CLEAPSS For teachers and technicians

CIRCULATION LIST SCIENCE AND D&T

160 Autumn 2017

BULLETIN

Practical support for Science, D&T and Art

Editorial

CLEAPSS or CLEAPSE. Next steps in the evolution of CLEAPSS

What does the name CLEAPSS stand for? Few people realise that the name CLEAPSS was an acronym of the Consortium of Local Educational Authorities for the Provision of Science Services. As there are no Local Education Authorities anymore, CLEAPSS is now just a name. Until 1988 the organisation was known as CLEAPSE, the Consortium of Local Education Authorities for the Provision of Science *Equipment*, having started life designing and making apparatus to support the teaching of *modern* science. A clue to the unusual status of CLEAPSS is in these names. It is a *consortium* rather than a company. Until very recently all 182 local authorities in England, Wales and Northern Ireland were members of the consortium. Currently membership stands at 175 local authorities as in the last couple of years a small number of authorities in England have chosen to leave because most of their schools have become academies. Faced with this, and other changes, the local authority that employs the CLEAPSS staff on behalf of the Consortium has indicated that it wishes to withdraw from this arrangement. With similar circumstances facing all authorities it seems timely for CLEAPSS to review its governance arrangements. A number of options are being actively considered with the current front runner being conversion to a Charitable Incorporated Organisation (CIO). Suffice it to say that whatever these changes bring, CLEAPSS will continue to offer the same high quality services and the same exceptional value for money to all its members.

Sad news

It is with great sadness that I have to report the death of the CLEAPSS office manager, Pauline Mead. Pauline had worked at CLEAPSS for 37 years joining the organisation in 1980, and was the longest serving member of the current team. Pauline had developed a wealth of experience about CLEAPSS and how it works, particularly membership and its finances. Many of you will have been in contact with Pauline about invoicing and other membership matters. We extend our sympathy to Pauline's family and in particular to her daughter Vicky.

New advisers join CLEAPSS

We are delighted to welcome two new advisers who joined us in the summer term. Ai-Linh Tran is our new biology adviser, who is replacing Mary Philpott. Magda Polec has joined as an additional chemistry adviser. It is a little known fact that around 48% of helpline queries are about aspects of chemistry teaching so Magna adds much welcome expertise and capacity in this area.

Open evenings

The autumn term is often the time for inviting parents and potential pupils in to visit your school. Whilst thinking about and planning an open evening event, have a look at our guidance leaflet PS058 *Open evenings* for some useful advice and warnings.

CLEAPSS at ASE 2018

As ever, CLEAPSS will have a strong presence at the ASE Conference in 2018, which is being held in Liverpool. We will be running hands-on workshops in the *practical hub* during the Thursday and Friday plus a number of talks and lectures about how to get the best out of practical work, and more adventures in the world of microscale with Bob Worley.

Also make sure you come over to our stand in the exhibitor's tent, to collect your 2018-edition CLEAPSS mug and have a chat to CLEAPSS staff. See you there

CLEAPSS tries things out!

You might be wondering how it is that CLEAPSS practical methods have a habit of actually working. The answer, which is shockingly simple, is that we try them out before we publish them.

CLEAPSS HQ has a fully equipped laboratory as well as a clean room and a workshop. This means that we can test out our bright ideas before we release them to you. We can also try out activities that you ask us about, particularly those where you cannot get something to work. Our facilities also allow us to revisit traditional methods and see if we can simplify or improve on them.

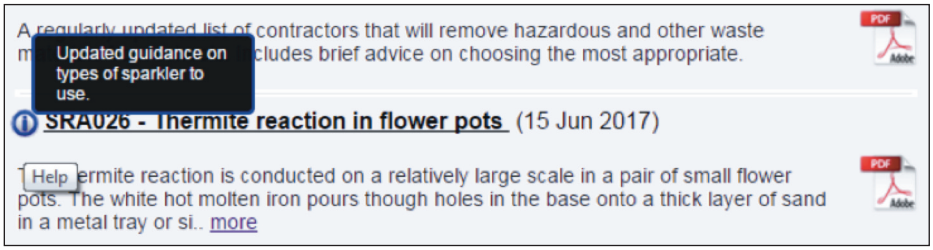
One of the interesting things we have noticed in recent year is how many of the established ways of doing practicals that have been around in schools for years have never actually been optimised. We are guessing that long ago in the mists of time someone tried something out, it worked and so everyone has just carried on doing it like that ever since. A recent example of this was the need to add ethanol

when making up some indicators, for example methyl orange. Recent work at CLEAPSS suggests that many of these will work equally well with just distilled water. This change makes them easier and safer to make up. Look out for future guidance on this.

