CPD, while science teachers and technicians took part in the CPD experience. Many of the courses offered took place in two parts (4½ days in all), with Part 2 taking place several weeks after Part 1.

Typical programmes included hands-on practical work, exciting speakers and discussion activities – all contributing to the 'delegate buzz'. Most sessions were held in the SSERC labs and meeting rooms, with residential accommodation and some course activities in local Dunfermline hotels. During Part 1, all course delegates were provided with a digital still or video camera, and

equipment such as alternative energy kits (chemistry and science courses), electrophoresis kits (biology course) or smart materials kits (physics), plus a host of ideas for engaging, participative activities to use with their pupils back in the classroom. Delegates were encouraged to try out or adapt activities from Part 1 of the course (the so-called 'gap task') and to 'show and tell' at Part 2. As a result, all delegates left the course with a host of new ideas to take forward in the classroom.

A typical delegate comment is: 'My classroom practice has changed as a result of this excellent, inspiring course'. This national initiative remains a collaborative Project whose partners include the Association for Science Education in Scotland, the Institute of Physics in Scotland, the Royal Society for Chemistry, Science and Plants for Schools, the Scottish Initiative for Biotechnology Education and the University of Edinburgh School of Chemistry. Planning is well underway for the 2008/9 programme of CPD that will support the needs of a variety of groups who are key to providing high quality learning and teaching experiences in the classroom:

We are delighted that the Scottish Government has granted further support for SSERC and its partners to continue and build on 'Support for Scottish Science Education through CPD' until March 2011.

Teachers and technicians (see back page of this Bulletin)

- A series of five-day courses in two parts for teachers, incorporating a 'gap task' to be completed by delegates. Attendees will be provided with equipment and resources to use back in school. Courses will be offered in biology, chemistry, physics, primary science and science for early secondary
- A two-day course for probationer teachers
- Practical workshops (twilight, half-day, day) for teachers and technicians

Technical support staff

- Continued development of nationally recognised qualifications and associated training courses
- Establishment of Local Authority Training Partnerships
- National two-day CPD Conference

PGDE science students

- A two-day residential course open to all PGDE science students in Scotland

New and aspiring Heads of Faculty

- Residential 2-part Leadership course for new and aspiring Heads of Faculty in association with the National Science Learning Centre, York
- 2-day residential 'expert' course offered to those who have attended previous Leadership courses

In addition, the funding has allowed a more formal partnership to be forged between the Association for Science Education in Scotland, the 'Project' and SSERC to provide the Scottish National Science Education Conference, to be held in March 2009.

Further information on all of these courses is available from the SSERC website:

<http://www.sserc.org.uk/public/CPD/2008-9/menu.htm>

or from Sheila Maclellan: sheila.maclellan@sserc.org.uk



How are we able to see transparent objects? They are distinguishable because when light passes from one medium to another of a different refractive index, light is reflected at the boundary. The behaviour of light at the boundary is described by Fresnel's equations. Though the term is not widely used in school physics, the reflection is called Fresnel reflection. Glass has a refractive index of around 1.4, whereas air has a refractive index of 1.0, so glass objects are easily seen.

If a transparent object is immersed in a transparent liquid that has the same refractive index as the material the object is made of, it disappears. This striking demonstration is easily performed. A Pyrex test tube is immersed in glycerol (Fig 1). Pupils will be amazed to see the small test tube suddenly appear when some of the glycerol is poured away (Fig 2).

If a plastic convex lens, the type used for ray tracing, is immersed in light oil [1] the lens is immersed in a liquid with the same refractive index as the plastic it is made from and the lens does not focus the light, (Fig 3), as it does if it is in air (Fig 4).

This happens because there is no refraction of light at the oil/plastic boundary as there is no change in the speed of the light as it passes from one medium to the other because they both have the same refractive index.

On looking more closely at the behaviour of the lens in air and in glass it is clear there are no Fresnel reflections when the lens is immersed in a liquid with a matching refractive index.

Index matching fluids are used when coupling light into optical fibres to reduce losses. Forensic scientists can identify whether the glass at the scene of a crime matches that found on a suspect by looking at the two samples of glass in oils of different refractions to see if they both disappear in the same oil and are therefore identical types of glass [2]. The concentration of sugar in water can be calculated by measuring the refractive index of the sugar solution. Biologists use immersion oil when doing high resolution microscopy to produce a high quality image [3], as the matching fluid prevents any refraction and Fresnel reflection occurring. These would lead to degradation in the quality of the image. Chemists use solvents to distinguish between soda and pyrex glass. This is described in SSERC Bulletin 182 [4].

References

- 1 The supermarket Morrison's own brand of Light Cooking Oil worked well.
- 2 <http://www.ncsu.edu/kenanfellow/2002/pligon/forensics/labs/GlassLab.html>
- 3 http://biology.clc.uc.edu/fankhauser/Labs/Microscope/Oil_Immersion.htm
- 4 Distinguishing Glass Types, SSERC Bulletin 182, P40, 1994



Figure 1: A small test tube almost invisible inside a larger tube of glycerol



Figure 2: The small Pyrex test tube only becomes visible when some of the glycerol is poured away

The experiments shown here could be used to enhance or challenge a student's understanding of refraction or could be developed into a project for Advanced Higher Physics.

