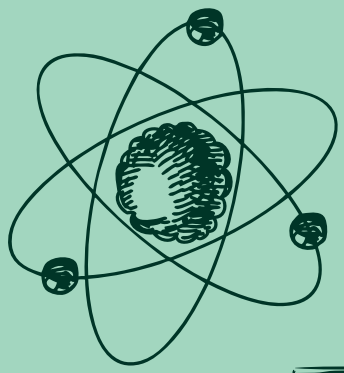
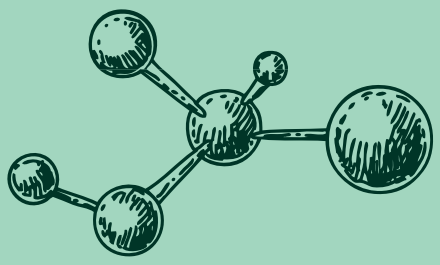
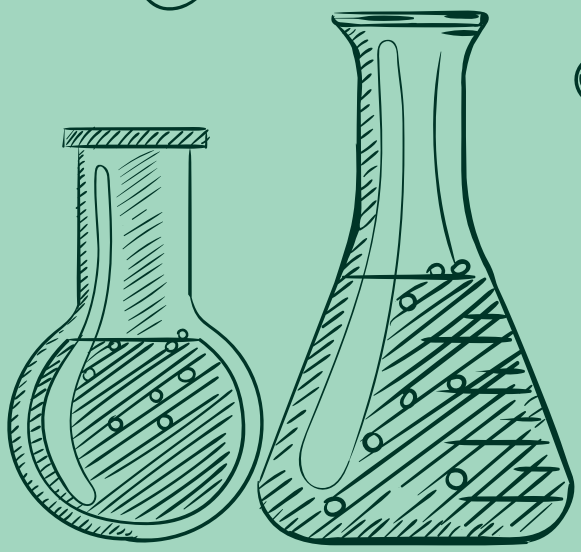
SURBITON

HIGH SCHOOL

Discover Science







Presented by Dr Keaney, Head of Science | Normal running time: approx. 45 minutes

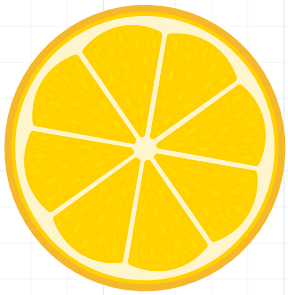
At Surbiton High School, we believe that learning about science is best done through experimentation. The most important trait you need to have to be a successful scientist is to be curious! Never take things for granted and always ask why things happen in the way that they do. Famous scientists like Marie Curie, Albert Einstein and Charles Darwin all had one characteristic in common – they were insatiably curious!

We hope this interactive Science session will spark your curiosity!

We are going to go on a journey of discovery to tap into your natural curiosity by carrying out some Chemistry experiments in your kitchen. You will have received your Surbiton High School Science Pack from the School with some items you will need for your experiments. You will also need some other items that you should be able to find in your kitchen.

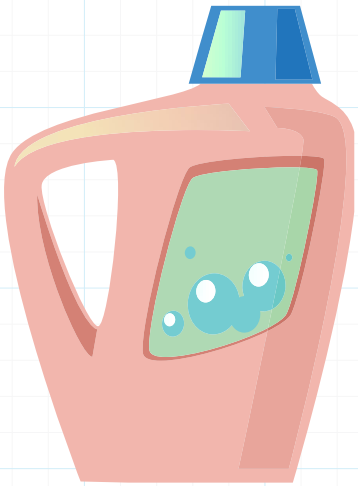
ITEMS IN YOUR SCIENCE PACK

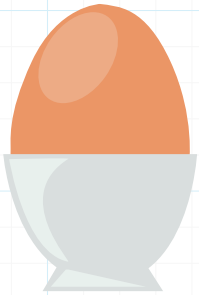
- Red litmus paper
- Blue litmus paper
- Universal indicator paper
- Filter paper
- Chromatography paper
- Clear plastic straw
- Two disposable pipettes