What's New – Don't forget the 'i'

On the new secondary science website there is a handy function, which allows you to keep up to date with all new and updated CLEAPSS guidance. In *What's New* we list all new and revised guidance. There is also an additional functionality which allows you to find out what is new about the guide.

If you hover your mouse pointer over the 'i' (see image below) then a pop-up box will appear telling you what is new about that guide. It will either be a new resource i.e. brand new, or if it is an update then it will explain what the update is. Below is an example of one such update.



Good Practical Science; a Gatsby Foundation report

The Gatsby Foundation has long championed the importance of good practical science and its latest effort is an international review led by Sir John Holman. The challenge to John was simple, though not an easy task: was it possible to develop a framework for good practical science in schools that would be applicable and helpful to most secondary schools in the country?

The short answer was yes. John and the Gatsby team, using a model of international visits, surveys and literature reviews, have developed a framework of ten benchmarks that have the appropriate flexibility to make them relevant for all.

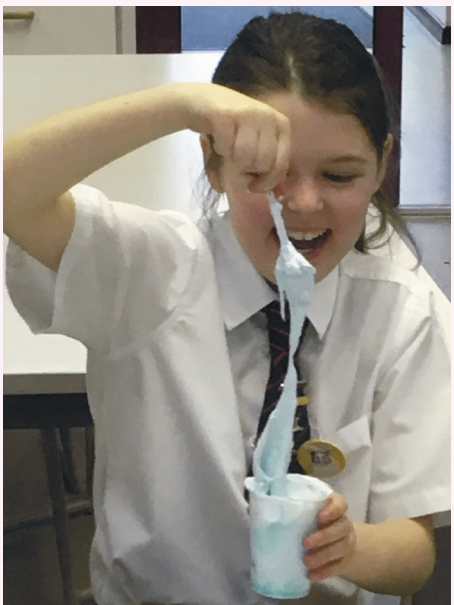
The research and visits undertaken for this report revealed that where science education is good, practical science is good, well-planned, frequent and varied. The report also highlights that in terms of equipment and facilities we are relatively well catered for in this country. In most cases a reprioritisation of teaching time could transform, for the better, the practical science offered to our young people. The report is due for publication in autumn 2017. Visit www.gatsby.org.uk/GoodPracticalScience for updates and progress

Science practical work in Holland

Science practical work in Germany

Slime

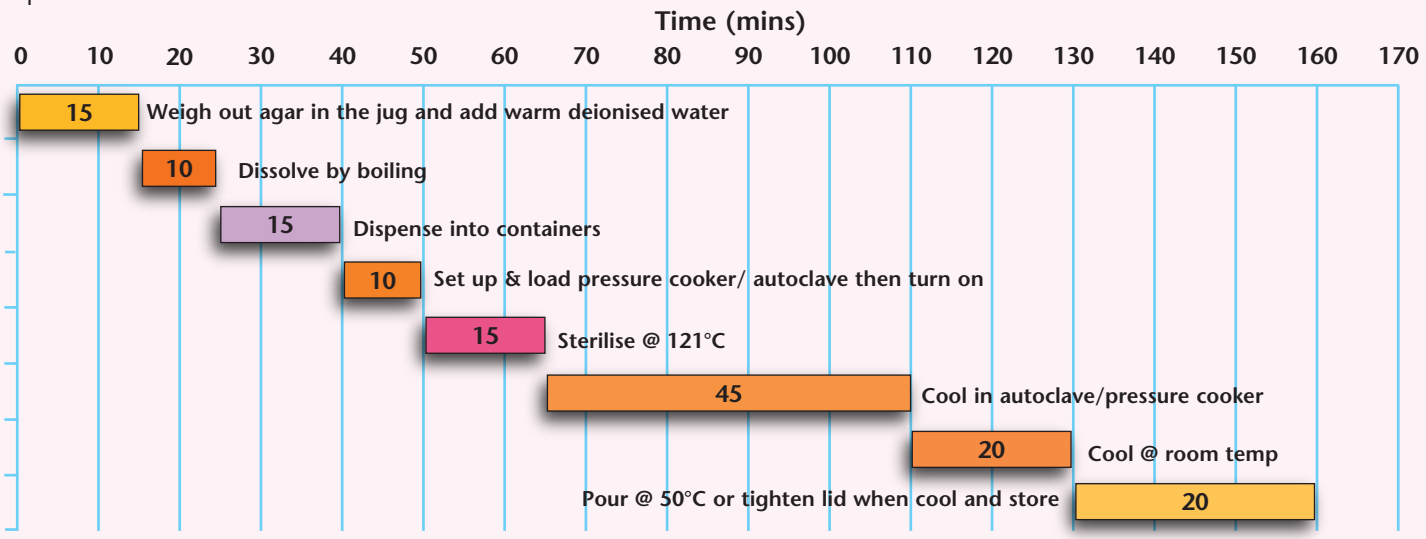
CLEAPSS now has a new 'safer slime' activity available. The activity P042 – *Slime time* has been specifically designed for use in primary settings and by primary aged children. If you have primary children visiting your school and would like to use this activity please search for 'slime' on the new CLEAPSS primary website.



