

Questacon at HOME

Activity sheet

Natural pH Indicators

Background

All substances can be classified as acidic, neutral, or basic. Acids are often sour - they include lemon juice, vinegar, and sour lollies! Basic (or alkaline) substances are often bitter or slippery - they include bicarb soda and soaps. We describe how acidic or basic something is using the pH scale. Substances that are neither acidic nor basic are pH neutral. In this activity, we will test the pH of household substances using our own indicators that give us information by changing colour!

Materials

- Cups, bowls and/or jars
- Red cabbage
- Boiling water
- Acidic substances; for example:
 - Vinegar
 - Lemon juice
 - Lemonade
 - Sparkling water
- Basic substances; for example:
 - Bicarbonate soda
 - Household, dilute ammonia

Safety

Take care when handling boiling water. Do not test the pH of any highly corrosive cleaning products. If you do test mild cleaning products, follow the safety instructions for handling. Supervision is recommended for young experimenters.

Procedure

Prepare your pH indicator: Place finely chopped red cabbage into a bowl and add boiling water until just covered. Let this sit for at least 10 minutes and collect the coloured liquid to use as your indicator.

Test the pH: Add a couple of tablespoons of various household liquids to separate containers. To test the pH of a solid (e.g. bicarb soda, citric acid) it must be dissolved in a small amount of water first. Add about 1 teaspoon of pH indicator to each container and observe any colour changes! Add more indicator if the colour is faint.

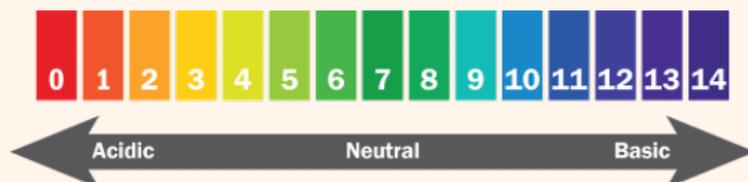


Activity Sheet

Tips & Tricks

- Don't forget to test what colour your pH indicator is at neutral pH 7 using water!
- Try mixing substances together and observe if the pH changes. For example, try mixing vinegar with bicarb solution. What happens to the colour?

What's the Science?



The pH scale describes whether a substance is acidic, neutral or basic/alkaline. This scale refers to the concentration of hydrogen ions (H^+) in solution - otherwise known as protons! Highly acidic solutions have loads of free protons, while alkaline solutions have very few. The pH scale is *logarithmic*, which means that every pH step down has ten times more protons than the previous step! These free protons impact how substances will react with each other.

pH indicators contain molecules that change colour depending on whether they have an extra proton bound to them. In an acidic environment, most of the molecules will have an extra proton bound. In an alkaline environment, most of them will not. This is what causes the colour to change!

Red cabbage contains molecules called anthocyanins that give many vegetables their rich red/purple colours. The pigments in this indicator will be red/pink in acidic solutions, purple at neutral, and blue/green/yellow in alkaline solutions.

What Questions should I ask?

- What colour is your pH indicator in acidic, neutral, and alkaline solutions?
- Do all pH indicators have the same colour changes? How many colours can they change to?
- What happens to the pH if you mix an alkaline and acidic solution?
- What happens to the pH if you add more water to your solution?
- What substances in your house are acidic? Alkaline? Neutral?

What's Next?

Create pH indicator strips! Place printing paper onto a plate. Pour liquid pH indicator onto it and allow to dry. Cut the paper into strips and dip them into the solutions to see the colour change.

Try out even more natural pH indicators! Pigments can be extracted from many brightly coloured vegetables, leaves or flowers to test if they are a pH indicator.

Indicators can be made by juicing, soaking in boiling water or soaking in alcohol (e.g. methylated spirits). Indicators can be prepared from turmeric (using an alcohol!), black tea, spinach, beetroot, cherries, blueberries, red apple skins and many richly coloured flower petals.