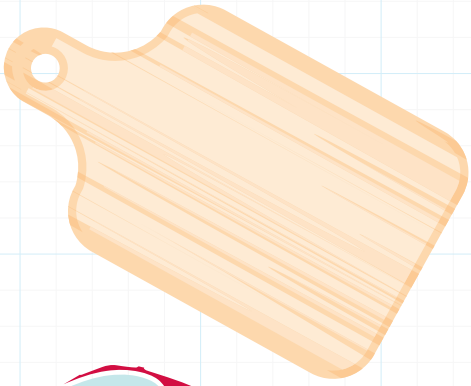


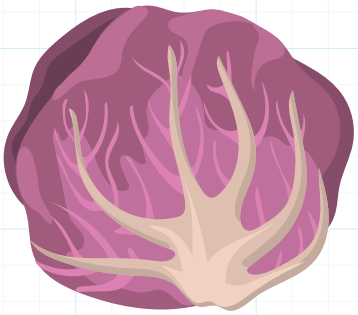
ITEMS YOU WILL NEED TO SUPPLY YOURSELF

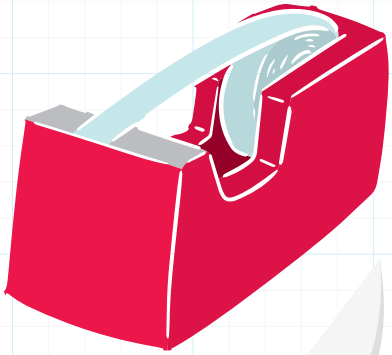
- Red cabbage, sharp knife and chopping board
- Access to a kettle
- Two glass jugs or bowls
- Sieve
- Household substances to test (lemon juice, vinegar, washing powder, baking powder, soap, milk etc)
- Blu Tack or Sellotape to seal your pH rainbow wand
- At least six small glasses or egg cups for your household substances
- Large glass, pencil, kitchen paper and four different water-soluble felt-tipped pens

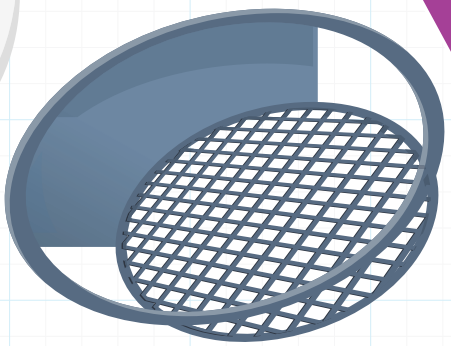




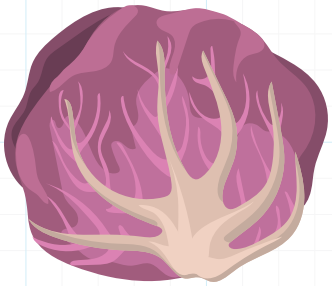








ACIDS, ALKALIS, pH AND INDICATORS



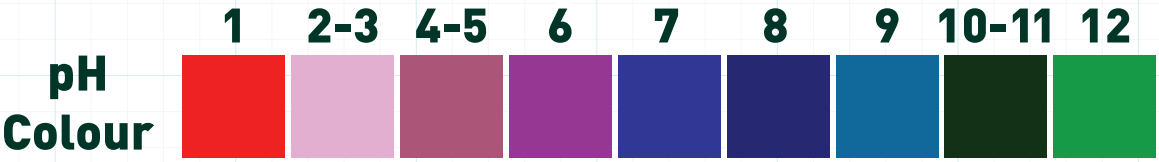
Substances can be acidic, alkaline or neutral. The scale we use to measure the acidity or alkalinity of a solution is called the pH scale. An approximate value for the pH can be found by using an indicator. Indicators change colour depending on what the pH is of the solution they are added to. We are going to make our own indicator using red cabbage, as well as using universal indicator and litmus indicator.

Red Cabbage Indicator

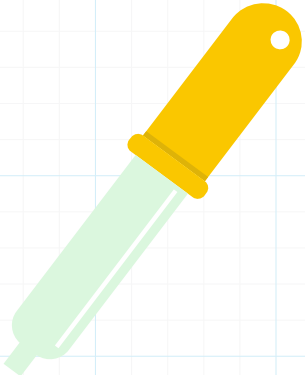
When red cabbage is boiled or soaked, it releases pigment molecules called anthocyanins. The anthocyanin molecules change colour depending on the pH of the environment they are in.

