ROYAL SOCIETY OF CHEMISTRY

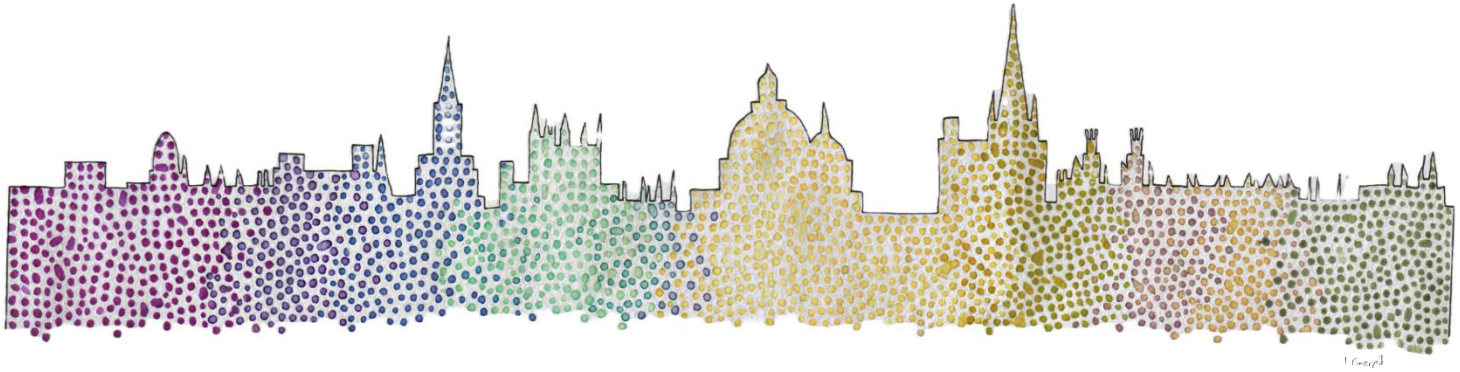
DEPARTMENT OF CHEMISTRY

UNIVERSITY OF OXFORD

CREATIVE CHEMISTRY CRESTS

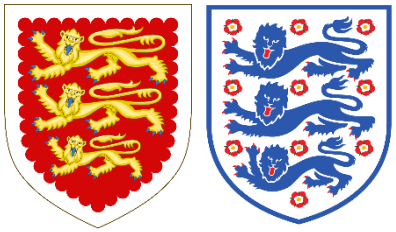
A guide for adults

Individual Pack



Background

Modern humans have communicated using visual imagery for over 51,000 years[1]! The use of shields became more commonplace in the 12th century, yet we see them in everyday life today with their continued use for football teams and on some school uniform. The University of Oxford has 28 colleges which accept undergraduates to study Chemistry. We have been inspired by the heraldic charges (symbols) on their shields to create our Creative Chemistry Crest[2] activity.

