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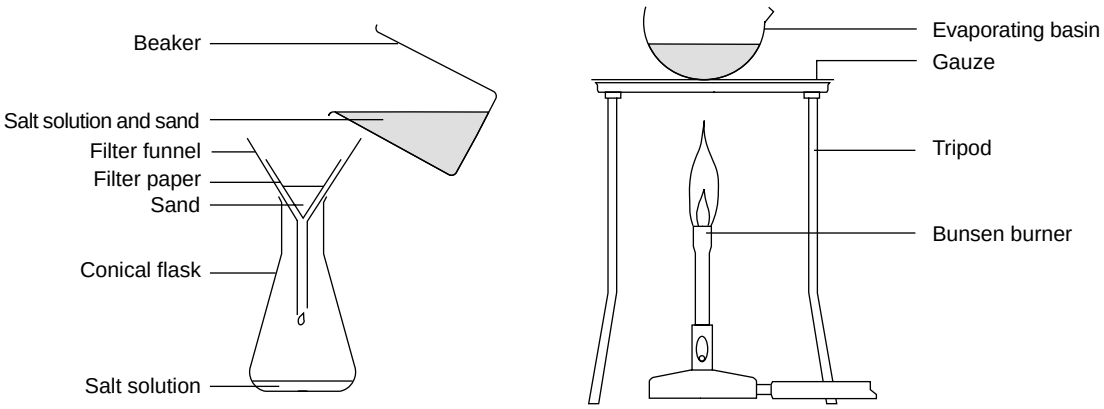
# Separating a sand and salt mixture

## Introduction

In this experiment simple processes are used to separate salt from a sand and salt mixture.




## What to do

1. Mix about 5 g of the mixture with 50 $cm^3$ of water in a 250 $cm^3$ beaker. Stir gently.
2. Filter the mixture into a conical flask and pour the filtrate into an evaporating basin.
3. Heat the salt solution gently until it starts to 'spit'. **Care:** do not get too close.
4. Turn off the Bunsen burner and let the damp salt dry.

## Safety

Wear eye protection.

## Questions

1. Why is the salt, sand and water mixture stirred in step 1?
2. What happens when this mixture is filtered in the step 2?
3. Why is the salt heated in step 3?

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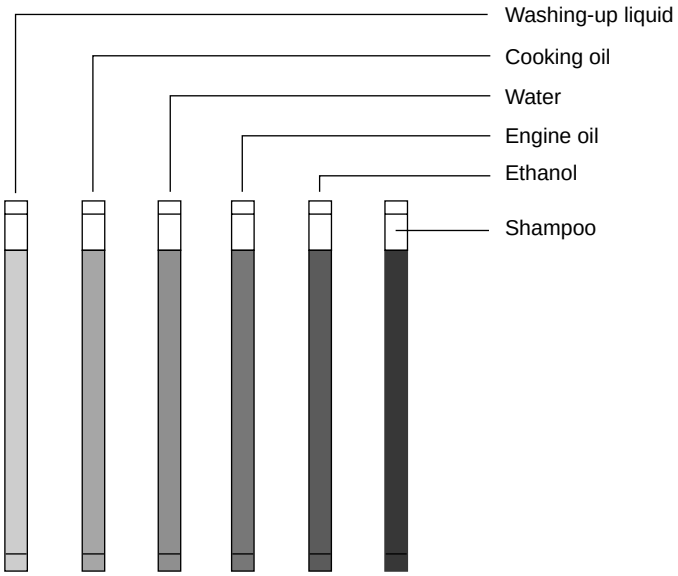
# Viscosity

## Introduction

The viscosity of a liquid is another term for the thickness of a liquid. Thick treacle-like liquids are viscous, runny liquids like water are less viscous. Gases exhibit viscosity in the same way. In this experiment, the viscosity of various liquids are compared.




## What to record

Complete a table like this:

| Liquid | Time taken /s |
|---|---|
| Washing up liquid | |
| Water | |

## What to do

1. Take one of the tubes provided.
2. Ensure the bubble is at the top and the tube is held vertical.
3. Quickly invert the tube and measure the time it takes for the bubble to reach the top.
4. Repeat this measurement for all the samples.

