Early career teaching – and microscale chemistry!

Sarah Longshaw

Hello!

Would you believe that, by the end of this month, we will be more than halfway through the academic year? Perhaps it's time to stop for a moment and reflect on what you have achieved so far this year. As teachers, we are always looking to improve our practice, to find new ways of addressing topics, and that's one of the things that makes teaching so rewarding – the endless variety. So, for those who haven't already encountered it, I'd like to introduce microscale chemistry, which I hope you will embrace as a useful addition to your repertoire.

Microscale chemistry is chemistry done on a smaller scale and often with simpler equipment and much smaller quantities of chemicals (this makes it much more sustainable and often a lot less expensive). However, the benefits don't stop there – it can also be easier for students to carry out (so reducing the cognitive load) and it can aid behaviour management, (since students need to move around less to collect and assemble equipment) and there is less clearing up (thus avoiding those usual pinch points around the sink!).

Let's take an example: one of the common practicals for Key Stage 3 (ages 11-14) chemistry is the testing of household chemicals, usually with Universal Indicator, to determine whether they are acids or alkalis. Typically, a class would have a range of chemicals including vinegar, lemon juice, soap solution, washing powder (solution), household cleaner, fizzy water, lemonade, and so on; they would test each one, record its colour and match this to the colour chart; then record the colour and pH. In a class of 30 students working in 3s (10 groups), with the seven substances mentioned, that would amount to 70 test tubes that are needed – so, two test tube racks per group before we even get on to how to share the substances tested and the need for accurate labelling!

How much simpler, then, to carry the practical out on a worksheet – like the one shown in Figure 1.

Acids & alkalis

- Place a drop of indicator onto each circle
- Place a drop of the solution indicated on top of the indicator
- Record the colour that the indicator changes to, in your table
- Record the pH value in your table (by matching the colour of the solution on the pH chart)

Vinegar	Lemon juice
Milk	Hydrochloric acid
Soap solution	Sodium hydroxide
Tap Water	Washing Powder
Toothpaste	Oven cleaner

Figure 1

This worksheet can be customised by the teacher to include only the substances being tested, and then placed inside a plastic wallet. The student will still need a table in which to record their results, but the solutions are placed onto the circles on the sheet and the indicator added on top (reducing the volumes used), making it less likely to muddle up the solutions being tested. It is also easier to compare the colours (as shown in Figure 2). At the end of the lesson, the plastic wallet is simply wiped down with a paper towel.

This technique of using 'puddles' on a worksheet in a plastic wallet works really well for precipitation reactions, such as the identification of halide ions

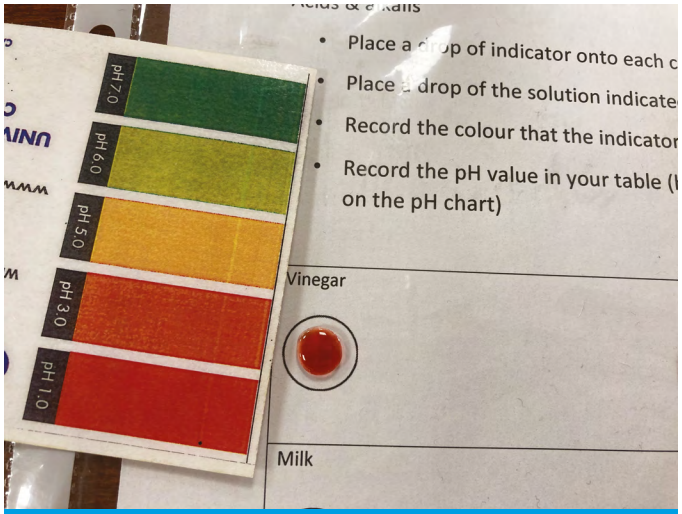

Figure 2

by adding silver nitrate solution. Using only small quantities really focuses the students' attention and they can watch the precipitate appear before them more easily than if they are carrying out the method in a test tube. Furthermore, because they use far less of the silver nitrate solution (which itself is costly), you can afford to carry out the practical in a number of different lessons. This revisiting helps to embed the knowledge in the students' memories and allows us to show how the test can be applied in real-life scenarios (developing those AO2 skills).

There are many different ways in which microscale can enhance chemistry teaching. The new book from ASE, *Understanding Chemistry through Microscale Practical Work*, written by Bob Worley and David Paterson, provides an excellent starting point. The book is set out to cover particular topics such as Quantitative chemistry or Rate and equilibrium, outlining the concepts being developed and suggesting some suitable microscale activities. Each chapter also examines a different aspect of pedagogy and includes further reading and suggested teacher activities. The book has been written by expert practitioners, is accessible and easy to read and will appeal to technicians and teachers alike. As expressed in one of the quotes from the book, *'In a little you can see a lot!'*.

See page 24 for more details about this exciting new publication from ASE, and how to order your copy!

New online science festival gets curious about the human body

Explore the amazing human body in this **free** online festival taking place on 9th-11th March 2022. *Curious About The Human Body* offers schoolchildren the opportunity to engage with STEM professionals through live online talks, videos and additional digital resources.

The festival has been specially curated for pupils aged 7-14 and is broken into four content sections:

- Body bits – looking at how the different body systems work, such as heart and lungs, the mind, and immune systems;
- Health tech – exploring innovative technology used to investigate and diagnose, such as using virtual reality to understand diseases better, machine learning algorithms to prevent the next pandemic and using artificial intelligence to detect cancer;
- Who are you – exploring DNA and how your genes make you who you are; discovering how DNA can be extracted and how fingerprints can be collected and analysed; and
- Keeping healthy – looking at at how to support a healthy body, including eating the right food or what a day in the life of a nutritionist looks like.

Pupils will have the chance to meet the experts live and ask questions in online interactive talks. For example, let Professor Judith Pratt from the University of Strathclyde take you on a tour of the brain, or find out more about what happens to the human body in space with former TEDx speaker from King's College London, Lauren Church.

Some of the other contributors to *Curious About The Human Body* include the Wellcome Centre for Anti-Infectives Research, European Institute of Innovation and Technology, Industrial Centre for Artificial Intelligence Research, European Space Agency, Leverhulme Research for Forensic Science and the Life Science Centre in Newcastle. More names will be confirmed and added to the line-up nearer the time.

Curious About The Human Body has been organised by Glasgow Science Centre, which started the *Curious About* digital science festivals as a platform for school science engagement during the COVID-19 pandemic. The festival website is live from 22nd February for everyone to browse the educational content available, and you can also sign up to the mailing list to receive newsletter updates.

Visit: https://curiousabout.glasgowsciencecentre.org/ to find out more.