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**SCIENCE
AT WORK**



Cosmetics

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SCIENCE AT WORK

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1 Skin

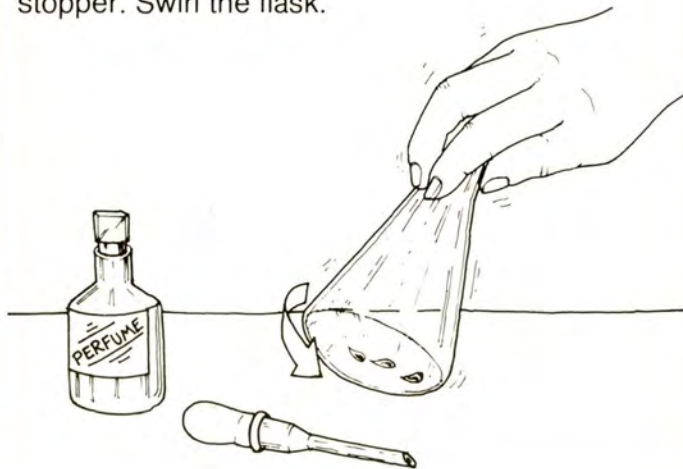
Making talcum powder

Apparatus

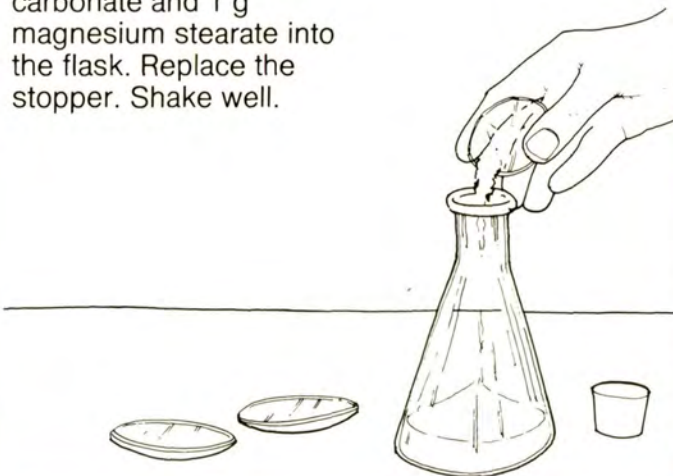
- ★ perfume
- ★ 20 g french chalk
- ★ 5 g calcium carbonate
- ★ glass stopper
- ★ 1 g magnesium stearate
- ★ 250 cm³ flask with stopper
- ★ dropper
- ★ 250 cm³ beaker
- ★ sieve
- ★ container with lid
- ★ label

You are going to make talcum powder. Talcum powder is a cosmetic you put on the skin to **absorb** (take up) moisture.

A Put **3** drops of perfume into the flask. Put in the stopper. Swirl the flask.



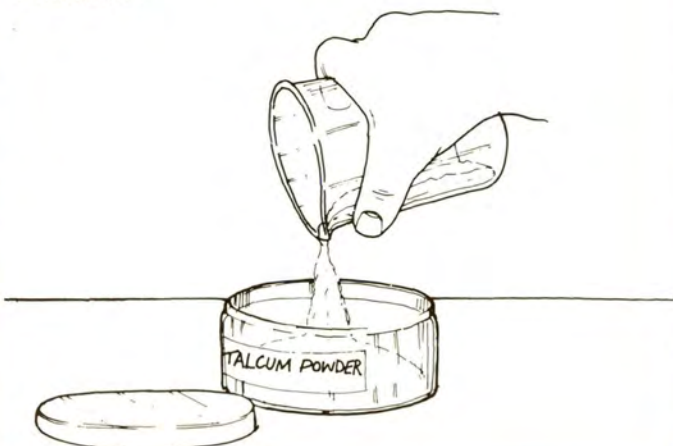
B Carefully, pour 20 g french chalk, 5 g calcium carbonate and 1 g magnesium stearate into the flask. Replace the stopper. Shake well.



C Push the powder through a sieve into a beaker. Use a glass stopper to break up any lumps.



D Put the talcum powder into a container. Label the container.



Q1 Why is the talcum powder sieved?

Q2 How would you find out which of the chemicals used in talcum powder is best at absorbing moisture?

National STEM Centre



N24708

Skin

Touch and the skin

Apparatus

- ★ labelled pieces of foam, wood, linen, velvet, blotting paper, tissue paper, glass, metal
- ★ blindfold ★ plastic glove ★ hand lens

You are going to find out how sensitive the skin is on different parts of the body.

Q3 Copy this table.

Name of material	My partner's guess (✓=right X=wrong)		
	using forehead	using back of hand	using fingertips

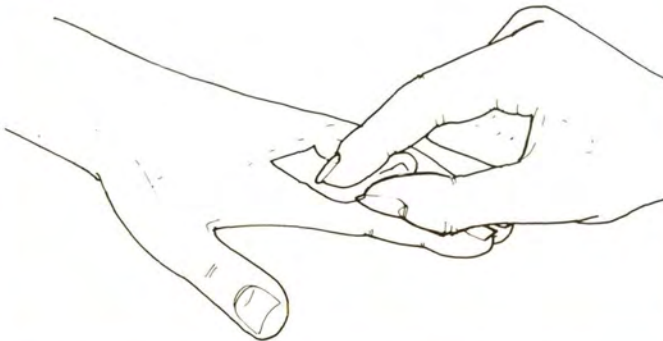
A Work with a partner. Look at the sample materials. Make sure you both know their names.



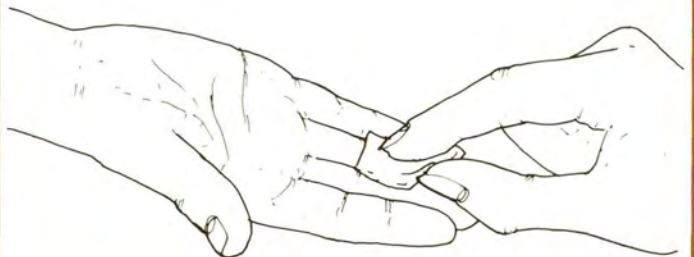
B Blindfold your partner. Stroke his forehead with one of the materials. Ask him to guess what it is. Record your partner's guess in your table.



C Now stroke the back of your partner's hand with another material. Record his guess in your table.

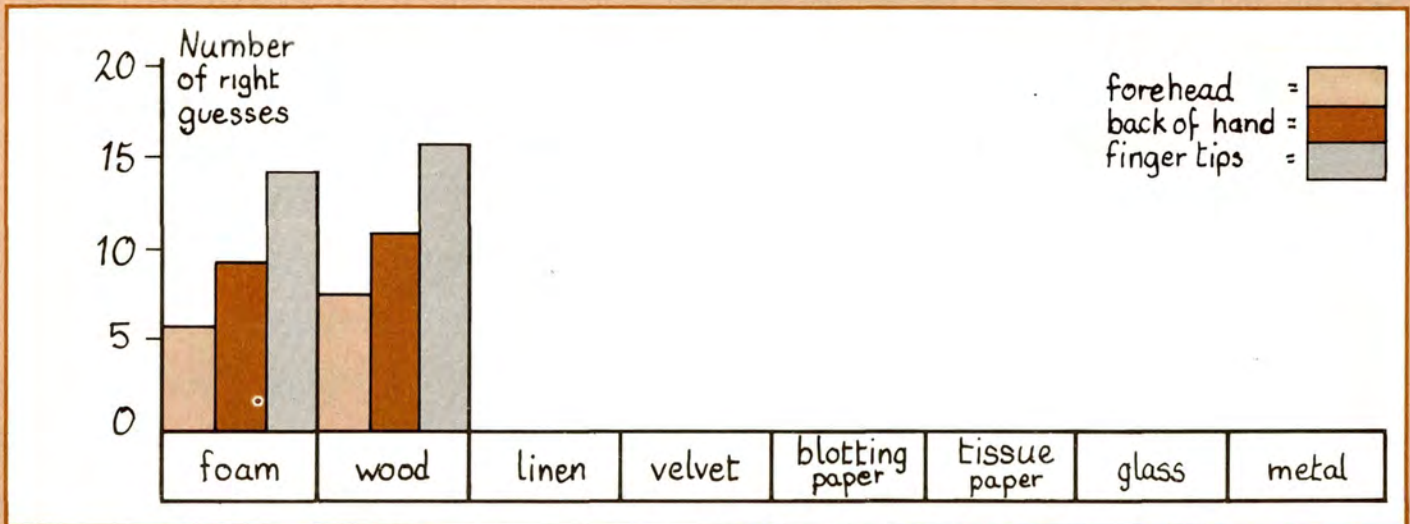


D Now stroke your partner's fingertips with another material. Record his guess in your table. Repeat steps B to D until each material has been tested 20 times on each part of the body.



Q4 Draw a block graph like this of your results. Plot the number of right guesses your partner made against the material tested. Use a different colour for forehead, back of hand and fingertips.





Q5 Is the skin sensitive to touch in all the parts of the body you tested?

Look at your block graph.

Q6 Name any material(s) your partner could not identify with the skin on his forehead.

Q7 Name any material(s) your partner could not identify with the skin on the back of his hand.

Q8 Name any material(s) your partner could not identify with his fingertips.

Q9 Which of the three skin surfaces was best at identifying materials by touch (which has the most right guesses in your table)?

E Put on a plastic glove. Leave it on for 5 minutes.



F Meanwhile, look at the skin of your other hand with a hand lens. Remove the glove and look inside.



Q10 When you looked at your skin what did you see?

Q11 When you took the glove off, what had happened to it inside?

Q12 Talcum powder is used to absorb moisture. Why do people put talcum powder into rubber gloves before wearing them?

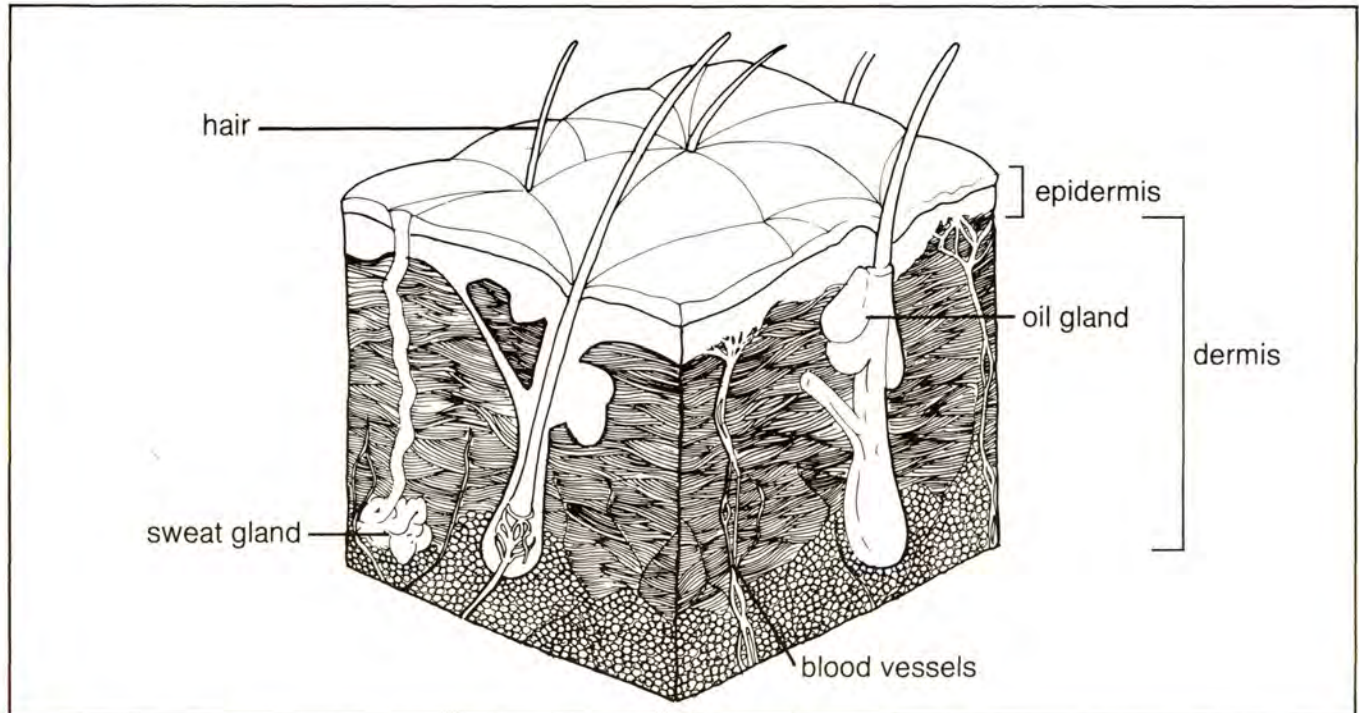
Skin

Information: What is skin?

The skin is the largest organ of the body. Skin is tough and flexible. It forms an unbroken layer over the whole body.

Skin varies in thickness over the body. On the eyelids the skin is 0.5 mm thick; on the sole of the foot it is about 5 mm.

Skin protects the body from damage. It is waterproof and makes a liquid (sweat) that helps to cool the body. The skin is sensitive to heat, cold, touch and pain.



The skin is made of two layers: the **epidermis** and the **dermis**. The epidermis is made up of dead cells which are worn away in flakes. The cells are replaced all the time. The surface of the skin is oily. Oil is made in glands at the side of the hair. Oil helps to keep moisture in the skin. Soap takes away some of the oil and the skin dries out or chaps. Some cosmetics leave an oily film on the surface of the skin and so stop water loss.