## Questions

1. Which liquid is the most viscous?
2. Which liquid is the least viscous?
3. Design a different experiment for comparing the viscosity of liquids.

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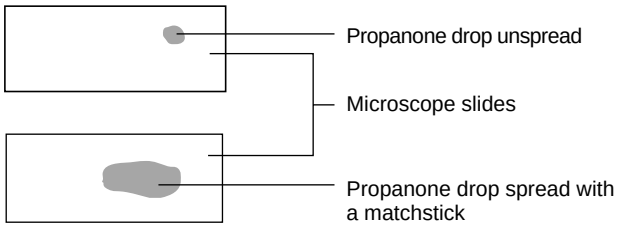
# Rate of evaporation

## Introduction

Evaporation is the conversion of a liquid into vapour, without necessarily reaching the boiling point. In this experiment the rate of evaporation is measured and compared under various different conditions.




## What to record

Complete the following table.

| Condition | Evaporation time (s) |
|---|---|
| Unspread, cool, air movement | |
| Unspread, cool, no air movement | |
| Spread out, cool, no air movement | |
| Spread out, warm, no air movement | |
| Unspread, warm, air movement | |
| Spread out, cool, air movement | |
| Spread out, warm, air movement | |
| Unspread, warm, no air movement | |

## What to do

1. Consider the following conditions for the evaporation of a drop of propanone on a microscope slide.

| Condition | How achieved |
|---|---|
| Warm | Warm slide in hands and hold on a flat palm. Alternatively, place the slide in warm water then dry the slide. |
| Cool | Room temperature. |
| Spread out drop | Spread the drop of propanone on the slide with a matchstick. |
| Unspread | Drop left as one drop on the slide. |
| Cool air flow | Fan with book. |
| Warm air flow | Blow across drop. |

2. Place a microscope slide in one of the conditions listed.
3. Add the single drop of propanone.
4. Measure the time for the drop to evaporate.
5. Repeat the experiment using different conditions.

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## Safety

Ensure there are no sources of ignition nearby. Wear eye protection.

## Questions

1. Name three factors that affect the rate of evaporation.
2. Why does evaporation produce a cooling effect?

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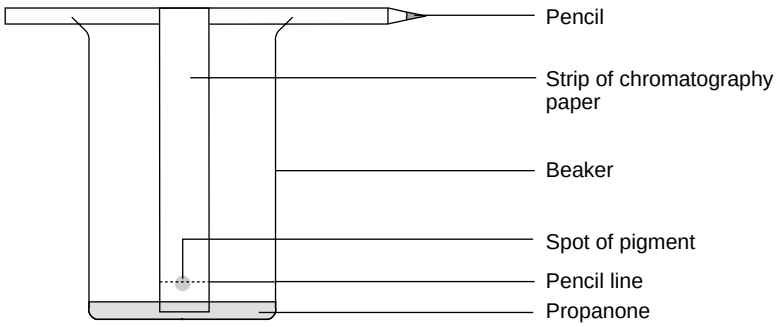
# Chromatography of leaves

## Introduction

Most leaves are green due to chlorophyll. This substance is important in photosynthesis (the process by which plants make their food). In this experiment, the different pigments present in a leaf are separated using paper chromatography.




## What to record

The chromatogram produced in this experiment can be dried and kept.

## What to do

1. Finely cut up some leaves and fill a mortar to about 2 cm depth.
2. Add a pinch of sand and six drops of propanone from the teat pipette.
3. Grind the mixture for at least three minutes.
4. On a strip of chromatography paper, draw a pencil line 3 cm from the bottom.
5. Use a fine glass tube to put liquid from the leaf extract onto the centre of the line. Keep the spot as small as possible.
6. Allow the spot to dry, then add another spot on top. Add five more drops of solution, letting each one dry before putting on the next. The idea is to build up a very concentrated small spot on the paper.
7. Put a small amount of propanone in a beaker and hang the paper so it dips in the propanone. Ensure the propanone level is below the spot.
8. Leave until the propanone has soaked near to the top.
9. Mark how high the propanone gets on the paper with a pencil and let the chromatogram dry.

## Safety

Propanone is highly flammable. Wear eye protection.