Making Red Cabbage Indicator

1. Cut one-quarter of the red cabbage into small pieces using your knife and chopping board. Either get an adult to do this for you or make sure an adult is supervising you if you are doing this yourself.
2. Put the chopped up red cabbage into a jug or bowl and pour boiling water onto the red cabbage. Again, either get an adult to do this for you or make sure an adult is supervising you.
3. Leave for 10 minutes, stirring occasionally (whilst you are waiting, you can carry out some tests with the other indicators).
4. Filter your red cabbage indicator into your second glass jug/bowl using the sieve.
5. Add a few drops of your red cabbage indicator to different household substances using the dropping pipettes and note what colour it turns in your results table.
6. Use the chart below to work out what the pH of your substance is.



Substance	Lemon juice	Vinegar	Milk	Washing powder solution	Soap solution	Baking powder solution
Colour of red cabbage indicator						
pH						



QUESTIONS ON THE pH SCALE AND RED CABBAGE INDICATOR

1. What is the range of the pH scale?

2. What is the pH of a neutral substance?

3. What is the range of pH for acidic substances?

4. What is the range of pH for alkaline substances?

5. What substances are acidic?

6. What substances are alkaline?

7. Apart from red cabbage, what other plants contain anthocyanins?

CHALLENGE QUESTIONS

8. What makes a substance acidic? (What type of particles does an acid contain?)

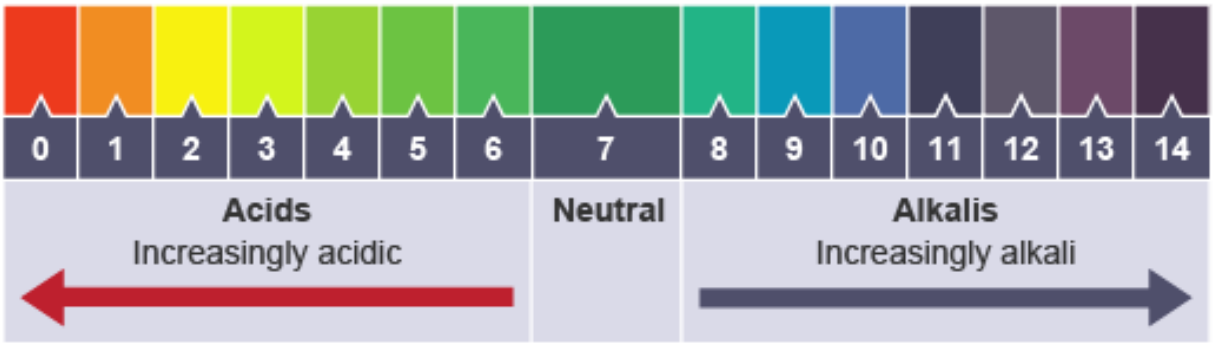
9. What is weird about the pH scale and how it relates to the concentration of these particles?

10. What is the function on anthocyanins in plant cells?

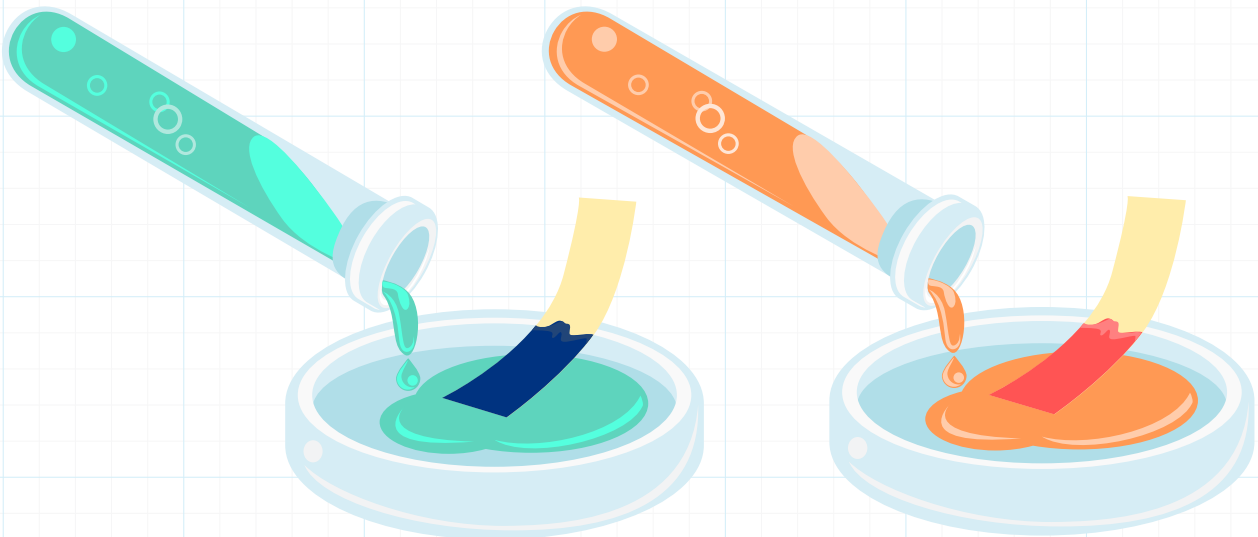
UNIVERSAL INDICATOR AND LITMUS INDICATOR

