Scottish Schools Equipment Research Centre

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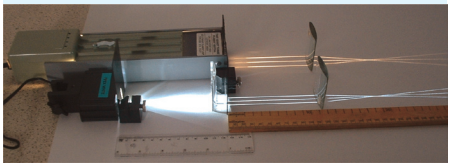
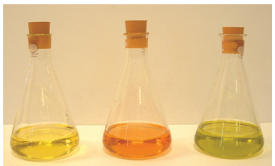
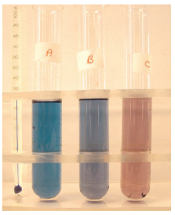
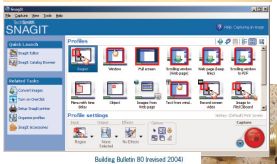








SSERC Conference: Towards a Science Nation

Keynote address: Professor Anne Glover

Professor Glover addresses SSERC Conference

Delegates at this year's SSERC Conference were treated to an engaging and inspiring keynote address from Professor Anne Glover, Chief Scientific Adviser for Scotland. Professor Glover's passion for science was evident from the start as she enthusiastically described her delight at a hands-on practical for school students she had been shown during a visit to SSERC some weeks earlier. This practical, on 'bioluminescent bacteria as biosensors', was a collaborative development between SAPS, SSERC and the University of Edinburgh, and is based upon work that Professor Glover and her research team at the University of Aberdeen had carried out.

Professor Glover highlighted that the creation of the role of Chief Scientific Adviser draws attention to the support for science accorded by the Scottish Executive. She described how an important function of the Chief Scientific Adviser will be to strengthen the science base within Scotland and to help raise the profile of science amongst the people of Scotland. Professor Glover went on to say that her perception of Scotland as a Science Nation was one in which science was accepted and appreciated throughout the whole of society. It was also crucial to use high quality scientific evidence to underpin policy-making decisions and to have a scientifically literate population able to engage in debate over challenging and sometimes controversial issues.

In terms of building a Science Nation, Professor Glover suggested that Scotland already has a good base with Scottish scientists at the forefront in the development of 'green' technologies. Scotland also rated amongst the top performing countries in science education in the developed nations as measured by The Programme for International Student Assessment (PISA) 2003. However our challenge is to keep children's natural curiosity alive and stimulate them to remain engaged and fired-up about science, so that a sufficient number study the sciences in 5th and 6th years at school and then at university. Young people are often unaware that qualifications in science subjects can serve to open doors to a wide range of careers, commercial as well as scientific. Professor Glover highlighted the important role that SSERC has in supporting teachers and technical staff in their efforts to make practical science interesting and exciting such that young people are engaged and their curiosity aroused. She then went on to talk about Science Centres saying that in addition to their general appeal, they also have an important role to play alongside schools in supporting the science curricula by providing complementary opportunities to kindle interest and curiosity.

Professor Glover urged that scientists recognise their responsibilities to let society know of the first-rate work that is being carried out and to act as positive role models to young people. This cannot be done without direct communication and scientists must go out and talk about what they actually do.

Drawing her address to a close, Professor Glover stressed that our future economic growth, survival and participation in the global economy will depend upon having well-trained scientists, and that we must have a scientifically literate and informed society that is active in the debate on the use of future technologies. *SSERC would like to thank Professor Glover for such an inspiring, informative and enjoyable presentation and to wish her every success in her new role as Chief Scientific Adviser for Scotland.*

Optics with LED sources

A method for doing ray optics experiments with a high-power white LED source is described.

Introduction

The conventional raybox source – a 12 V, 24 W tungsten filament lamp with vertical filament – has disadvantages. Its radiation is redder than normal sunlight and, because the light diverges in all directions, only a tiny fraction is made use of. Also the lamp is less than 15% efficient and its relatively high wattage can cause the lamphouse to get rather hot. In principle a white LED should do better. It is an efficient, very-low power source whose radiation can be highly directional and match the colour content of sunlight.

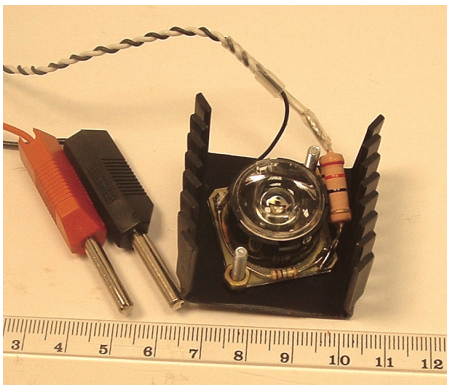


Figure 1 - Lumiled (type: Luxeon 1W Star with Optic (Low Dome Batwing)) fastened to heatsink and with series resistors.

LED source

The recommended LED source is a 1 W white Lumiled with optic (low dome batwing). The source has a continuous broad-band spectrum generated by exciting a phosphor with blue radiation and the resulting colour matches sunlight

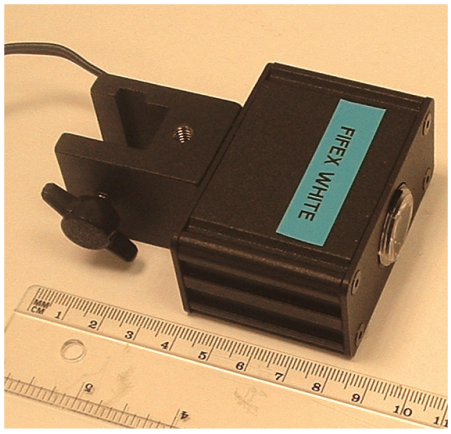


Figure 2 - White LED source from Harris (L87348) (made by FifeX).

as if from a black-body source at 6000 K. The LED has a primary lens to collect and direct the radiation in one direction with little spreading. The 'batwing' description refers to the shape of intensity versus angle of divergence for a cross-section of the beam. A secondary lens further collects and shapes the radiation resulting in a narrow, slightly-diverging, intense beam of uniform brightness – rather like a searchlight.

This LED source (RS 467-7519, £5.56, product type LXHL-NWE8) has greatly dropped in price since it was first marketed. Details of how to wire it up and mount on a heatsink (Fig. 1) can be found in the Bulletin articles section of SafetyNet on the SSERC website:

http://www.sserc.org.uk/members/SafetyNet/bulls/212/physics2.htm

It is also now made ready-assembled in a chunky black mount from FifeX (Fig. 2) (with the encouragement of SSERC), and sold through Philip Harris (L87348, £65) (the price includes a plugtop power supply).

Method

The Lumiled source was placed on its side on a sheet of white card and a single slit (S1), 1.0 mm wide, was placed directly against it, the slit centred on the lens (Fig. 3). The mid point of the LED source is 15 mm above the benchtop, giving it enough height to illuminate the surface. Because of the divergence of light from the LED, the vertical slit effectively becomes the source. A cylindrical convex lens whose focal length lies between 100 mm and 150 mm is sat on the bench in front of the source. (If a higher-power lens is used, distortion can be significant.). The lens used had a focal length of about 110 mm. When placed 110 mm from the slit, it produces a collimated beam of light. When a plate with 3 vertical slits (S2) (each 1.0 mm wide) is placed a little beyond the lens in the collimated beam, there are three parallel rays, well defined and clearly seen, running for at least 500 mm along the white card on the benchtop's surface. Each ray diverges a little, but by an amount which is acceptably trivial. The width of the ray is 1.0 mm at S2 and 3.0 mm 300 mm from S2. If a converging lens is placed in the rays, the resulting convergence narrows the rays. In consequence, the rays are generally all between 1 and 2 mm wide where they would be worked with.

