Chemistry
the next generation
part of Chemistry for our future

13
ACTIVITY

10-12 age group
1 HR
36 STUDENTS
6 STUDENTS PER GROUP
2-6 SUPERVISORS
150 FIRST TIME SET UP*

COLOUR CHEMISTRY

background

Colour is at the heart of many important functions in the world around us and by exploring the basic principles in this hands-on workshop, students can understand where it comes from and how we see the effects that we know and love.

pre-planning required

weeks before
Work out how you want to link the activities together. This could be through a formal presentation or directed discussion. What questions do you want the students to think about?

days before
Gather together the equipment. For the chromatography, test the felt tip pens to see which colours split the best (black, brown and grey are usually good). Use a hole punch to create stencils from card or laminate sheets. (Flowers, bugs and simple designs work best). For the scatter tubes activity, cut the card (1/8 A4) and silver (~3 cm square) paper to size. Cut 20 cm lengths of garden wire for the bubbles activity. For the exploding milk colours you need to buy a pint of milk per six groups. Finally, practice the traffic light demonstration.

SAFETY

A risk assessment must be done for this activity.

The activities

The five activities can be combined in any way to suit the class group.

Based on an activity from the University of Nottingham and developed further by the Centre for Effective Learning in Science (CELS) at Nottingham Trent University.

materials required

Chromatography
- large circle of filter paper [PS]
- plastic or paper bowl [PS]
- selection of felt tip pens [PG]
- selection of stencils [PG]
- cup of cold tap water [PG]

Bubbles
- 20 cm length of garden wire [PS]
- plastic or paper bowl [PG]
- small amount of diluted washing up liquid [PG]
- cup of cold tap water [PG]

Scatter tubes
- piece of card [PS] (dark coloured, 1/8 A4)
- piece of silver prism paper (~3 cm square)
- roll of tape [PG]
- pair of scissors [PG]
- small torch [PG]

Multi-coloured milk
- shallow tray – eg a foil flan dish with no holes in the bottom [PG]
- enough milk to cover the base of the tray [PG]
- four different food colours [PG]
- four droppers or pipettes [PG]
- small amount of diluted washing up liquid [PG]

Traffic light demonstration
- 2 x 1dm^3 beakers
- 250 cm^3 beaker
- stirring rod
- 750 cm^3 of warm water (~ 60°C from kettle)
- 12 g of glucose
- 6 g of sodium hydroxide pellets
- 0.04 g of indigo carmine indicator
- kettle

PER STUDENT [PS] PER GROUP [PG]
* REPEAT USAGE IS £3–£5 PER GROUP OF 36 STUDENTS

Chromatography

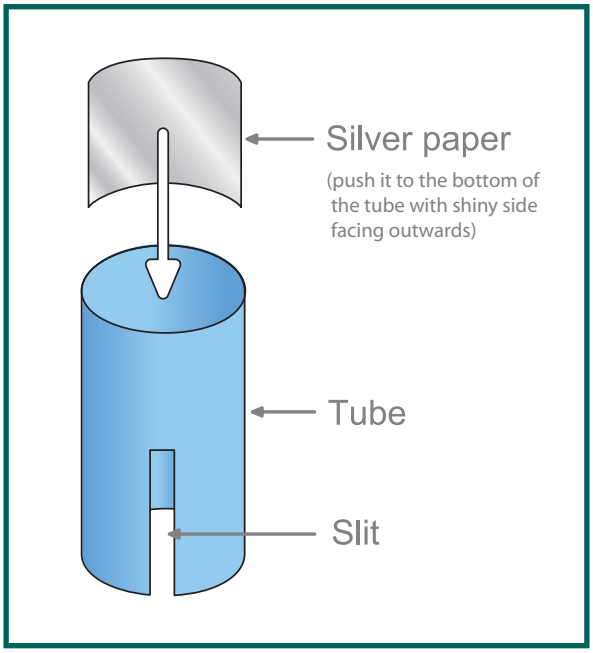
1. Choose a stencil pattern and colour-in the dots using a selection of colours, or design your own using a series of dots.
2. Rest the circle of filter paper on the paper bowl.
3. Dip your finger in the cup of cold tap water to get a drop on the end and let it fall onto one of the coloured dots. Repeat this for all the dots.
4. Watch what happens to the colours and ask the students to describe what they see. Explain how colours that we see can be made up from a series or other colours. Explain how this method can be used to identify inks in forensic science.