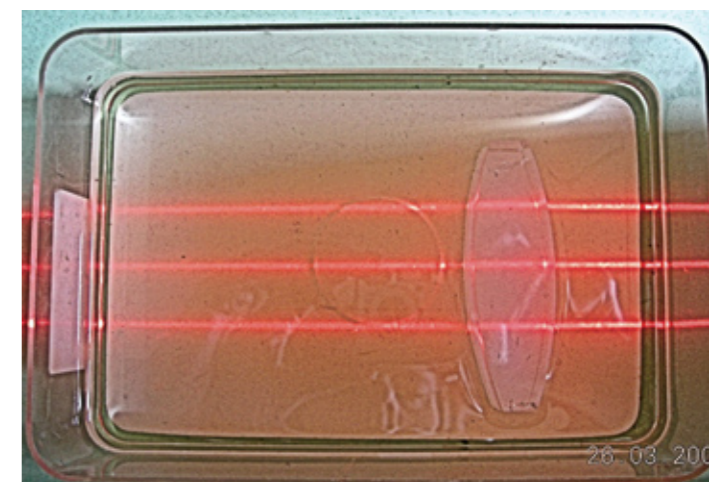


Fig 3: Convex lens in light oil

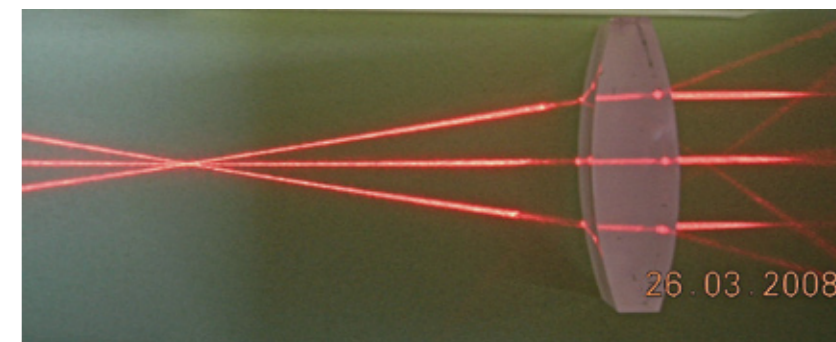


Fig 4: Convex lens in air

Recently, we have been looking at analysing motion using video clips from digital cameras. *Tracker.jar* is a free motion analysis application written by Doug Brown of Cabrillo College, California. It can be downloaded here:

<http://www.cabrillo.edu/~dbrown/tracker/>

This site also has links to two other free applications that you may need to download in order for *tracker.jar* to run, namely *Quicktime 7* and *Java 1.5* (or later). Many computers have these installed as a matter of course. Doug Brown's site also has downloadable sample videos.

Tracker.jar cannot presently read the video files created by the camcorders we have been giving away at SSERC courses. It requires video clips in the *avi*, *mov* or *mp4* format. The simple test is that if the video can be played with *Quicktime*, it can be analysed with *tracker.jar*. Fortunately, even if your camera produces videos that do not run in *Quicktime*, you can download a free, easy to use converter from www.stoik.com. Its use is described in a separate handout available from our website [1].

In a nutshell, *tracker.jar* allows you to import a video of a moving object and to track the motion of a point or points on the object, frame by frame. The software can graph displacement, velocity, acceleration and more. Think of it as a 21st Century version of strobe photography. Whilst you would be unlikely to use *tracker.jar* to work out the value of *g* to 3 decimal places, it is superb for teaching velocity/time graphs and for analysing motion in two dimensions. There is far more to this resource than we will cover here. If you do use some of its other features, please feed back your experiences to SSERC (gregor.steele@sserc.org.uk).

Starting Tracker

When you start *tracker.jar* you will see the following screen:

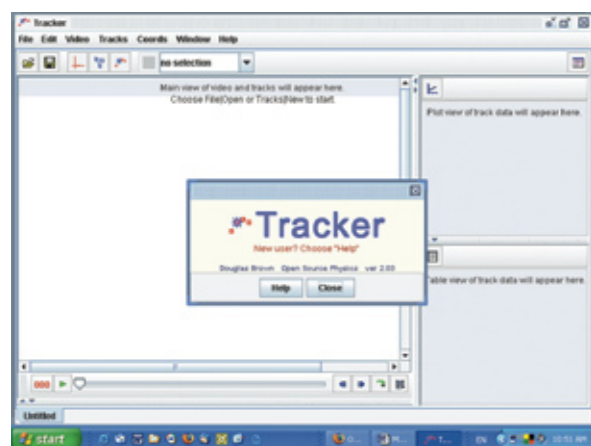


figure 1: tracker main screen

Click **Close**, which closes the window that offers help, not the application. The first thing you must do is to import a video into *tracker.jar*. Choose **Import...** from the **Video** menu.

