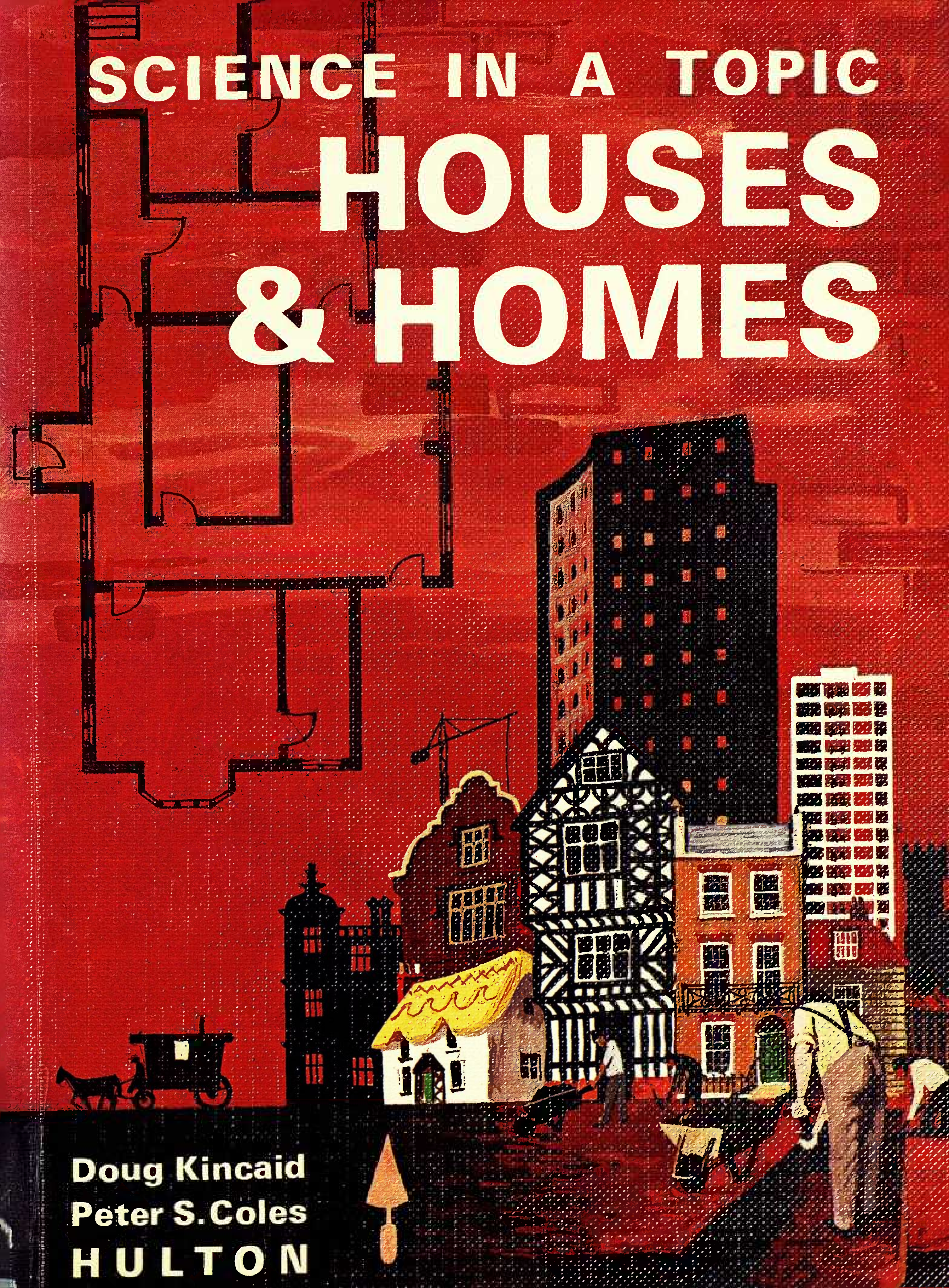
SCIENCE IN A TOPIC

HOUSES & HOMES



Doug Kincaid
Peter S. Coles

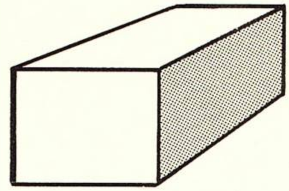
HULTON

MODEL MAKING - HOMES OF THE WORLD

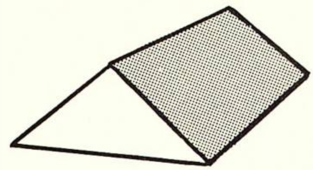
(see pages 40–41)

By using two basic shapes and varying the measurements a great variety of buildings can be constructed.
The shape is then covered with materials such as the real house would be constructed of – wood, plaster, stone, mud, leaves.
In the modelling these materials can be simulated by balsa wood, 'lolly' sticks, split cane, thin branches, polyfilla, raffia and dried grass.
A mixture of polyfilla and sawdust (1:1) makes a good modelling compound for bases, which can be coloured or sprinkled with peat, stones, sand, which will then set hard.

The two basic shapes

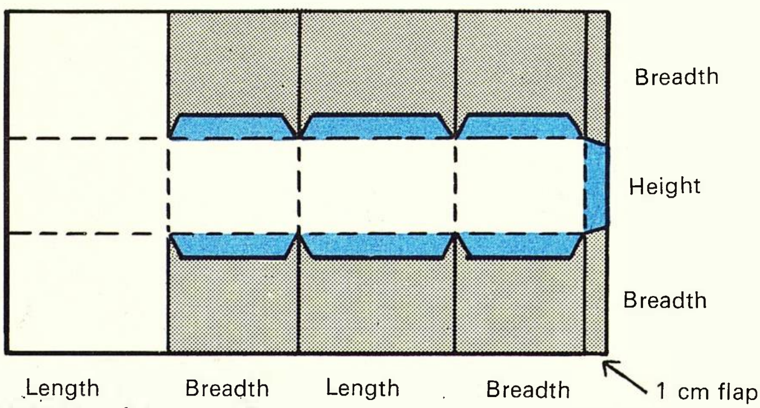


The Box

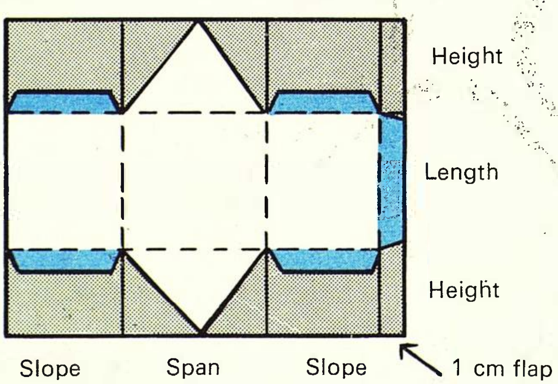


Triangular Prism or Wedge Shape.