Planning for microbiology

It is important to plan well in advance for microbiological practicals as preparing agar can take approximately 3 hours from initially weighing it to pouring the agar plates. However, a key misconception is that agar needs to be made just before the lesson. This is not so! It can be prepared in advance, sterilised and stored in medical flats or universal bottles. This can help alleviate much of the stress within the prep room for last-minute orders.
The Gantt chart below gives the approximate time for the preparation of 1 litre of agar for class use. See the guidance leaflet GL229 for details of how to do this. The actual timings would depend on your resources, the number of bottles being prepared and how successfully you manage to avoid interruptions during the process!

HOT OFF THE PRESS! We have recently published a document on agar, GL229 titled *Agars for Microbiology*. This comprehensive guide covers from the basics of types and uses, down to the nitty-gritty details of how many Petri dishes can be poured from a litre of agar.



The plates can take between 30 minutes to 2 hours to solidify depending on the room temperature. The best time to prepare agar plates is the day before so that they have time to set completely and to allow some residual condensation to evaporate.

Remember to: weigh out the agar powder in a fume cupboard that is turned off to prevent dust being raised (you can become sensitised if over-exposed), and use aseptic technique (to prevent contamination) when pouring plates.

V8, SMA & Nutrient Agar

'So, how long do agar plates last?' Well, if you store them stacked upside down they can be left at room temperature (not the fridge) for at least a week. If there are no signs of contamination and the plates have not dried out then you can still use them. With storage bottles, tighten the lids when they have cooled down and store in a cupboard or drawer. They will remain viable for many months. Simply, melt the agar again when you need to use it.
Look out for revisions to our microbiology publications in the future.

Saving your school money. Cautionary tales of good intent

We were recently contacted by a technician who found an autoclave on ebay for less than half the price of a typical model and had gone ahead and ordered it …. from Wisconsin…. using his personal bank account. Unfortunately it wasn't until later that problems were revealed. The device was not CE marked, did not conform to the Pressure Equipment Regulations and was probably not legal for sale in the UK. Furthermore, it did not come with a written scheme of examination for use under the Pressure Systems Safety Regulations. Sadly in this case, the technician ended up out of pocket as the school refused to reimburse him. CLEAPSS advice is to be wary of buying things on-line, and definitely to avoid safety-critical items supplied directly from overseas.

In a similar vein, we have had a number of requests from technicians and teachers for us to reimburse travel or hotel costs associated with CLEAPSS courses that have not run because of disappointing recruitment. CLEAPSS advice is not to book non-refundable hotel or travel until you have received a final e-mail confirming that the event is to go ahead – usually 10 working days before the course. Advanced booking of non-refundable deals is usually cheaper than refundable ones, and a desire on your part to save your school money is understandable. However, both of these involve an element of risk that CLEAPSS cannot offer to underwrite. Our training represents extremely good value for money (£125 a day, per delegate) but this is only possible if we operate this no reimbursement policy. Remember to check your school's policy on booking travel & hotels in advance, and remember if the school wants you to save them money by booking non-refundable deals then it must carry the associated risk.