[1] Stoik help sheet – http://www.sserc.org.uk/members/SafetyNet/bulls/225/video_conversion.doc

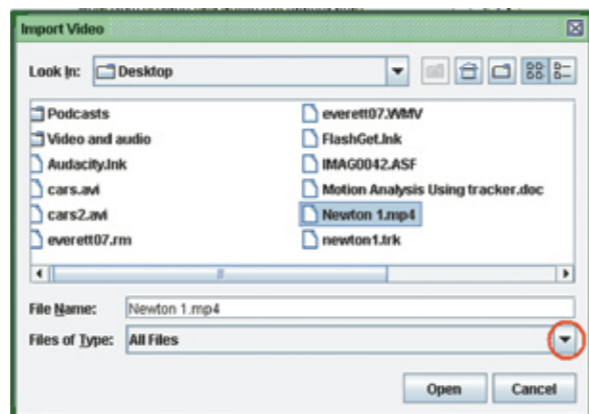


Figure 2: importing a video clip

For some files, you may have to use the arrow on the **Files of Type** box (circled in red above) to select **All Files**.

Click the name of the file, e.g. *Newton 1.mp4* you want to import, then click **Open**.

Your video will then be loaded into *tracker.jar*.

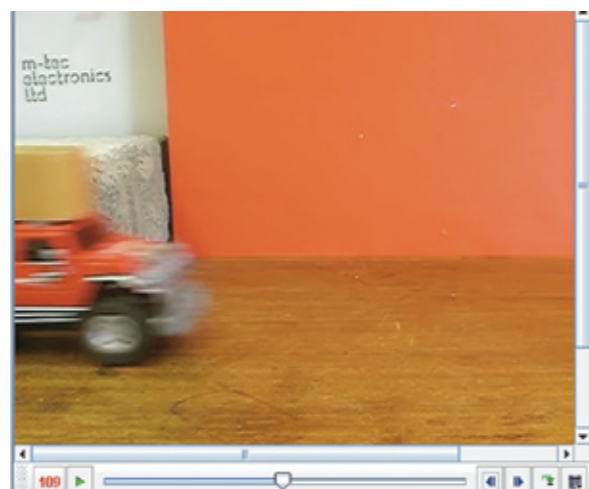


Figure 3: video loaded into tracker.jar

The clip can be played, paused and so forth using the standard controls at the bottom of the screen.

The forward and rewind buttons advance the movie one frame at a time.

Important Note on Saving

Saving a file using **File. Save As...** produces a file with the *.trk* file extension. Two important points are:

Double clicking this file does not open up *tracker.jar*. These files can only be opened via *tracker.jar*.

.trk files are useless without the original video file.

Before analysing the video, we need to be familiar with certain controls:

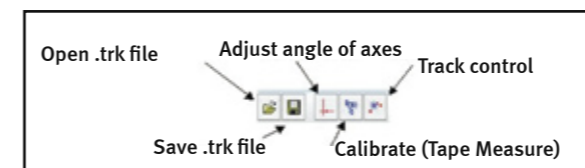


figure 4: tracker controls

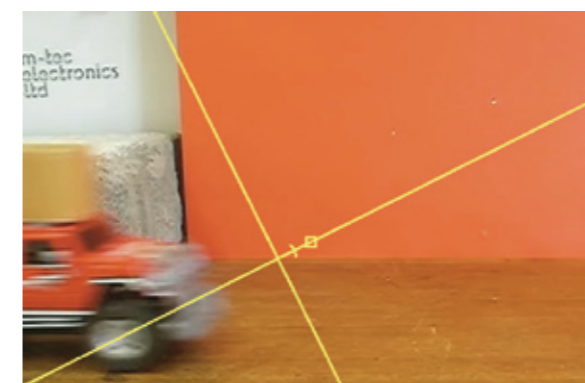


Figure 5: adjusting the axes

The **axes button** allows you to position the origin and to adjust the angle of the axes, very useful if you are dealing with motion down a slope.



Figure 6: the tape measure

Clicking the **tape measure button** (Fig. 6) reveals a double-headed arrow. This can be positioned alongside an object of known length on the screen, for example a ruler. The ends of the tape measure can be dragged to the ends of the ruler. The number (in scientific notation) alongside the tape measure can then be edited. For example, the tape measure could be placed alongside a 15 cm ruler in the video. Note that when the number alongside the measure is edited, 15 will be displayed as 1.500E1.

If all you are interested in is the shape of motion graphs, there is no need to use the tape measure.

Clicking the track control button produces this window:

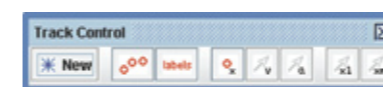


Figure 7: tracker controls

To track: Click **New**.

From the menu that appears, choose **Point Mass**.

You will then see a message telling you to use **Shift + Click** to mark the mass. You may have to use your video controls to move through the video to the point where you want to start marking.

We made our own NCAP-style stickers to give us handy reference points.

Shift-click on a point on the moving object. The video will then move to the next frame. **Shift-click** on the same point. As you mark, a displacement/time graph appears on the right.



figure 8: tracking a point

Double click the graph to make it larger.

Left click the quantity on an axis to change it, e.g. to graph velocity instead of displacement.

Right click a quantity to change the scale. This is quite important: *Tracker.jar* autoscales, so a velocity/time graph will default to displaying between a maximum and minimum value. A fairly constant velocity could thus appear to be wildly varying.

