

## Is toothpaste basic?

Use this practical with your learners to test the basicity of different toothpastes. The investigation can be set up as a problem-solving task where learners can design their own practical using the prompt: what toothpaste is best for neutralising mouth acid? [Guidance](#) on how to set up a problem-solving task can be found alongside other [In search of solutions](#) activities. The practical described here can also be repeated with indigestion tablets or use this similar [experiment](#) involving titration.

### Learning objectives

1. Develop observation skills by comparing the pHs of different toothpastes.
2. Determine which properties are best for neutralising mouth acid and why.

### Equipment list

- 3 test tubes
- Distilled water
- 3 brands of toothpaste (we used Aquafresh 24h sugar acid protection, Colgate cavity protection and Arm and hammer charcoal white\*)
- 3 eye droppers / Pasteur pipettes
- 1 spotting tile
- Universal indicator
- 0.1 M ethanoic acid (danger: corrosive and flammable)
- Safety spectacles

\* Other toothpaste brands are, of course, available to be tested. Those used here provided a good selection of properties (neutral, alkaline and basic). Neutral toothpastes will contain no bases or alkalis in the ingredients. Calcium carbonate will often be the insoluble base included as an ingredient, acting as an abrasive too. Bicarbonate of soda (sodium bicarbonate) is the alkaline ingredient to look out for.

### Method

1. Take three test tubes and add approximately 1 cm of water to each.
2. Add a pea-sized amount of one of the toothpastes to a test tube and mix. Repeat for the other toothpastes in separate test tubes.
3. Add a drop of one toothpaste solution to a well in the dimple tray and add a drop of universal indicator to the well. Note the colour change in your results table. Repeat for the other toothpaste solutions in empty wells.

4. Add a drop of 0.1 M ethanoic acid to three empty wells and note the colour when a drop of universal indicator is added.
5. Add a drop of the first toothpaste solution to a well with acid. Note any colour change. Repeat for the other two toothpaste solutions.
6. Complete the table with your results and draw your conclusions.

## Results

Toothpaste	Solution colour with indicator, approx pH (instruction 3)	Colour change with acid and approx pH (instructions 4 and 5)	Insoluble base, alkali, or neither
Aquafresh 24h sugar acid protection	Green, 7	No change: red/orange, 3/4	Neither
Colgate cavity protection	Green, 7	Red/orange to orange/yellow, 5/6	Insoluble base
Arm and hammer charcoal white	Blue, 9/10	Red/orange to yellow/green, 6/7	Alkali

## Answers

Some of these answers should be adapted if you used other toothpaste brands.

1. The pH of 0.1 M ethanoic acid is about 3.
2. Ethanoic acid is being used as it is a preservative in some foods.
3. Any fizzy drink, tomato ketchup (although the colour might inhibit using indicators), citrus fruits or yoghurt could also be used.
4. Acids are corrosive and contribute to tooth erosion and decay, so it is helpful if toothpastes neutralise mouth acid.
5. Colgate and Charcoal white can neutralise mouth acid.
6. Charcoal white could result in an alkaline mouth cavity.
7. Colgate cavity protection would be best for mouth cavity acid neutralisation as it will neutralise any acid without leaving an alkaline mouth cavity.
8. Dilution by rinsing with water is an alternative way of rectifying mouth cavity changes in pH.
9. Use this question to see whether your learners can compare basic, alkaline and neutral toothpastes and justify their answer using the results of the practical and their understanding of neutralisation reactions.