Remember, remember the 5th of November… Oh and don't forget to read PS81

As the nights draw in people start to think about fireworks nights, and recreating explosive science in the lab. There are plenty of relevant practicals you can do. However, school staff are legally bound by the explosive regulations, which place certain restrictions as to what you can and can't do in schools. If you want to know more about this, read CLEAPSS Guide PS81 Fireworks and explosives, or contact the CLEAPSS *Helpline*.

In other news, we have clarified the type of sparkler used in our version of the Thermite reaction; you need to ensure you are using a genuine Category 1 sparkler. A Category 1 sparkler should not carry any wording suggesting that it is for 'outside use only'. If such wording is present you should treat the sparkler with caution and check it carefully against the guidance in L195 or SRA026. If you are still in doubt please contact CLEAPSS for further advice.

Problems with stored bottles of corrosive chemicals.

We have received a number of *Helpline* queries recently involved plastic bottles containing concentrated nitric acid which appear to be to be leaking and/or releasing corrosive/toxic fumes (see Bulletins 125 and 152 for similar reports). Some of these bottles are several years old – purchased as long ago as 2008 and dating to the period when many suppliers switched over from glass to plastic bottles.

We are investigating this and will issue more detailed guidance during the autumn term.

Be vigilant when using **plastic** bottles containing **corrosives**. Look out for obvious signs of leakage from the bottles, unusual smells or unusual deposits on the outside of the bottle. If you notice any of these or have any other reason to be concerned about the condition of the bottle do not attempt to move it. Contact CLEAPSS for further advice

Please note that at present this advice applies only to **plastic** bottles containing **corrosives**. You do not need to carry out a full scale audit of all plastic bottles. At this stage it would be appropriate to proceed with caution, as suggested above.

Chemicals not listed on *Hazcards* or E233

It is vital that staff in schools manage all chemicals competently and safely, and part of this is providing the chemical with an appropriate hazard labelling.

Generally, if in doubt, teachers and technicians will follow CLEAPSS' published advice. However, a number of technicians told us that, in their chemical stores, they had some chemicals we don't list on Hazcards or the Chemical Stocklist, E233.

There may be several reasons for this:

- The chemical might be there, but under an alternative name. Search for it in E233 or GL121 *Hazcard Index*.
- The chemical might not have been used widely in recent years. If it is really no longer used, then dispose of it through a registered waste disposal company. However, if it is still being used then please let us know what for so we can consider adding it to our list, or suggest safer alternatives if appropriate. In any event, contact us for advice on how to label the chemical.
- The chemical may be a mixture, eg, Biuret or Benedict's reagents or universal indicator. Refer to the *Recipe Book* if you have made the reagent from a CLEAPSS recipe. If it was purchased, see how the supplier has classified and labelled it and convert it to a relatively similar CLP version. Do your best with this labelling and follow CLEAPSS guidance. If you are in the process of relabelling older chemicals in the store, follow our general advice in GL111.

When you use chemicals, refer to more-detailed activity-specific guidance for advice on control measures.

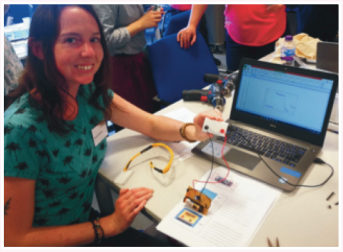
We will review our documents and consider including any additions when we bring out the next editions, so your feedback is welcome.

A new way of thinking about practical science

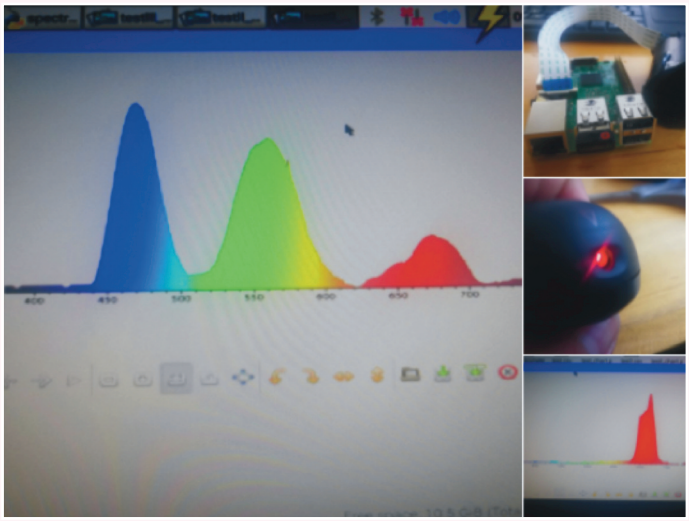
Over the last few years a so-called 'maker-culture' has swept the world with a massive following. People who use new technologies to build objects, which replicate what a purchased version can do for a fraction of the cost, are known as 'makers'. This leads to a very exciting question; can we make our own scientific equipment? The answer is yes.

