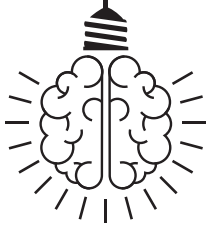
Teacher's notes

- bringing Catalyst alive in the classroom



Discover ideas and resources to build on the ideas covered in edition 29 of Catalyst.

Contents

Extracting limonene: a teacher's guide

By Mark Langley, Professional Development Lead, STEM Learning

Matching article:
'From orange peel to chewing gum?'

Supporting resources:
www.stem.org.uk/ca/limonene

Orange peel contains a large amount of limonene, but it can be interesting to compare it to other citrus fruits as well (limes and grapefruits work well). The practical procedures support students developing key techniques.

Most of the limonene is contained in the citrus oils, found in the outer peel rather than the pith, so students should be encouraged to peel the fruit carefully. Most students will be happy to peel the fruit - however, some people are sensitised or allergic to citrus, so alternative activities should be considered.

Student practical

The simplest extraction is to place the peel into a side-arm boiling tube roughly a third full, and add enough tap water to cover the peel. The tube should be clamped to avoid movement. The side arm tube should have a delivery tube attached, which acts as an air condenser, leading into a test tube. If the boiling tube is heated gently until the water starts to boil, a mixture of the citrus oil and water will distil over into the test tube. Encourage the students to heat gently - holding a Bunsen burner may give more controlled heating.

The distillate produced will be a mix of many compounds, but there will be enough limonene present to test for the presence of unsaturation - so a few drops of very dilute bromine water or acidified potassium manganate (VII) solution will be decolourised. Looking at a model or structure of limonene, students can identify function groups and also why limonene responds to an unsaturation test.

Teacher demonstrations

Orange peel, chopped and mixed with water, can be refluxed for about 10 minutes, allowed to cool and then set for distillation. A mix of water and limonene will distil over - this can be seen as a thick meniscus on the distillate collected. Careful use of a disposable pipette can allow you to 'hoover-up' the oily layer and transferred into a small bottle. This will smell very strongly and could then be reacted further for unsaturation tests - or even used as an air freshener by allowing it to evaporate!

This practical can be a good introduction to reflux and distillation techniques for advanced level students - before they tackle potentially more hazardous reactions.

Steam distillation

True steam distillation uses a supply of steam to pass through a gently heated sample of the material, in this case citrus, to remove compounds of interest. This is particularly useful for materials with high boiling points (such as limonene at 176°C) but which may react or decompose when heated in air below their boiling points.

It is possible for students to do this, though it can be challenging. For some useful resources to support this, follow the resource at the top of this section.

The plasma globe mystery

2

By Tom Lyons, ESERO-UK Teaching Fellow, STEM Learning

Matching article:
'Recreating the conditions of space at our fingertips'

Plasma is ionised gas. It can be fully ionised, like in the Sun, or partially ionised, as it is in neon signs. Students can observe plasma in the classroom using a plasma globe. Here is a suggested teaching sequence that will add some mystery and get your students thinking:

1. Connect and switch on the plasma globe and cover with a cardboard box, before the students enter the classroom.
2. SAFETY - cover the other electrode end of the fluorescent tube with electrical tape as touching the electrodes can cause a shock, when near the plasma globe.
3. Hold one end of the fluorescent tube near the cardboard box and watch as the tube lights up between your hand and the end of the tube.
4. Students can give their ideas about what is inside the box and how it can make the fluorescent tube light up.
5. Remove the box and let the students touch the globe so that they can see the path of the plasma inside the globe.

The electric field inside the globe ionises the noble gases inside, with the plasma filaments taking the path of least resistance. The electric field can also cause the mercury vapour in the fluorescent lamp to be excited, producing UV radiation which causes the phosphor coating inside the tube to fluoresce.

Ugly animals need love too

3

By Karen Hornby, Subject Specialist, STEM Learning

Matching article: **'For me, the idea of de-extinction is now as dead as a dodo'**

Supporting resources:
www.stem.org.uk/ca/ugly-animals

There have been many campaigns to raise awareness of the needs of endangered animals but these have tended to focus on beautiful, cute and fluffy species. But ecosystems need the less aesthetically-pleasing animals just as much, and these are species that are less likely to attract support campaigns.

We've found a great resource to challenge students to undertake their own ugly animal research, looking at how the extinction of species affects the ecosystem, adaptation, evolution, and the medical and other benefits that some animals can bring.

The activity is introduced with a video showing several examples of medicines from ugly animals, including spider venom used to treat cancer and a poison produced by the cone snail used in pain relief. Two hundred different secretions with medical properties have been isolated from frog skin alone, including antibiotics which could be used to treat resistant strains of diseases such as MRSA. When a species dies out all of the potential treatments are lost with it.

And don't forget about plants! The Millennium Seed Bank aims to conserve plant species by the long term storage of their seeds. Johnathon Kendon, conservation biotechnologist at Kew, contributes to the conservation of orchids, ferns and other plants threatened with extinction by such things as deforestation, climate change, collectors or volcanic eruptions. We've included a set of activities in which students consider the effect of human activity on the environment and find out about career opportunities available in ecology and plant biology:

But what can happen if you do reintroduce a species into a habitat? We've added a surprising video about the reintroduction of wolves to our list of useful resources.

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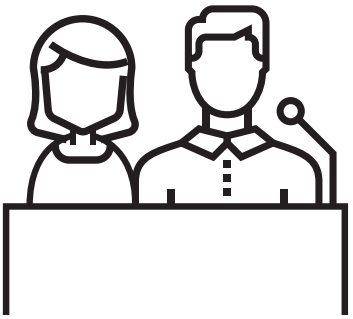

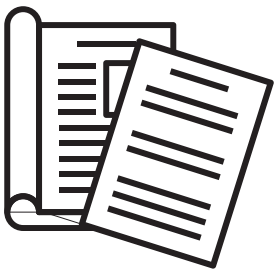

Thank you

We hope you enjoyed the 'new look' Catalyst, and matching teachers' notes. If you have any feedback, or ideas for topics you'd like to see covered in future editions please email:

catalyst@stem.org.uk

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