## Questions

1. How many substances are on the chromatogram?
2. What colours are they?
3. Which colour moved furthest?

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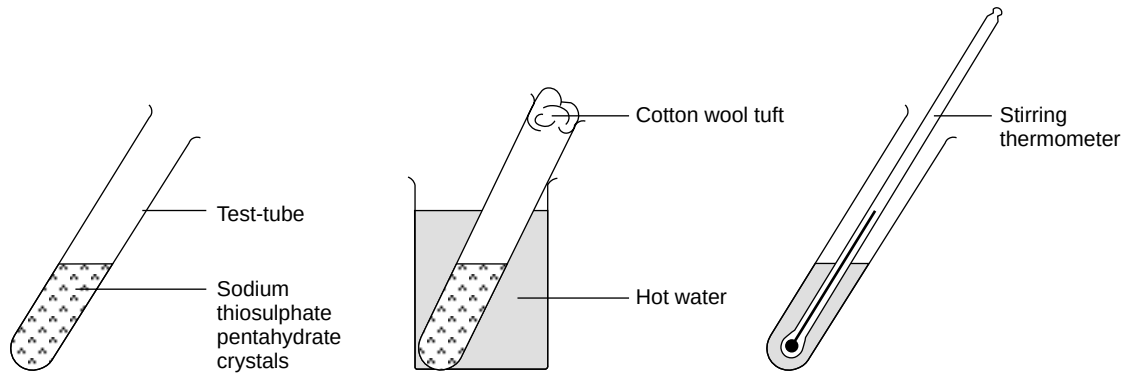
# Energetics of freezing

## Introduction

When a substance changes state, energy can be produced or absorbed. This experiment illustrates the energy change when a liquid freezes to form a solid.




## What to record

Record the temperature of the liquid, record the temperature as the liquid solidifies (this is the melting point of sodium thiosulfate pentahydrate).

## What to do

1. Half fill a test-tube with crystals of sodium thiosulfate pentahydrate.
2. Warm the test-tube gently in a beaker of hot water to melt the crystals.
3. Put a tuft of cotton wool in the top of the test-tube to exclude dust.
4. Stand the test-tube in an empty beaker and leave in a still place to cool.
5. Remove the cotton wool, put a thermometer in the melt, and record the temperature.
6. Stir with the thermometer and observe the temperature change at regular intervals as it solidifies.

## Safety

Wear eye protection.

## Questions

1. When a liquid turns into a solid is the process exothermic or endothermic?
2. When all the liquid has turned into solid the temperature begins to drop. Why is this?

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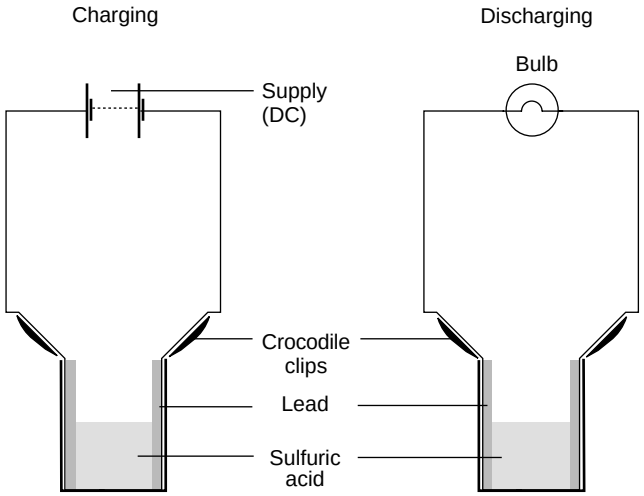
# Accumulator

## Introduction

Some types of cell are rechargeable. These cells store electricity. The most common rechargeable cell is the lead-acid type, which is the basis of car batteries. This experiment illustrates the charging and discharging of a lead-acid cell.




## What to record

Complete the table:

| Charging time /s | Time bulb is lit /s |
|---|---|
| 180 | |
| 210 | |
| 240 | |
| 270 | |
| 300 | |

## What to do

1. Connect the apparatus as shown.
2. Charge the cell at 4.5 V for three minutes.
3. Connect the cell for discharge.
4. Time how long the cell keeps the bulb lit.
5. Recharge the cell for a longer time and see how long the bulb stays lit.
6. Wash hands after handling lead.

## Safety

Wear eye protection. Care with sulfuric acid.