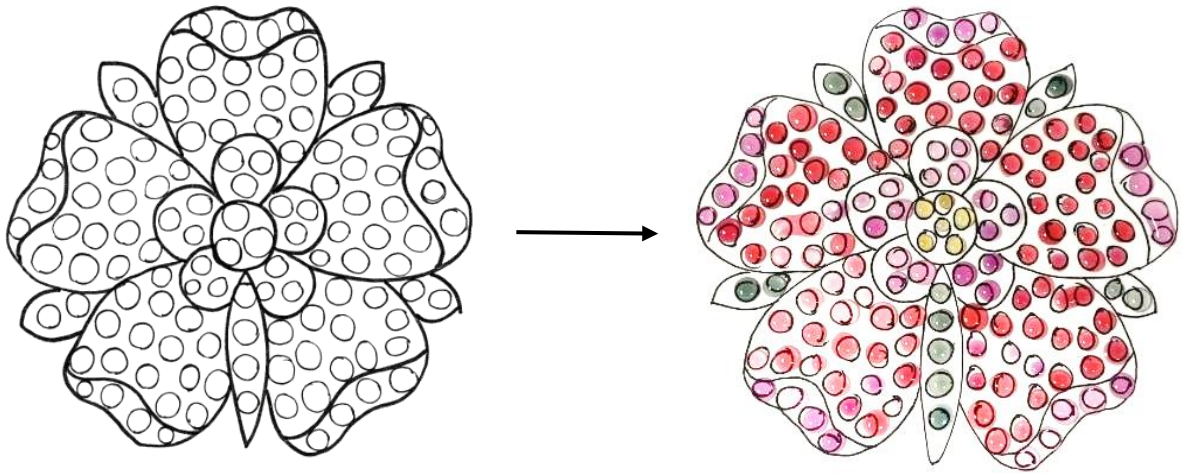


L-R: Shields of Oriel College, Oxford, and the English football team. Both shields draw on their association with Kings of England, hence the use of lions.

Activity

The challenge is to create a piece of artwork, like the example below, using different combinations of indicators and colourless solutions.

The aim is to place one small drop of coloured indicator in a circle of the art design, followed by one drop of the colourless solution on top. It is helpful to practice at the side of the laminated sheet before filling in the design to get the drops as small as possible. If the drops are too large, they may merge with adjacent drops.



Equipment:

- ☐ Paint brush
- ☐ Water (not provided)
- ☐ Red cabbage (not provided)
- ☐ Hibiscus powder
- ☐ Butterfly pea powder
- ☐ Bicarbonate of soda powder
- ☐ Washing powder
- ☐ Distilled vinegar (not provided)
- ☐ Paper towels (not provided)
- ☐ College crest laminates
- ☐ Small coloured cups (optional)
- ☐ Blu tack (optional, not provided)

[1] BBC News, 3rd July 2024, *World's oldest cave art found showing humans and pig* accessed online 12th July 2024: https://www.bbc.co.uk/news/articles/c0vewjq4dxwo

[2] Please note that we have used artistic licence in calling these heraldic charges from college shields crests. For more information about heraldry see: https://www.english-heritage.org.uk/guide-to-heraldry

Making up the solutions:

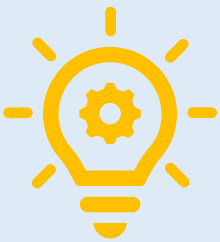
Indicator solution	Method
Red cabbage solution	Boil some chopped red cabbage in water for 5 minutes. Drain liquid into a separate glass. Cool, then add to a cup.
Butterfly Pea solution	Stir in ½ teaspoon of powder to ½ cup (125 mL) of boiled water. Allow to cool. Strain, if necessary, and add to a cup.
Hibiscus solution	Stir in ½ teaspoon of powder to ½ cup (125 mL) of boiled water. Stir until no more will dissolve. Allow to cool. Strain, if necessary and add to a cup.

Colourless solution	Method
Sodium bicarbonate solution	Stir in 1 teaspoon of powder to ½ cup (125 mL) of water. Add to a cup.
50% distilled vinegar solution (colourless)	Add equal amounts of distilled vinegar and water to a small cup and mix. Take care when pouring vinegar to avoid the eye area or contact with open cuts on skin.
Washing powder solution	Stir in 1 teaspoon of powder to ½ cup (125 mL) of water. Transfer a small volume to a cup. Take care to avoid prolonged contact with powder. Wash hands after making up the solution.

Method:

1. Use blue tac to stick down your laminated crest to the table to make sure it is flat.
2. Set out your cups of indicators and colourless solutions and allocate one paintbrush to each.
3. Use the paintbrushes to add drops of the coloured solutions to your picture. Try to avoid cross-contamination of solutions, if possible, by using separate paintbrushes.
4. Add drops of different colourless solutions with separate paint brushes and observe the colour change.
5. Enjoy creating your Chemistry Crest!

(Warning: solutions may stain clothes)



Further Ideas and Tips:

- The above solutions can be portioned into an ice cube tray and frozen so that you can easily repeat this activity later.

For other plant indicator ideas see https://bit.ly/GardenIndicators

The science behind the art...

What do chemists mean when talking about things being acidic and basic?

