

# Colour creation

## - Your task

Starting from Universal indicator solution, water, hydrochloric acid solution and sodium hydroxide solution only:

- 1 Produce six different coloured solutions (*ie* red, orange, yellow, green, blue and violet).
- 2 When you have completed Part 1 (or after 20 minutes), produce a reliable "recipe" for creating one colour decided by your teacher.

Based on a suggestion by A. Honeyman.

## Time

60 minutes.

## Group size

2–3.

## Equipment & materials

### Per group

Rack of test tubes, glass droppers, beakers (100 cm<sup>3</sup>), measuring cylinders (10 cm<sup>3</sup>).

Universal indicator solution ..... – 5 cm<sup>3</sup>,

Distilled water or tap water (**NB** check that the water is neutral),

Hydrochloric acid (0.1 mol dm<sup>-3</sup>) ..... – 50 cm<sup>3</sup>,

Sodium hydroxide (0.1 mol dm<sup>-3</sup>) ..... – 50 cm<sup>3</sup>.

## Health & Safety notes

This is an open-ended problem solving activity, so the guidance given here is necessarily incomplete. Teachers need to be particularly vigilant, and a higher degree of supervision is needed than in activities which have more closed outcomes. Students must be encouraged to take a responsible attitude towards safety, both their own and that of others. In planning an activity students should always include safety as a factor to be considered. Plans should be checked by the teacher before implementing them.

You must always comply with your employer's procedures and in some cases may decide that a particular activity is inappropriate in your situation. Further information on Health and Safety should be obtained from reputable sources such as CLEAPSS [<http://science.cleapss.org.uk/>] in England, Wales and Northern Ireland and, in Scotland, SSERC [<https://www.sserc.org.uk/>].

At these concentrations hydrochloric acid and sodium hydroxide are of low hazard so eye protection is not essential.

Universal indicator may be made up in ethanol and so could be flammable. If so, keep away from sources of ignition.

It is the responsibility of the teacher to carry out a suitable risk assessment.

## Curriculum links

Indicators. Acids and alkalis.

## Possible approaches

Useful as an end of term activity. Enables students to gain an appreciation of the nature of indicators. (Demonstration of the effects of acid and alkali on Universal indicator may be needed for younger groups.) Students tend to get bored if they are not meeting with success, especially if they have no plan and are mixing at random. Students may need encouragement to tackle the experiment in a systematic way. They may also need to be helped to see that further dilution of the acid and alkali will result in less abrupt colour changes (alternatively students could be given more dilute acid and alkali). Some students found it very difficult to produce the 6 colours. To avoid the possible difficulties associated with different shades of the same colour, a constant volume should be presented in the tubes for judging (eg half full tubes) and also a constant volume of indicator used each time.

### Part 2

Each team must show their recipe to the judge. They should then try to make their given colour, following their recipe, under the eyes of the person acting as judge. One teacher commented: "the colour I chose for the recipe was yellow – green is easy and orange is almost impossible!"

## Evaluation of solution

These are suggestions only:

### Part 1

Credit could be awarded for each different colour produced and for the first group to finish.

### Part 2

Full credit could be awarded for a "recipe" which "works", ie produces the stated colour, first time. A descending order of credit could be awarded for a "recipe" which does not "work" when followed, but which does produce the stated colour after ONE adjustment (eg "add 3 more drops of solution X") or for a recipe which does not "work" first time, nor after one adjustment but which produces the stated colour

## Credits

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*Health & safety checked May 2018*

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