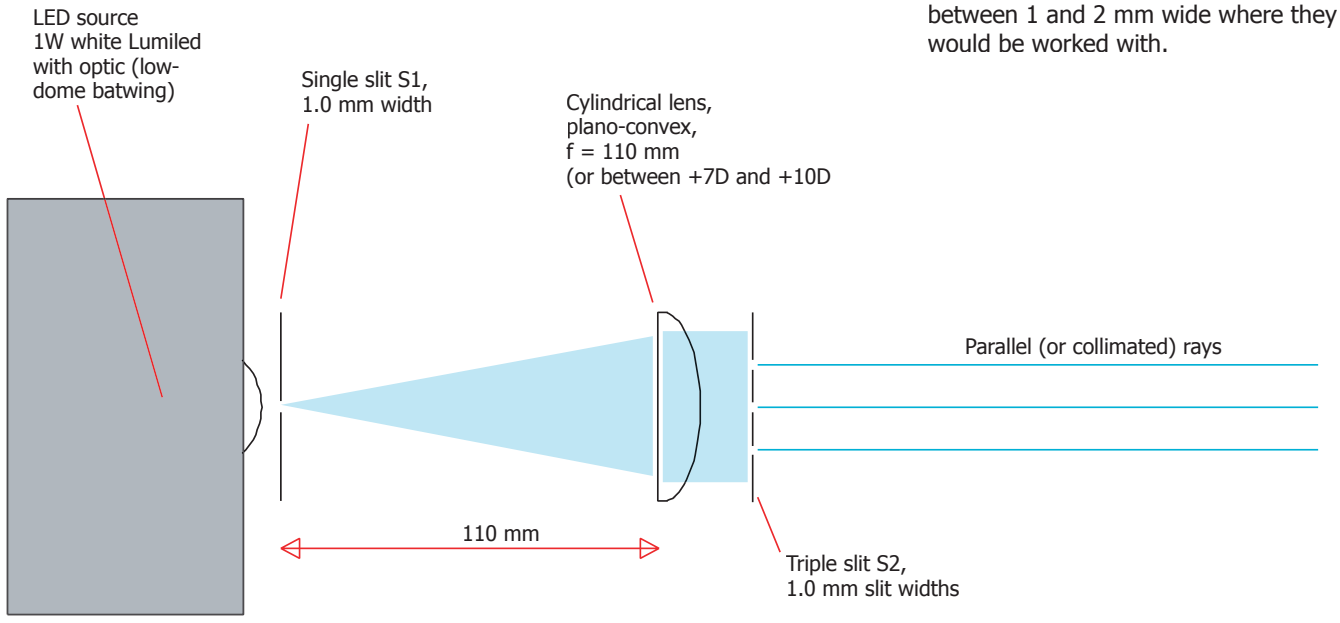


Figure 3 - Optical setup to produce three parallel rays from a LED source.

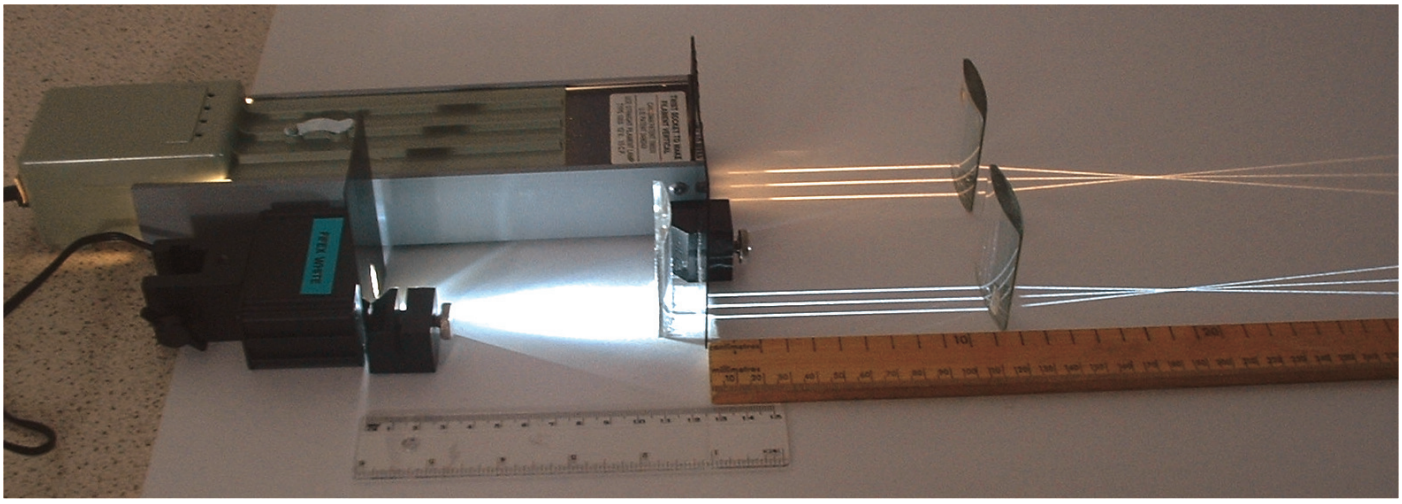


Figure 4 - Photographic comparison of rays made by a LED source with ones from a conventional raybox.

A comparison was made with one of the best conventional rayboxes (Fig. 4). The tests were made in shaded daylight where the daylight was reduced by grey louvered blinds. Relative to it, the Lumiled optical source resulted in:

- rays that were much whiter;
- rays more uniform in intensity;
- rays continuous rather than broken;
- a longer working length of ray;
- rays that diverge slightly more, in the sense of becoming thicker (by 1 mm every 150 mm versus 1 mm every 200 mm);
- trivial heat generated.

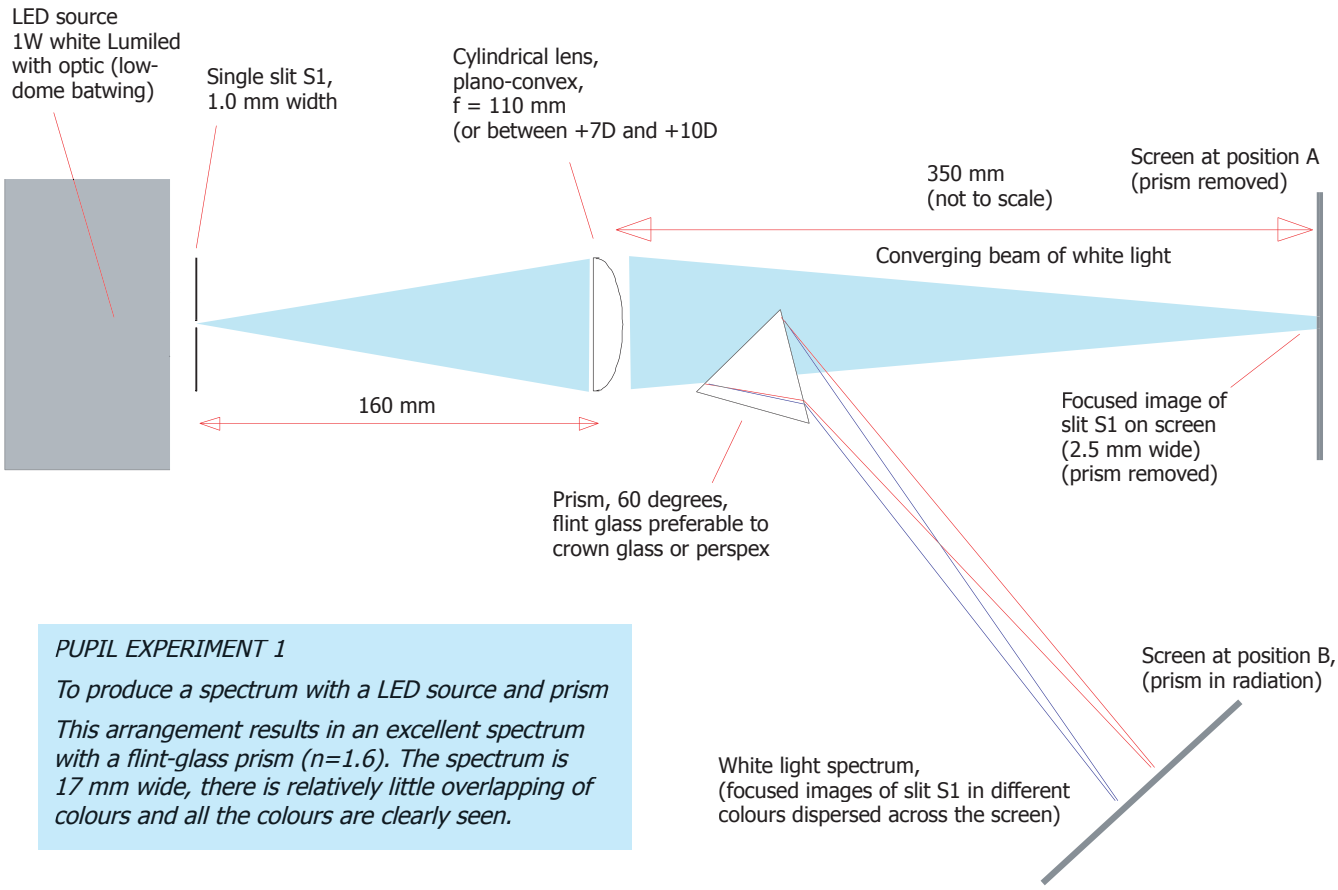
With five improvements and one small detriment, a 1 W LED is better than a 24 W tungsten filament lamp as the source of radiation in ray optics.