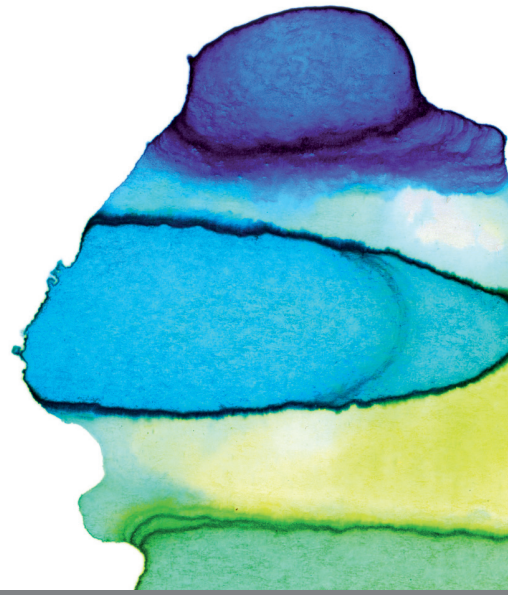
Bubbles

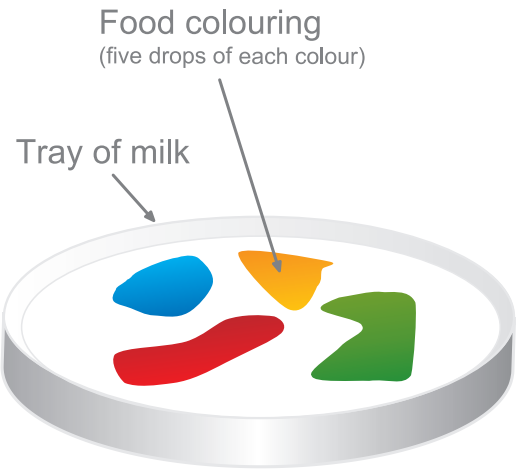
1. Empty half a cup of cold tap water into a paper bowl and place it in the middle of the table.
2. Add some washing up liquid.
3. Take a length of garden wire and carefully twist it into a looped shape.
4. Dip it into the bubble mixture to get a film and then hold it up to the light and observe. Discuss with the students what's happening. Where else do they see similar effects?

Scatter tubes

1. Take the piece of card and bend it to make a short fat tube.
2. Stick it in place using tape.
3. Cut an opening in the tube at one end by making two slits, lifting the flap and cutting it off.
4. Fix the piece of silver paper on the inside of the tube at the back opposite the opening.
5. Stand the tube on a white surface and shine the torch through the opening and look down the top of the tube.
6. Record your observations and discuss the results. How do these compare with those in the bubble experiment?







Multi-coloured milk

1. Pour the milk into a clean shallow tray so that it covers the bottom. Make sure there are no traces of washing up liquid in the tray.
2. Add five drops of one food colouring on top of each other in one quarter of the tray.
3. Repeat with the other colours so you have four separate puddles of colour in the milk.
4. Add one drop of diluted washing up liquid to the centre of the tray and watch what happens. Can the students suggest why this happens?
5. Add a further drop of washing up liquid onto each colour and observe.

   Discuss possible reasons for the observations. Explain how surface tension works using examples the students will understand – eg pond skaters, flour etc. Explain that milk is made of fat and water. The food colouring mixes with the water. The washing up liquid breaks the surface tension of the fat and water and allows the colours to mix together making swirl patterns.

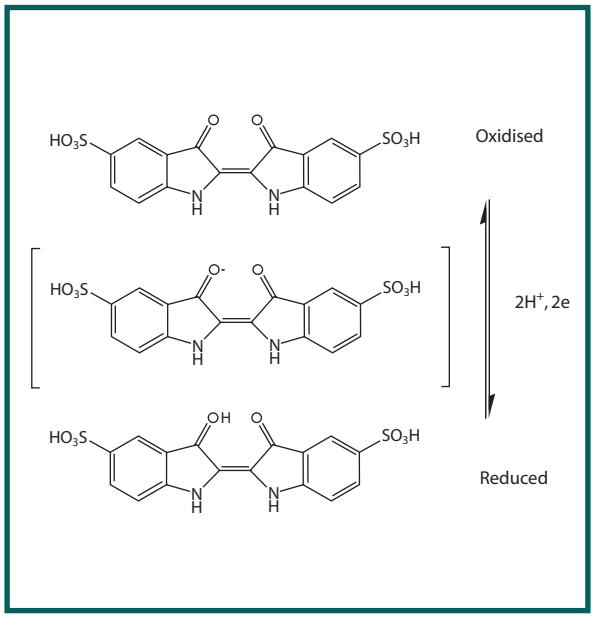
Traffic light demonstration

This experiment should be done as a demonstration at primary level.

1. Dissolve the sodium hydroxide pellets in 250 cm^3 of cold tap water with stirring.
2. Dissolve the glucose in 750 cm^3 of warm water (~ 60 °C).
3. Add the indicator to the glucose solution and mix together until all the solution is dark blue.
4. When the class is watching, pour in the sodium hydroxide solution and watch what happens.
5. Pour the whole solution slowly from a height into the other large beaker.

Why does the colour change?

The sodium hydroxide makes the solution basic. The glucose acts as a reducing agent with the indigo carmine behaving as an indicator in the redox process. Indigo carmine can exist in oxidised, reduced and intermediate forms. Each form has a slightly different structure which means that each structure absorbs a different frequency of light; hence the three different colours – red, yellow and green. When the mixture is first poured into the beaker the indicator is in its green oxidised form – this is where the reaction mixture is most exposed to oxygen in the air. The colours then change through red and on to yellow as the indigo carmine is reduced.



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