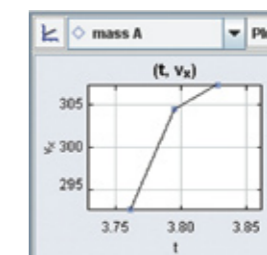


Figure 9: An autoscaled graph

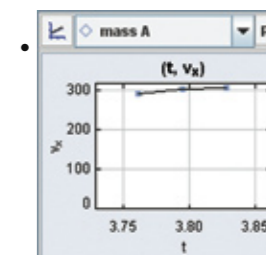


Figure 10: Same graph but with velocity origin set to zero

Top Tips

- Use as plain a background as possible
- Use an object that contrasts well with the background
- Use a tripod
- Fast moving objects in video frames are blurred. try to track the same spot on the blurred object in each frame
- Put a sticker on the moving object to help with tracking

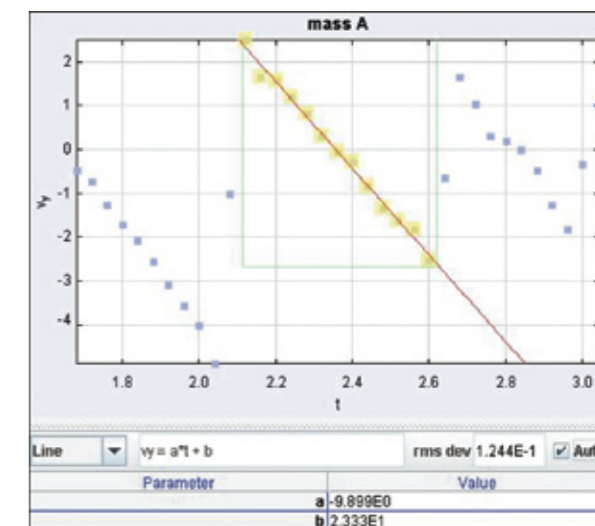


Figure 11: Vertical velocity of a bouncing ball



Introduction

Pupils studying Higher Biology often have difficulty in understanding the concept of plant compensation points (the light level at which the rates of photosynthesis and respiration are equal). The difficulty probably arises from the much neglected fact that plants respire. Teaching and learning about plants tends to focus on photosynthesis, with the process of respiration often being ignored altogether. The experiment described here provides a method for exploring the light conditions under which either respiration or photosynthesis dominates.



Figure 1: Effects of different concentrations of CO₂ on the colour of hydrogencarbonate indicator

Preparing for the Activity

Most materials required for this experiment are available in the SAPS photosynthesis kit (see SSERC Bulletin 219 [1]).

The alga, *Scenedesmus quadricauda*, is firstly immobilised using sodium alginate/calcium chloride mixtures (a detailed procedure for making algal balls can be found in SSERC Bulletin 219). The balls are then illuminated under different light intensities while immersed in hydrogencarbonate indicator. This indicator is very sensitive to changes in carbon dioxide levels and so can be used to estimate the concentration of dissolved CO₂. The colours displayed by hydrogencarbonate indicator at different concentrations of CO₂ are shown in Figure 1 (ranging from pH = 7.6 (yellow) to pH = 9.2 (purple) in increments of 0.2). The indicator is orange in colour at normal atmospheric CO₂ levels.

Under conditions where the rate of photosynthesis is greater than the rate of respiration, the hydrogencarbonate indicator turns from orange through red to purple (i.e. there is a net loss of CO₂ from the solution and hence a rise in pH). The hydrogencarbonate



Figure 2: Variation of light intensity using (from left) clear plastic, 71%, 50%, 25%, 12.5% ND filters and aluminium foil

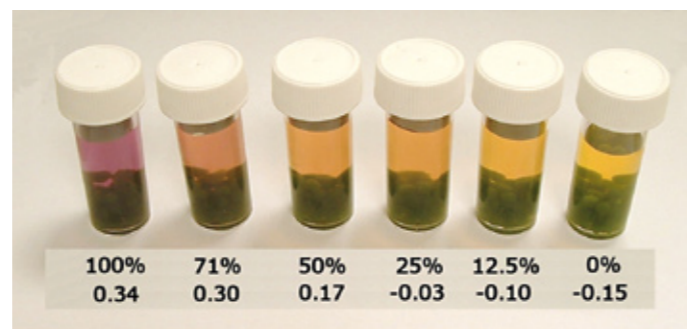


Figure 3: Appearance of hydrogencarbonate indicator after 50 minutes irradiation

indicator turns from orange to yellow under conditions where respiration dominates (i.e. there is a net increase of CO₂ in solution and hence a fall in pH).

Six Bijou bottles were set up each containing 50 algal balls and 4 cm³ of hydrogencarbonate indicator maintained at atmospheric levels of CO₂ by aeration for one hour prior to the experiment. A further Bijou bottle containing only aerated hydrogencarbonate indicator was prepared and this bottle was designated as the blank.

Bijou cover	Clear plastic	ND=0.15	ND=0.30	ND=0.60	ND=0.90	Aluminium foil
Light transmitted through the ND filter (%)	100	71	50	25	12.5	0.0
Absorbance (550 nm) of sample after 50 minutes irradiation	0.34	0.30	0.17	-0.03	-0.10	-0.15

The intensity of light reaching the algal balls was varied by wrapping one layer of a different neutral density (ND) filter around four of the bottles. The neutral density filters allow a given proportion of light to pass through. One bottle was left uncovered to allow the maximum light intensity through. The final bottle was covered in aluminium foil to exclude all light (Figure 2). All bottles were then placed close to, and at the same distance from, a fluorescent tube. The heat given off by the fluorescent tube was negligible. After 50 minutes irradiation the absorbance of the six solutions was measured in a colorimeter¹ using a 550 nm filter. Results are shown in the table here and in Figure 3. The indicator solution used to zero the colorimeter was the blank described above.