Q13 Where do you find thick skin?

Q14 What is the dead layer of the skin called?

Q15 What does soap do to the skin?

Q16 Why do face creams make the skin soft?

Q17 Where is the liquid that collected in your plastic glove (during the experiment) likely to be made?



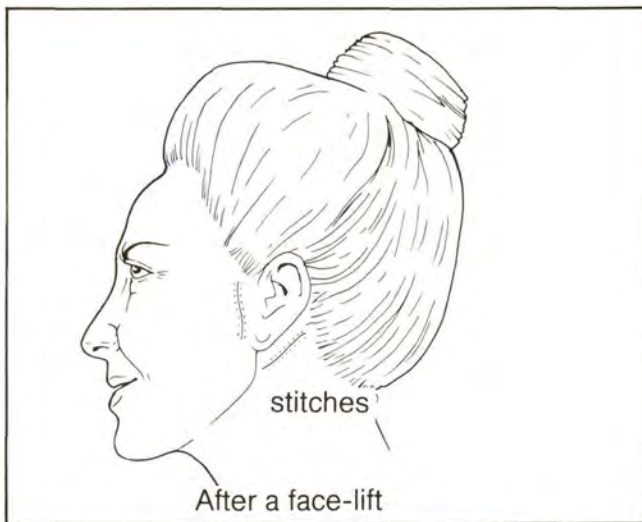
If you pinch the skin on the back of your hand, you can lift up the epidermis and the dermis. As you get older, the skin gets looser and will not drop back so quickly.



Skin is attached to the muscle beneath by elastic fibres. Young people have snug-fitting skin. In old age, the skin sags and wrinkles as the fibres stop being elastic.



Plastic surgery makes good damaged, deformed or missing parts of the body. Cosmetic surgery changes a person's looks because the person wants to look different. Wrinkled and sagging skin of the face and chin may be treated by a type of cosmetic surgery called **face-lifting**.



A surgeon makes **incisions** (cuts) at the ears. He removes some of the flesh from beneath the cuts. Then he pulls the skin tight across the bones of the face. The pulled skin is stitched in place. A face-lift lasts for 7 to 8 years.

Q18 Why do old people have wrinkled faces?

Q19 What is a face-lift?

Q20 What is the difference between plastic surgery and cosmetic surgery?


2 Making cosmetics

After shave

Apparatus

- ★ 30 cm³ industrial spirit ★ 3.5 cm³ glycerine ★ measuring cylinder
- ★ funnel ★ bottle with stopper ★ 2 clamp stands with clamps ★ stop clock
- ★ 2 thermometers with bungs ★ 2 watch glasses ★ 2 pieces of cotton
- ★ 2 rubber bands ★ tap water ★ 3 labels

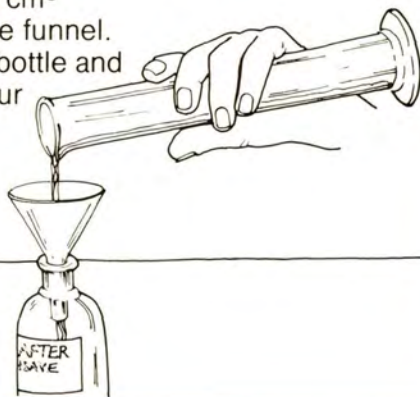
You are going to make after shave and find out what it does.

 Keep industrial spirit away from any flame.

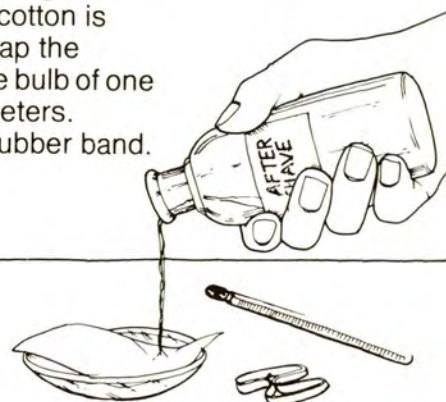
Q1 Copy this table.

Thermometer bulb covered with :-	Temperature of bulb in °C after :-						
	0 mins	5	10	15	20	25	30
Cotton + aftershave							
cotton + water							

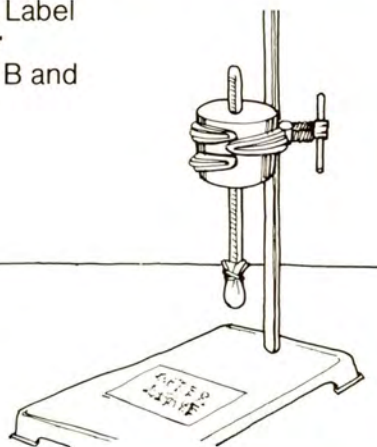
A Put a funnel into a bottle and pour in 30 cm³ industrial spirit and 3.5 cm³ glycerine. Add 15 cm³ water. Remove the funnel. Put the lid on the bottle and shake it. Label your after shave.



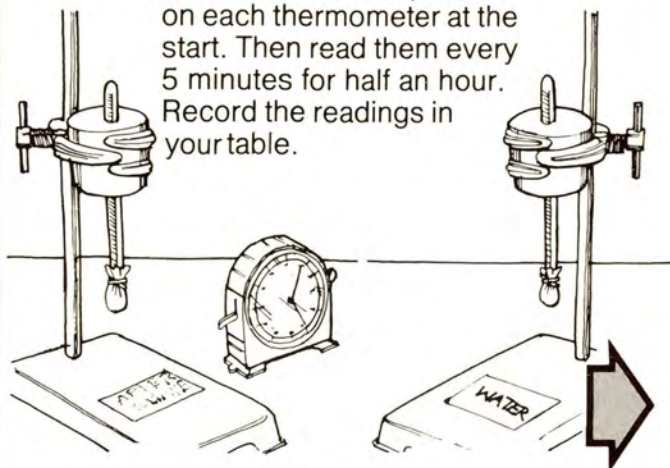
B Put some of your after shave onto some cotton on a watch glass. Make sure the cotton is quite damp. Wrap the cotton round the bulb of one of the thermometers. Secure with a rubber band.



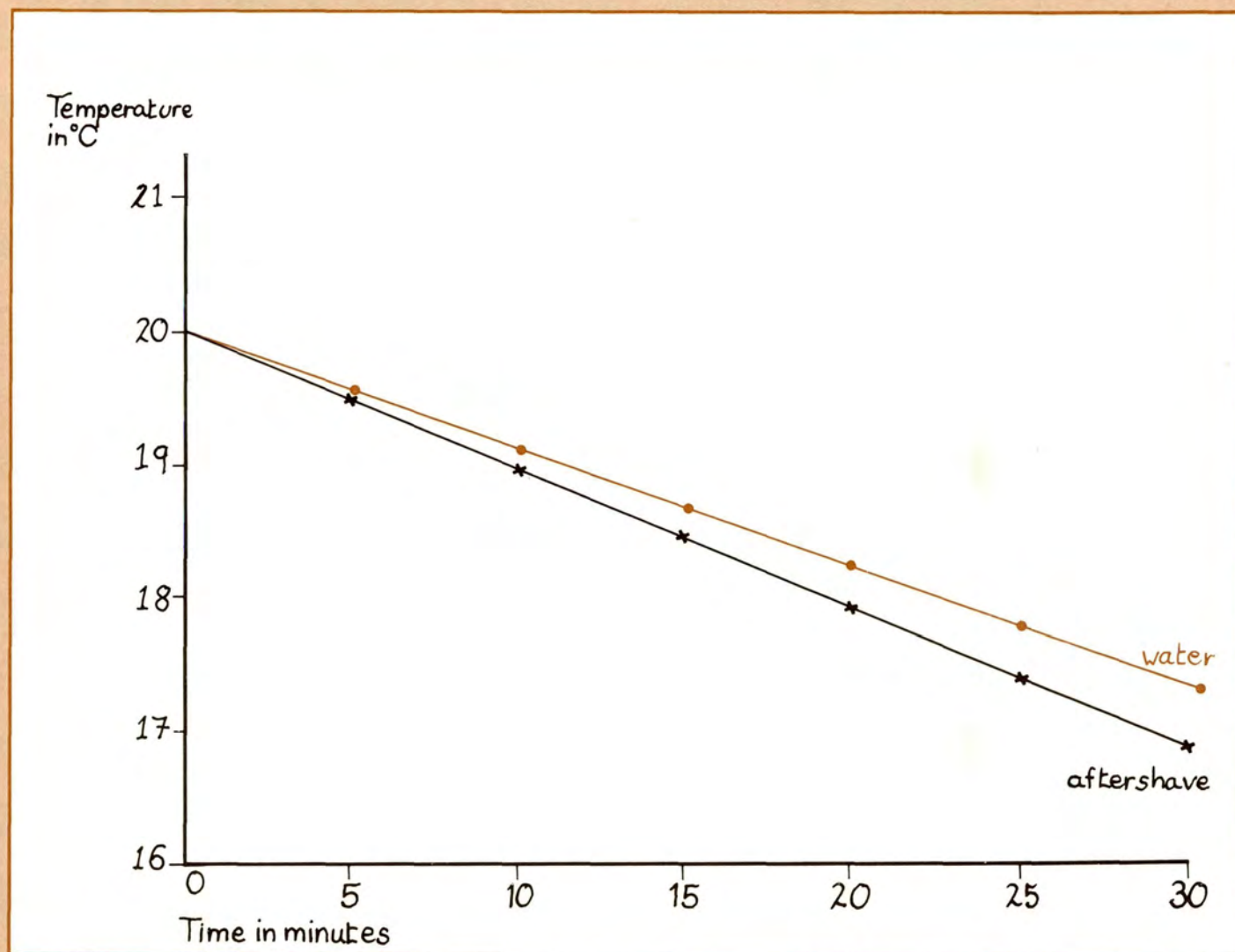
C Fasten the thermometer in one of the clamps. Label the clamp stand **after shave**. Repeat steps B and C with water.



D Read the temperature on each thermometer at the start. Then read them every 5 minutes for half an hour. Record the readings in your table.



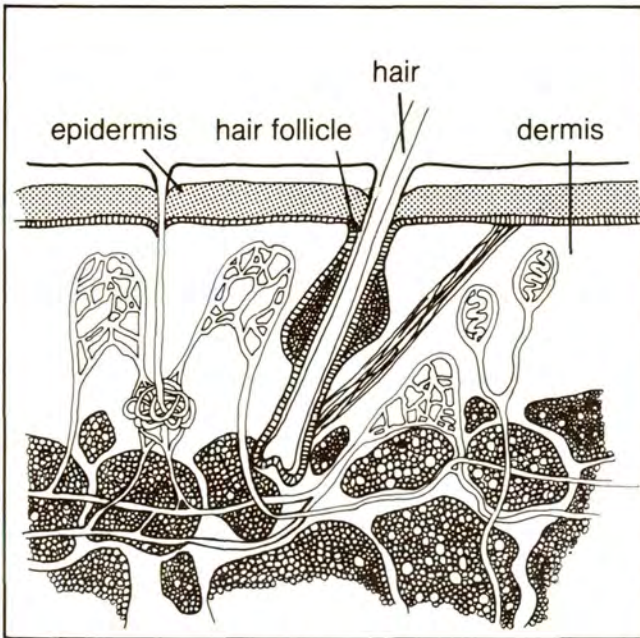
- Q2** Draw a graph like this of your results. Plot the temperature of the thermometer bulb against time. Use a different colour for each line. Label each line.



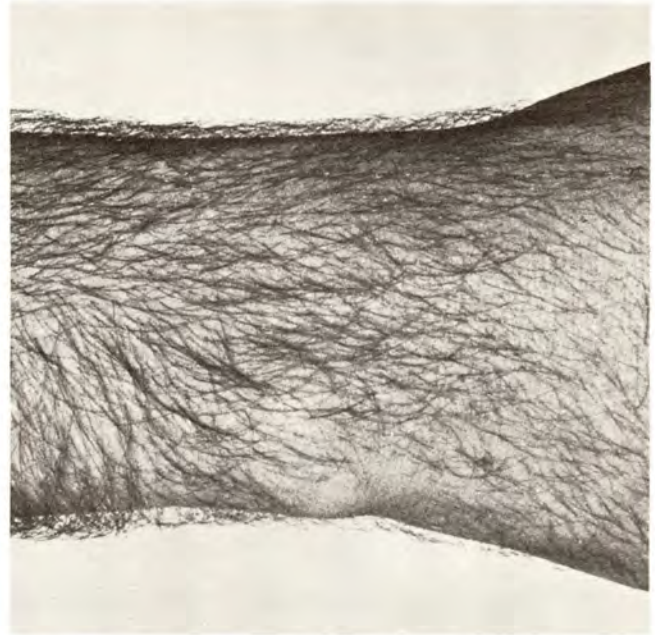
- Q3** What was the temperature of both thermometer bulbs when you started the stop clock?
- Q4** Look at the temperature of the thermometer bulb in cloth soaked in water. Did it go up, down or stay the same during the experiment?
- Q5** Look at the temperature of the thermometer bulb in cloth soaked in after shave. Did it go up, down or stay the same during the experiment?
- Q6** Why does after shave feel cool when it is put on the skin?