Over the last couple of years, CLEAPSS has developed new and innovative ways of carrying out certain practicals in Physics. These include a millisecond timer for acceleration due to gravity, a light gate to measure the acceleration of a cart, a voltage logger, and even an interface to log your GM tube's pulses to a computer (useful for classroom demos). Most of these use the Arduino microcontroller platform. These have all been mentioned in previous Bulletins, but their usefulness in making scientific equipment at a relatively low price is astounding. Look out for more guidance and a 'getting started' guide in the near future. Project boxes and even LCD displays can be easily attached enabling a sense of professionalism to your project.

Delegates at the ASE Conference in York last summer had a chance to make their own Arduino-based voltage loggers which can be used in capacitor-decay experiments (see picture top right). All the delegates involved managed to successfully make the apparatus. We talked about the need to program the controller and asked them to copy and paste the code (all code for these projects can be found in the relevant guides) and then they soldered the circuit. It took around 20 minutes to complete, demonstrating that making such apparatus for yourself can be quick and pain-free.



Other programmable platforms, such as the BBC Microbit and the Raspberry Pi, can be used. We stumbled across an excellent tutorial to use a Raspberry Pi to build your own computerised spectrometer with a total project cost of about £40. The tutorial is at:
http://blog.durablescope.com/post/BuiltASpectrometer/
and we used our own guidance on a mobile phone spectrometer http://science.cleapss.org.uk/Resource-Info/GL143-Making-your-own-phone-spectrometer.aspx. This will allow you to take pictures of the spectra, and the software will place it on a spectrogram enabling peak wavelengths to be determined. The photo below shows the spectrum for a white LED. We normally tweet this sort of opportunity, so follow us on twitter.com/CLEAPSS to stay in the loop!



Ultraviolet lamps

It appears the, *de facto*, school UV-C source, the TUV6 bulb, has been quietly and unceremoniously discontinued by its manufacturer Phillips. We recommend looking after these bulbs if you have them, as they are needed for the photoelectric effect experiment in A-Level Physics.

However, you can also purchase hand-held, battery-powered UV-C sterilisers that emit UVC from a lamp rated at about 3W. These are advertised for killing bacteria, viruses and moulds and have a relatively broad beam for sweeping over surfaces. They are much more hazardous than hand-held low-power UVA ultraviolet lamps and could be easily mistaken for one.

With care, they can be used as a source for demonstrating the photoelectric effect because the output is almost all in the UVC band at 254 nm. If you chose to purchase such a device, we advise you chose one that is battery-operated with a UVC lamp rating not more than 6W.

CLEAPSS obtained a hand-held battery-powered sterilising wand (a Verilux Cleanwave) to test the output which was given as 3W. The irradiance measured just outside the wand aperture was 2.7 Wm-2. At this level, if you put your fingers in front of the aperture the exposure limit would be exceeded in approximately 20 seconds. For activities such as demonstrating the photoelectric effect, consider mounting the device in a stand and clamp (but don't overtighten the clamp) with the beam directed downwards onto the zinc plate, away from the eyes and skin. We have spoken to a few school science suppliers who may release a laboratory UVC source in the near future.

See the CLEAPSS leaflet GL127 *Ultraviolet (UV) light sources*, for further information

Mainly D&T

Over the past two terms we have been developing and testing the new CLEAPSS D&T website. All the materials that were on the old site have been transferred across and the new site is now live. From it users can access Futureminds, safety documentation and CLEAPSS services, such as courses and the Helpline.