## Questions

1. Draw a line graph of your results. Charging time along the horizontal (*x*) axis and time lit along the vertical (*y*) axis.

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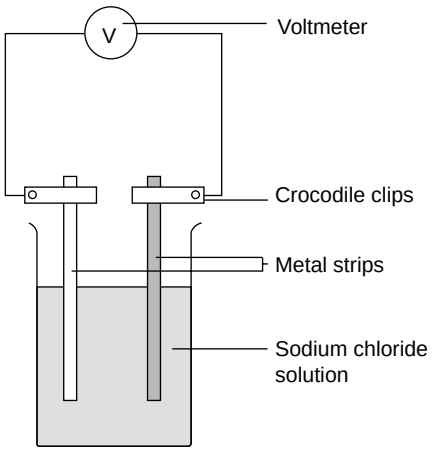
# Electricity from chemicals

## Introduction

Reactive metals form ions more readily than less reactive metals. This experiment illustrates the tendency of various metals to form ions. Two different metals and an electrolyte form a cell. The more reactive metal becomes the negative pole from which electrons flow.




## What to record

Complete the table.

## What to do

1. Set up the apparatus as shown.
2. Record the voltage.
3. Try all the combinations of metals.
4. Wash hands after handling lead.

## Safety

Wear eye protection.

| Metals used | Which metal forms the positive terminal (+ve) | Which metal forms the negative terminal (-ve) | Voltage (V) |
|---|---|---|---|
| Zinc and copper | | | |
| Copper and lead | | | |
| Lead and iron | | | |
| Zinc and lead | | | |
| Iron and magnesium | | | |
| Zinc and iron | | | |
| Zinc and magnesium | | | |
| Lead and magnesium | | | |
| Copper and magnesium | | | |
| Copper and iron | | | |

**Questions**

1. Place zinc, magnesium, copper, lead, and iron in order of reactivity.

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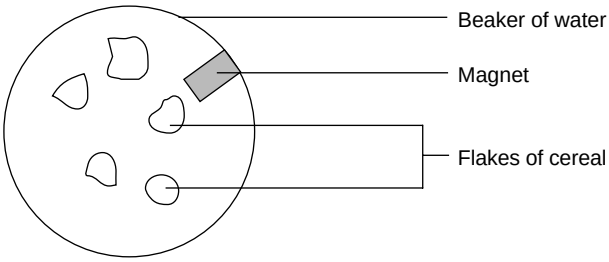
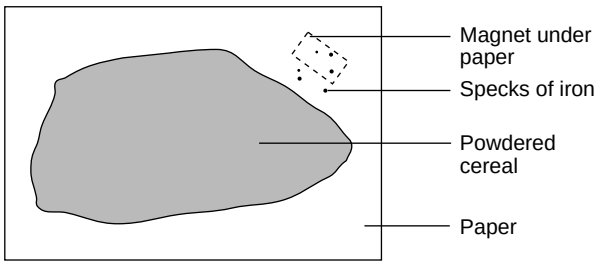
# Iron in breakfast cereal

## Introduction

Many breakfast cereals are fortified with iron. This iron is metallic and is added to the cereal as tiny particles of food grade iron before packaging. This experiment involves extracting the iron.




## What to do

1. Float four to six pieces of cereal on the surface of a beaker of water.
2. Hold a magnet close to the cereal and see if this can cause a piece to move.
3. Put some cereal into a mortar and use a pestle to produce a very fine powder.
4. Spread the powder on a piece of paper.
5. Put a magnet under the paper and move the paper over the magnet.
6. Observe closely in the region of the magnet as the cereal moves over it.