Making cosmetics

Information: Hair



Hair is made of a protein called **keratin**. Hair grows out of a special group of cells at the base of a fold in the epidermis of the skin. The fold is a **hair follicle**.



Different parts of the body have different kinds of hair. The armpit has coarse hair. Eyebrows and eye lashes have short and curved hairs.



People have different amounts of hair on their bodies. Some races have more body hair than others. The Ainu tribe in Japan have more body hair than most.



Hair contains the **pigment, melanin**, which gives it colour. In old age tiny air bubbles in the hair make hair look grey.



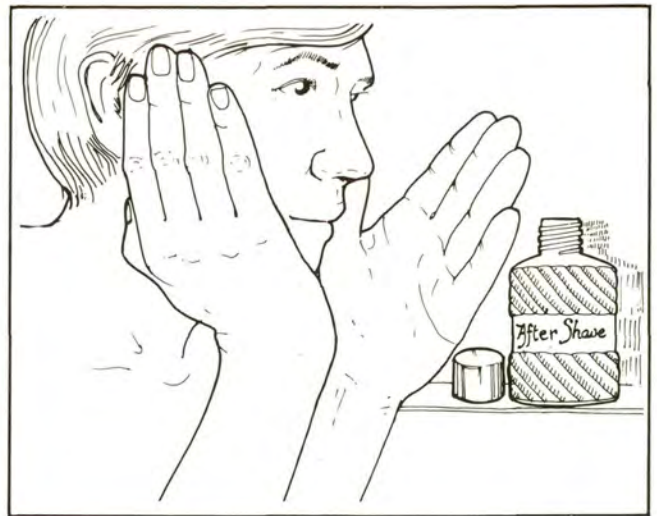
Some people grow their hair long. Some people prefer short hair. People who belong to certain religions do not cut their hair at all, like this Sikh. Hair on the **scalp** (head) grows about 0.35 mm each day.



Between 11 and 14 years of age, boys start to grow hair on their faces. Some men like to shave their beards, some do not.



Shaving cosmetics help to make shaving easy and pleasant. If a man's beard is wet, the hair is softened and easier to shave off. This softening with water takes 3 to 4 minutes.



Shaving soaps, lathers and creams make a foam that stays on the face for some time. After shave lotions help to soothe and cool the shaved skin.

Q7 What is the name of the protein in the hair?

Q8 What makes the hair coloured?

Q9 At what age do young men start to grow beards?

Q10 How do shaving soaps make shaving easier?

Q11 Why do men use after shave lotions?

3 Emulsions and skin creams

Making an emulsion

Apparatus

- ★ 10 cm³ olive oil
- ★ 10 cm³ liquid paraffin
- ★ soap solution
- ★ distilled water
- ★ caustic soda
- ★ 6 test tubes with stoppers
- ★ test tube rack
- ★ 2 droppers
- ★ three 10 cm³ measuring cylinders
- ★ wax pencil
- ★ stop clock
- ★ gloves
- ★ goggles

You are going to find out how emulsions are made.

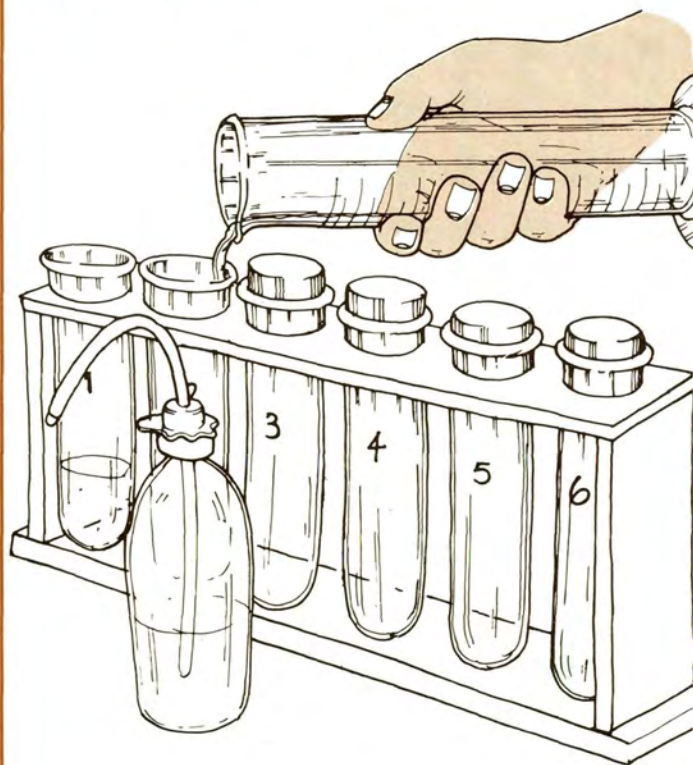


Gloves and goggles must be worn during this experiment.

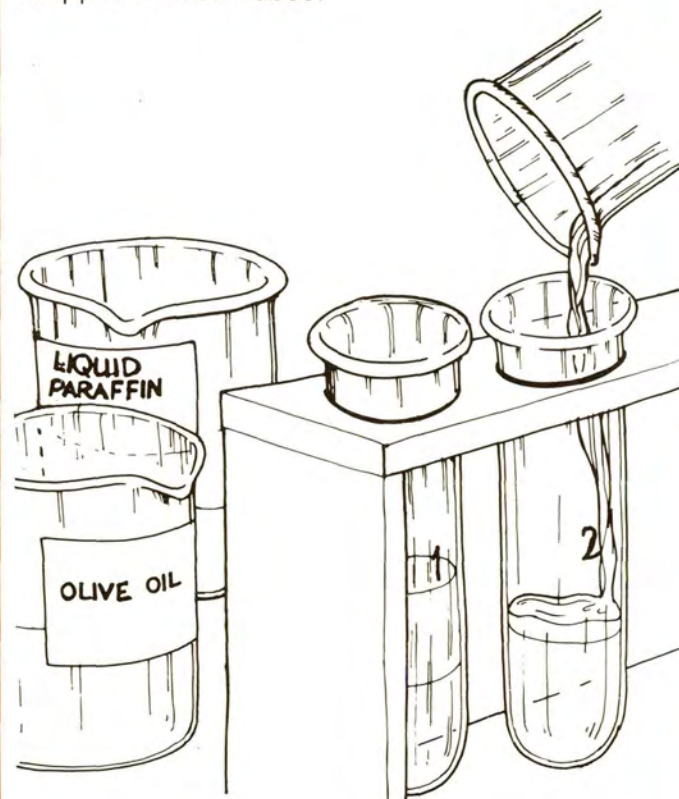
Q1 Copy this table.

Tube N ^o	Contents of tube	Appearance after 5 mins
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A Label the test tubes 1 to 6 with a wax pencil. Put 2 cm³ distilled water in tube 1 and tube 2.

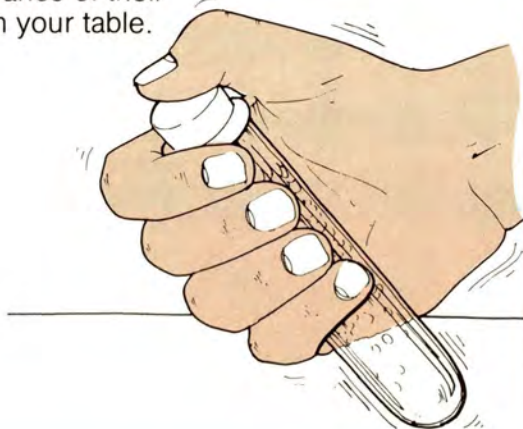


B Add 2 cm³ olive oil to tube 1. Add 2 cm³ liquid paraffin to tube 2. Put stoppers in both tubes.

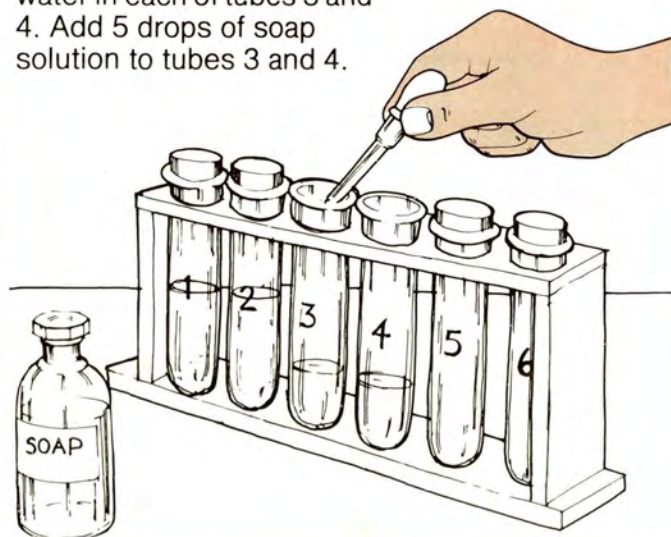


Emulsions and skin creams

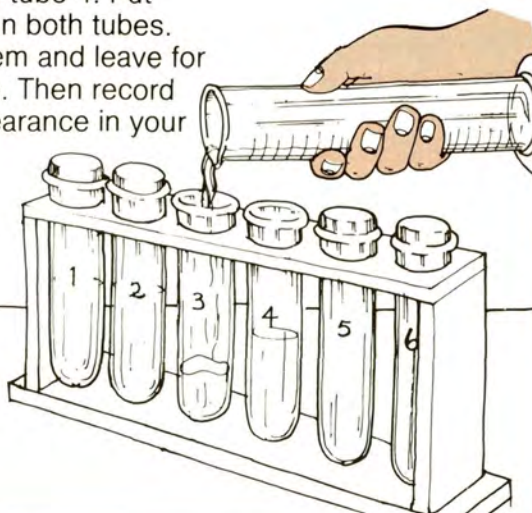
C Shake tubes 1 and 2 well. Replace them in the test tube rack. Leave them for 5 minutes. Then record the appearance of their contents in your table.



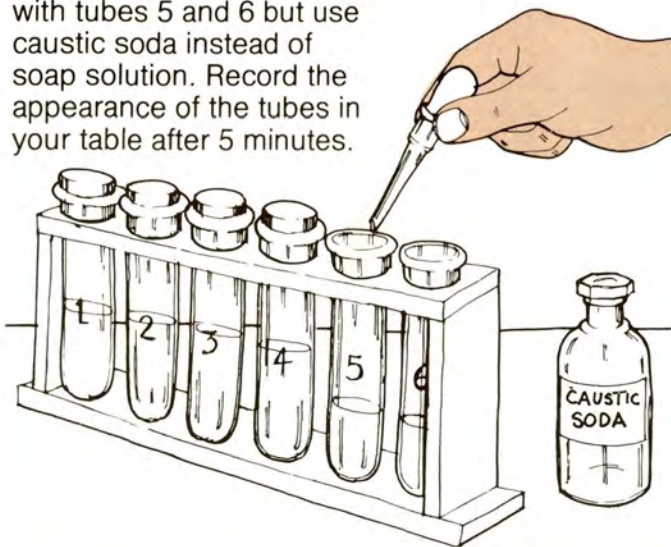
D Put 2 cm³ distilled water in each of tubes 3 and 4. Add 5 drops of soap solution to tubes 3 and 4.



E Add 2 cm³ olive oil to tube 3 and 2 cm³ liquid paraffin to tube 4. Put stoppers in both tubes. Shake them and leave for 5 minutes. Then record their appearance in your table.



F Repeat steps D to E with tubes 5 and 6 but use caustic soda instead of soap solution. Record the appearance of the tubes in your table after 5 minutes.



Q2 What happens when cold water and olive oil are mixed (tube 1)?

Q3 What happens when cold water and liquid paraffin are mixed (tube 2)?

Q4 What does soap do to:
a) olive oil and water (tube 3)?
b) liquid paraffin and water (tube 4)?

Q5 When an oil and water are mixed successfully an **emulsion** is made. In which tube(s) did you make an emulsion?

Q6 When caustic soda is added to oil, it reacts with some of the oil to make soap. The soap makes any remaining oil emulsify. In which tube(s) did this happen?

Emulsions and skin creams .

Making a cold cream emulsion

Apparatus

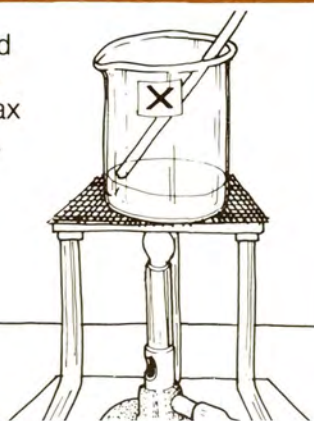
- ★ 13 g beeswax
- ★ 45 cm³ liquid paraffin
- ★ 1 g borax
- ★ 16.5 cm³ rosewater
- ★ perfume
- ★ two 250 cm³ beakers (labelled X and Y)
- ★ 3 stirrers
- ★ dropper
- ★ Bunsen burner
- ★ tripod
- ★ gauze
- ★ 3 heatproof mats
- ★ label
- ★ wide-necked jar
- ★ gloves
- ★ safety goggles

You are going to make a cosmetic emulsion (cold cream).

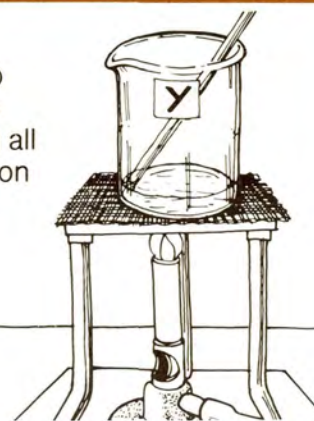


Gloves and goggles must be worn during this experiment.