Other applications

The method can be applied to many demonstrations in 2-dimensional optics, some of which will use a single ray, some a set of rays (collimated, diverging, or converging), and some a broad beam of light. For the last of these, slit S2 should be removed. Here are two examples of pupil experiments:

1. Dispersing white light with a prism (Fig. 5).

2. Raindrop analogue with a circular perspex disk (Fig. 6 / over).



PUPIL EXPERIMENT 1

To produce a spectrum with a LED source and prism

This arrangement results in an excellent spectrum with a flint-glass prism (n=1.6). The spectrum is 17 mm wide, there is relatively little overlapping of colours and all the colours are clearly seen.

Figure 5 - Optical setup to produce a spectrum with a prism.

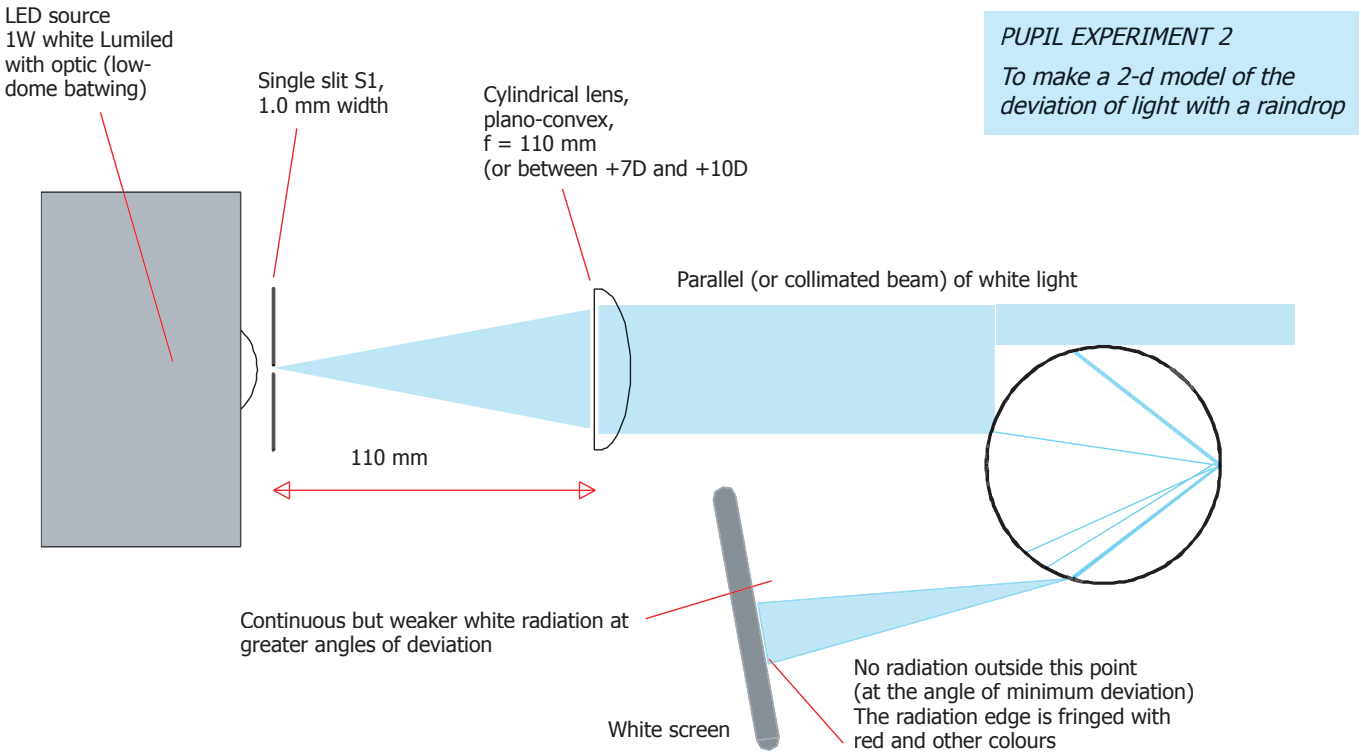


Figure 6 - Optical setup to show effects of double refraction and total internal reflection with a circular Perspex block (sunlight on raindrop model).

Summer Schools 2007

We are delighted to announce that funding has been made available from the Scottish Executive Education Department to enable Biology, Chemistry, Physics and Primary Summer Schools to go ahead. A two-day residential for all the PGDE science students studying at Scottish universities will also be held. All the Summer Schools are well-suited for inclusion in a CPD portfolio and aim to offer participants the opportunities to:

- Explore activities that will support the aims of 'A Curriculum for Excellence'.
- Raise the levels of knowledge and confidence in the teaching of Science throughout the curriculum.
- Update their knowledge and skills in Science through a range of interactive sessions that include group tasks, practical activities, discussions, lectures and visits.

The Summer Schools are being supported by the partners* in the Support for *Science Education through CPD Project*.

Fliers and registration forms can be downloaded from www.sserc.org.uk or further information is available from sheila.maclellan@sserc.org.uk Tel: 01383 626070

Details	Biotechnology and Biosciences	Chemistry	Physics
Who is it for?	Biology teachers and technicians	Chemistry teachers and technicians	Physics teachers and technicians
When ?	25th-29th June	25th-29th June	16th-19th May
Where?	King's Buildings, University of Edinburgh	King's Buildings, University of Edinburgh	Lauder Business and Learning Conference Centre (LBCC), Dunfermline
Accommodation	Pollock Halls of Residence, University of Edinburgh	Pollock Halls of Residence, University of Edinburgh	Holiday Inn Express, Dunfermline
Cost	£190 to include dinner, bed and breakfast for four nights	£190 to include dinner, bed and breakfast for four nights	£190 to include dinner, bed and breakfast for three nights
Programme incl.	• exciting and relevant practical work • interesting lectures • visits: Roslin Institute, Scottish Agricultural Science Agency Royal Botanic Garden, Edinburgh • discussions - social events	• exciting practical work • interesting lectures • industrial visits • discussions • social events	• Physics beyond the school gate • breaking down the boundaries • innovation in learning through ICT • social events
Websites	www.saps.org.uk	www.sserc.org.uk	www.sserc.org.uk

* Partners in the Supporting Science Education through CPD initiative and involved in the organisation of the Summer Schools include *Development to Update School Chemistry* (DUSC), the *Institute of Physics*, *Science and Plants for Schools* (SAPS), the *Scottish Initiative for Biotechnology Education* (SIBE) and *SSERC*.