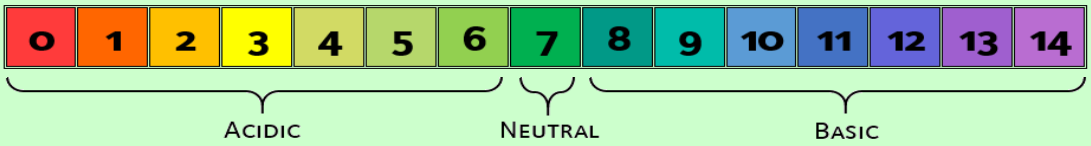
You will have encountered acids and bases in everyday life. If you've ever eaten an apple, you're eating an acid! The tangy aspect comes from malic acid, a natural fruit acid. Lemons are another good example.

If you wash your hands with soap, then you've encountered a base. Soaps are basic.

Acids have a pH less than 7, bases have a pH more than 7.

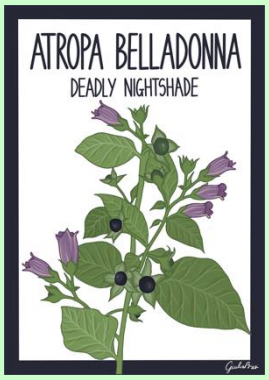
So, let's remind ourselves, what is pH? pH is just a measure of how **acidic** or **basic** something is. pH is used to **define** what an acid and base actually is. The pH scale ranges from 0-14:

Chemists are interested in plant chemicals as they are incredibly useful in helping us to feed the 8 billion people on our planet. These chemicals can be used to stop oxidation of food (which spoils it), to preserve food flavour and colour or to recolour food after processing. Additionally, plants provide a medicine cabinet! Take Deadly Nightshade – the alkaloid in this plant, atropine, is used to widen the pupil to allow for eye examinations. On the acid side, salicylic acid in willow is the starting point for aspirin, a widely used painkiller.

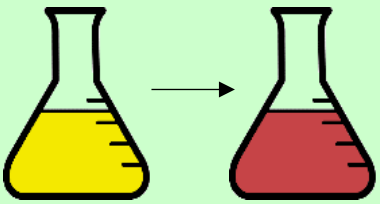


Acidic has a sour taste

Basic has a soapy feel



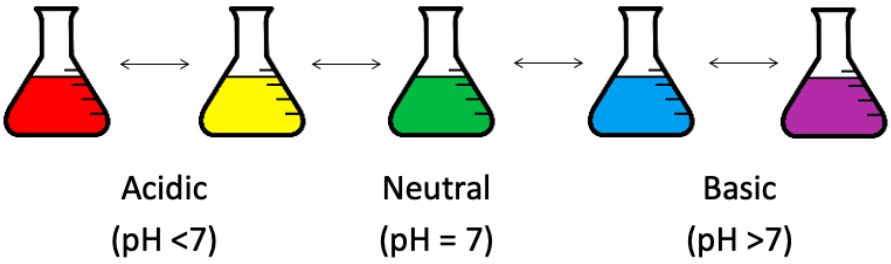
Some indicators are two-colour indicators. They have a distinct colour change, displaying one colour in acidic conditions, and changing to another colour when in basic conditions. One example is curcumin, a molecule found in turmeric, which is yellow in acid, but changes to red in alkaline conditions.



Acidic (pH <7)

Basic (pH >7)

Some indicators display a range of colours at different pH values. An example of this is universal indicator.



When you boil red cabbage, you may notice a purple colour. The reason for the purple colour of these fruits and vegetables is a family of molecules called **anthocyanins**, which are a family of molecules (chemicals) that are really good for you! They help to regulate blood sugar, help to prevent inflammation, and protect your heart. These molecules are released from red cabbage when you boil it.

Did you know?

Hydrangea plants, in either acidic or basic soils, form different coloured flowers. In the former they are blue, and in the latter, pink!

Questions:

(a) What is the pH range of an acid and a base? [acid – pH<7, base – pH>7]

(b) Do you know of any examples of plants that may use acids and bases for different functions? [Plants contain a large variety of chemicals, including many that are acids and bases. They use these for many different functions, e.g. for defence, to stop a herbivore (a plant-eating animal) from eating them! Or to attract animals who will eat them and thus disperse their seeds (at the core of an apple are apple seeds!).]