## Questions

1. Are all metals attracted to a magnet?
2. What are the symptoms of iron deficiency in the diet?

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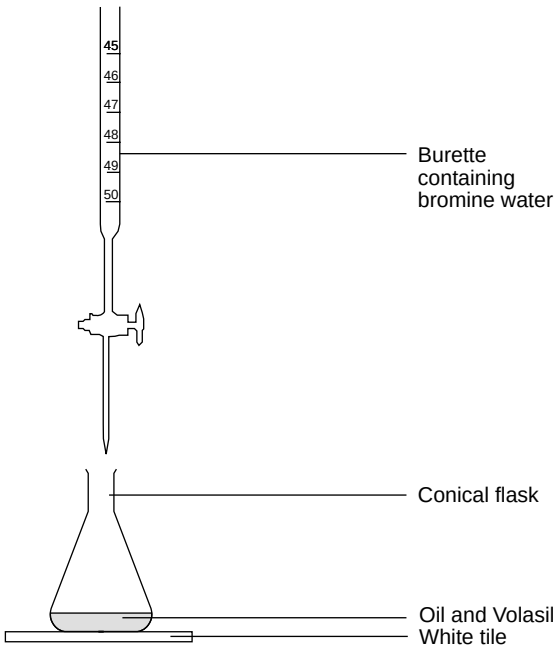
# Unsaturation in fats and oils

## Introduction

Advertisements often refer to unsaturated fats and oils. This experiment gives a comparison of unsaturation in various oils.




## What to record

Volume of bromine water required for each oil.

## What to do

1. Using a teat pipette, add five drops of olive oil to 5 $cm^3$ of Volasil in a conical flask.
2. Use a burette filled with a dilute solution of bromine water (0.02 mol $dm^{-3}$) **(Harmful and irritant**). Read the burette.
3. Run the bromine water slowly into the oil solution. Shake vigorously after each addition. The yellow colour of bromine disappears as bromine reacts with the oil. Continue adding bromine water to produce a permanent yellow colour.
4. Read the burette. Subtract to find the volume of bromine water needed in the titration.
5. Repeat the experiment with: five drops of cooking oil (vegetable) and five drops of cooking oil (animal).

## Safety

Wear eye protection.

## Questions

1. Which sample is the most saturated and which is the most unsaturated?
2. This comparison is only approximate. How could the method be improved?
3. What does unsaturated mean?

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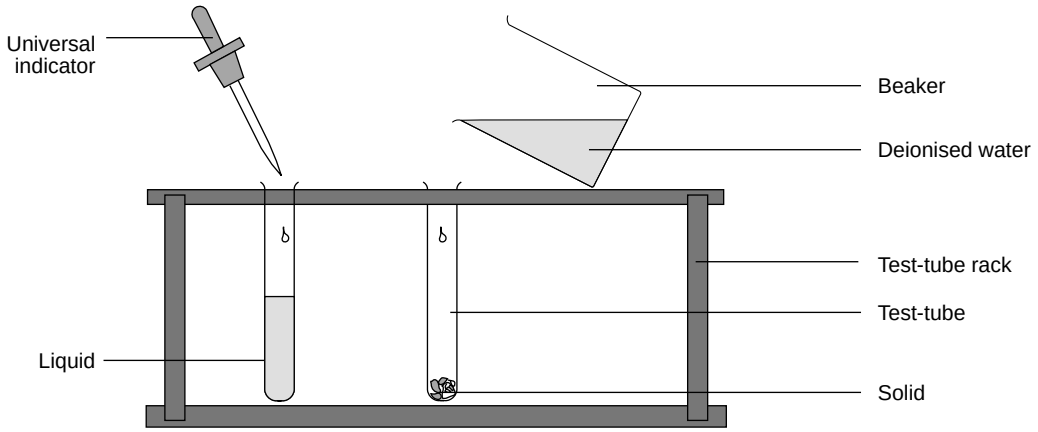
# The pH scale

## Introduction

The pH of a substance can be found by dissolving a small amount of the substance in deionised water and adding a few drops of Universal Indicator solution. The colour produced is compared with a pH chart.




## What to record

Prepare a table for your results

| Solution | Colour with Universal Indicator | pH |
|---|---|---|
| | | |

## What to do

1. Place one spatula measure of solid, or pour a few drops of liquid into a test-tube.
2. Half-fill the test-tube with deionised water from a small beaker, and shake to dissolve the solid or mix the liquid.
3. Add a few drops of Universal Indicator to the test-tube. Make a note of the colour in the table. Compare it against the pH colour chart and record the pH of the nearest colour in the table.

## Safety

Wear eye protection.

## Questions

1. List the substances that were acidic, substances that were alkaline and substances that were neutral.
2. Why might a scientist prefer to use Universal Indicator rather than a different indicator like litmus?
3. What would happen if equal amounts of vinegar and limewater were mixed?