Traffic Lights

Introduction

This is a variation on the *Blue Bottle experiment* which featured in Bulletins 204 [1] and 210 [2]. Here the methylene blue is replaced by indigo carmen.

What you will need

Chemicals

sodium hydroxide solution, 250 cm^3 of 0.5M (corrosive)
glucose powder, 7.5 g
indigo carmine indicator, 5 cm^3 (made up by dissolving 0.1 g of the powder in 100 cm^3 of distilled water

Equipment

flask, conical, 500 cm^3 + stopper (or large bottle)

Preparing the solution

1. Place the sodium hydroxide, the glucose and the 10 cm^3 of the indigo carmine dye in the conical flask or bottle and **stopper it tightly**.

2. Shake the mixture to dissolve the glucose. It will go green.

3. Allow the mixture to stand until it turns yellow, passing through an intermediate stage in which the solution is a red/ orange colour.

The Demonstration

Shake the flask gently. The solution will turn from yellow to red/orange. Now shake the flask vigorously (hold in the stopper) and see the solution turn green (Figure 2).

Allow the flask to stand and the contents will turn red/orange and then yellow again.

This process can be repeated a number of times before the colour changes slow down. This slowing down is caused by the glucose being consumed. The reaction can be refreshed by the addition of more glucose powder.

The Reaction

Indigo carmine undergoes a reversible reaction:

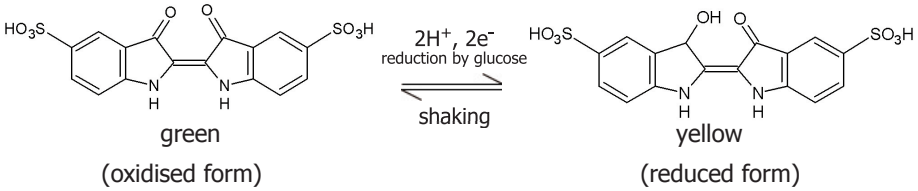


Figure 1 - Reversible reaction

Shaking the flask brings more oxygen into the solution, provoking the formation of the oxidised (green) form. This indigo carmine will slowly be reduced by the glucose to its yellow form. The intermediate colour is due to the formation of a red semiquinone intermediate.

Chemical	Main Hazard	Control Measures
Sodium hydroxide	Corrosive	Wear gloves and indirect vent goggles
Indigo carmine	Harmful if inhaled or absorbed through the skin.	Avoid raising dust and wear gloves and goggles while preparing the solution
Hold the stoppers in when you shake the flasks during preparation or demonstration.		

References

1. http://www.sserc.org.uk/members/SafetyNet/bulls/204/chemistry.htm#Magic%20Bottle

2. http://www.sserc.org.uk/members/SafetyNet/bulls/210/chemistry.htm

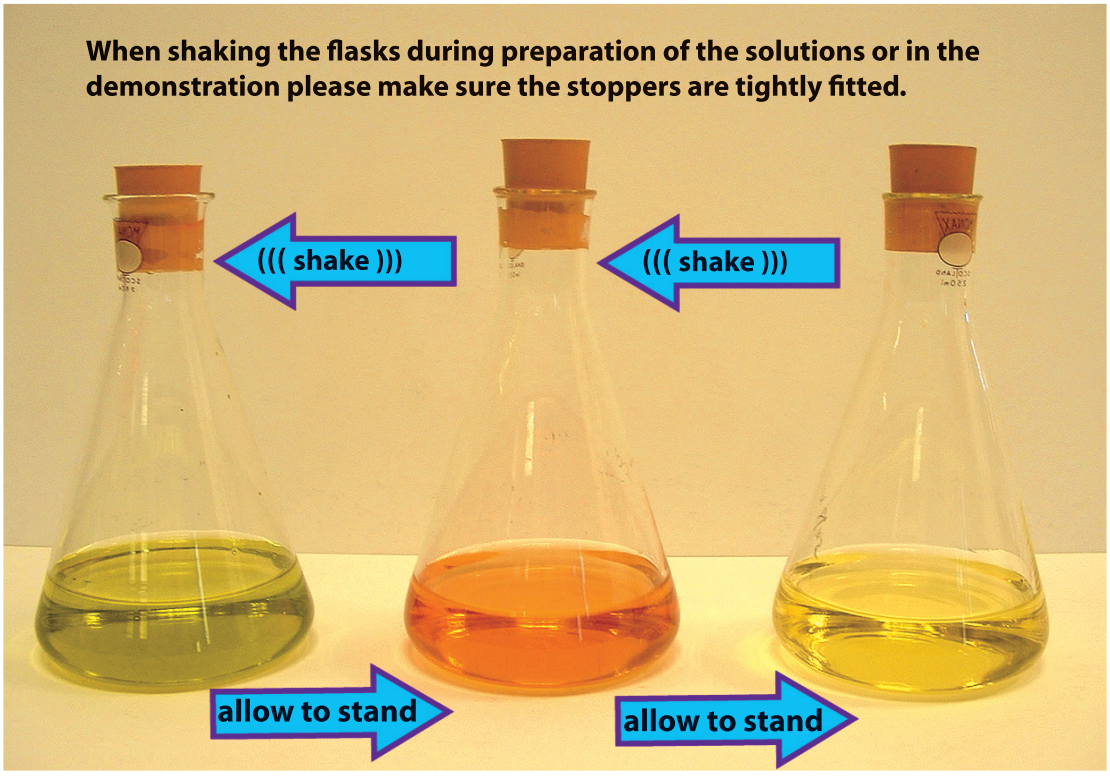


Figure 1 - Colour changes as indicator solution is shaken then allowed to stand.

Equilibrium continued

Introduction

In *SSERC Bulletin 219* [1] we gave details of a simple demonstration showing the effect of temperature change on the position of an equilibrium. Using the solution of cobalt chloride and additional chloride ions the colour change between blue and pink takes place over a particular, smallish temperature range with an intermediate colour of mauve.

When the solution is blue the predominant species is the tetrachlorocobaltate anion with very little hexa-aquocation present. When it is pink the latter cation is the most populous species. The mauve solution contains both of the coloured ions in approximately equimolar proportions. An easy way of convincing pupils of this is for them to hold a *blue* test-tube across a *pink* and see the mauve colour in the area of overlap (Figure 4).

By altering the proportions of cobalt salt and extra chloride added, the solution can be tuned to change colour at different temperatures. A set of tubes so tuned can function as a crude thermometer.

What you will need

Chemicals

cobalt(II) chloride
industrial methylated spirits (IMS, clear)
distilled or de-ionised water
hydrochloric acid (concentrated)
sodium chloride

Equipment

balance
spatula
weighing boat
test tubes, 5 off
pipette, 5 cm^3 or small measuring cylinder
measuring cylinder, 100 cm^3
burette + stand
beakers, 250 cm^3, 6 off
supply of hot water (also iced water optional)
thermometer, 0-100^oC

Preparation of solutions

Dissolve 2 g of cobalt chloride in 100 cm^3 of IMS and 16 cm^3 of distilled water.

Tuning each tubeful - Dispense three aliquots of 5 cm^3 of the cobalt solution into 3 test tubes labelled *A*, *B* and *C*. Place one tube in a water bath (250 cm^3 beaker three quarters filled with water at 20°C). Run in concentrated hydrochloric acid from the burette, dropwise with shaking or stirring and allowing time for temperature equalisation, until the colour **just** turns blue. That tubeful is now *tuned* to change colour slightly below 20°C. Repeat with tubes *B* and *C* in the beaker waterbaths at other temperatures, say 30°C and 40°C.