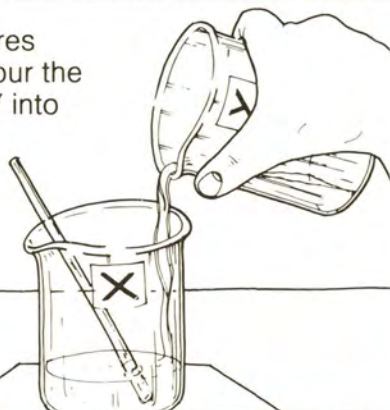
A Put 13 g beeswax and 45 cm³ liquid paraffin into beaker X. Heat until the wax melts, stirring all the time. Leave to cool on a heatproof mat.



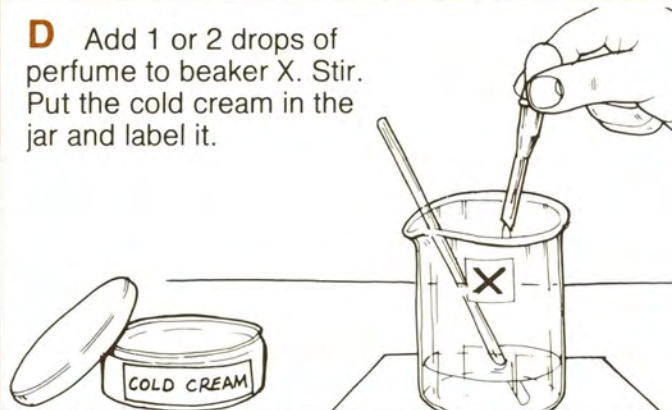
B Put 1 g borax and 16.5 cm³ rosewater into beaker Y. Heat until the borax dissolves, stirring all the time. Leave to cool on a heatproof mat.



C When the mixtures have both cooled, pour the contents of beaker Y into beaker X. Stir.



D Add 1 or 2 drops of perfume to beaker X. Stir. Put the cold cream in the jar and label it.



Q7 Why do you need to heat the chemicals to make cold cream?

Q8 Put some of the cream onto the back of your hand. Why do you think it is called cold cream?

Q9 If liquid paraffin and rosewater were shaken together and then left for 5 minutes, what do you think would happen?
(Clue: look back to page 11.)

Q10 How can you get liquid paraffin and rosewater to “mix together” (make an emulsion)?

Q11 In this experiment, borax and beeswax react together to make an emulsifier. What happens when liquid paraffin and rosewater are mixed with an emulsifier?

Information: Cosmetics

A cosmetic is anything that makes the skin or hair more beautiful. Cosmetics have been used for centuries.



The ancient Egyptians were using cosmetics some three and a half thousand years ago.



At the time of Queen Elizabeth I, a red colour from beetles was used to colour cheeks, like rouge or blusher does today.

Today, chemists use many different substances to make cosmetics. They use paraffin and petroleum jelly. They use oils from plants like olive oil and animal fats like **lanolin** (wool grease). Oils and fats go bad when they are kept, so cosmetics must have preservatives. They also have perfumes, dyes and chemicals that kill bacteria. Only pure chemicals can be used to make cosmetics.

Cosmetics must not stop the skin working. Some creams may block the openings of the sweat glands. Dirt gets trapped in the blocked pores and blackheads are formed.

Well-applied make-up can have striking results.



Without make-up.



With make-up.

Q12 What is a cosmetic?

Q13 Name one animal fat that is used to make cosmetics.

Q14 Why must the skin be cleaned after creams have been used?


4 Soap

Making soap

Apparatus

- ★ 1 cm³ olive oil
- ★ 5 cm³ methylated spirit
- ★ 10 cm³ caustic soda
- ★ 10 cm³ salt solution
- ★ distilled water
- ★ 3 small measuring cylinders
- ★ two 250 cm³ beakers
- ★ clock glass
- ★ stirrer
- ★ gauze
- ★ tripod
- ★ heatproof mat
- ★ Bunsen burner
- ★ funnel
- ★ filter paper
- ★ test tube with stopper
- ★ safety goggles
- ★ gloves

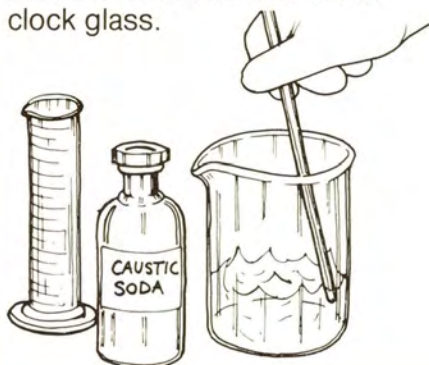
You are going to make soap from olive oil.

 Take care not to splash caustic soda on the skin. If you do, wash it off with lots of water. Gloves and goggles must be worn.

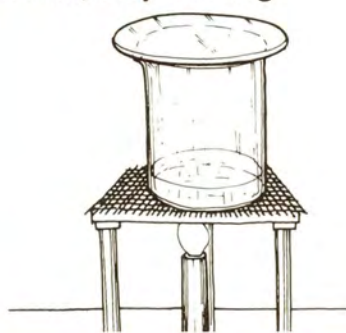
A Put on safety goggles and gloves. Pour 1 cm³ olive oil and 5 cm³ methylated spirit into a beaker.



B Carefully, pour 10 cm³ caustic soda into the beaker. Stir. Cover the beaker with a clock glass.



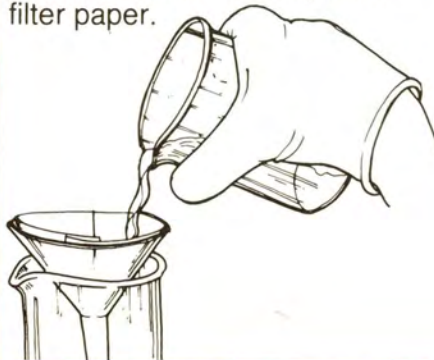
C Heat gently until the mixture boils. If the mixture froths up the side of the beaker, **stop heating**.



D Let the mixture cool. Then add 10 cm³ salt solution. Boil the mixture again.



E Let the mixture cool again. Filter the mixture. The soap you have made will stay in the filter paper.



F Put some of your soap into a test tube of distilled water. Put a stopper in the tube. Shake well.



Q1 Does your sample smell like the soap you use at home?

Q2 Does your soap make a lather with distilled water?

Q3 How could you make your soap more like toilet soap?

Information: Soap

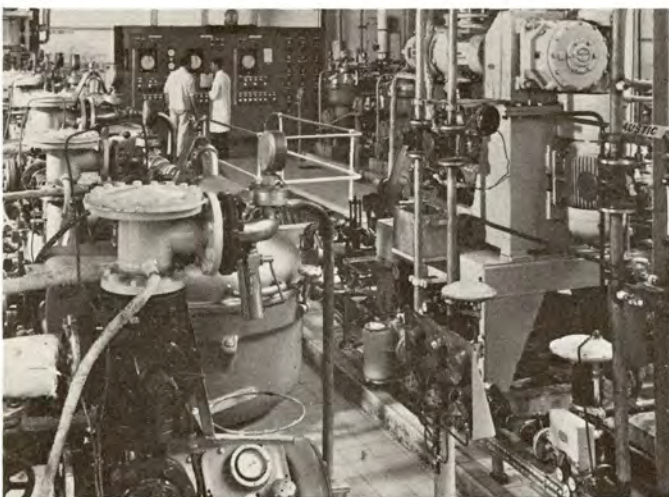
Soap was invented around 1000 AD. Up until the seventeenth century, most people made their own soap. It was made by boiling animal or vegetable fats with caustic soda.



The main animal used for fat was the whale. Now, many people object to killing whales for their **blubber** (fat). Other oils can be used instead to make soap.



Vegetable fats used in soap came from plants like the olive tree. Groundnut (or peanut) oil was also used.



Vegetable fats began to be needed for making margarine and other foods. So in the 1930s, scientists invented 'soaps' that could be made from mineral oil – the oil from oil wells. The photograph shows a factory which makes soap continuously from mineral oil.

Q4 What was the main type of animal fat used in soap?

Q5 What problem did soap makers have to solve in the 1930s?

Q6 What is mineral oil?

Q7 What is used to make soap as well as oil and caustic soda? (Clue: look at the work you did on page 14.)

5 Hard and soft water

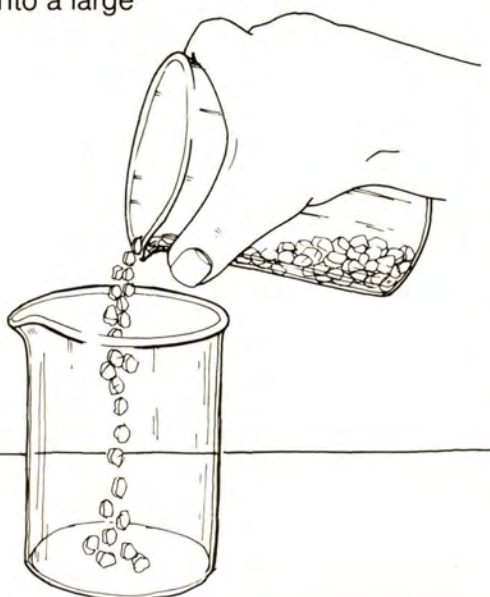
Making bath crystals

Apparatus

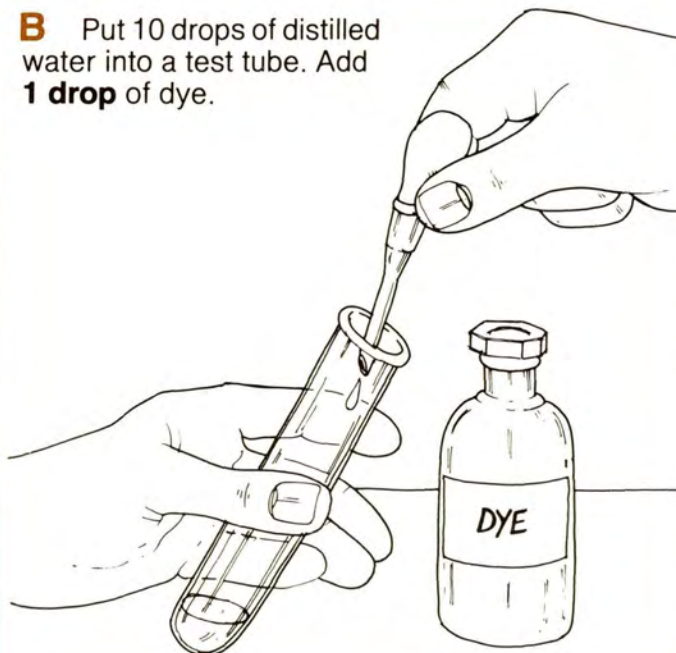
- ★ 100 g sodium carbonate
- ★ distilled water
- ★ dye
- ★ perfume
- ★ label
- ★ large beaker
- ★ dropper
- ★ test tube
- ★ wooden spoon
- ★ plastic bag
- ★ rubber band

You are going to make some bath crystals.

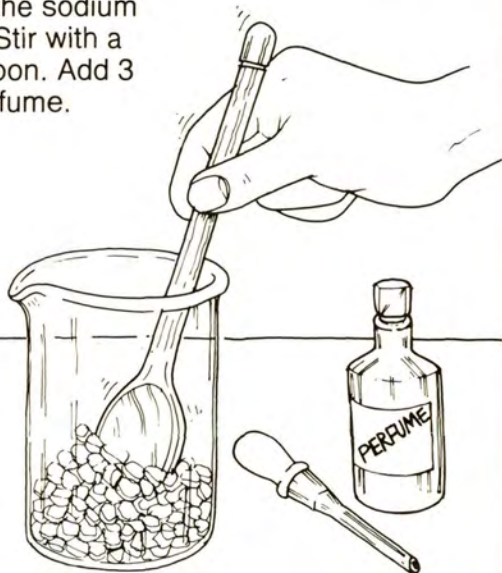
A Put 100 g sodium carbonate into a large beaker.



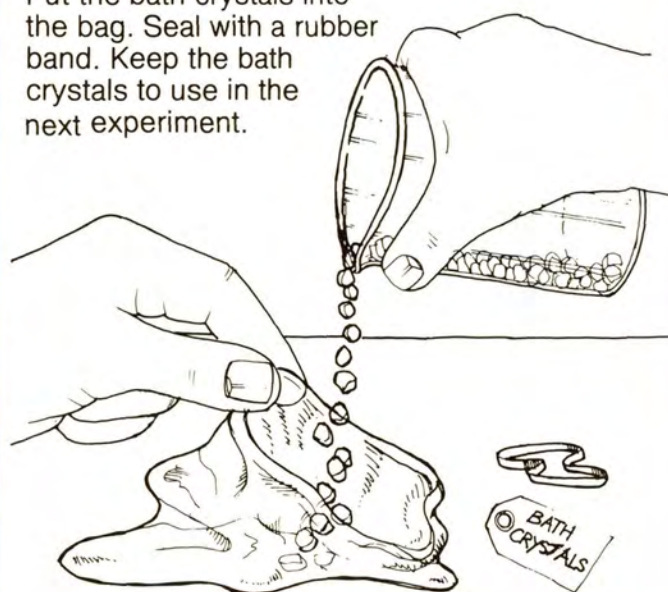
B Put 10 drops of distilled water into a test tube. Add **1 drop** of dye.