Plan for the bottom unit – the box shape.



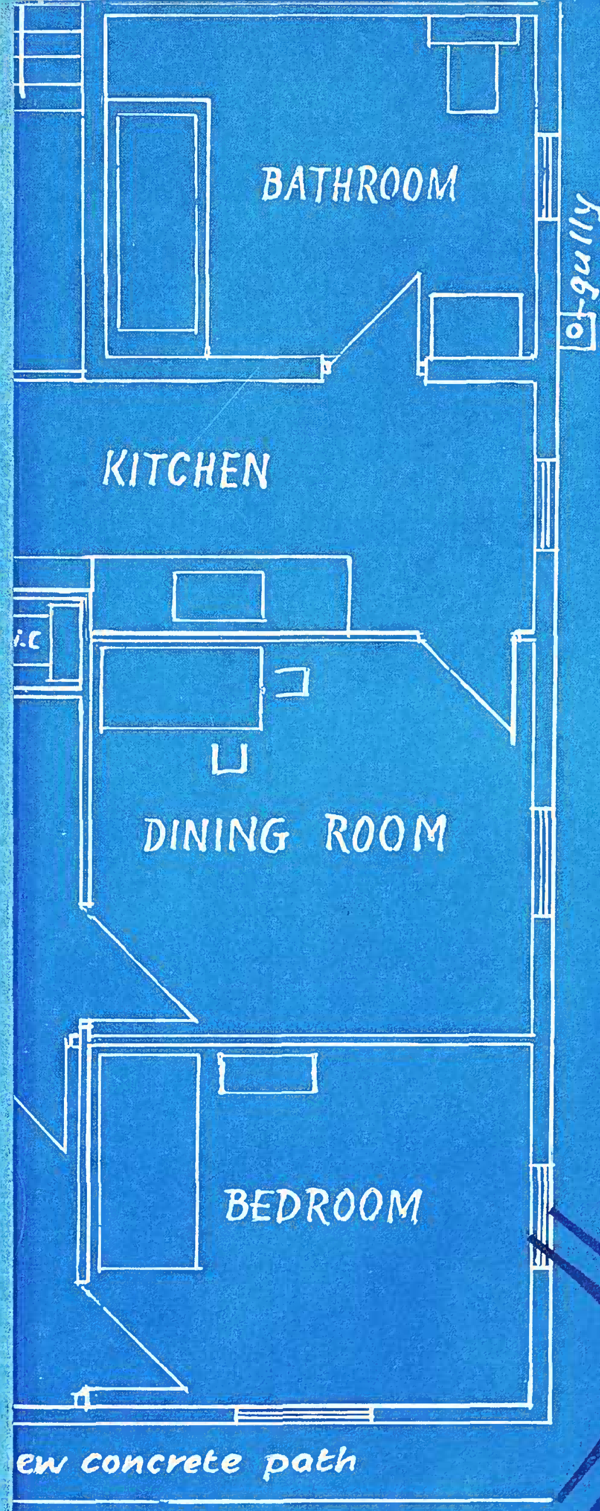
Plan for the roof unit – the triangular prism.

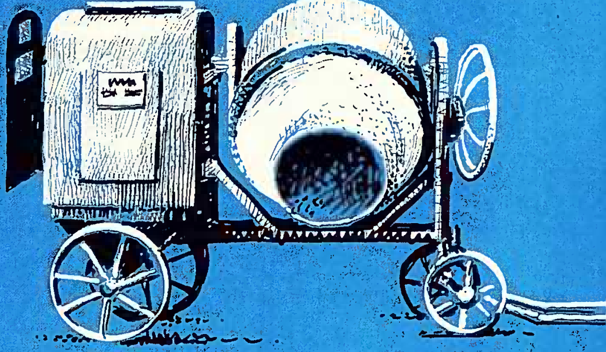


Method for making the units.
See back end paper diagrams.

The measurement for each house varies – turn to back end paper for examples.
Substitute the measurements for your house for the length, breadth, span etc.

1 Mark out main measurement lines.
2 Mark the flaps – 1 cm wide.
3 Cut away areas around flaps (shaded grey).
4 Score and fold flaps (coloured).
5 Glue sides first, then bottom, finally top.