Front cover picture:

The droplet art picture was created by Isobel Everest, a School Science Technician, and gifted to the Department of Chemistry at the University of Oxford, in celebration of the Oxford Botanic Garden's 400th Anniversary. The picture uses extracts of oxalis (left) and pink rose (right) combined with aluminium ion solutions of different pH.

Chemistry at Home: Creative Chemistry Crests

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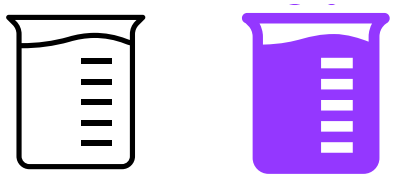
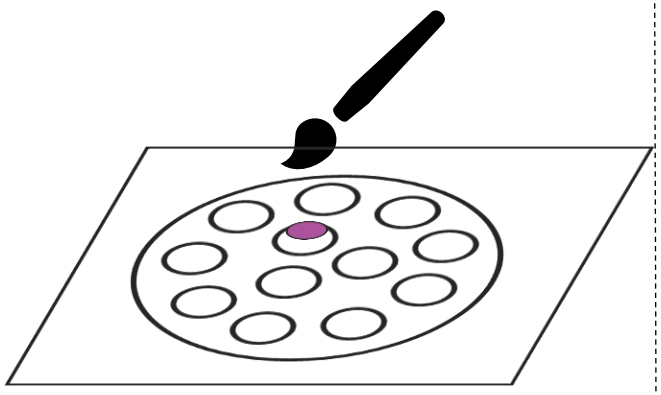
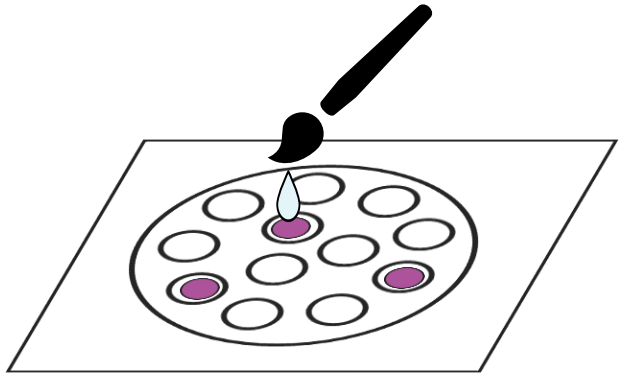
1 Choose the coloured indicator and colourless solution combination to use.



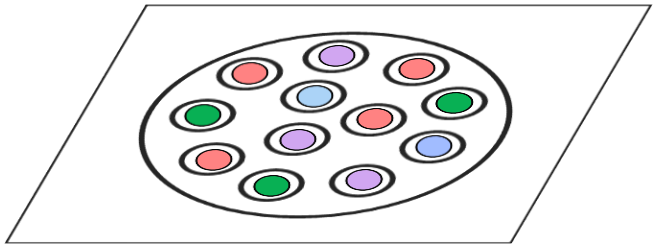
2 Carefully paint a drop of indicator into the circles. You can practice at the side to see what colour you make.



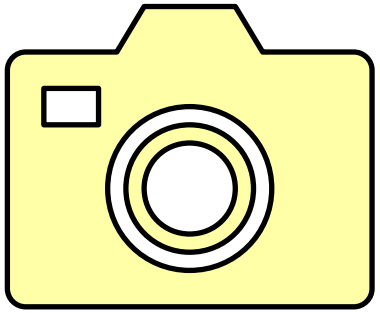
3 Carefully paint one drop of colourless solution on top of the indicator.