The equilibrium equation can be expressed as follows:

$$[Co(H_2O)_6]^{2+}(aq) + 4Cl^-(aq) \rightleftharpoons CoCl_4^{2-}(aq) + 6H_2O(l)\ \Delta H +ve$$

Pink — Blue (see colours below)

Now place the three tuned tubes in turn in 5 beaker waterbaths and see if the colour change is remembered. Alternatively place them together in the same waterbath, raise the temperature slowly and observe the colour in the tubes turn blue in succession at their tuned temperature. Could this be the next executive desk toy?

Curricular references

Higher Chemistry, Unit 3, Chemical Reactions, (c) - the concept of dynamic equilibrium and shifting the equilibrium position.

Advanced Higher Chemistry, Unit 2: Principles of Chemical Reactions, (b) Chemical equilibrium.

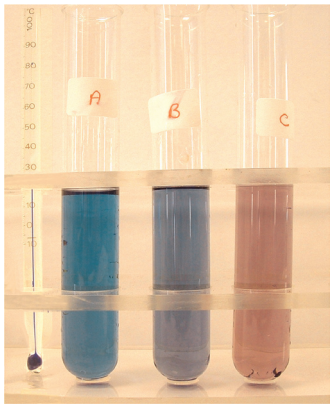


Figure 1 - *A* is tuned to change colour at slightly below 20^oC

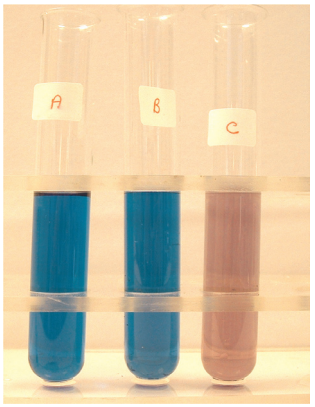


Figure 2 - *B* is tuned to change colour at 30^oC

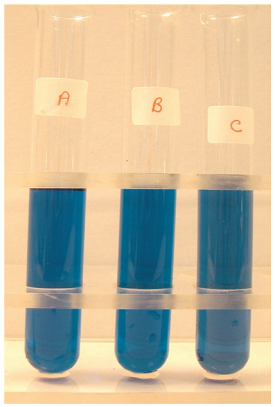


Figure 3 - *C* is tuned to change colour at 40^oC

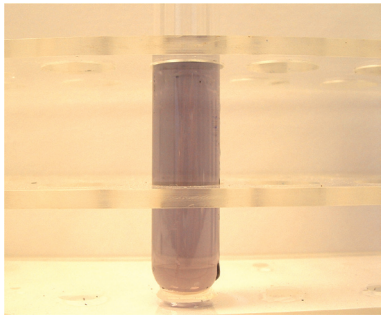


Figure 4 - mauve colour

Reference

1. *SSERC Bulletin No. 219*, Autumn 2006, p6

Chemical	Main Hazard	Control Measures
Cobalt(II) chloride	**Category 2 carcinogen** by inhalation. Sensitiser by skin contact.	Avoid raising dust. Wear eye protection and gloves to prepare solution from the powder. The solution poses negligible risk.
Hydrochloric acid (concentrated)	Extremely irritant and corrosive vapour. Liquid and vapour causes severe burns to eyes, lungs and skin.	Wear nitrile gloves/gauntlets and eye protection. Fuming hydrochloric acid should only be handled in a fume cupboard.

Variations

1. The chloride could be supplied by using saturated sodium chloride solution instead of the acid. This avoids the corrosiveness of the acid. However, owing to the limited solubility of the salt, a larger volume of up to 10 cm^3 is needed to supply a sufficiently high concentration of chloride ions.

2. Using a small scale as described above gives the advantage of a more rapid temperature equilibration. A teacher demonstration might need a larger scale.

3. Ideas for a further extension would be to use it as the basis of an investigation on a more quantitative basis. Using a colorimeter, the concentration of each species could be measured and thus the constancy of the equilibrium constant at a given temperature. If the equilibrium constant were measured at a few temperatures the enthalpy of the reaction could be calculated.

SnagIt

Screen capture and editing software from TechSmith

Introduction

Let's face it, the computer screen and what's on it is one of the principal ways many of us communicate these days. But how do we go about capturing or recalling what we see on screen? Why would we want to do this? Typical scenarios where we might need this facility are :-

• putting together step-by-step screenshot instructions on how to use a software application

• capturing images and screenshots to illustrate a *PowerPoint* presentation or interactive whiteboard lesson

• showing an error message exactly as it appears on screen

• recording a purchase confirmation screen when buying online

• attaching a screenshot to an e-mail to illustrate a point

"Screen capture might not be something you consider important, in fact you might not even have used it, but if you produce teaching materials then this is something that could easily save you hours of work, and make your life a lot less stressful!" *John Hammell, Network Manager in an Edinburgh school*

Screen capture on a budget

Until recently at SSERC, we've managed to do most things with the basic screen-capture facilities on Windows via the *PrtScr* key (copies the whole screen to the Windows clipboard) or *Alt+PrtScr* (copies the contents of the active window to the clipboard). Thereafter the image can be pasted directly into *Word*, *PowerPoint* and *Excel* or into graphics editors such as *Paint, Paint Shop Pro* or *Photoshop* for further editing. This works fine but is rather limited in scope :-

• You are restricted to what is on-screen or within the chosen active window. It is infuriating when there is invariably just one wee bit of a web page which is just off screen and can't be captured. In the past we've resorted to printing bits of screens and physically Sellotaping them together!

• Further editing software is needed to select the relevant part of the screen area.

• Links are not retained, as areas captured are simply bitmapped images.

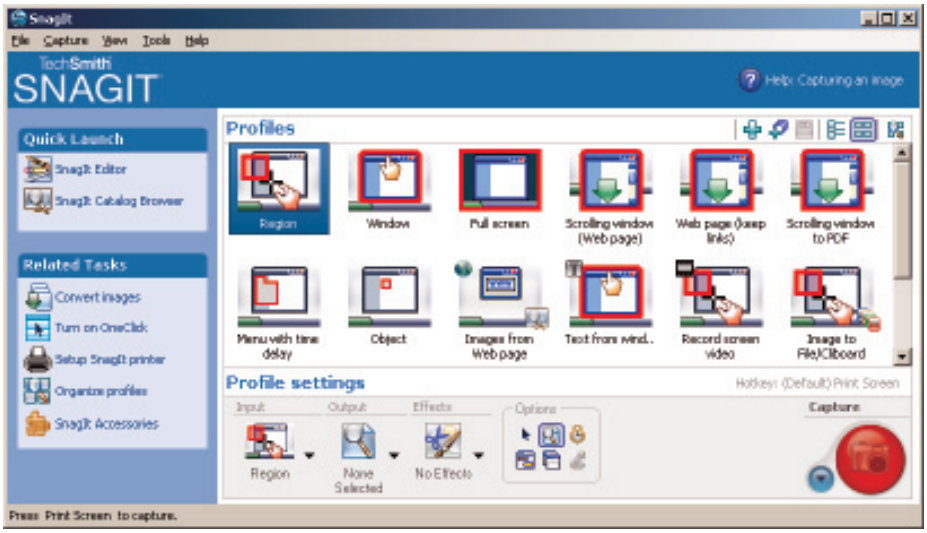


Figure 1 - Main Menu - Options available for screen capture - basic capture profiles and settings

TechSmith's SnagIt 8.2.0 is the latest incarnation of a software application that has evolved over the past 15 years from a basic screen capture utility into much, much more. The latest version comes with the original SnagIt capture utility and a built-in companion editor called, amazingly enough, *SnagIt Editor*. SnagIT is available either as an internet download or as fully packaged software, complete with *Getting Started Guide & disc* ... and the best bit ... the academic licences are very heavily discounted (£14 + VAT for the download or £20 + VAT for the full package)! Multi-user licences are available from :-

www.blueorange.org.uk/camtasia.htm

What can SnagIt do?