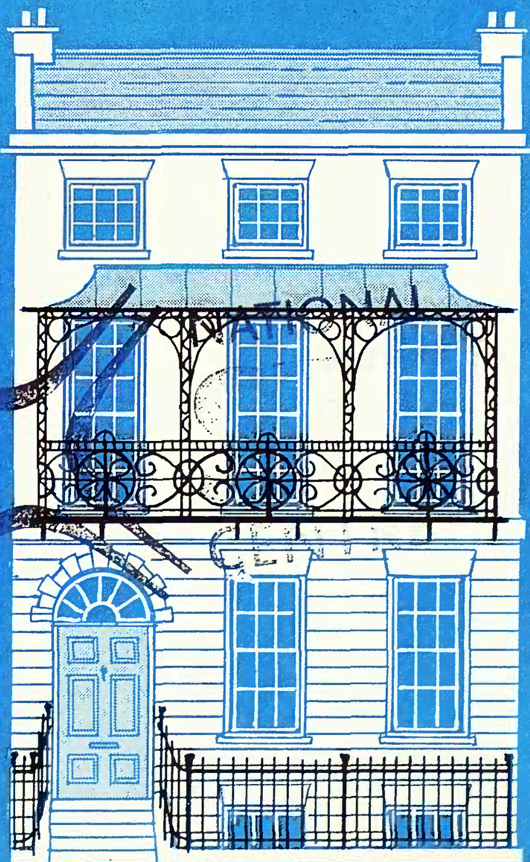


Science in a topic

HOUSES & HOMES

by DOUG KINCAID
and PETER S. COLES

Illustrated by Chris Hoggett



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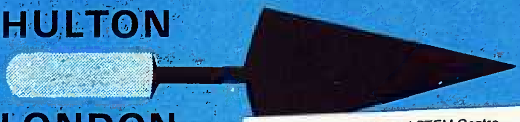
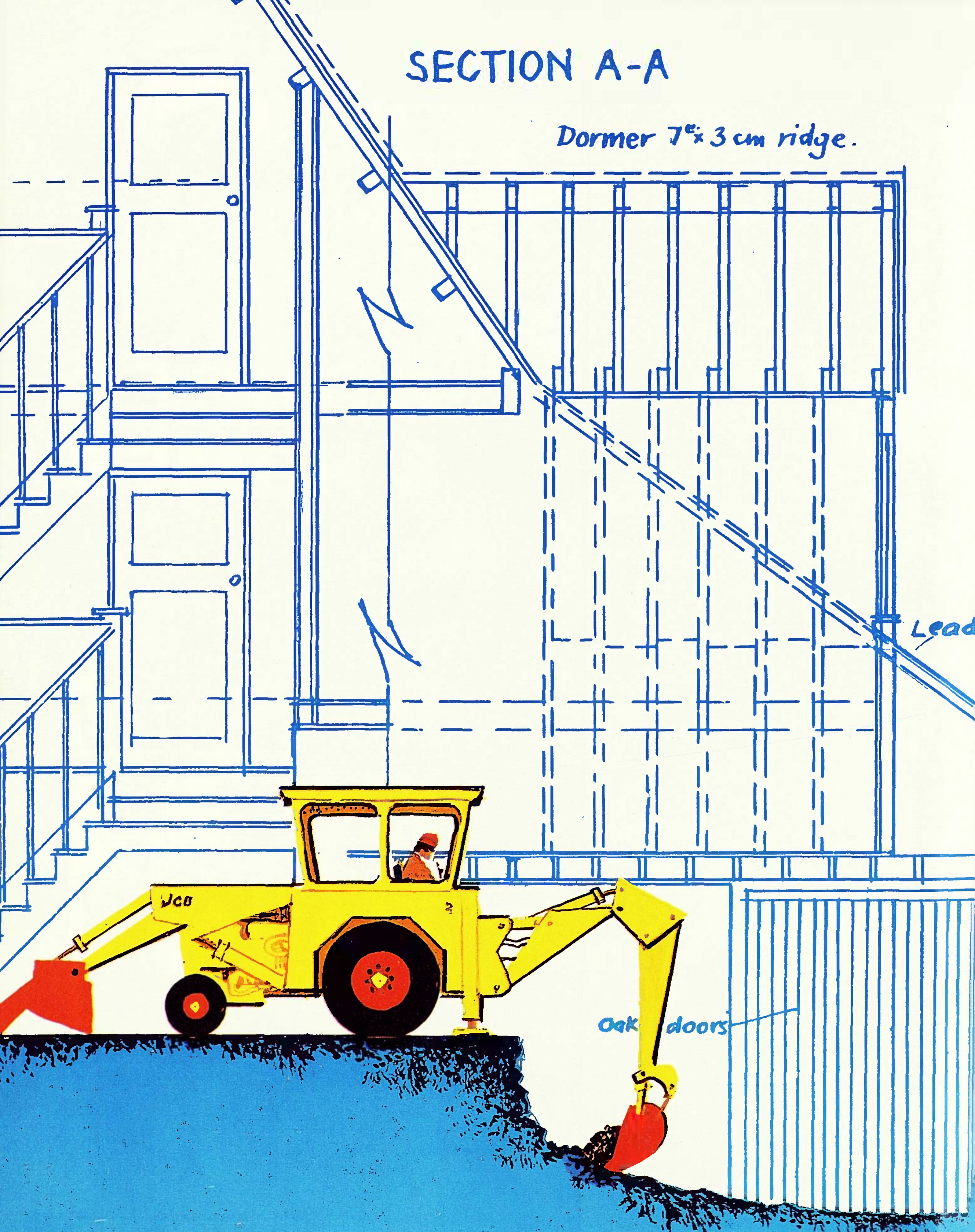




 ISBN 0 7175 0669 X
First Published 1974 · Hulton Educational Publications Limited
Reprinted 1981