Universal indicator is made of several different compounds that show smooth colour changes over a wide range of pH values. In your Surbiton High School Science Pack, you have a booklet of universal indicator paper, a booklet of red litmus paper, and a booklet of blue litmus paper. Test your household substances with all three types of indicator paper and record your findings in the results table below. Use the universal indicator colour chart to help determine the pH.

Universal Indicator Colour Chart



Substance	Lemon juice	Vinegar	Milk	Washing powder solution	Soap solution	Baking powder solution
Colour of universal indicator						
pH						
Colour of red litmus indicator						
Colour of blue litmus indicator						



QUESTIONS ON INDICATORS

1. If red litmus paper turns blue, what does this indicate?

2. If red litmus paper stays red, what does this indicate?

3. Is this the same or different for blue litmus paper?

4. Why do you think universal indicator would be more useful?

5. Are there any situations where red/blue litmus paper would be more useful?

6. What living organism is litmus derived from?

7. Is there a machine that can measure pH?

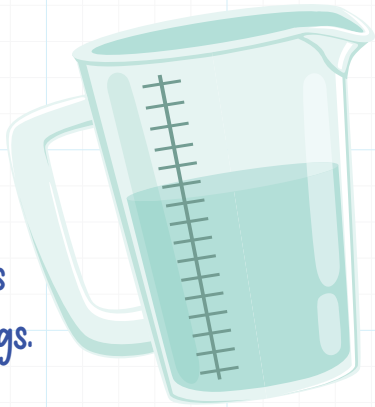
CHALLENGE QUESTIONS

8. Why might using this machine be better than using an indicator?

9. Why do indicator molecules change colour in acidic and alkaline conditions?

10. Why do doctors sometimes monitor the pH of a patient's blood?

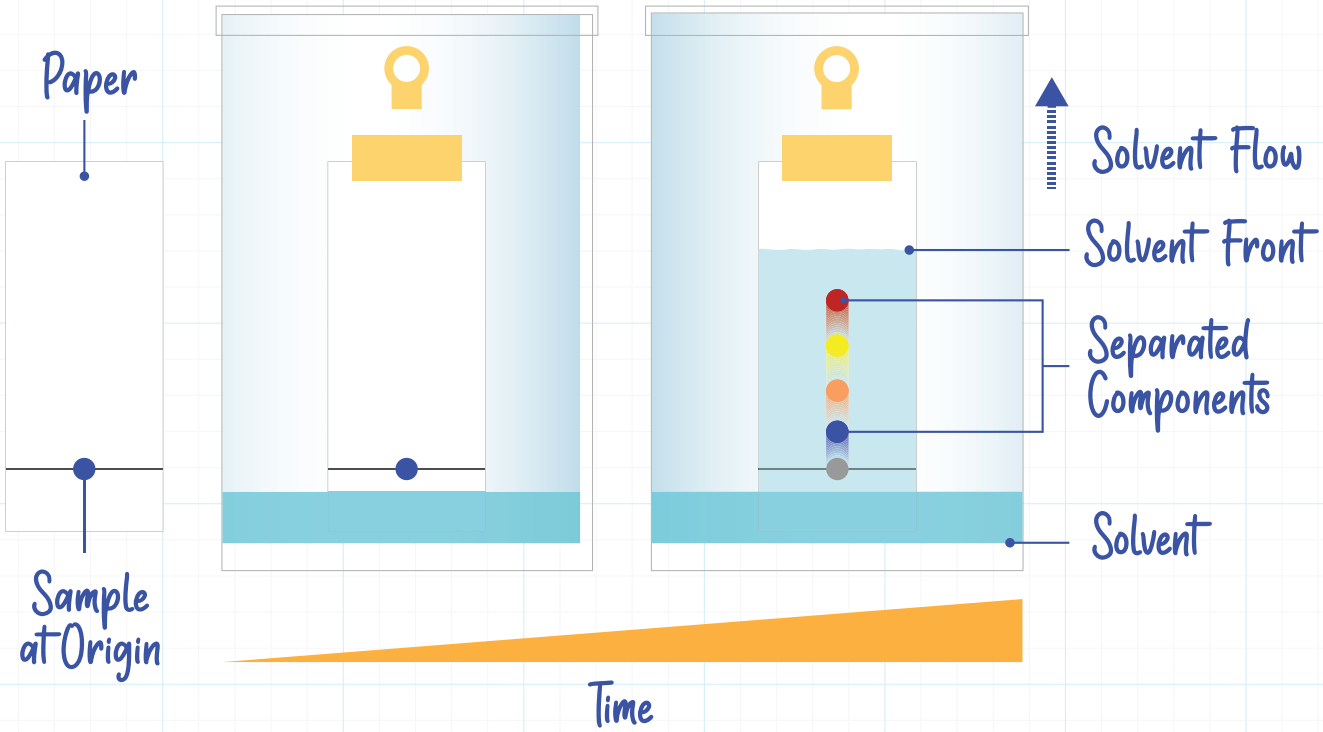
CHROMATOGRAPHY



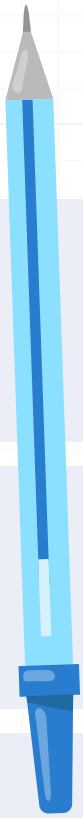
Chromatography is a method of separating substances from one another. It is often used when the substances are coloured, such as inks and food colourings. We are going to use chromatography to separate the different dyes found in the ink of felt-tipped pens.

1. Take your chromatography paper (the white rectangular sheet) and draw a pencil line across the bottom of the paper (start line on the diagram).
2. With your pencil, make four marks at regular intervals across the pencil line.
3. Use your different water-soluble felt-tipped pens to make four different 'blobs' of colour on the pencil markings.
4. Put about 1cm depth of water into your large glass. The glass must be at least as wide throughout the glass as the width of the chromatography paper.