C Pour the coloured water onto the sodium carbonate. Stir with a wooden spoon. Add 3 drops of perfume. Stir again.



D Label the plastic bag. Put the bath crystals into the bag. Seal with a rubber band. Keep the bath crystals to use in the next experiment.



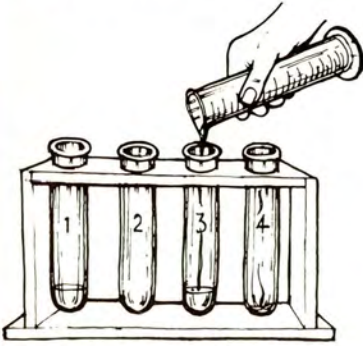
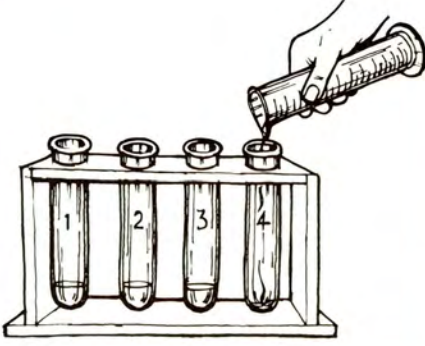
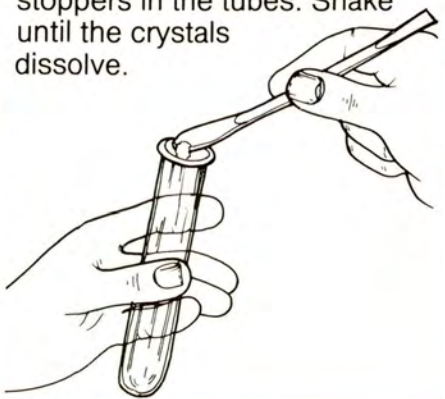


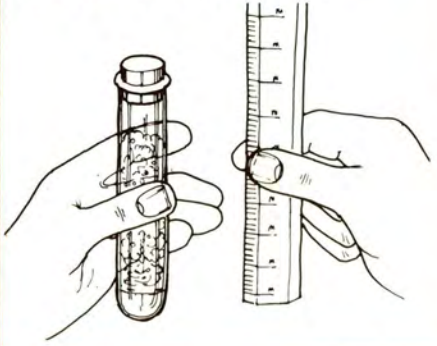
Testing bath crystals in hard and soft water

Apparatus

- ★ bath crystals ★ hard water ★ soft water ★ soap solution ★ spatula
- ★ four test tubes with stoppers ★ test tube rack ★ ruler
- ★ 10 cm³ measuring cylinder ★ dropper ★ wax pencil

You are going to see how bath crystals work in hard and soft water.

Q1 Copy this table.

Tube No	Soft or hard water in tube?	Bath crystals in tube?	Height of lather after shaking (cm)
<p>A Label the test tubes 1 to 4. Put 2 cm³ soft water into tubes 1 and 3.</p> 			
<p>B Put 2 cm³ hard water into tubes 2 and 4.</p> 			
<p>C Add 2 spatulas of bath crystals to tubes 1 and 4. Put stoppers in the tubes. Shake until the crystals dissolve.</p> 			
<p>D Add 10 drops of soap solution to each tube.</p> 			
<p>E Put stoppers in all the tubes. Shake each tube and see if any lather forms.</p> 			
<p>F Use a ruler to measure the height of the lather in each tube (in centimetres). Record the results in your table.</p> 			

Q2 Which type of water is best for making lather – hard or soft?

Q3 What happens when soap alone is added to hard water?

Q4 What happens when bath crystals and soap are added to hard water?

Q5 How do bath crystals work?

Hard and soft water


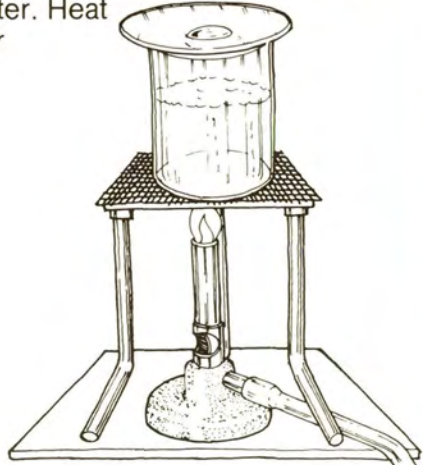
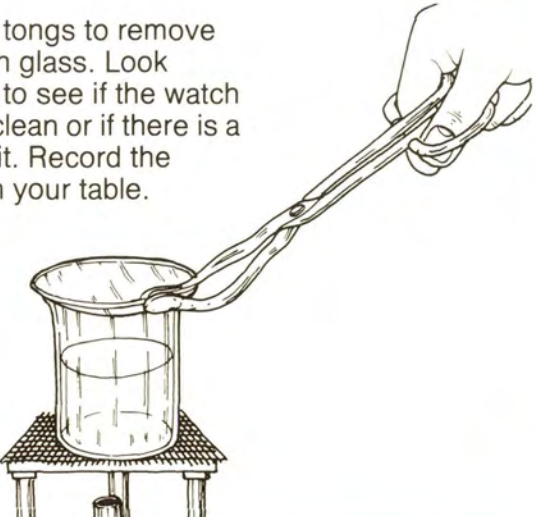
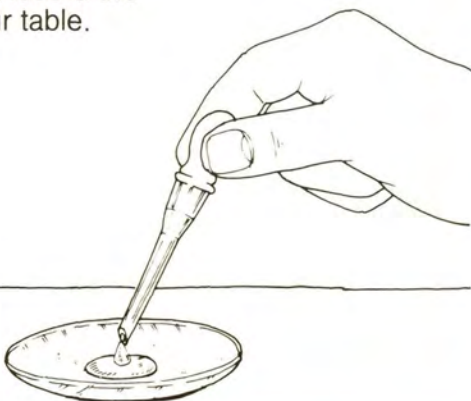
Comparing hard and soft water

Apparatus

- ★ hard water
- ★ soft water
- ★ dropper
- ★ 2 watch glasses
- ★ tongs
- ★ beaker
- ★ gauze
- ★ Bunsen burner
- ★ tripod
- ★ heatproof mat

You are going to find the difference between hard and soft water.

Q6 Copy this table.

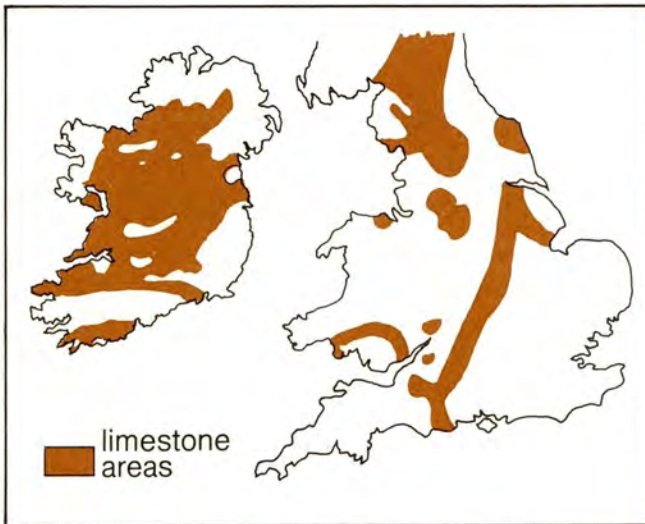
Type of water	Appearance of watch glass after evaporation
<p>A Put a few drops of soft water onto a clean watch glass.</p> 	<p>B Place the watch glass on a beaker of water. Heat until the soft water evaporates.</p> 
<p>C Use tongs to remove the watch glass. Look carefully to see if the watch glass is clean or if there is a stain on it. Record the results in your table.</p> 	<p>D Repeat steps A to C with hard water on a clean watch glass. Record the results in your table.</p> 

Q7 What is the difference between hard and soft water?

Q8 What do you think happens when soap is mixed with hard water and a scum is formed?

Information: How hard water is formed

Air contains carbon dioxide. Carbon dioxide dissolves in rain water to form an acid. The acid dissolves the limestone in rocks. The water flowing over these rocks contains dissolved calcium and magnesium salts that have come from the limestone.



Water in the streams and rivers from limestone areas contains dissolved salts. This water is hard. Hard water forms a scum with soap.



Bath crystals soften hard water. When hard water is boiled, the solids it contains are left on the sides of the container as **fur**. This can block pipes.



When hard water drips in caves the water evaporates and the solid is left behind. The solid forms columns. The ones "holding tight" to the ceiling are **stalactites**. Those coming up from the ground are **stalagmites**.

Q9 Why is rain water acid?

Q10 What happens to limestone rocks when rain falls on them?

Q11 Why do hot water pipes in hard water areas get "furred up"?

Q12 What are stalactites?

Q13 How are stalactites formed?

Q14 Do you live in a hard or soft water area? How do you know?

6 Making eyes!

Making eye shadow and mascara

Apparatus

- ★ Eye shadow: 2 g ceresin wax, 13 g petroleum jelly, 1 g beeswax, 3 cm³ liquid paraffin, pigment
- ★ Mascara: 1 g black pigment, 3.5 g stearic acid, 1 g carnauba wax, 1.5 g triethanolamine, 4 g beeswax
- ★ two 100 cm³ beakers
- ★ 2 stirrers
- ★ tongs
- ★ gauze
- ★ tripod
- ★ heatproof mat
- ★ Bunsen burner
- ★ 2 containers
- ★ 2 labels
- ★ foil

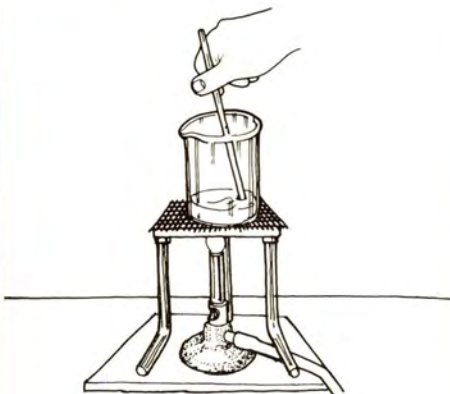
You are going to mix chemicals to make eye shadow and mascara.

Eye shadow

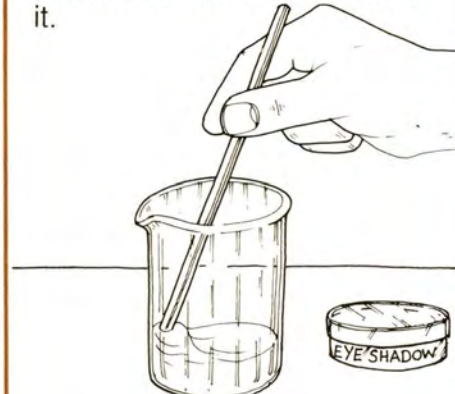
A Put 2 g ceresin wax, 13 g petroleum jelly, 1 g beeswax and 3 cm³ liquid paraffin into a beaker.



B Heat **gently** to melt the waxes. Stir all the time. Allow to cool.



C Put in the pigment a little at a time. Stir. When the colour is as you like it, put the eye shadow into a container. Label it.

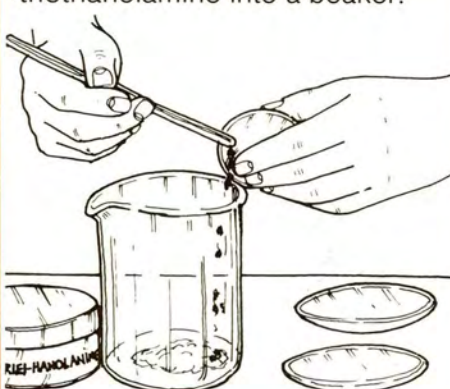


Mascara

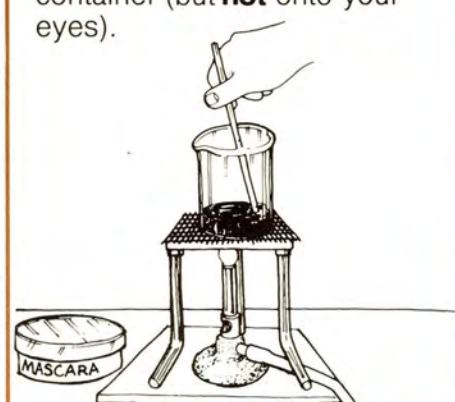
D Line your mascara container with foil. Label it.



E Put 1 g black pigment, 4 g beeswax, 3.5 g stearic acid, 1 g carnauba wax and 1.5 g triethanolamine into a beaker.



F Heat the beaker **gently**. Stir all the time. Allow to cool. Then put the mascara into the container (but **not** onto your eyes).



Information: Eyes

We use our eyes to see and to communicate our feelings to other people.



These pictures show how the eyes can express emotions. Can you see what the little girl is feeling in each picture?

If you have some old magazines, try cutting out a big colour photo of a face. Try to change the expression by putting on eyes from another picture.



Since eyes are used to communicate, people use cosmetics to make eyes more beautiful.



You can see how much difference cosmetics make to the eyes in these pictures.

Q1 Why do women use mascara and eye shadow?

Q2 Could mascara and eye shadow be harmful?