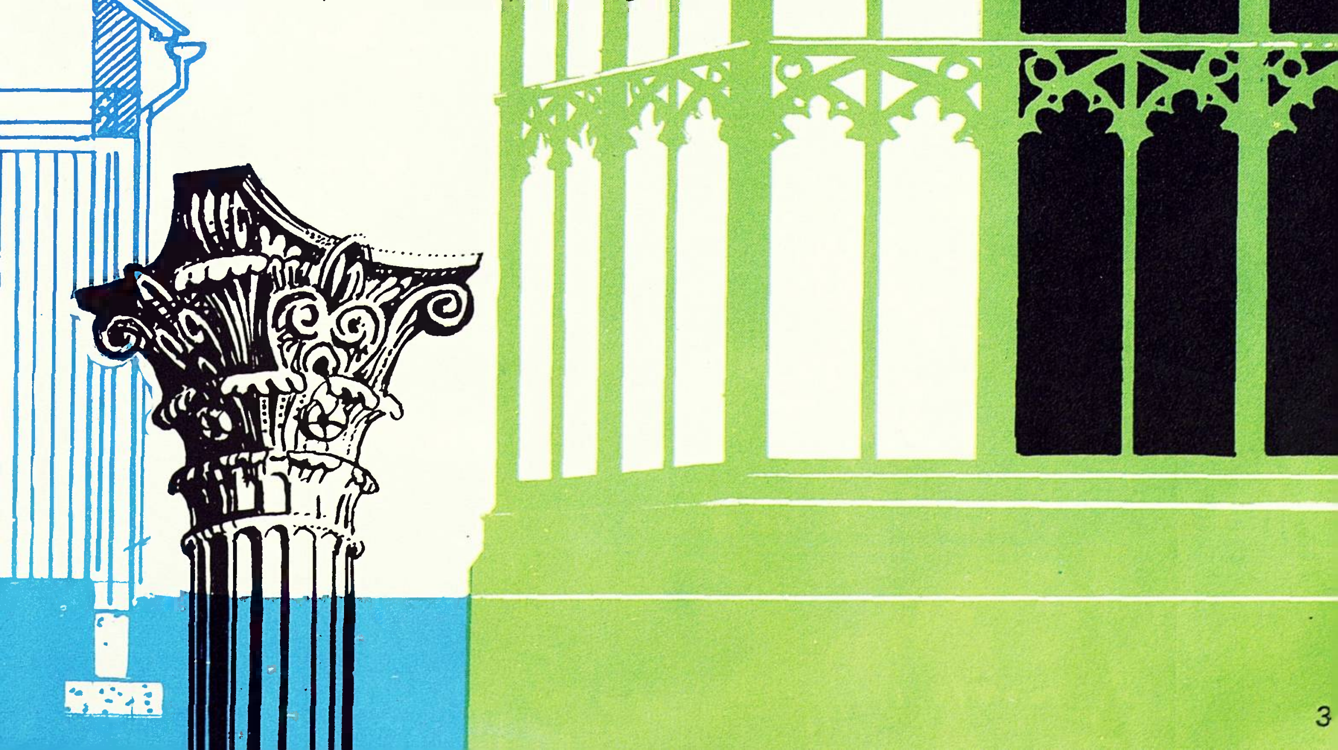
SCIENCE IN A TOPIC

HOUSES & HOMES

About this book

This book is different from most others because:—

1 It is not complete, but only part of a study – the science part. There will be a need to use many other books to find out about other aspects of the topic – History, Geography . . .
2 It will not tell you information but will only ask you questions and suggest ways that you might find the answers for yourself. Many of the suggestions were some children's ways of trying to find an answer – you may have better ideas.
3 It is hoped that arising from these questions other questions will occur to you – do pursue these. (Your own questions and the ways you find to answer them are really the most important.)
4 You do not need to work through the book in the order set out; the sections of work can be done in the order that you wish.
5 There is no need to complete all of one section. If the work becomes harder as you progress through a section, see how far you can go.



CONTENTS

Science in a Topic Series

by Doug Kincaid, County Staff Advisory Teacher, Science and Lady Spencer-Churchill College, Buckinghamshire.
Peter S. Coles, B.Sc., Chief Adviser, Berkshire

Other titles:

Ships	Moving on Land
Clothes and Costume	Roads, Bridges and Tunnels
Communication	In the Air
Food	Sports and Games

Published by Hulton Educational Publications Ltd., Raans Rd., Amersham, Bucks.
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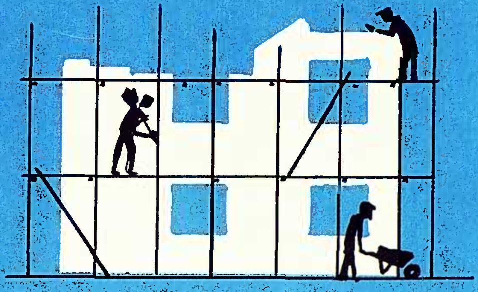
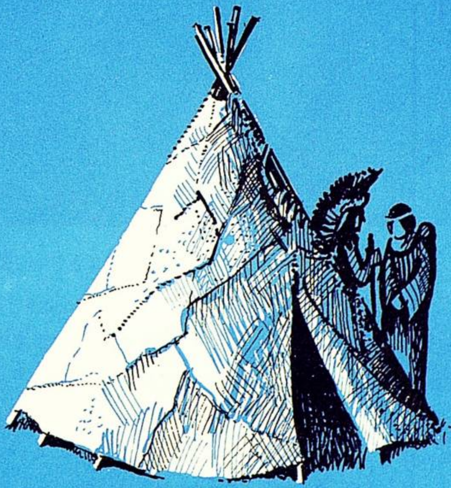
LOOKING at Homes

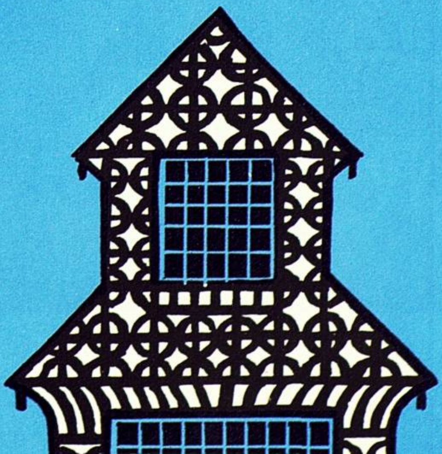


A good way to find out about houses and how they are built, is to visit a building site. Your teacher should be able to arrange a visit with a site foreman.



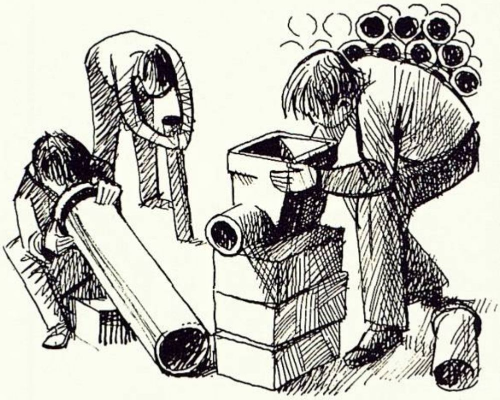
Here are some questions for you.

1. What patterns can you observe?
2. What textures can you collect?
3. What shapes are being used?
4. How many types of fastening can you find?
5. What tools and machines are in use?
6. What different types of pipe are there? Why are they used?
7. What metals can you find in use?
8. Where can you find plastics being used?
9. What cement is used? Where does it come from?
10. What is mortar? What are the ingredients?