Using what are called *Capture Profiles (Inputs)* SnagIt can capture any :-

- screen as seen on the monitor active window
- user-defined rectangular portion of any screen, even on a multi-monitor setup
- scrolling window
- web page, including links window and save it as a pdf file
- drop-down or cascading menu
- single image from an MPEG-4 video stream
- screen action, including mouse movements, in standard AVI video format
- text from a window
- object including graphics

The main features of SnagIt are remarkably intuitive and very easy to use (Figure 1). It is simplicity itself to record an on-screen process (static or moving) and play it back to a number of users at a later date, either as a file from a network share, part of a PowerPoint presentation or as a link on a website/intranet. SnagIT also has a very useful text capture mode, which lets you highlight text in on-screen windows that you normally cannot take words from by the usual copy & paste method, and save them out as editable text.

Where windows need to be scrolled in order to view all of the text, or in order to see all of an image, SnagIT can automatically scroll the windows for you. SnagIT can also scroll through a document or Web page and capture the whole thing, not just the portion that fits on your screen, so there are few limitations as to what it can grab. This is particularly useful if you intend to print, for example, a poster of a whole web page or a complete pdf.

It can even take images from *DirectX* applications, including PC games, so you are not restricted to the Windows desktop. What you capture can be further tweaked with the all the tools you see in Figure 2 (over the page). The product, either from the capture and further editing, can be copied to the clipboard or directly to another program such as Word, Excel or PowerPoint.

Delving deeper, the extensive range of processing options take some figuring out. However, fairly quickly you begin to realise how much scope there is with this package and we are sure it won't be too long before you end up exploring all the available options e.g. :-

You can download other more specialised capture profiles from the SnagIT website or even create your own customized ones. SnagIT's batch processing is ideal for high-volume work; where you can set up capture profiles by specifying input setting, image processing and output settings, then point it at a folder of images and let it process them all in seconds.

You can even link it to a scanner and a printer so that the whole start to finish process can be handled by the software,

with no intervention whatsoever. Image-editing features let you tweak resolution, alter the scaling, add annotations and watermarks, as well as carry out colour conversions, colour substitutions, and other effects such as altering brightness, hue, and gamma correction.

Conclusions

Summing up, SnagIt can do so much more than the basic capture offered by *PrtScr* and *Alt+PrtScr* and is well worth the money, even if you just want an easy-to-use graphics editor.

Recommended.

Figure 2 - SnagIt Editor - As easy a graphics editing tool as you could wish for.

Index to SSERC Bulletins 211 to 219

Introduction

Listed below are the main articles from Bulletins 211 to 219 sorted alphabetically. A more comprehensive list may be found on the online version of SafetyNet on the SSERC website at :-

www.sserc.org.uk/members/SafetyNet/bulls/Subsections/menu1.htm

You can choose between drop-down menus sorted by subject, alphabetically and by Bulletin number or by Excel spreadsheets where the full data has been sorted alphabetically or by Bulletin number. Where articles and Bulletins are available online (onl) the menus and spreadsheets will have hypertext links.

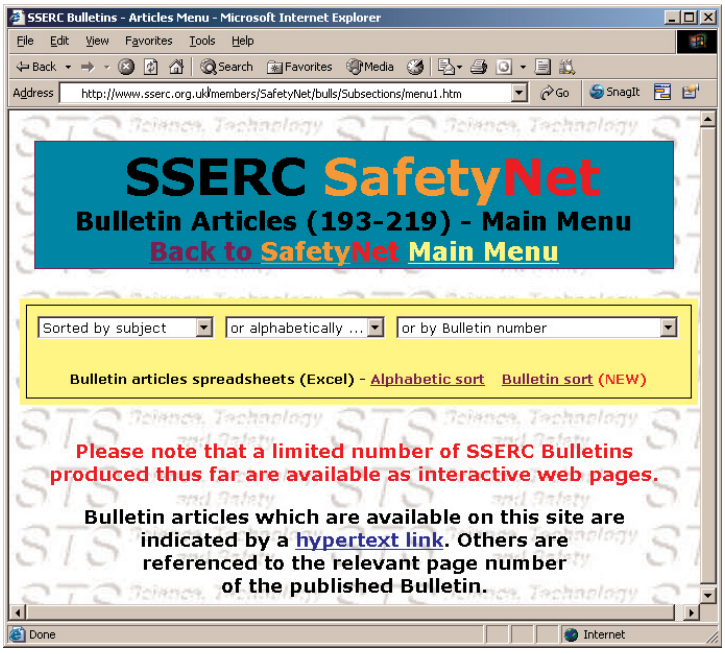


Figure 1 - Bulletin articles drop-down menus and spreadsheets on the SSERC SafetyNet

Bulletin article	No.	Page	Subject
Absorption spectrum , sodium - with a white Lumiled	212	9	Chemistry Notes
Absorption spectrum , sodium - with a white Lumiled	212	9	Physics Notes
Accident with a pinhole camera	212	2	Safety
Air rifles - gas cartridge	211	8	Safety
Assessing risks	213	2	Safety
Audacity - adopt an audacious approach to the study of sound	218	2	ICT
Audacity - adopt an audacious approach to the study of sound	218	2	Physics Notes
Audacity - more experiments	219	12	ICT
"Biuret Reagent, A safer"	214	3	Safety
Buchanan filter - an aid to filtering protoplasts	216	10	Biology Notes
Cabomba - A reliable alternative to Elodea?	215	10	Biology Notes
Catalase - enzyme investigation using	211	12	Safety
Chemiluminescence	216	9	Chemistry Notes
Chromatography - Griffin Paper Electrophoresis Kit	212	3	Safety
"Compost formation, Investigating"	213	10	Biology Notes
"Contacts at SSERC, Core Partners & CPD Projects"	215	4	News & Comment
CPD Grant awards - Editorial	214	1	Editorials
CPD News - Scottish Technicians' Consultative Conference 2006	219	11	News & Comment
CPD news - Supporting Scottish Science Education	218	6	News & Comment
CPD News - Update - ISE 5-14 through CPD draws to a close	219	8	News & Comment

Are laboratories with peripheral benching safe & fit for purpose?

Introduction

Many schools are now being built or refurbished by using Public and Private Partnership (PPP) or Private Finance Initiative (PFI) schemes. Many of the laboratories built so far under these schemes seem to have a common design feature of peripheral benching carrying the services of gas, water, drainage and electricity and with loose tables and chairs in the central area. This layout is cheaper to build.

Implications for safety

Such designs have implications for safety and for the way in which risk assessments can be used and how a practical subject is delivered. It is easy to see that the teaching of practical science subjects in such rooms will be less safe than it is in many of the older lay-outs with island and peninsula benching. The use of the new laboratories with peripheral workplaces was discussed with the staff in 15 PPP schools in one city and with staff in a number of other authorities. The undesirable aspects of doing practical work at peripheral benching are that:

(i) Pupils work with their backs to the teacher who then cannot see if they are about to take some dangerous action, either unintentionally or mischievously. Equally it's not possible to see if eye protection is being worn properly. We know some teachers use a variety of management strategies to mitigate the situation, eg restricting the number of pupils doing practical work so that only one side of a room is used at any time;

(ii) The valuable contact by eye is lost and what must be one of the best parts of teaching a practical subject is difficult if not impossible to achieve - that of discussing an experiment and its design with individuals as they are doing it. In addition these discussions often include gentle reminders on safety precautions. It is true that with the traditional island and peninsular benches a teacher standing in any one spot could have eye contact with only about half the class. However a few steps this or that way allows the other half to be faced;

(iii) With the high light levels near windows Bunsen flames will be nigh invisible and the risk of clothes and hair being set on fire will increase;

(iv) Gas taps and electrical sockets are out of sight making it easy for pupils to covertly tamper with them. Some of these taps have been sited far back or are arranged in clusters with large spaces between the groups of taps. There have been cases of pupils knocking over apparatus, because of having to over-stretch, or reach past others;

(v) Pupils are easily distracted by looking out the window;

(vi) It is difficult for pupils to see demonstrations carried out by the teacher who has his or her back to pupils and is in front of the apparatus. The teacher will need creative footwork, half standing to one side and leaning across, a posture which is certainly not conducive to safe working with apparatus and chemicals. If laboratories have to be fitted with peripheral benching then a decent teacher demonstration bench is essential;

(vii) Some physics experiments and demonstrations are virtually impossible to do without an island or peninsula bench, e.g. propelling a trolley with twine attached to a suspended weight;

(viii) Where storage cupboards have been built above the benches many of these are low enough to give rise to a fire risk if Bunsens are lit underneath them;

(ix) When windows have to be opened for ventilation the draught will be at its strongest over practical areas with the resulting danger of blowing out Bunsens.