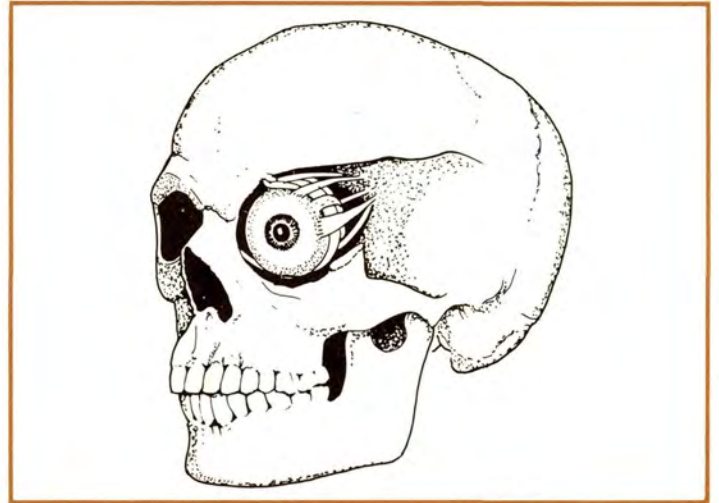
Q3 Why should you remove eye make-up at night?

Q4 We use our speech and eyes to communicate. Are there any other ways that humans express their feelings?

Making eyes!

Information: Protecting and improving eyesight

Sight is the most precious of our senses. Our eyes are protected in many ways. They are fitted into bony hollows in the skull. The eyebrows, lids and lashes all protect the eyes from damage.



Many of the things that were once used to protect or improve the eyesight are now used **cosmetically**. They are used to make the person wearing them more attractive. Some examples are given below.



Dark glasses are made to protect the eyes from the sun's rays.



Now they are often used as a fashion accessory.



Eyedrops are used to treat certain eye conditions. Blue-coloured eyedrops are used cosmetically to make the eyes sparkle.



Contact lenses were invented to help correct eyesight. They are also useful for sportsmen. They can be used to change the colour of the eye.

7 Nails

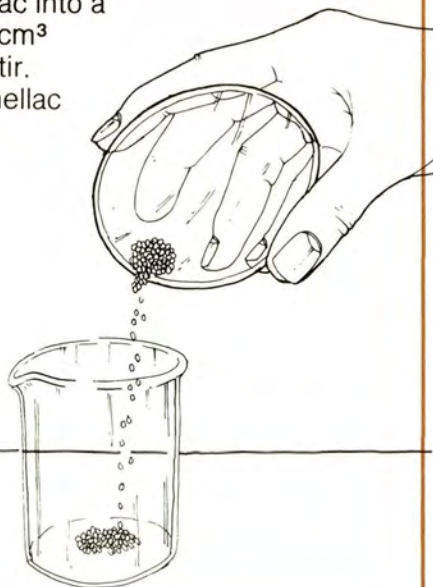
Making nail varnish

Apparatus

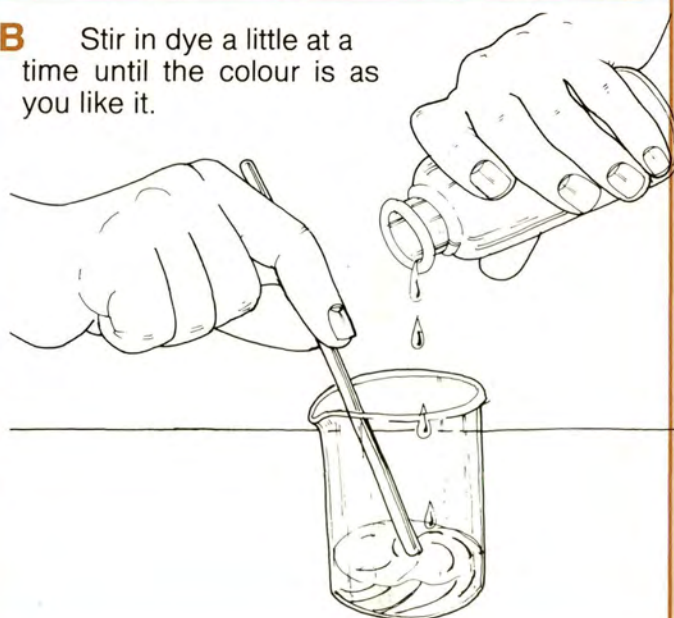
- ★ 3 g shellac flakes
- ★ 6.5 cm³ industrial spirit
- ★ red dye
- ★ 100 cm³ beaker
- ★ stirrer
- ★ bottle with screw top
- ★ label
- ★ small brush
- ★ 3 slides

You are going to mix chemicals to make nail varnish.

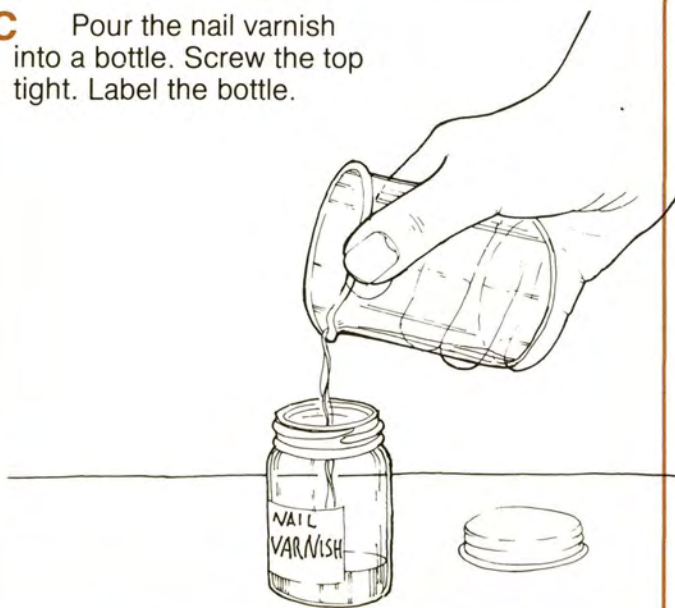
A Put 3 g shellac into a beaker. Add 6.5 cm³ industrial spirit. Stir. Leave until the shellac dissolves.



B Stir in dye a little at a time until the colour is as you like it.



C Pour the nail varnish into a bottle. Screw the top tight. Label the bottle.



D Streak 3 slides with the nail varnish and keep these for the next experiment.



Q1 Shellac is the varnish. What do you think happens to the spirit when varnish dries on the nail?

Q2 Why must the bottle cap be screwed tight?

Nails

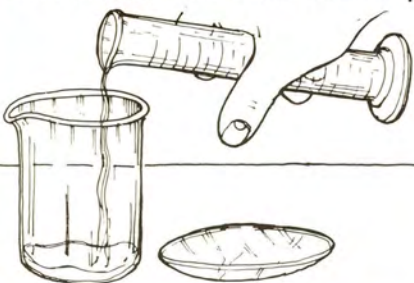
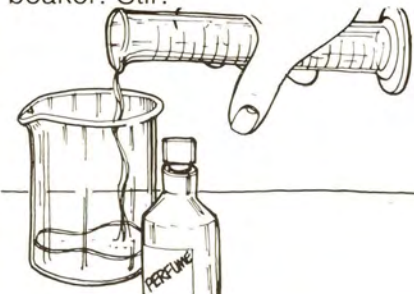

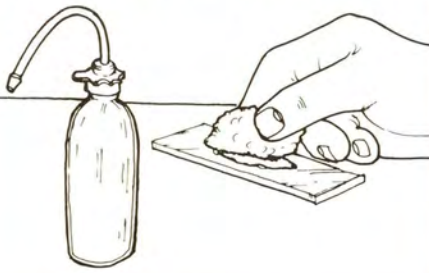
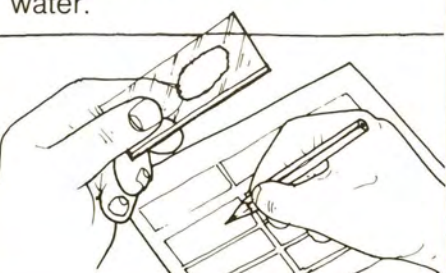

Nail varnish remover

Apparatus

- ★ 80 cm³ industrial spirit ★ cotton wool ★ 7 g glycerine ★ 0.1 g perfume
- ★ 250 cm³ beaker ★ measuring cylinder ★ stirrer ★ bottle with screw top
- ★ 3 slides streaked with nail varnish ★ distilled water ★ label
- ★ commercial nail varnish remover

You are going to make nail varnish remover and compare it with commercial (bought) nail varnish remover.

Q3 Copy this table.

Substance tested	Appearance of slide after testing	
<p>A Put 20 cm³ water into a beaker. Add 7 g glycerine. Stir until the glycerine has dissolved.</p> 	<p>B Add 80 cm³ industrial spirit and 0.1 g perfume to the beaker. Stir.</p> 	<p>C Put your nail varnish remover into a bottle. Screw on the lid. Label the bottle.</p> 
<p>D Take a varnished slide. Rub the varnish with cotton wool soaked with distilled water.</p> 	<p>E Record in your table the appearance of the slide after being rubbed with distilled water.</p> 	<p>F Repeat steps D and E with the nail varnish remover you made. Then repeat with commercial nail varnish remover. Each time record your results in the table.</p> 

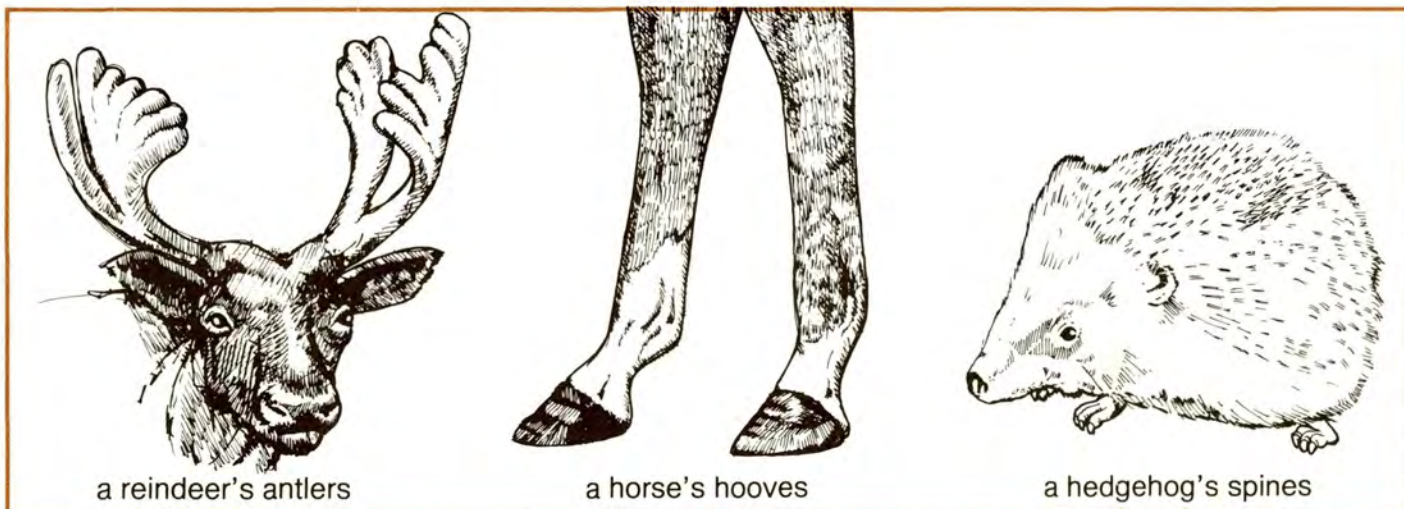
Q4 Which of the substances you tested removed nail varnish?

Q5 Was your own nail varnish remover as good as the commercial one?

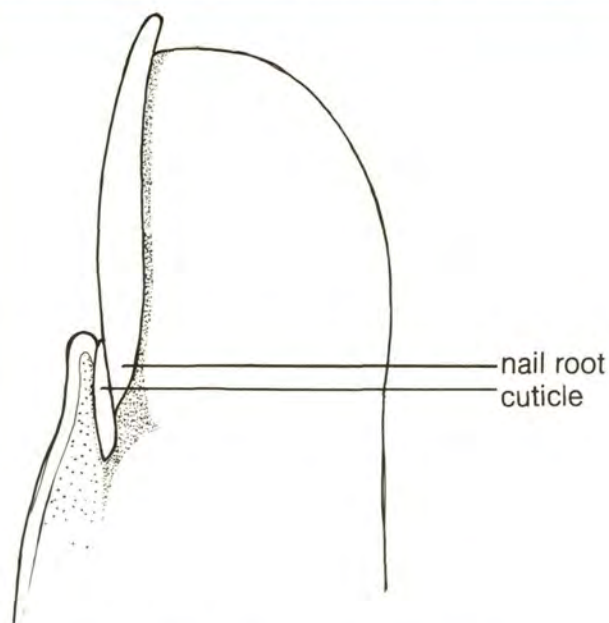
Q6 Anything that dissolves a solid is called a solvent. Which of the substances you tested were not solvents?

Information: Nails

Nails are found at the ends of human fingers and toes. The nail is a protective cover. It is also useful for helping us to pick things up and for scratching! A nail is made of **keratin**. Hair is also made of keratin. Many parts of the bodies of animals are made of keratin, such as:



Nails are about 0.6 mm thick. Nails grow about 0.1 mm each day. Some people grow their nails very long, or use false nails.



Nails grow as long as we live. Growth takes place at the root of the nail. The root is protected by a layer of tough epidermis, known as the **cuticle**.