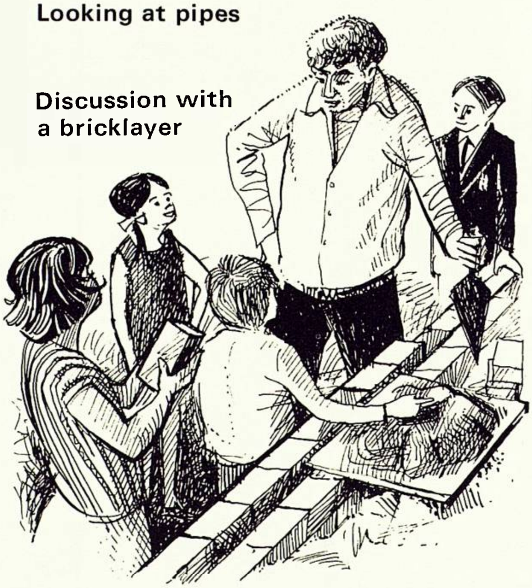
SECTION ONE

ON THE SITE



Looking at pipes

Discussion with
a bricklayer

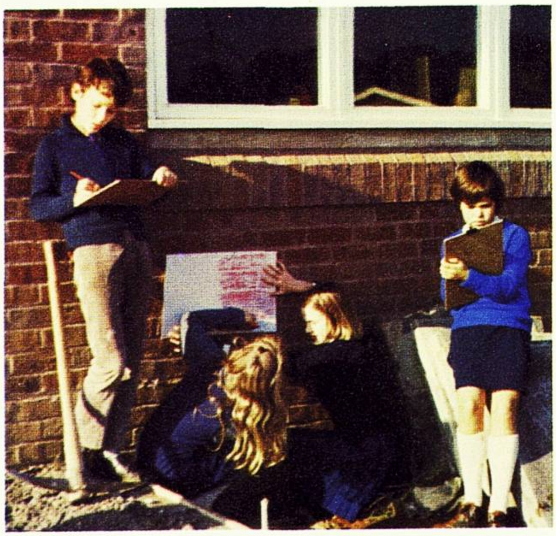


Here are some pictures of boys and girls exploring a building site.

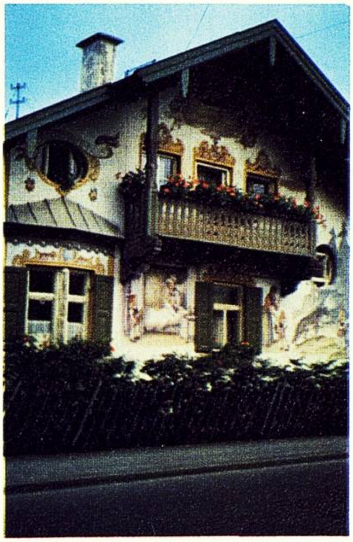
Above: Looking at tiles

Below: Drawing roof structures

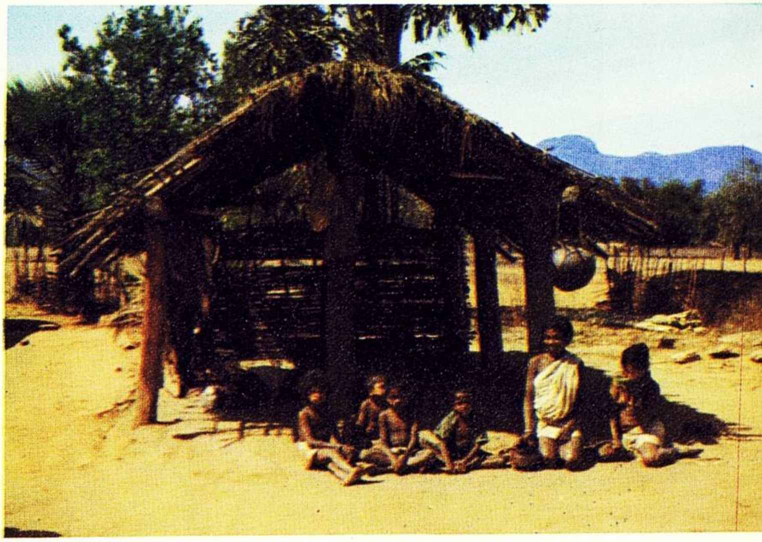
Below right: Taking rubbings of wall texture and pattern