A significant addition to the new site is a 'Projects' section. This contains a number of typical projects or themes that we see being delivered in D&T, Food, Art and Design or Construction. For each 'project' we have identified a number of key CLEAPSS documents that teachers and technicians should be aware of when planning their activities. We do not expect our 'projects' to match with everything a department may be teaching, but we hope that they represent the sorts of activities being undertaken. For example, many schools make clocks with KS3 pupils, so there is a 'project' entitled clocks. Within the clock page is a list of MRATs and other associated items that should be referred to in planning this type of activity.

We intend to build upon these projects over time, so if you have some interesting projects and would like to help us, please send a brief outline of the activity with a couple of high quality images of a finished artefact and we will generate the associated documents to go with it on the website.

Send ideas or comments about the new website to: dt@cleapss.org.uk

Futureminds has proven to be a great success amongst those that have seen it. We have seen around 2000 downloads of each edition over the past year, so we would like to say a big thank you to all of the contributors.

The summer edition had lots of information about the new GCSE which will now be live in most secondary schools. It also had a number of interesting food articles and stories from the 4x4 challenge, CAD and 3D printing, robotics and material technology.

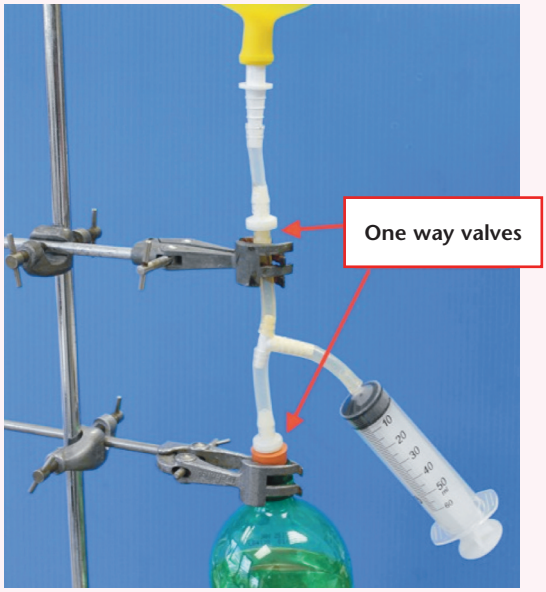
The autumn edition is being prepared as you read this Bulletin, with articles from the Food Teachers Centre, Textiles Academy, Celtic Kilns and a number of other educational suppliers and support agencies. There will also be an article detailing the findings from our work with HSE on the use of 3D printers in schools, which includes information about the control measures schools should consider when embarking on the use of these machines.

The final few pages of each of the ***Futureminds*** publications contain the *smallprint* which includes our H&S updates for schools, and some of our more popular tweets.

If you have any comments about ***Futureminds***, or would like to contribute an article, please contact Dave: dt@cleapss.org.uk

Gas-filled balloons

Filling balloons with a gas for demonstration purposes can prove difficult unless you use a gas cylinder. We have developed an alternative which uses a 60 ml plastic syringe and two non-return valves to draw up gas that has been generated and collected in a plastic container. The gas can then be forced into the balloon. The gas can only move in one direction due to the one way valves and the balloon can easily be tied off when full. This is being trialled at CLEAPSS and we consider that it may have other uses, such as creating a vacuum for filtration.



Knitted CLEAPSS!

It was a typical busy day on the Helpline when a large cardboard box appeared in the office. Prising it open, we received the most amazing surprise – A SET OF KNITTED REPLICAS OF OURSELVES!!!

Our wonderful knitting technician friend Maggy Fillery from Bethany School had spent 3 years creating cartoon versions of all the CLEAPSS staff pictured in *Bulletin* 151 and a few who had escaped that photo opportunity, plus a doughty technician to organise our model Chemical Store. These knitted classics currently live on our bookshelves, smiling down on us as we hold our meetings, and they will be accompanying us at conferences and exhibitions. Even our hairstyles and clothes have been lovingly recreated. The knitted technician, who is yet to reveal his name, has already started traversing the country, assisting with Safety with Chemicals courses. We feel deeply honoured to be captured in this way and send our thrilled thanks to Maggy for such a lovely present.

CLEAPSS working with Chinese teachers

For a fortnight at the start of the summer holidays, CLEAPSS advisors Samir and Chris ran STEM workshops in China for teachers. This was arranged as part of a joint venture between Essex County Council, CLEAPSS and the Jiangsu Province educational board. In China, practical work in school science is much less common than in the UK, a situation that many Chinese educators would like to change. Over the two weeks, nearly 100 teachers worked through various CLEAPSS procedures, and even had a chance of making their own equipment. Not only did the delegates see science demonstrations and how they should be carried out safely and successfully, they also managed to have a go at experiments themselves. This was an important step in building confidence.