Discussion

It can be seen that for three of the solutions the change in absorbance after 50 minutes irradiation was negative. This means that in these three solutions there had been a drop in pH

and hence a net increase in CO₂ concentration. At these light intensities, respiration is therefore the dominant process. In the remaining three solutions the positive change in absorbance indicates that photosynthesis is the dominant process. The point at which there is no net change in the concentration of dissolved CO₂ is defined as the compensation point and can be estimated from plots such as Figure 4.

From the graph (Figure 4) the compensation point can be estimated as 29% of the maximum light intensity (see red arrow). At that light intensity the hydrogencarbonate indicator would not change colour as the processes of photosynthesis and respiration would be 'compensating' for one another i.e. the uptake of CO₂ by the plant through photosynthesis is exactly matched by its release through respiration. Therefore, at the compensation point there is no change in the concentration of dissolved CO₂, no change in pH, and therefore no change in indicator colour.

Further experimental details will appear on the SSERC website [2].

¹The colorimeter used here was a WPACO75 which is capable of reading values below zero. We are aware that some older colorimeters in schools may not have this facility.

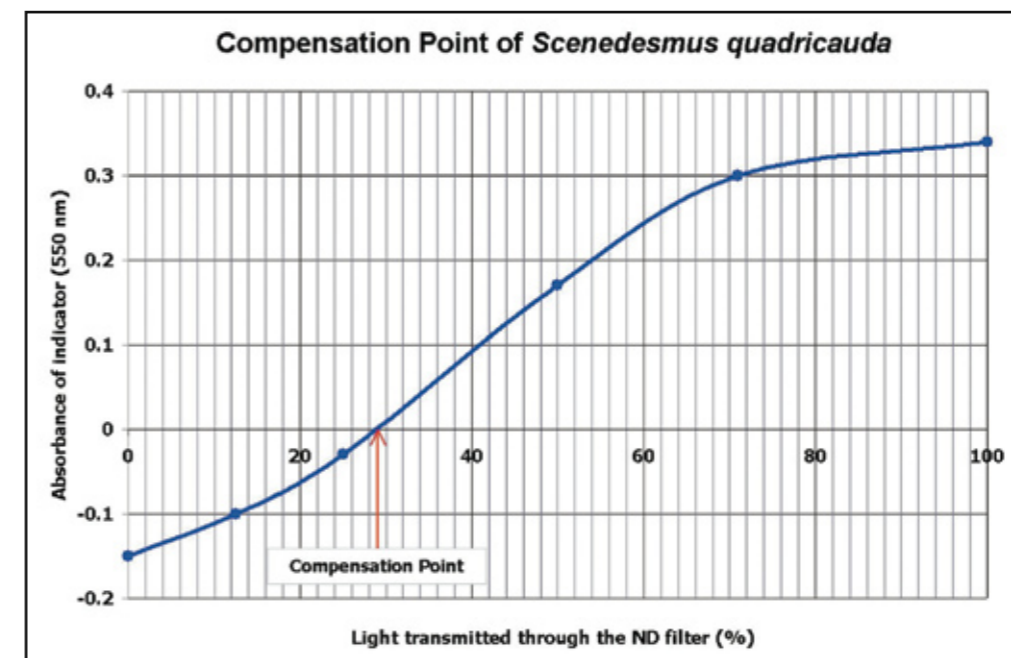


Figure 4: Effect of light intensity on the absorbance of hydrogencarbonate indicator solution

References

- [1] - <http://www.sserc.org.uk/members/SafetyNet/bulls/219/Biology.htm#The%20SAPS%20Photosynthesis%20Kit>
 [2] - http://www.sserc.org.uk/members/SafetyNet/bulls/225/Compensation_Point.htm



Figure 1: RCD cutout as typically found on a distribution board

RCDs now needed in homes and schools under new regulations

The IEE Wiring Regulations have been changed: the new regulations [1] came into force on 1 July 2008. One of the main changes for schools and homes is additional protection for socket-outlets with residual current devices (RCDs) - additional in the sense that the RCD supplements the normal fault-condition protection provided by fuses and other overcurrent trips.

Indeed all wiring to a.c. socket-outlets that are for use by ordinary persons and are intended for general use should be protected by RCDs (Fig. 1).

There are exceptions. If disconnection from the mains supply presents a danger or difficulty then the socket-outlet supplying that equipment need and possibly should not be protected with an RCD. This might apply to fume cupboards, other types of local exhaust ventilation (LEV), refrigerators holding flammable or microbiological substances and freezers. Excepted socket-outlets should be appropriately marked (such as "Freezer only"). However, as the dangers from disconnection may not be great, it may not be reasonably practicable to except them.

