

Red cabbage pH indicator experiments

Equipment and resources

- Coffee filters - previously soaked in cabbage juice
- Straws
- Cabbage
- Lemon Juice
- Orange juice
- White vinegar
- Washing powder
- Baking powder
- Cola
- Vinegar
- Experiment

1. Making a pH rainbow wand

Fill a clear straw with red cabbage juice. Add a little lemon juice or vinegar to one end of the straw and add a few drops of baking soda or washing powder to the other end of the straw. The cabbage juice will act as a universal indicator and will respond to the pH gradient by creating a rainbow. The process and the science will be explained during the demonstration.

If the table is very busy, it would be good to perform the colour change on a larger scale by mixing the cabbage juice directly with the test solution in a plastic cup. The colour of the solution can be made red to start with by adding some acid, before bringing the solution back to neutral with the addition of an alkaline solution. This will look impressive but can't be done continuously due to problems disposing of the liquids.

Questions

Ask the children what colour they would expect the cabbage water to go when adding vinegar and baking powder.

Explain what is happening.

2. Using red cabbage pH indicator paper

Note: this activity may also be used during public events, open days and so on.










Provide learners with pre-prepared red cabbage pH indicator paper. Using common household liquids the children can investigate changes in colour of the paper, with discussions about whether the liquids are acidic or basic.

The test solutions will be set out in transparent, labelled, plastic cups. There will be a tray with the strips of pre-soaked and dried coffee filters on. Learners will be encouraged to use droppers to take some solution from each cup and drip it onto their filter paper. They can even make pretty pH pictures and patterns if they wish.

Example of things that could be used:

- Lemon juice = acidic = red solution
- White vinegar = acidic = red solution
- Washing powder solution = alkaline = green/yellow
- Baking powder solution = weakly alkaline = blue/green

There will be a pH scale for the cabbage water indicator on the accompanying 'Rainbow cabbage' handout, which is also shown below:

pH	1	2–3	4–5	6	7	8	9	10–11	12
Colour									

For any necessary disposal of the household solutions you should have a bucket and access to a sink close by.

Questions

- Ask the children to have a go themselves with ready-made cabbage filter paper.
- Ask them whether they think something is acid or alkaline.
- Ask them to predict the colour that the paper will go.

Background

The scale for measuring the acidity or basicity of a solution is called pH. The pH scale ranges from 0 to 14 and is essentially an indication of the concentration of positive hydrogen ions in a solution. A low pH corresponds to a high hydrogen ion concentration and a high pH corresponds to a lower concentration of hydrogen ions. Water is neutral and has a pH of roughly 7. Solutions with a pH less than 7 are acidic and solutions with a pH greater than 7 are basic/alkaline.

An approximate measure of pH can be obtained using a pH indicator, which will change colour around a particular pH value. In these experiments, red cabbage water will be used as an indicator.

When red cabbage is boiled or soaked it releases pigment molecules called anthocyanins. Anthocyanins are also found in flower petals and fruits such as plums, blackberries and blueberries. They have many different functions in plants – for example, they are antioxidants meaning they can protect plants from free radicals, which may cause cell death. However, their benefit to human health is still poorly understood. Anthocyanins have also been used to colour food for many years.

These anthocyanins change colour depending on the pH of the environment they are in. In very acidic solutions (pH 1–3) the anthocyanin indicator should turn red. In very alkaline solutions (pH 10–12) the indicator should turn green/yellow. In neutral solutions (pH 7–8) it should remain dark blue/purple.