Q7 What is the chemical that makes hair and nails?

Q9 What is the link between a reindeer's antlers and a hedgehog's spines?

Q8 Why do we need nails?

8 Toothpaste

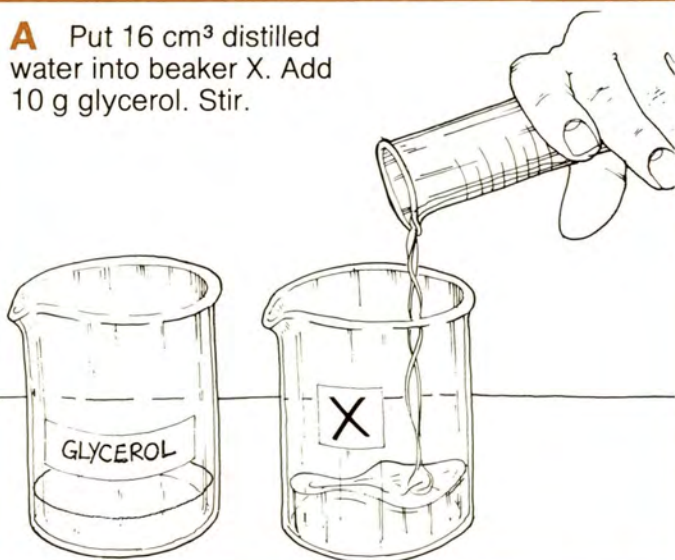
Making toothpaste

Apparatus

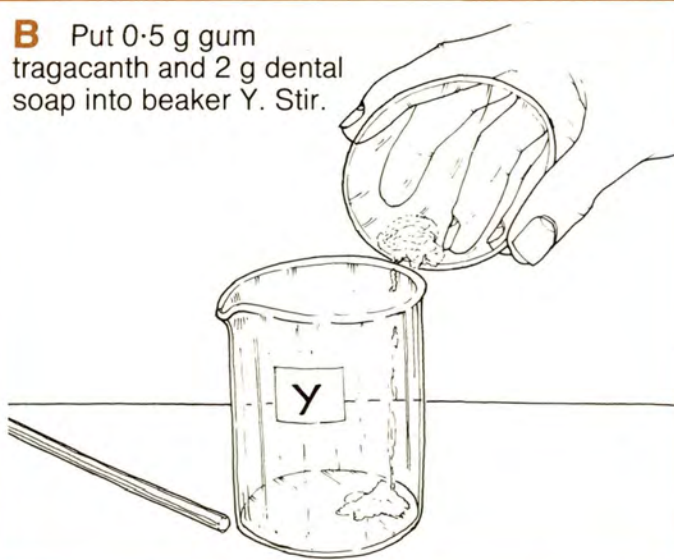
- ★ 23 g calcium carbonate
- ★ 2 g soap castile powder
- ★ 10 g glycerol
- ★ stirrer
- ★ 0.5 g gum tragacanth
- ★ distilled water
- ★ 100 cm³ measuring cylinder
- ★ two 100 cm³ beakers labelled X and Y
- ★ container with lid
- ★ label

You are going to mix chemicals to make toothpaste.

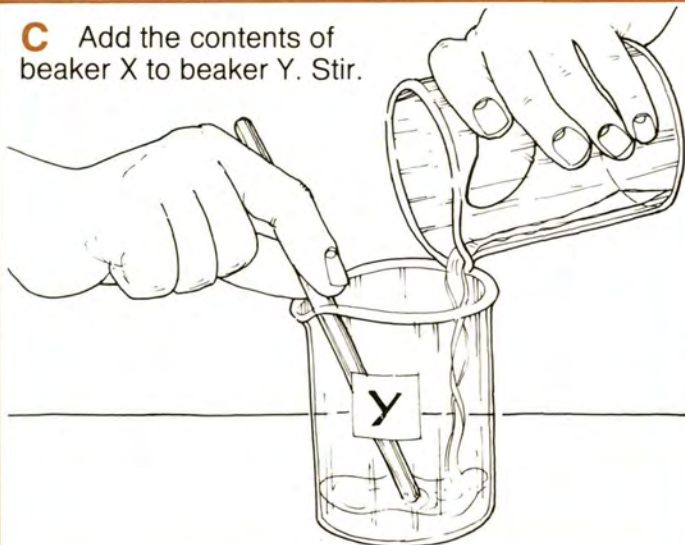
A Put 16 cm³ distilled water into beaker X. Add 10 g glycerol. Stir.



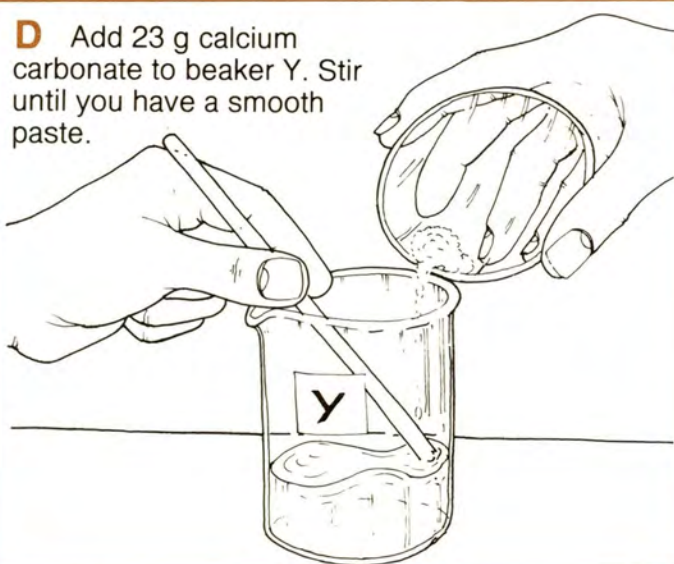
B Put 0.5 g gum tragacanth and 2 g dental soap into beaker Y. Stir.



C Add the contents of beaker X to beaker Y. Stir.



D Add 23 g calcium carbonate to beaker Y. Stir until you have a smooth paste.



E Put your toothpaste into a container. Label it. Keep your toothpaste for the next experiment.

Q1 Does the toothpaste you have made look like the kind you use at home?

Testing home-made and commercial toothpastes

Apparatus

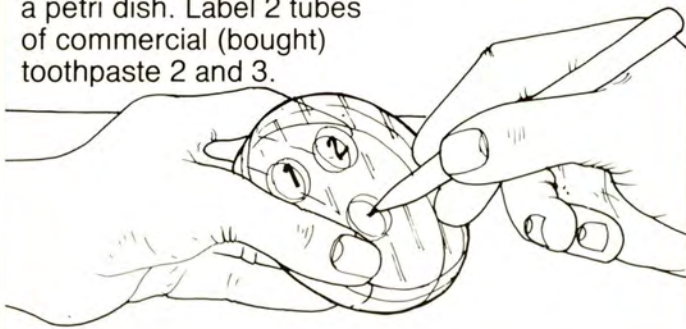
- ★ toothpaste you made in last experiment ★ petri dish with agar and wells
- ★ 2 different tubes of commercial toothpaste ★ 3 spatulas ★ wax pencil
- ★ oven ★ ruler ★ 3 glass rods

You are going to find out if toothpastes can stop the growth of bacteria.

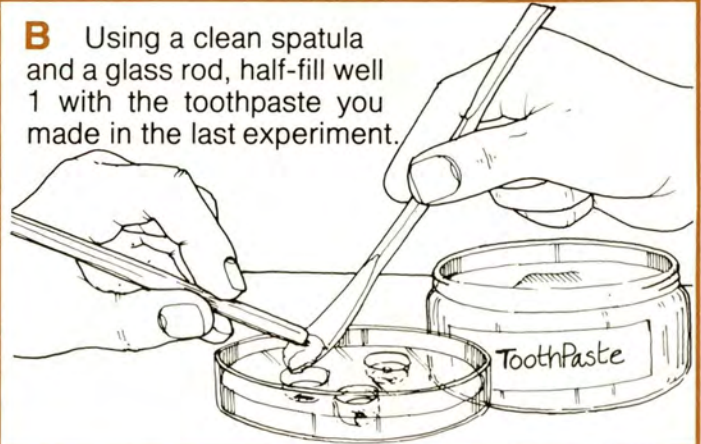
Q2 Copy this table.

N ^o of well	Type of toothpaste in the well	Distance across clear area round well
------------------------	--------------------------------	---------------------------------------

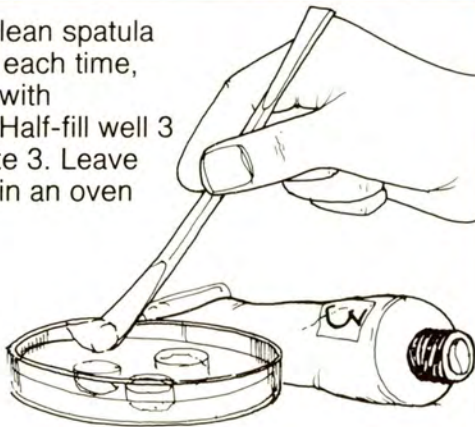
A Using a wax pencil, label the wells in the base of a petri dish. Label 2 tubes of commercial (bought) toothpaste 2 and 3.



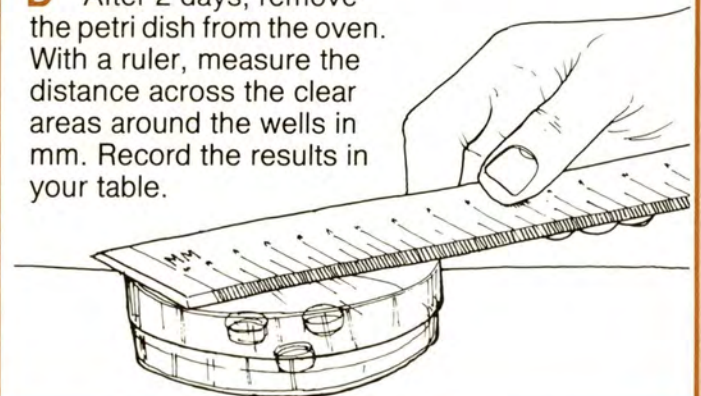
B Using a clean spatula and a glass rod, half-fill well 1 with the toothpaste you made in the last experiment.



C Using a clean spatula and glass rod each time, half-fill well 2 with toothpaste 2. Half-fill well 3 with toothpaste 3. Leave the petri dish in an oven for 2 days.



D After 2 days, remove the petri dish from the oven. With a ruler, measure the distance across the clear areas around the wells in mm. Record the results in your table.



- Q3** The agar had bacteria in it. Where these grow, the agar is cloudy. If the agar is clear, the bacteria are not growing. Which well had the biggest clear area?
- Q4** Which of the toothpastes you tested was best at stopping the growth of bacteria?

Toothpaste

Information: The mouth and teeth

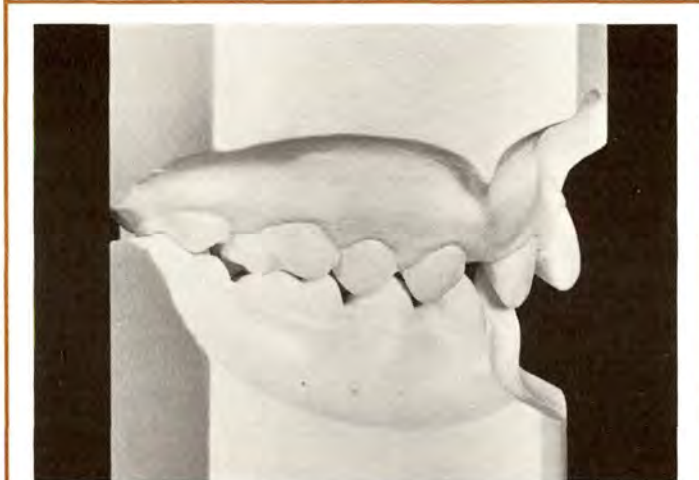
Food enters the body through the mouth. The lips work as a seal. The lips are sensitive to heat, cold and touch. The lips move to help form sounds into words. The teeth, tongue and cheek muscles also help in speech.



The remains of meals can stick between the teeth. Bacteria feed on these remains and make acid. The acid can dissolve the hard layer of **enamel** on the outside of the teeth.



The teeth **decay** (go bad) if the food remains are not brushed away. The top teeth should be brushed downwards, the bottom teeth upwards.



Not everyone's teeth grow straight. Some teeth grow so crooked that they look ugly and cause health problems.



Often, cosmetic dentistry can improve the teeth, as you can see in these photographs. They show casts of teeth before and after straightening.

Q5 What are the jobs of the lips?

Q6 Is it best to clean teeth before or after a meal?

Q7 Which way should a toothbrush be moved when the top teeth are cleaned?

Q8 How can the dentist help someone with very crooked teeth?