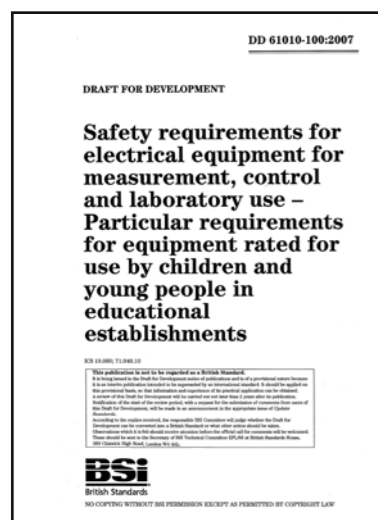


Figure 2: Standard for school electrical products

Another exception which we do not think will ever apply in schools is where socket-outlets are under the supervision of skilled or instructed persons. Additional protection might not be needed in these places. But because a *skilled person* means someone such as an experienced engineer or electrician and an *instructed person* means a less-qualified electrician undergoing supervised training the exception does not apply to schools.

We are pleased to find that the need for RCD protection on socket outlets has become generally recognised. As we wrote in the last issue of the *Bulletin* we risk assessed socket-outlets in 1995, from which we saw the need for labs to have RCDs [2].

The changed regulations mean presumably that all new schools and renovations will have RCDs protecting every socket-outlet. But as for some of the rest of you, no doubt you will have to whistle.

Product-safety standard for schools

SSERC makes wide use of standards. They help us decide whether a hot object is safe to handle, a bright lamp can be looked at, or a live wire is touchable. Standards come from the British Standards Institution (BSI). Most of them originate from international groups on which BSI is represented. BSI then adopt the standard for use in the UK.

While some of the general safety standards apply to all age groups, most of the standards on laboratory equipment relate to use by adults, not children.

For want of a suitable standard to which to design school laboratory equipment, in 1993 the British Educational Suppliers Association (BESA) with the guidance of SSERC and CLEAPSS agreed that member companies should design electrical equipment to BS EN 61010-1 *Safety requirements for electrical equipment for measurement, control and laboratory use*. The title sets out its scope. It was fairly suitable for our purposes, but not entirely so in that it relates to the adult work-place and does not include power supplies. So SSERC, CLEAPSS and BESA put in some extra conditions such as reducing aperture sizes from 4 to 1 mm and applying it to all electrical lab apparatus including power supplies.

Now we are pleased to report that BSI have published a draft standard (Fig. 2) being a safety specification for electrical products for use by children in schools [3]. Being derived from BE EN 61010-1, it sets additional conditions on fusing, the accessibility of dangerous parts, surface temperatures, water resistance and the emission of UV and laser radiation.

The scope covers use by children and young people in school under supervision. There are stricter temperature limits for products that might be used by children under 13. Laser sources can be used by children provided the child is aged 11 or over and the laser product is Class 1 or Class 2. This opens the way for SSERC to ask the Scottish Government to relax its current guidance that use of lasers by pupils is only for S3 and above.



Products designed to the standard shall be marked with a special symbol (Fig. 3) showing the age-range for which the product has been rated.

Figure 3: Symbol for a product rated for use by children at least 11 years old

References

- [1] BS 7671:2008 *Requirements for Electrical Installations, IEE Wiring Regulations, Seventeenth Edition.*
- [2] RCD protection, Bulletin 185, SSERC 1995
- [3] DD 61010-100:2007 *Draft for development: Safety requirements for electrical equipment for measurement, control and laboratory use - Particular requirements for equipment rated for use by children and young people in educational establishments.*

The following experiment highlights a method of determining the rate constant and the order of a reaction. It uses the reaction between household bleach and blue food colouring.

We came across the article [1] recently when seeking materials to address the lack of suggested activities in some parts of the Advanced Higher Chemistry syllabus [2] on Pages 33-34.

In these experiments the household bleach decolourises the solution of blue food dye within about ten minutes.

The overall rate equation is:

$$\text{Rate} = k [\text{blue dye}]^a [\text{bleach}]^b$$

The rate of dye decolouration can be followed using a colorimeter, and by applying the Beer-Lambert Law the concentrations of dye can be calculated.

From these results, the rate constant for the reaction (k), and the orders of reaction (a and b) can be determined with respect to dye and bleach concentration.

Exemplar Results		
Time / min	Absorbance at wavelength 590 nm	
	0.50 cm ³ bleach	0.25 cm ³ bleach
0	0.84	0.84
1	0.68	0.75
2	0.58	0.67
3	0.46	0.62
4	0.37	0.56
5	0.30	0.50
6	0.25	0.45
7	0.20	0.41
8	0.16	0.36
9	0.13	0.33
10	0.10	0.30

These absorbance values are used to calculate the concentrations of the dye. The calculation uses the molar absorptivity value of the blue dye which is quoted as being $1.38 \times 10^5 \text{ cm}^{-1} \text{ mol}^{-1} \text{ litre}$ at 630 nm.



Figure 1: Most blue food colourants used in cookery contain the dye E133 (brilliant blue) which is oxidised to a colourless form by NaOCl.



Figure 2: Household bleach is an aqueous solution of sodium chlorate(I) (sodium hypochlorite - NaOCl).

We used a WPA CO 7500 and the closest wavelength to 630 nm which could be selected was 590 nm. These results were obtained using this. If you happen to have 630 nm filter, then it should be used.