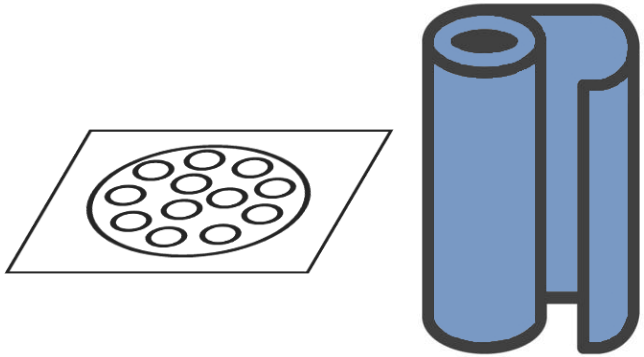
4 Repeat with different combinations to complete your pattern.

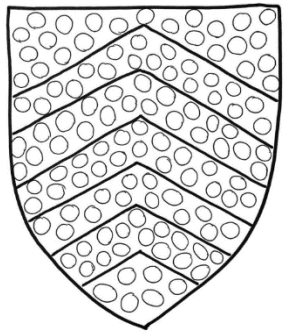


5 Take a picture of your indicator art.

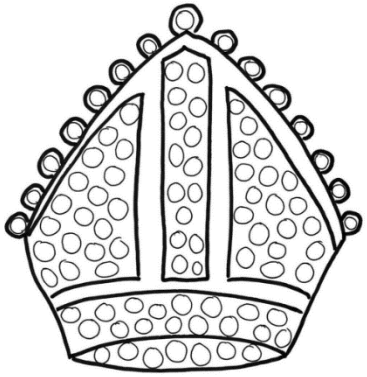


6 You can wipe down the laminated sheet and change the pattern.

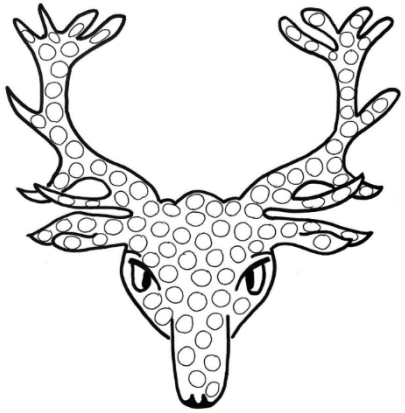




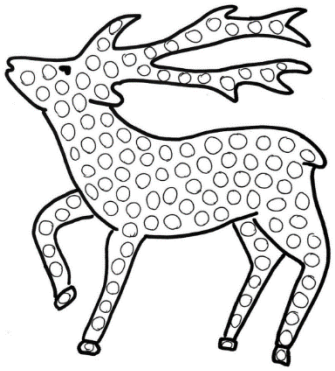
Merton



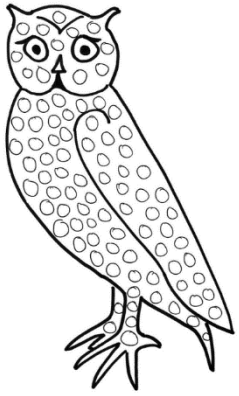
St Peters, Brasenose, Corpus Christi, Lincoln



