

Colour Chemistry

Colour Chemistry Workshop – Main Activity

Summary

During this workshop pupils are given the opportunity to make their own paints using food-based pigments, PVA glue and water.

The paints can then be used on watercolour paper, giving a creative element to the activity.

Brushing over painted paper with either lemon juice or a bicarbonate of soda solution causes a colour change in some of the pigments.



The workshop has been successfully run with pupils from year 3 to year 8 as well as a table-top activity at a large family community event. The activities use non-expensive ingredients, require no unusual scientific equipment, are easy to prepare, and are fun to do!

Kit list

For making paint:

- PVA glue
- Pigment powders – Matcha, Raspberry, Beetroot, Turmeric, Butterfly Pea
- Water
- Paint trays or plastic Petri dishes
- Lolly sticks or other stirrers
- 1/32 Tsp measuring spoons or similar
- Pipettes
- Beakers or cups
- Paint brushes
- Watercolour Paper (we used 190gsm)

For colour changes:

- Examples of heat reactive colour changing materials such as putty or baby spoons
- Examples of uv reactive colour changing materials such as putty or reactive sunglasses
- Lemon Juice
- Bicarbonate of Soda solution

Description of the Colour Chemistry PowerPoint presentation

Slide 1 – Title slide

This image shows various coloured liquids in a variety of scientific equipment. What could these liquids be? Younger pupils may need help with this.

Start with the green one in the middle and ask if they have a similar looking green liquid at home. Usually, they will say washing up liquid. Explain that this is a chemical and it's coloured green. Can they think of any other green liquid chemicals?

How about the red? Common answers for the red are fruit drinks and blood! Ensure that pupils realise that all these are types of chemicals.



Slide 2 – Colourful chemicals

Talk about how many different colours each of these products can be.

We will be concentrating on paint.



Slide 3 – Images of Tenby

Tenby is famous for the coloured buildings in the harbour. Here is a photograph and a painting showing the same scene. The painting is by the Welsh artist Gwilym Prichard and its title is "Snow – South Beach, 2010". The artist has used paint and the real buildings have been painted. What are the differences between the paint the artist has used and the paint on the outside of the buildings?



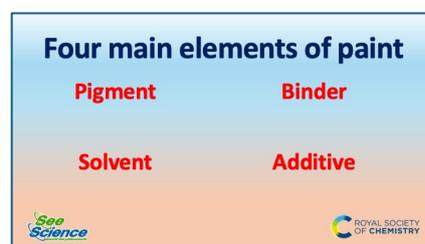
The artist has used oil paint which has given the picture texture as well as colour.

The paint on the outside of the buildings is very vibrant in colour, is waterproof, does not fade in the sun and can withstand the salt in the air.

Slide 4 – Four main elements of paint

All paints, whatever their uses have 4 main elements:

- Pigment – this is what gives paint its colour. Pigments are usually made from minerals or from biological substances. The pigments we will be using are all biological plant-based.
- Binder – this is the substance that binds the elements together. Common binders used in paint are oils, acrylics and, historically egg yolk. We will be using PVA glue.
- Solvent – this is the substance that makes the paint thin enough to paint with. We will be using water.



- Additives – these are what gives paints their unique properties. For instance, the outdoor paint used on the buildings in Tenby have additives in them that make them weather-proof. We won't be using any additives as we don't need our paint to do anything unique.

Slide 5 – Instructions

- Put a small blob of PVA glue in the centre of a Petri dish – around the size of a 2p coin once it has settled.
- Using the small measuring spoon, add some pigment to the PVA glue.
- Mix the pigment into the glue using a lolly stick.
- If you want to have a deeper colour, add more pigment.
- Once you are happy with the colour, use a pipette to add 2 or 3 drops of water then stir.



Is the paint a suitable texture to paint with? If not, add more water 1 or 2 drops at a time until you are happy with it.

Now paint!

We gave everyone a postcard sized piece of paper (A6) which is a quarter of an A4 sheet.

Once everyone has had a chance to create their own masterpiece, discuss whether they think the paint they created is good and explain why.

Slide 6 – Changing Colour

Some materials can change colour under specific conditions.

The mug in the picture is made using thermochromic pigment that changes from dark green when cool to bright yellow when hot.

Common colour changing triggers are heat (thermochromic) and uv light (photochromic).



If you have them, show example materials and ask pupils to explain the colour change.

Another trigger for colour change can be pH (halochromic). Some of the pigments used in this activity will change colour with pH. Lemon juice can be used to create a lower acidic pH and a sodium bicarbonate solution can be used to create a higher alkaline pH. Provide some of each for the pupils to investigate what happens when they brush over their painted paper with a little of one of these.

The butterfly pea powder is by far the best colour change so, for younger pupils who may not want to spoil their artistic creations, provide a new piece of paper with three streaks of the blue butterfly pea powder paint painted onto it. Ask them to paint over one streak with the lemon juice, one with the sodium bicarbonate solution and leave the other untouched, for comparison.

These are the colour changes:

Pigment	Colour in Neutral	Colour in Lemon Juice	Colour in Sodium Bicarbonate
Matcha	Green	No change	No change
Turmeric	Yellow	No change	Red/Brown
Raspberry	Pink/Red	Brighter red	Grey/Green
Butterfly Pea	Blue	Pink/Purple	Bluey Green

Slides 7 and 8 – Colourful Careers

The Royal Society of Chemistry have a collection of job profiles on their website, profiling real chemists and what they do.

The last two slides of the presentation show two of these that have a particular association with colours and paints.

Find more details on both here: edu.rsc.org/future-in-chemistry/career-options/job-profiles