Firstly, calculate the dye concentrations using the Beer-Lambert Law:

$$\text{Absorbance (A)} = l \times c \times \epsilon$$

where:

l is the distance that the light passes through the solution - path length (1 cm)

c is the concentration of dye

ϵ is the molar absorption for the blue dye ($1.38 \times 10^5 \text{ cm}^{-1} \text{ mol}^{-1} \text{ litre}$ at 630 nm)

Time / min	Concentration of dye ($\times 10^{-7}$ moles l^{-1})	
	0.50 cm^3 bleach	0.25 cm^3 bleach
0	61	61
1	49	54
2	42	49
3	33	45
4	27	41
5	22	36
6	18	33
7	14	30
8	12	26
9	9.4	24
10	7.2	22

Secondly, calculate the values of $\ln[\text{blue dye}]$ and $1/[\text{blue dye}]$ for both bleach concentrations.

Time / min	0.50 cm^3 bleach		0.25 cm^3 bleach	
	$\ln[\text{dye}]$	$1/[\text{dye}] \times 10^5$	$\ln[\text{dye}]$	$1/[\text{dye}] \times 10^5$
0	-12.01	1.6	-12.01	1.6
1	-12.22	2.0	-12.12	1.8
2	-12.38	2.4	-12.24	2.1
3	-12.61	3.0	-12.31	2.2
4	-12.83	3.7	-12.41	2.5
5	-13.04	4.6	-12.53	2.8
6	-13.22	5.5	-12.63	3.1
7	-13.44	6.9	-12.73	3.4
8	-13.67	8.6	-12.86	3.8
9	-13.88	11	-12.94	4.2
10	-14.14	14	-13.04	4.6

Finally, plot $\ln[\text{blue dye}]$ versus time, and $1/[\text{blue dye}]$ versus time for both bleach concentrations to find the order of reaction with respect to the blue dye.

If the reaction is **first order** with respect to the blue dye, then

$$\text{Rate} = k_{obs} [\text{blue dye}]^1$$

where k_{obs} is the observed rate constant.

The integrated form of this equation is

$$\ln[\text{blue dye}] = -k_{obs}t + \ln[\text{blue dye}]_0$$

where t = time, and $[\text{blue dye}]_0$ is the initial concentration of blue dye.

The integrated form of the equation can be compared to the equation of a straight line ($y = mx + c$)

So plotting $\ln[\text{blue dye}]$ versus time will give a straight line with a gradient of $-k_{obs}$ if it is a first order reaction with respect to the blue dye.

If the reaction is **second order** with respect to the blue dye, then

$$\text{Rate} = k_{obs} [\text{blue dye}]^2$$

where k_{obs} is the observed rate constant.

The integrated form of this equation is

$$1/[\text{blue dye}] = k_{obs}t + 1/[\text{blue dye}]_0$$

where t = time, and $[\text{blue dye}]_0$ is the initial concentration of blue dye.

This integrated form of the equation can once again be compared to the equation of a straight line ($y = mx + c$)

So plotting $1/[\text{blue dye}]$ versus time will give a straight line with a gradient of $+k_{obs}$ if it is a second order reaction with respect to the blue dye.

Calculation of Values

From your graphs you now know if the reaction is first order or second order with respect to the blue dye. You can also calculate k_{obs} for each linear graph.

The overall rate equation for the reaction between bleach and the blue dye is:

$$\text{Rate} = k [\text{dye}]^a [\text{bleach}]^b$$

In the two experiments the initial (or starting) concentration of dye was kept constant, but the concentration of bleach was changed.

Here we have used household bleach with a stated value of 5.25% (m/v) sodium hypochlorite, giving a concentration of 0.705 mol l^{-1} . So 0.5 ml of bleach in 10 ml blue dye solution gives a concentration of 0.035(3) mol l^{-1} . Its exact concentration can, of course, be obtained by iodometric titration.

The order of the reaction with respect to the bleach can be determined by observation of the experimental data obtained.

The value of k can now be calculated for each experiment and averaged to provide a final value. With the necessity of using the 590 nm filter instead of the 630 nm one, the value of k will obviously be slightly inaccurate. However, the process of its calculation holds true.

The complete experimental procedure, treatment of results, and how the reaction can be used to calculate Activation Energies by using the Arrhenius Equation, will be posted on the SSERC Website in the near future.

References

- [1] Department of Chemistry, University of Waterloo, Ontario, Canada
Published in Chem 13 News/October 2007
- [2] <http://www.sqa.org.uk/files/nq/ChemistryAH.pdf>

Keeping your radioactive sources safe during school refurbishments



We wrote about source security in 2006 [1, 2] after a school lost its radioactivity cabinet, along with its stock of sources. Alas, in 2007, the same thing happened in another school. With three lost cabinets in five years, what can we all learn to stop further loss? The first happened just after a school closed down; the other two in major refurbishments in holiday time. The common factor in all three was that school staff entrusted outside contractors to shift the radioactivity cabinet. The message is a simple one. Do the job yourself, preferably with the help of trusted colleagues. Never call on an outsider to shift radioactive sources.

Therefore if your school is due to be refurbished, or move to other premises, let the school management know that even although your employers will engage others to shift your stock of chemicals and apparatus you and your colleagues will move the sources yourselves.

Flitting to a new home

The file on the SSERC website 'Transport 2007' [3] explains how sources should be transported by road. You can carry the sources in your own car provided that your insurers let you. Probably they won't, in which case the specialist carriers, *Strand Transport*, should be engaged. They are trustworthy, competent and the cost would be about £40. Contact details are in 'Transport 2007'.