9 Perfumes and essences

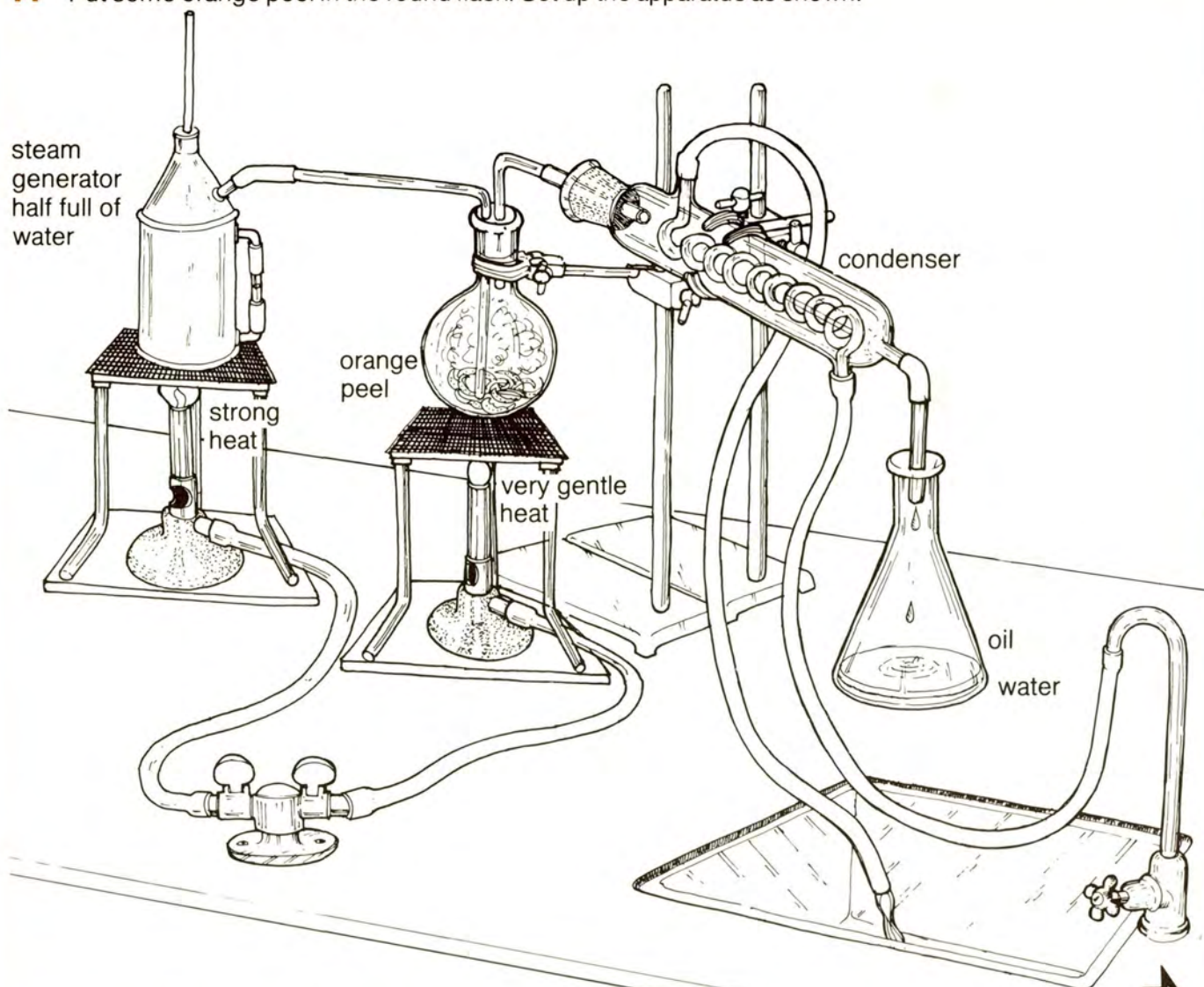
Getting oils from plants

Apparatus

- ★ orange peel
- ★ anhydrous sodium sulphate
- ★ steam generator with tubes
- ★ separating funnel with stopper and stand
- ★ conical flask
- ★ condenser
- ★ small beaker
- ★ 2 clamp stands and bossheads
- ★ wooden clamps
- ★ small bottle
- ★ 2 Bunsen burners
- ★ 2 tripods
- ★ 2 gauzes
- ★ 2 heatproof mats
- ★ round flask with tubes

You are going to extract (get out) the oil from an orange peel.

A Put some orange peel in the round flask. Set up the apparatus as shown.

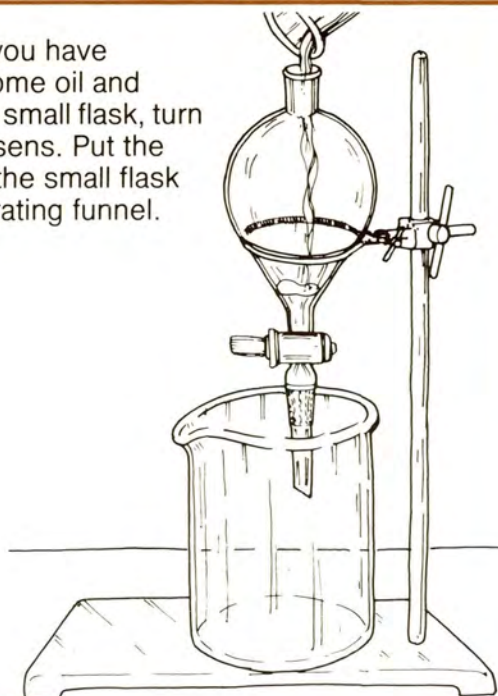


B Turn on the water tap. Light the Bunsen under the steam generator. As the steam passes into the flask, start to heat this **very gently**.

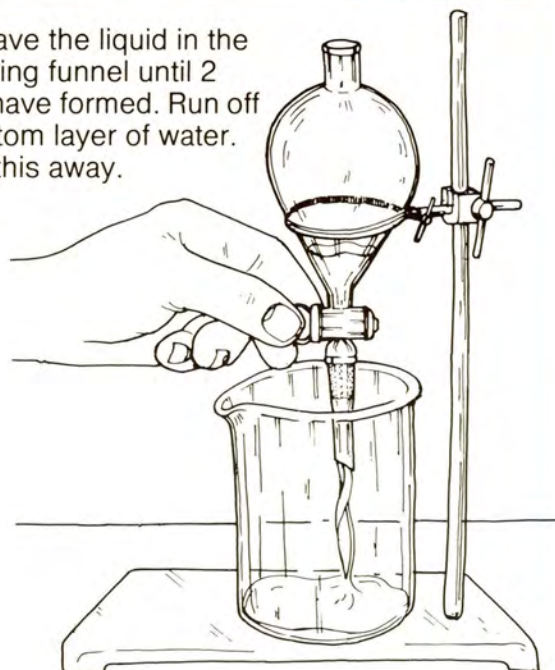


Perfumes and essences

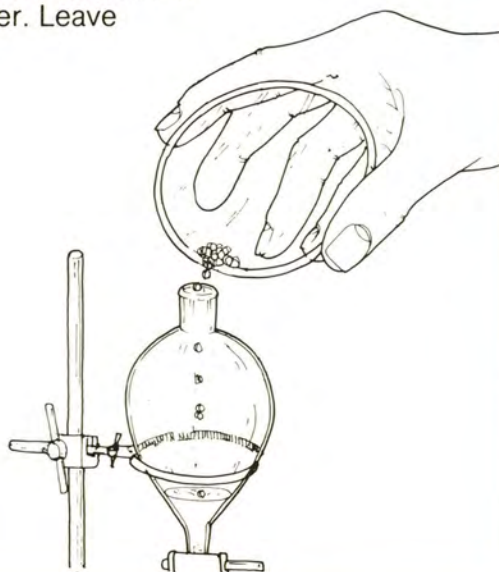
C When you have collected some oil and water in the small flask, turn off the Bunsens. Put the liquid from the small flask into a separating funnel.



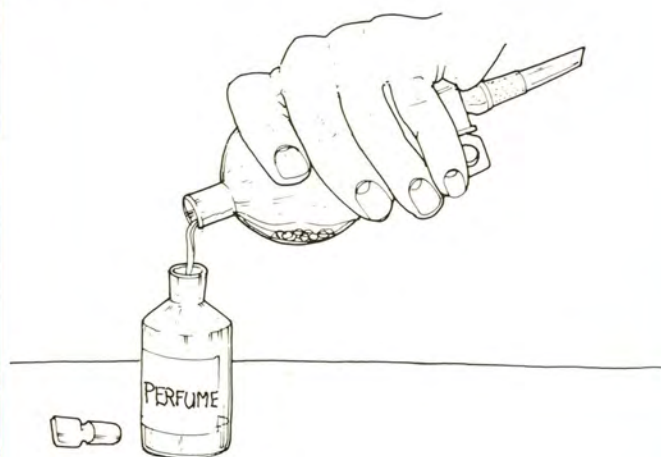
D Leave the liquid in the separating funnel until 2 layers have formed. Run off the bottom layer of water. Throw this away.



E Add a few grains of anhydrous sodium sulphate to your oil in the funnel. Put in the stopper. Leave overnight.



F Pour the dry oil into a bottle. Label the bottle **perfume**.



Q1 What happens to the oil in the orange peel during this experiment?

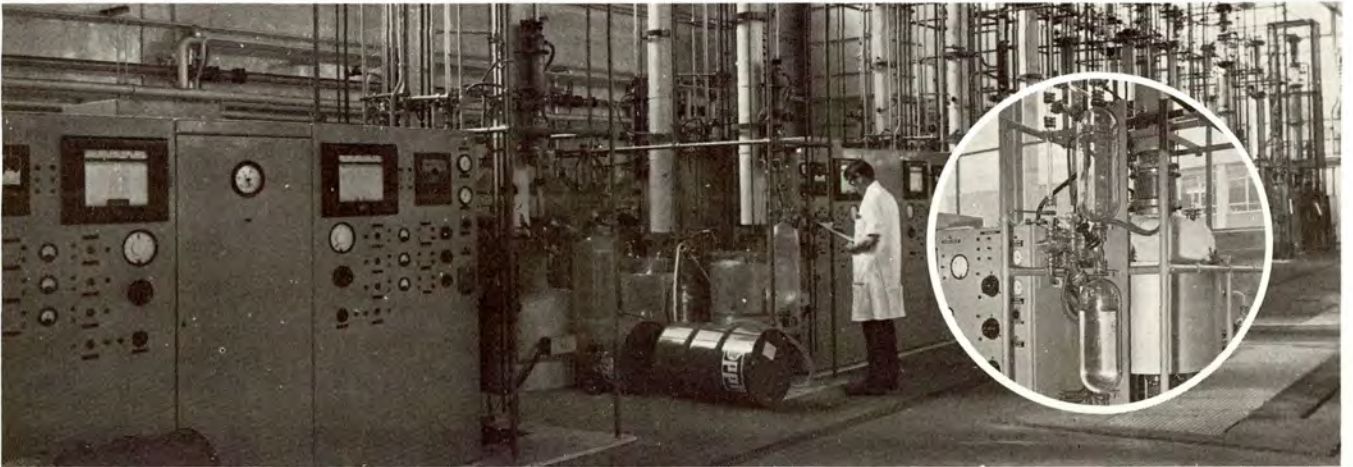
Q2 What happens as gases pass through the condenser?

Q3 Why does tap water need to go into the condenser through the bottom tube?

Q4 Anhydrous sodium sulphate is used to dry the oil. What does **anhydrous** mean?

Information: Perfumes

Strong smelling oils that come from herbs, fruits and flowers are called **essential oils**. They used to be signs of great wealth. Two of the gifts from the three Kings to the infant Jesus were perfume oils – **frankincense** and **myrrh**. Later, oils were used as ointments.



Today, these oils are mostly used to make perfumes. The method used most to get oils from plants like lavender, is **distillation**. The photograph shows a distillation plant, and a close-up of a **still**.



The photograph shows rose petals arriving at a distillation plant. It takes 250 million rose petals to make 1 kg of rose oil. The demand for oils cannot be met by the supply of natural ones.



Many expensive perfumes used to be based on oil extracted from the **civet cat**. This is now only used for a few, very expensive perfumes. Many people object to animals being used in this way. This oil can now be made by man.

Perfumes and essences



The body cells that can detect smell are in the nose. The senses of smell and taste are linked. If the nose is pegged, you can mistake the taste of an onion for an apple!

Q5 What is the method most widely used to extract oils from plants?

Q6 What is the oil used in the most expensive perfumes today?

Q7 Where is our sense of smell found?

Q8 How would you show that a sense of smell is needed for people to taste things properly?

Information: Selling cosmetics



Packaging is very important in the cosmetics industry. An attractive range of products is more likely to sell well.



Advertising is also most important. Many firms spend a great deal of money promoting their products.

Acknowledgements

The publishers wish to thank the following for kind permission to reproduce photographs:

Richard Exley (old person and child, page 5); Radio Times/Hulton Picture Library (Ainu men, page 8; stalactites, page 19; civet cat, page 31); IPC Magazines (grey-haired person, page 8; whales, page 15; girl with long nails, page 25); Air-India (Sikh, page 9); Gillette Industries Limited (man shaving, page 9); Max Factor Limited (cover; before and after make-up, page 13; before and after eye make-up, page 21; girl making-up, page 32); Spanish National Tourist Office (olive tree, page 15); Lever Brothers Limited (soap making, page 15); Houseman (Burnham) Limited (hot water pipe, page 19); Longman Group Limited (child's expressions, page 21); Tony Duffy (person skiing, page 22); Oliver Goldsmith (sunglasses, page 22 — sunglasses designed by Oliver Goldsmith and made in the factories of Oliver Goldsmith in England); Optrex Limited (eyedrops, page 22); David Culow (contact lenses, page 22); PPL International Limited, Ashford, Kent (2 photos of perfume distillation plant, rose petals, page 31); Courreges (Empreinte perfume bottles, page 32).

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John Taylor

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