HOMES OF OTHER LANDS

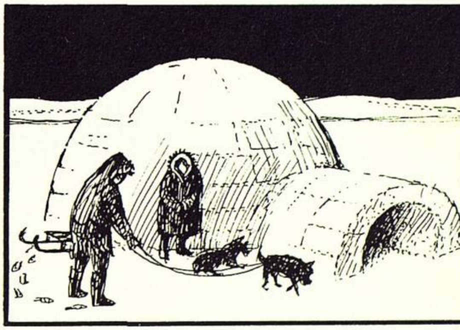


A house in Oberammergau



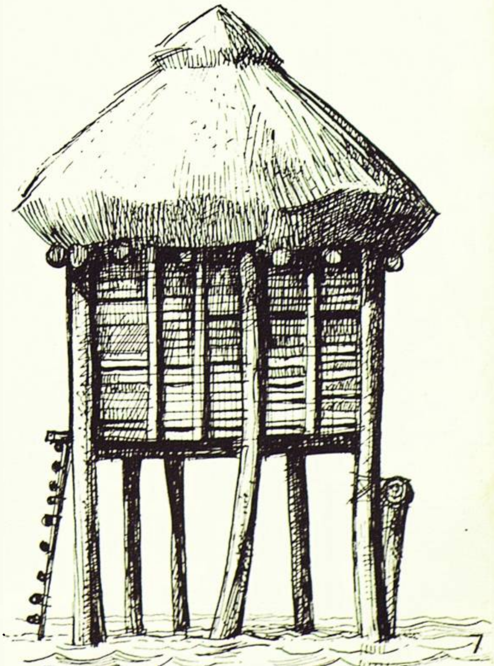
Village home in South Bastar, India

Right: An Eskimo igloo



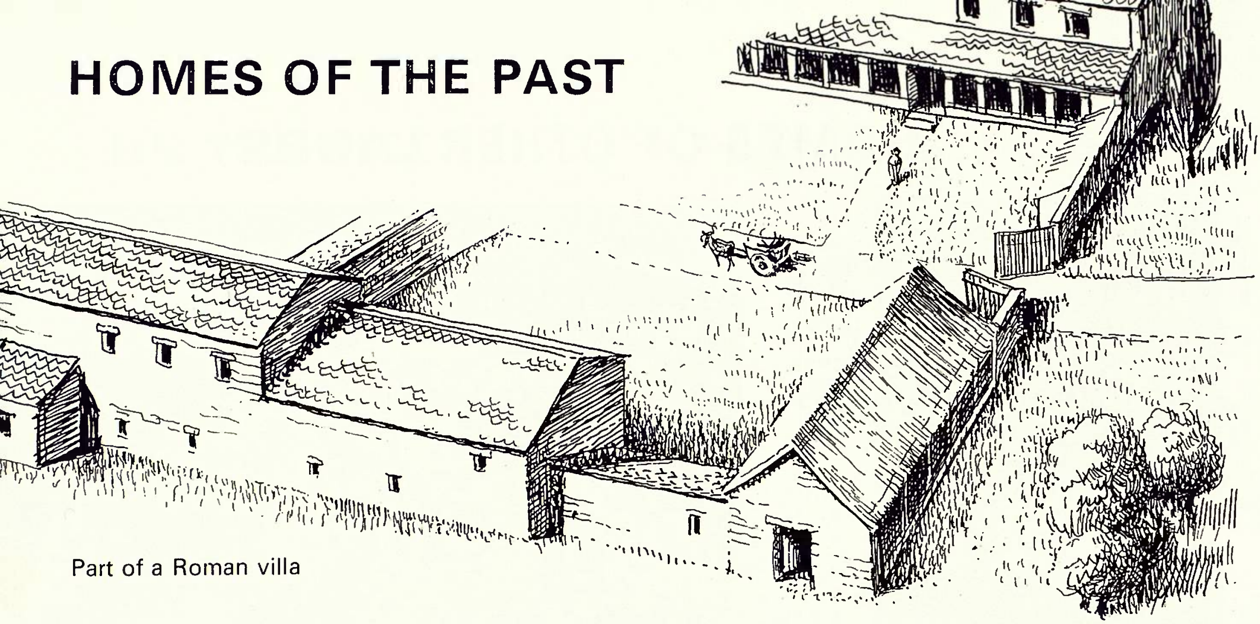
It would be interesting to look at the building materials and methods used by peoples of other lands.

Floating homes: Kowloon, Hong Kong



Right: A house on stilts, West Africa

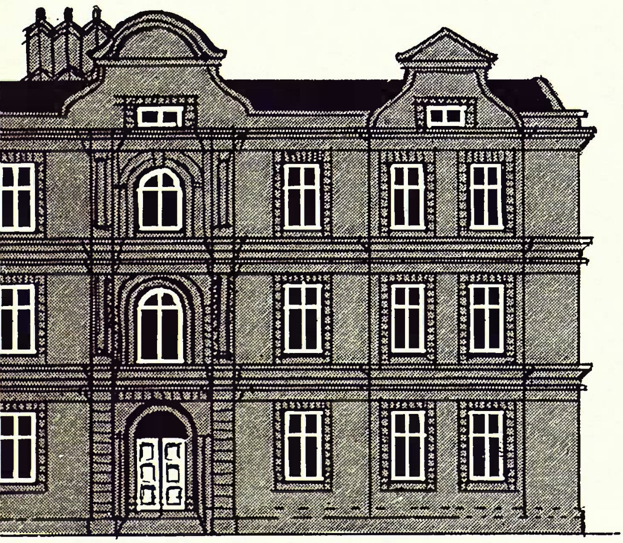
HOMES OF THE PAST

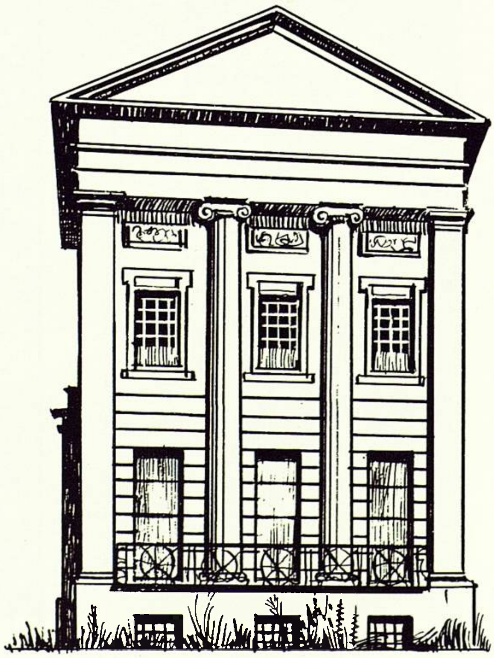


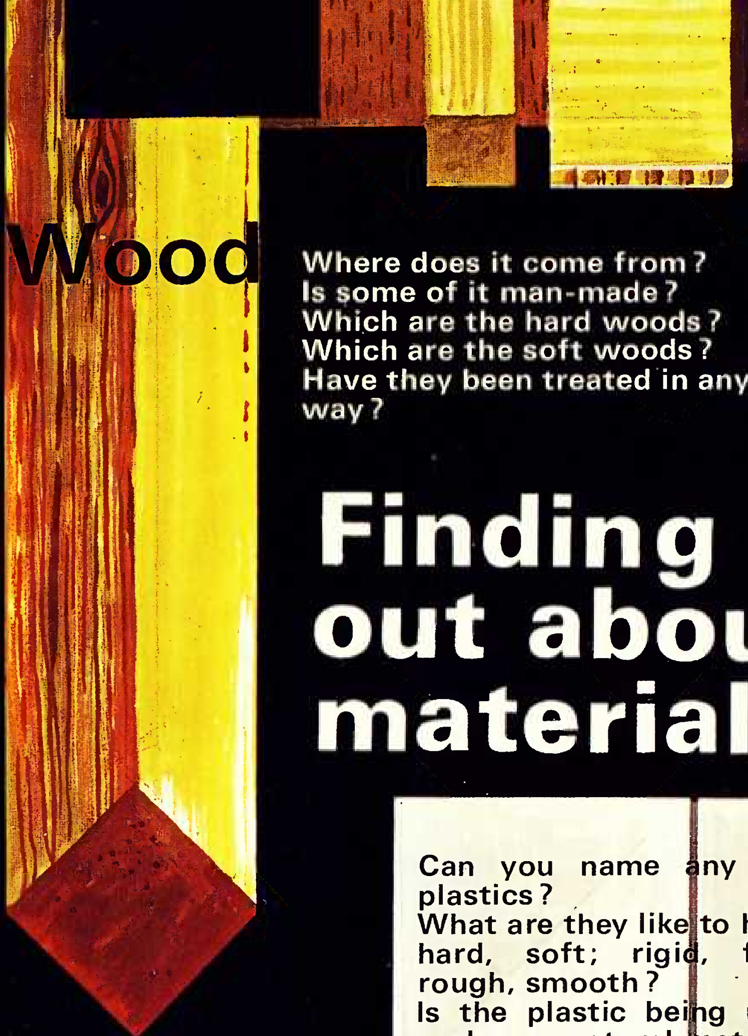
Part of a Roman villa

A 15th century
manor house

Right: A Regency house – rather like a Greek temple!
Below: A 17th century palace