5. Attach the top of your chromatography paper onto your pencil. You are going to put the pencil across the top of the glass with the very bottom of the chromatography paper being suspended in the water. The pencil 'start' line should never be below the water, so you might need to roll the chromatography paper around the pencil to make it shorter.
6. Leave your experiment. The water will gradually soak up the filter paper.
7. When the water has soaked up to the top of the chromatography paper, carefully take it out and leave the paper to dry. You should get a pretty pattern showing the separated dyes.

Paper Chromatography



QUESTIONS ON CHROMATOGRAPHY



1. Why do some substances travel further than others?

2. How could chromatography be used to identify an unknown substance?

3. Why must the 'start' line be drawn in pencil?

4. Why must the 'start' line never go below the water?

CHALLENGE QUESTIONS

5. What is an R_f value?

6. How is the R_f value calculated?

7. How could the R_f value be helpful in identifying an unknown substance?

CHROMATOGRAPHY USING THE CIRCULAR FILTER PAPER (OR COFFEE FILTER PAPER)

You can use the principle of chromatography to make pretty circular patterns which could then be made into a Christmas card. Another idea to keep you busy after our session!

1. Use a pencil to make a hole in the centre of your circular filter paper.
2. Use your water-soluble felt-tipped pens to make marks near the hole. You could draw circles with the different colours or make 'blobs' at different points around the hole.
3. Cut a strip of kitchen paper and roll the top of the strip into a point so you can feel it through the hole in the filter paper.
4. Half fill your glass of water and then place the filter paper on top of the glass, so the bottom of the kitchen paper is suspended in the water.
5. Leave your experiment. The water will soak up the kitchen paper and then out from the hole in the centre of the filter paper.
6. When the water gets to the outer edge of the filter paper, remove from the water and leave to dry.

I hope you have enjoyed completing the Chemistry experiments in our Science Activity Booklet. Hopefully, you have an idea of how we learn in Science at Surbiton High School.

Good luck in your entrance exams and remember to stay curious.

Dr Keaney (Head of Science)

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