Advantages

There are a couple of plusses for the peripheral services model:

(i) During non-practical and book sessions all the pupils can be facing the front and not be sitting sideways as happens with island benches. Also discussion groups can be arranged round tables.

(ii) There are some safety advantages; test tubes being heated can be pointed towards the wall or window and hence away from both the user and others. In the event of an unexpected danger, pupils can move back into the centre of the room.

Conclusion

Many of these PPP and PFI schools have been opened with a fanfare and with politicians declaring that the community now has schools fit for the 21st century. There is little doubt that the overall environment in most of the new or refurbished schools has been greatly improved. However safety has been reduced in those science laboratories where practical work can only be done on peripheral benches. If a cost/benefit analysis and a full assessment had been done beforehand unsuitable systems like these would almost certainly not have been built. Unfortunately those already built will have to be used for thirty years. It must be said that some teachers like the peripheral work arrangement with its flexibility of desks and tables in the centre, but most do not.

When practical work is carried out in these laboratories many of the general or model risk assessments made by SSERC [1], CLEAPSS [2], ASE[3] and others will not be adequate and will certainly need to be adapted for these circumstances.

The *DfES publication Building Bulletin 80 (revised 2004)* [4] shows 22 laboratory designs. None of these places all the pupils at window or wall benches; only six designs place a small number of pupils, between three and six at peripheral benching. Clearly the design experts considered an entirely peripheral lay-out unsuitable. It is a pity that the message did not get through to the designers of some of today's new schools.

References

1. www.sserc.org.uk/members/SafetyNet/HazChem/NewHaz15/Introduction/HAZ.HTM

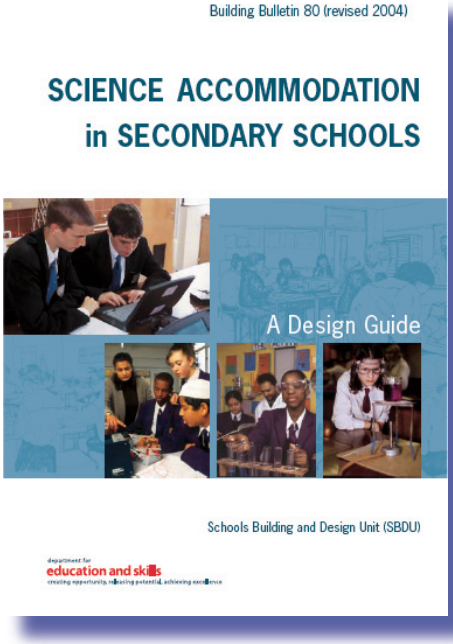
2. *CLEAPSS Hazcards* (1995 updated 2004). New edition planned for late Spring, 2007.

www.cleapss.org.uk/secfr.htm

3. *ASE Topics in Safety*, 3rd edition *2001; Safeguards in the Laboratory* 11th edition 2006, *Chemicals List* on ASE web-site

www.ase.org.uk/htm/book_store/list.php?KeywordString=Safety

4. *www.ase.org.uk/ldtl/docs/BB80.pdf*



Lampholders

Coupling rings

We were sent a tip by Inverclyde Council on a means of preventing mains lampholders such as ones fitted in microscope lamps falling apart. The key part that holds a lampholder together is the *coupling ring* (sometimes also known as the *union ring*) (Fig. 1). When the coupling ring screws tight (Fig. 2) the main parts of the lampholder are clamped shut. The danger is that the ring can come loose either because it wasn't sufficiently tight in the first place, or had been unscrewed by children.

By fitting a shakeproof washer with internal serrations (Fig. 3) between the coupling ring and the outer part of the lamp shade (Fig. 4) and securing these parts with the shade ring (fitted internally within the lamp shade), Inverclyde were able to produce a lampholder that cannot fall apart. Suitable large diameter shakeproof washers (internal type) are available from your local BSL depot. The only suitable size we could find was M27. M25 or M26 might be a better fit, but we couldn't trace them.

There is a special part which, when fitted, prevents a lampholder being opened. This is a coupling ring which has a grub screw to lock the ring in position (Fig. 5). The part name is 'Heavy BS Union Ring with Grub Screw' (product code BC4). It is supplied by S Lilley & Son Limited. A pack of 10 costs £5.68 and carriage is £3.50.

Cord grips

The type of cord grip shown in Figure 4 is not wholly dependable. This is a plastic grip which screws into the brass lampholder. Being plastic, the grub screw cannot be screwed down absolutely tight for fear of cracking and therefore tends to work loose. (The term 'cord' stands for the 3-core flexible insulated cable supplying the lamp with electricity.) Moreover because the cord is gripped by a plastic screw biting into the insulated sheath of the cord, this may result in a failure of the insulation. Summarizing the defects of this cord grip: (1) it tends to work loose quite readily; and (2) it damages the cord long term.

What are the options? Either put up with this cord grip as it is, but if you do, it needs to be frequently checked, possibly every three months, to see that it is tight, or replace the entire lampholder with one that would seem to have a superior design of cord grip, such as Lilley product number 3000E 'Cord Grip

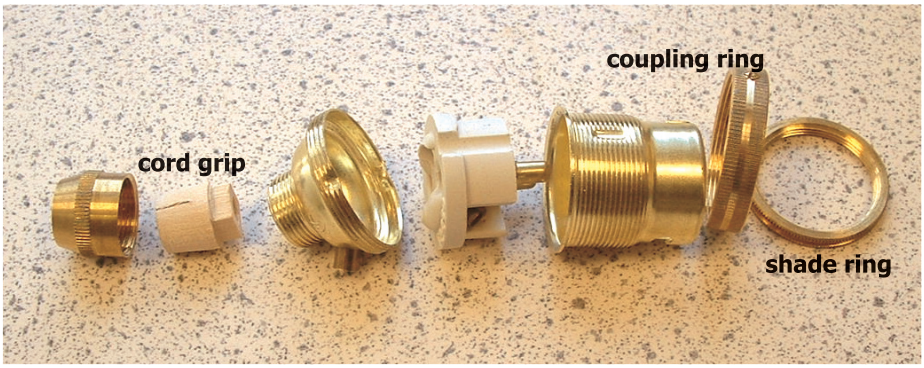


Figure 1 - Opened lampholder, showing parts (Lilley & Son product 3000E).

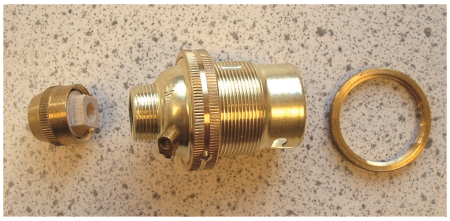


Figure 2 - Main parts held together by coupling ring.

Figure 3 - Main parts held together by coupling ring.

BC B22 Lampholder with Shade Ring and Earth', and is sold directly by Lilley in packs of 10 (£11.43 per 10). This part can be supplied with a heavy lock ring using order code B22LR, adding £2.49 per 10 to the total lampholder price. Carriage is £6.50.