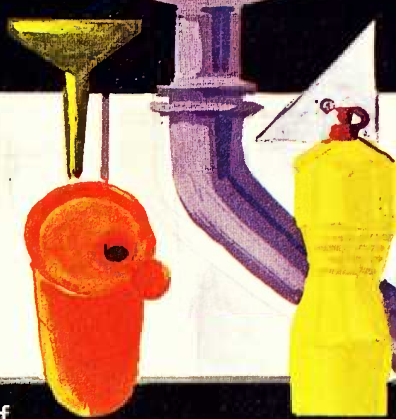


Wood

Where does it come from?
Is some of it man-made?
Which are the hard woods?
Which are the soft woods?
Have they been treated in any way?

Finding out about materials

Plastic

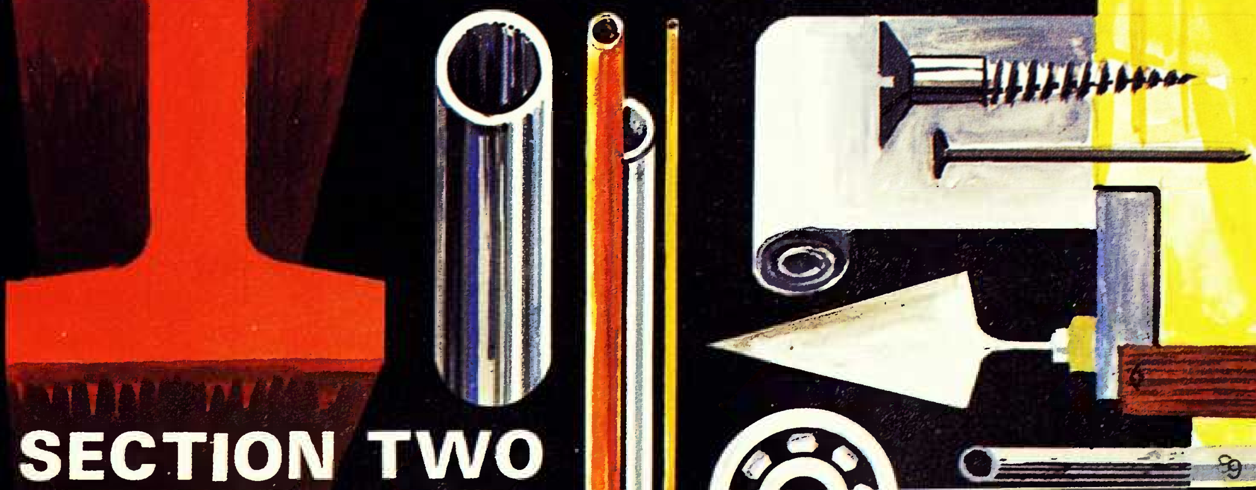


Can you name any of the plastics?
What are they like to handle – hard, soft; rigid, flexible; rough, smooth?
Is the plastic being used to replace a natural material?

With the help of your teacher and other members of your class make an interesting collection of these materials. Ask questions. Try to find answers.

Metal

How many metals can you name?
In what different forms have you found them?
Are they pure or are some alloys?



SECTION TWO

WOOD

A close look at some sections of trees using a hand lens or low-power microscope will help you to understand how a tree grows and how a craftsman works with wood.

Using a microscope

Working with wood for yourself

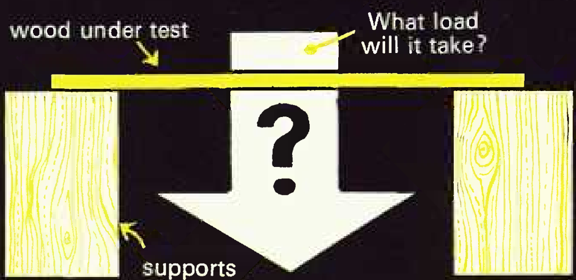
Try sawing, across and along the grain. Try sanding in various directions. Use your hand lens again to find how your tools have affected the wood. What other tools are used on wood? Can you find out how and why they are used? Can you try them for yourself?
How do these working experiences relate to the structure that you have observed? Have you found a knot? What do you think caused this? How do your tools affect this area?

As you worked with wood you will have noticed its *grain.*

Can you find examples of the beauty of grain being used in the home?

How strong is wood? Is one wood stronger than another?

You will find that most samples of wood are so strong that very large forces would be needed to test them. You can, however, experiment with thin strips or with balsa wood.



This test rig will enable you to compare the strength of your plywood with a piece of equal thickness. You could also test the strengths of thin strips of different woods.

An interesting experiment would be to compare the strength of plywood and ordinary wood.

You can make your own plywood from sheet balsa.

Some woods in your home need to be harder than others to avoid scratching and denting.

How can we test for hardness?

Try pressing your thumb nail into balsa wood. Try this with some of the other samples.

Geologists use such a test for finding about the hardness of rocks and minerals. What will scratch what?

Can you devise a 'scratch test' for the hardness of woods? (You might try – your nail, a plastic knitting needle, a coin, sharpened pieces of different woods, a nail, a piece of flint.)