It was an eye-opening experience for the delegates. It was very encouraging that, despite their limited practical experience, the delegates were determined to implement many of the ideas in their classrooms. They recognize that where students are engaged in science (and what better way to engage them than by practical science) they will be better motivated toward getting the best exam results, and it will help them draw links between what is observed and the theory.

Delegates had an opportunity to make the CLEAPSS Laser modulator, and found our guidance, with its wealth of pictures, easy to follow. Building the CLEAPSS voltage logger to test RC circuits was also a big hit. Many links to STEM areas were discussed, from computer programming for science to 3D printing robots, and the CLEAPSS space mission from last year.

using the CLEAPSS colourimeter

Sharing the experience of making equipment

Free workshop for technician groups

Last summer glassware manufacturer SciLabware ran free workshops for technician groups around the country,
the aim of which was to help technicians make informed choices when it comes to purchasing glassware and plasticware. The workshops have been very popular and SciLabware is pleased to announce that it will again be offering these free workshops.

For the latest information, including booking details, please see http://www.scilabware.com/TECHNICIANS-WORKSHOP/

CLEAPSS Technician Training Programme

The 2017 CLEAPSS Technician Training Programme group

The majority of technicians who took part in this year's programme were fairly new to the job, but some have been working as a technician for a while. They all brought a variety of experiences and expertise from previous work, which they were able and willing to share. Overall, therefore, the group 'gelled' very well and their feedback has been very positive. Everyone on the programme felt the training gave them greater confidence to carry out their jobs and raised their profile. They also came away with lots of new ideas to try out and a group of colleagues to network with. Have a look at Tweets by @cleapss #cleapsstraining to see Sherline's informative record of the how the programme went.

Next year the CLEAPSS Technician training programme will be run at CLEAPSS, which is on the campus of Brunel University in Uxbridge. It will run over the same sort of time as this year's programme, which is from February to July 2018, with a day's training taking place roughly every two weeks.
See our website for further details.

CLEAPSS cluster of courses in January 2018

As usual we will be offering 4 courses on successive days, between Tuesday 30 Jan and Friday 2 Feb 2018 in our lab in Uxbridge. The 4 courses are the 3 with an * in the courses table below and a once-only offering of the intermediate level course Supporting Safe and Successful Classroom Chemistry. See the website for details.

Forthcoming Courses

Course	September	October	November	December	January 2018
Don't buy it, make it			Keele		*Uxbridge
Electrical Inspection & testing (PAT testing)		East Sussex	Hertfordshire, York		
Fume cupboard testing					
Health and safety for science technicians	Preston	Essex, Southhampton, Manchester	Wrexham, London, Birmingham		
Health and safety management for heads of science	Bradford		Sheffield, Cumbria, Southampton		
Health and Safety update for science teachers	Coventry	Sheffield	Southampton	London	
Introduction to preparing solutions and apparatus safety		Wimborne	Southampton, Gloucester		
Introduction to supporting physics teaching		Devon	Southampton		
Keep it safe. Health and safety in practical science for new teachers			Birmingham, Sheffield, Uxbridge, Leicester	Southampton, Wiltshire	
Microscope maintenance		London			
Prep room management and H&S for senior technicians		Skipton, London	Birmingham	Leicester	
Radiation Protection Supervisor training Full day	London	Keele, Southampton	Birmingham, London, Barnsley	Manchester, London, Leicester	London
Reduced and microscale chemistry					
Safety inspection of autoclaves, pressure cookers & model steam engines					*Uxbridge
Safety with chemicals for technicians				London	Devon
Supporting safe and successful classroom physics	Leicester	London	Devon, Essex	Worthing	*Uxbridge
Supporting safe practical microbiology I	York	Hull, Skipton	Wigan, London, Sheffield		Keele
Working with Glass		North Yorkshire	Southampton		
Auditing H&S in D&T					
Health and safety management for heads of D&T					
Supervising health and safety in D&T					
Primary science: Making science fun and memorable			Uxbridge, Cumbria		