However if the new building is not far away you could carry the package of sources - packed as instructed in 'Transport 2007' - on foot, perhaps with a colleague for security, to the new site. By this means the sources would be under your control all of the time and the chance of them going astray would be negligible.

If you decide to take the sources on foot, pack them in a rucksack to sit about 10 cm from your back. (I knew a university physicist

who used to carry sources around the streets of Edinburgh in a wicker shopping-basket.) The radiological risk of harm to the carrier is negligible.

If you use *Strand Transport*, you need to ensure that the package does not go astray by seeing that there is someone from the science department in your present building on the day of shipment to hand over the package to the carrier and someone else from your department on site at the new premises to receive the package from the carrier. The sources must then be locked away. Since there can be lots of packages lying around during removals, take care to ensure that your package does not get lost with others.

HSE notification

If there is a change of premises, the Health and Safety Executive (HSE) should be told. Please ask your Radiation Protection Adviser (Jim Jamieson) for advice.

References

1. Security of radioactive holdings, Bulletin 217, SSERC, 2006.
2. Security of radioactive holdings: <http://www.sserc.org.uk/members/SafetyNet/Radioactivity/Security.doc>
3. Transport 2007: http://www.sserc.org.uk/members/SafetyNet/Radioactivity/Transport_2007_Guidance.rtf

Expectant or young mothers- Guidance on working with radioactive sources

Expectant or breastfeeding mothers can find guidance on working with radioactive sources on our website [1]. The risk to a woman in one of these conditions is very small. The additional dose from handling either a beta or gamma source while taking normal precautions is equivalent to about a 20-minute exposure to background radiation indoors. Therefore there is no reason why normal work with sources should not be carried out.

The only sources which should not be used are geological specimens. The risks from handling lumps of rock, though the risks are often small, are less predictable.

Reference

- http://www.sserc.org.uk/members/SafetyNet/Radioactivity/Expectant_or_young_mothers_2007.doc

CPD to support Curriculum for Excellence in science - sponsored by the Scottish Government

Practically-based, residential workshops for teachers of biology, chemistry, physics & integrated science. Participants will receive resources and equipment for use in the classroom.

Programme for 2008 – 2009

Building on the evident success of the 2007 – 2008 CPD programme run by SSERC and its partners, we are offering residential courses to support Curriculum for Excellence. Each of these courses will follow an interactive approach with a focus on practical work and active learning. We will address how contemporary issues and the associated science can be explored through the curriculum. Links to final programmes for individual courses will be posted on the SSERC website.

Course structure

Each of the courses will run in two parts. Typically, Part 1 of the courses will start on a Thursday morning and finish shortly after lunch on Saturday; Part 2 will run from Friday until Saturday. Teaching approaches to support learning

will be key features of these courses. Equipment and resources (whose value is in excess of the registration fee) to aid implementation in the classroom will be given to participants. Participants will be expected to undertake, between Parts 1 and 2 of the course, a classroom-based project – the so-called ‘Gap Task’. Previous experience has shown that, as a result of this approach, participants have access to a host of new ideas and methodologies to use in their teaching.

Registration

Application forms for individual courses can be downloaded from the SSERC website:

<http://www.sserc.org.uk/public/CPD/2008-9/BTG.htm>

email: cpd@sserc.org.uk

Forms should be returned to SSERC three weeks prior to the course start date.

The registration fee is £100 to include accommodation (2 nights Part one, 1 night Part two), dinner, bed and breakfast. All participants will be invoiced one week prior

to the start of the course.

Please note that these courses are underpinned and supported from a variety of third-party sources. Attendance at Part 1 and Part 2 is compulsory. In the event of failure to attend both Part 1 and Part 2 of the course, without adequate reason, the full estimated cost of the residential course (£500) will be charged. **Please ensure that your institution is aware of this rule prior to submission.**

These residential courses are part of a programme sponsored by the Scottish Government and are designed and organised by a partnership which includes: Association for Science Education in Scotland, the Institute of Physics in Scotland, Royal Society of Chemistry, SAPS Scotland, The University of Edinburgh (the School of Chemistry, Scottish Initiative for Biotechnology Education (SIBE) and SSERC.



SUBJECT	DATES		
	PART 1	PART 2	APPLY BY:
BIOLOGY	Thursday 4th - Saturday 6th September 2008	Friday 6th - Saturday 7th February 2009	Oversubscribed
CHEMISTRY	Thursday 13th - Saturday 15th November 2008	Friday 27th - Saturday 28th March 2009	23rd October 2008
PHYSICS	Thursday 28th - Saturday 30th August 2008	Friday 12th - Saturday 13th December 2008	Oversubscribed
PRIMARY A	Thursday 30th October - Saturday 1st November 2008	Friday 20th - Saturday 21st March 2009	9th October 2008
PRIMARY B	Thursday 4th - Saturday 6th December 2008	Friday 24th - Saturday 25th April 2009	15th November 2008
SCIENCE	Thursday 2nd - Saturday 4th October 2008	Friday 20th - Saturday 21st February 2009	14th September 2008

Quotes from last session

"I'm more aware of the experimental techniques available to classes at all levels."

"I am leaving this course very inspired and motivated to use these good practices in my classroom and within the wider school."

"Getting ready-made resources to use back at school was excellent."

"The gap task has given me new ideas for different approaches to my teaching."