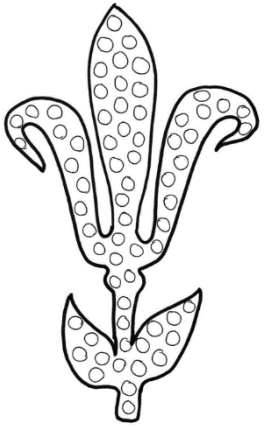
Hertford



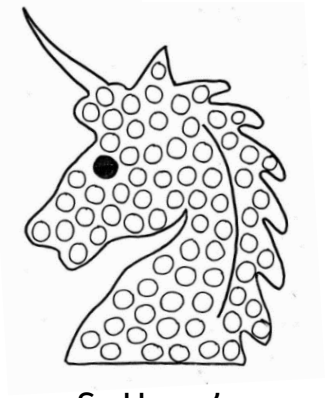
Jesus, Lincoln



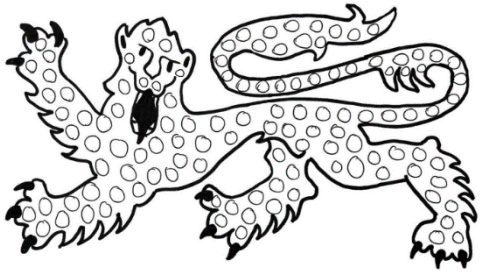
Corpus Christi



Magdalen

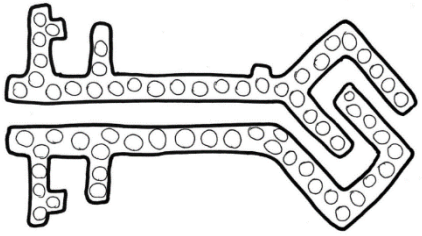


St Hilda's

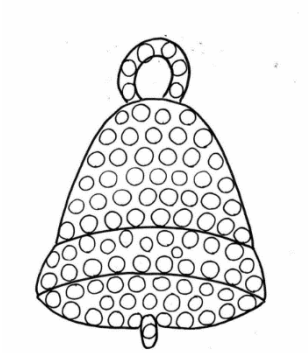


Oriel, Lincoln, Balliol, St Johns

St Edmund Hall, Christ Church

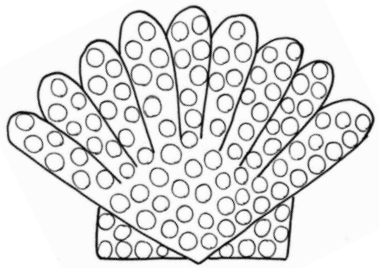


Exeter

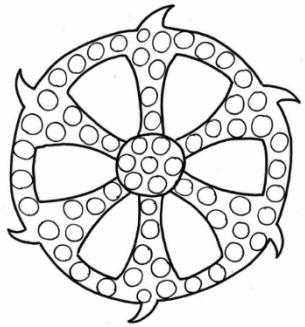


Lady Margaret hall

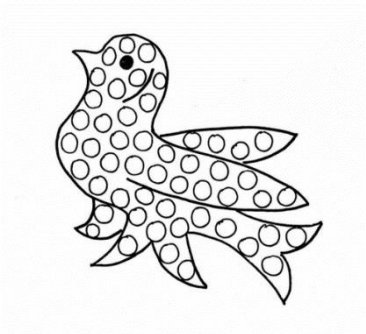
St Anne's



Wadham



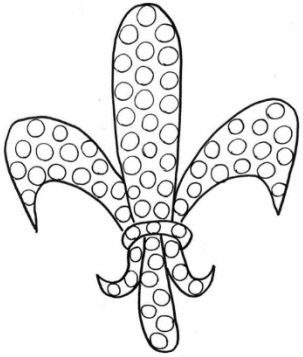
St Catherine's



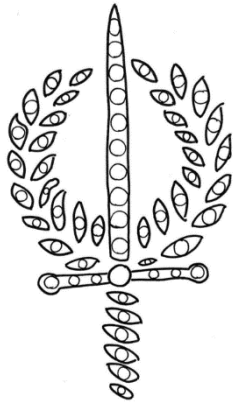
Worcester, University College

Trinity

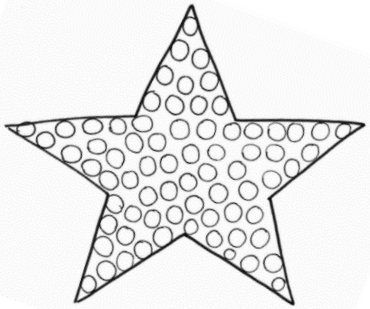
Queen's



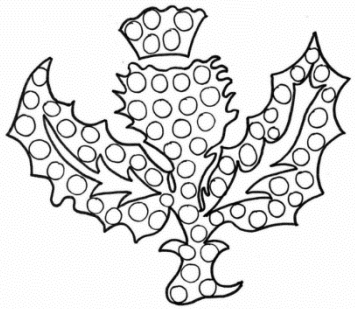
St Hugh's. Trinity



St Anne's



Keble, Somerville, Lincoln



Pembroke

New College, Brasenose,
Corpus Christi, Christ Church,
Pembroke, Wadham