This cord grip (in 3000E) has a split wooden collar that exerts uniform compression right round the cord (Figs. 1 and 5). The collar is secured by a brass ring that screws into the lampholder and can be tightened by pliers. It is less likely to work loose than the type illustrated in Figure 4.

Address:

S Lilley & Son Limited
80 Alcester Street
Birmingham
B12 0QE
Tel: 0121 622 2385
Email: sales@s-lilley.co.uk

BSL: see phone book or use this website (www.bslbrammer.co.uk/PDFs/tools.pdf) for local depot.

Figure 4 - Lampholder secured with shakeproof washer.

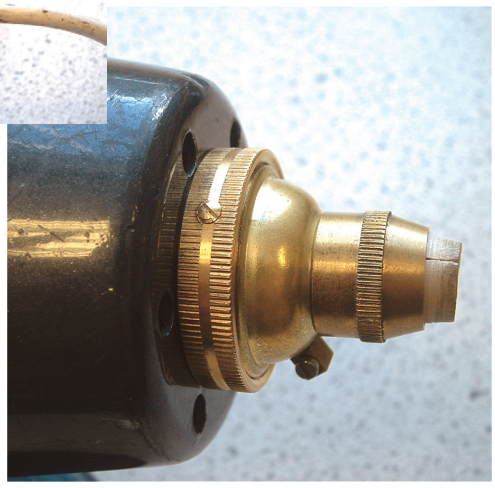


Figure 5 - Lampholder (3000E) secured with grub screw in coupling ring.

SSERC Shop - Surplus

Prices do not include VAT. It will be added to your order. Schools will be able to reclaim this input VAT. Postage and packing, will be charged for. Please don't send cash with an order, but wait for us to bill you with an advice note then pay on that. Official orders may be used. Please order at least £10 worth of goods to minimise the proportion that is p & p costs.

614 Miniature motor: 3 V to 6 V d.c. No-load current: 220 mA at 9600 r.p.m. and 3 V. Stall torque 110 mN m. Body: 30 mm x 24 mm dia. Shaft: 10 mm x 2 mm dia. 45p

593 Miniature motor: 1.5 V to 3 V d.c. No-load current: 350 mA at 14800 r.p.m. and 3 V. Stall torque 50 mN m. Body: 25 mm x 21 mm dia. Shaft: 8 mm x 2 mm dia. 30p

621 Miniature motor: 1.5 V to 3 V d.c. Open construction, ideal for demonstration. Dimensions: 19 x 9 x 18 mm. 8-tooth pinion on output shaft..... 25p

839 Solar motor: 12 mm long by 25 mm dia. Shaft: 6 x 2mm dia. (see also Item 838 - solar cell)..... £1.70

773 Tachometer (ex equipment) £2.25

811 Worm and gear for use with miniature motors, 34 : 1 reduction ratio plastic worm and gear wheel. 35p

836 Motor mounts: Plastic push-fit with self adhesive base pad. Suitable for SSERC motors 593 & 614. (pk of 10)..... £1.95

893 Zinc rods: Length 125mm, supplied packs of 10 (per pack).. £2.70

801 Propeller: 3 blades, each 62 mm. Fits 2 mm shaft 35p

792 Propeller kit: with 10 hubs and 20 blades for making 2 or 3 bladed propellers. 130 mm diameter. Accepts either 2 mm or 3 mm shafts. £3.40

790 Buzzer: 3 V. 55p

827 Buzzer: 6 V. 55p

821 Reducer: 3 mm to 2 mm, enables gears, pulleys and wheels to be fitted to motor shaft, per 5..... 25p

867 Reducers: as above but 4 mm to 2 mm, pack of 5..... 25p

868 Reducers: as above, but 4 to 3 mm, pack of 5..... 25p

165 Bimetallic strip: Original type, length 10 cm. High expansivity metal: Ni/Cr/Fe - 22/3/75. Low expansivity metal: Ni/Fe - 36/64 (invar). 15p

166 Ditto, but 30 cm length..... 40p

861 Bimetallic strip: (new type - won't rust after exposure to Bunsen flame, hence higher price) 10 cm length. 30p

862 Ditto, but 30 cm length..... 80p

837 Ring magnet: 40 mm o.d., 22 mm i.d. 35p

823 Ceramic block magnets: Poles at ends, 10 x 6 x 22 mm. 12p

723 Microswitch: Miniature, SPDT, lever operated. 40p

354 Reed switch: SPST, 46 mm long overall, fits RS reed operating coil Type 3. ..... 10p

738 Relay: 6 V coil, DPDT, contacts rated 3 A, 24 V d.c. or 110 V a.c... 75p

688 Croc clip: Miniature, insulated, red..... 5p

759 Ditto, black. 5p

788 Crocodile clip leads: Assorted colours, insulated croc. clip at each end, 360 mm long. £1.35

789 MES lamp, 3.5 V, 0.3 A 10p

690 MES lamp, 6 V, 150 mA..... 10p

866 Lens-end lamps, MES, 1.2 V. Ideal where a concentrated

691 MES battenholder. 20p

730 Battery holder: AA-type cell, holds 4 cells, PP3 outlet..... 20p

835 Battery holder: AA-type cell, holds 2 cells, PP3 outlet..... 15p

729 Battery connector: PP3 type, snap-on press-stud, also suitable for items 692 and 730. ..... 5p

882 Quartz clock movement: Dimensions: 56x53x17 mm. With wall hanging bracket. Suitable for dial thickness up to 10 mm. Includes plastic hands suitable for dial diameter to 200 mm. Requires an AA cell. (See CD Clocks, Newsletter 18.) £1.75

358 Capacitor, electrolytic: 28 µF, 400 V..... £1.00

615 Thermocouple wire: Type K, 0.5 mm dia., 1 m of each type supplied: Chromel (Ni Cr) and Alumel (Ni Al); for making thermocouples, (Bulletins 158 and 165). £3.10

640 Disk thermistor: (substitute type) resistance of 15 kohm at 25°C, β = 4200 K. Means of accurate usage described in Bulletin 162. ..... 30p

838 Solar cell: 100 x 60 mm, 3.75 V per cell max..... £2.10

507 Optical fibre: Plastic, single strand, 1 mm dia. Applications described in Bulletin 140 and SG Physics Technical Guide Vol.1. Priced per metre. 50p

508 LEDs: 3 mm, red. Price per 10. ..... 50p

761 Ditto, yellow. Per 10. ..... 60p

762 Ditto, green. Per 10..... 60p

891 Ultra Violet LEDs: 5mm LED in plastic clear untinted package.
Peak wavelength: 400nm; Spectral halfwidth: 20nm; Viewing angle: 20°
Luminous intensity: 160mcd; Emission: Violet & UV; Forward voltg: 3.8V
Typical operating current: 20mA; Series resistor for 5 V supply: 68 ohm
Cathode identified by short leg or flat on rim.
Also included with your order of UV LEDs supplied from SSERC, are the following items at no extra cost:
* Hazard sign with adhesive backing (1 per LED)
* UV filter film, cutoff wavelength about 390nm, 3 sq in (1 per LED)
* Instruction sheet, including risk assessment (1 per order)
* Manufacturer's data sheet (1 per order)
* Experimenting with UV LEDs, reprint from Bulletin 206 (1 per order).....£1.50 each

Light Shaping Diffuser - As described in SSERC Bulletin 216, page 6. Supplied in 35mm slide holder, two types:

894 Elliptical cross-section beam. 40° x 0.5°..... £4

895 Round cross-section beam. 10°..... £4

883 Convex meniscus lens: Focal length = 500 mm, dia. = 50 mm. APPLICATON: Demonstration of large scale, circular, interference fringes with laser radiation. Manufactured specially for SSERC with generous grant from EPSRC. £7.00

860 Nylon mesh for protoplast isolation/fusion protocol, 70µm pore size, per 305 mm square..... £7-00

Latest Equipment Offers available online on the SSERC website (below left) - http://www.sserc.org.uk/members/equipoff.htm