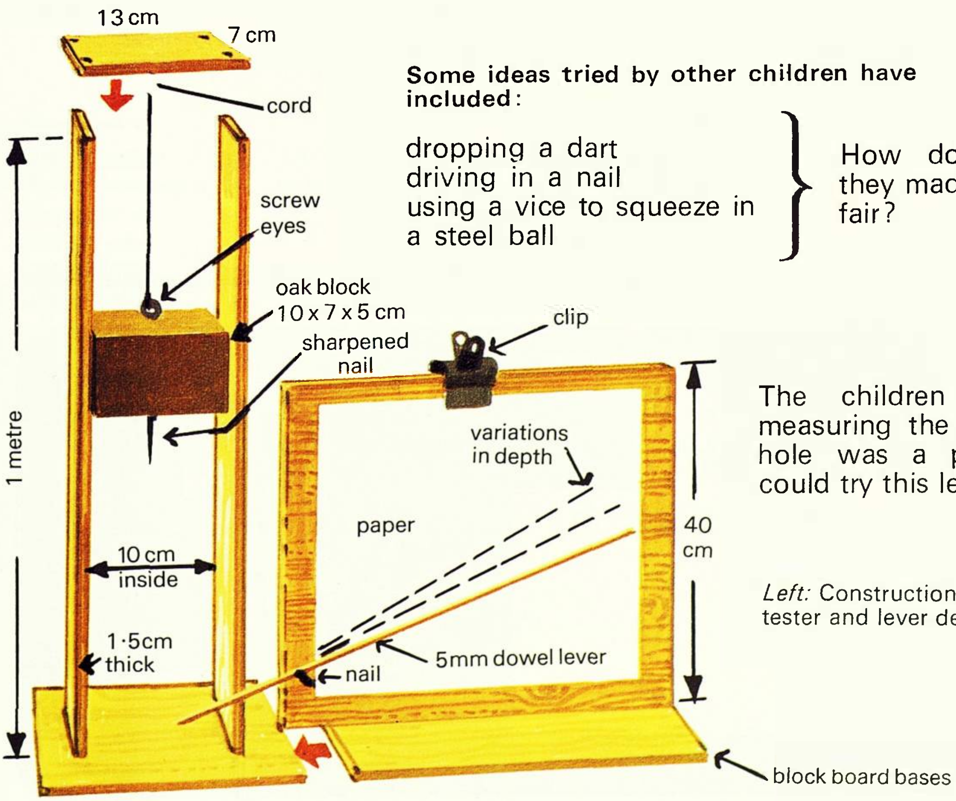
How could hardness be compared more precisely?

Here are some children working with a hardness tester which they have found successful.

Some ideas tried by other children have included:

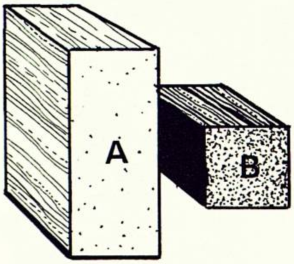
dropping a dart
driving in a nail
using a vice to squeeze in a steel ball

How do you think they made these tests fair?



The children found that measuring the depth of the hole was a problem. You could try this lever idea.

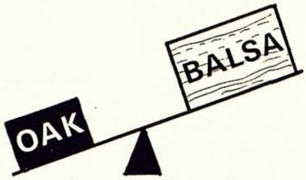
Left: Construction of the hardness tester and lever device



How heavy is wood?

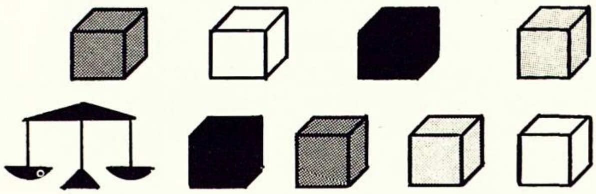
It is no use saying that piece A is heavier than piece B.

One could be balsa wood and the other oak. To compare heaviness we should need similar sized pieces of different woods.



Which are the heaviest woods?

By lifting and judging can you place them in order of heaviness? Now check your judgement with a balance.

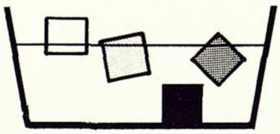


Does all wood float?

Experiment with your samples in water.
How does the 'heaviness pattern' relate to your floating and sinking pattern?

Are there differences in how woods float?

Look carefully at your floating samples.
Are there differences in the level of floating?
Do they always float the same way up?
How does time affect floating?



Drawing would be a good way to record your observations.

To compare 'heaviness' we must compare the mass of equal size pieces. 1 cm^3 is a convenient size. We can find the DENSITY of our wood by dividing its mass in grams by its volume in cubic centimetres.

MASS	VOLUME	DENSITY
75g	100 cm^3	0·75 g per cm^3
50g	40 cm^3	?
40g	50 cm^3	?

You may then think about how DENSITY is related to floating and sinking. (Clue: 1 cm^3 of water has a mass of 1 gram.)

FROM TREE TO HOME

Trees are not immediately suitable for making most wooden things. The picture shows timber being seasoned in a wood yard.

Why is it necessary for wood to be stored for a time in this way?

Here is an experiment you could do to find out how wood changes when it is cut from a tree.

Arrange with your teacher to cut several pieces of branch of the same thickness and length. See how these change with time under different conditions.

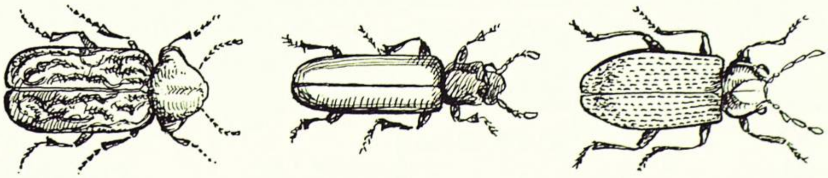
Some conditions you could investigate

CONDITIONS	OBSERVATIONS	
	UNPEELED WOOD	WOOD WITH BARK REMOVED
Over a radiator		
Outside		
In an oven		

You would need to find the mass in grams of each piece before starting the experiment and at intervals during your investigation.
Are there any other changes? Does length change? Does thickness change? Do cracks appear? Is there any bending? (This bending is called warping.)
Have you noticed any of these changes occurring to wood in your home? You could extend your research to find if thickness or kind of tree makes any difference to this drying process, which the timber merchant calls 'seasoning'.

Protecting wood

Examine some rotting wood.
What do you think causes rotting?
Find out about woodworm, termites, and death watch beetles.

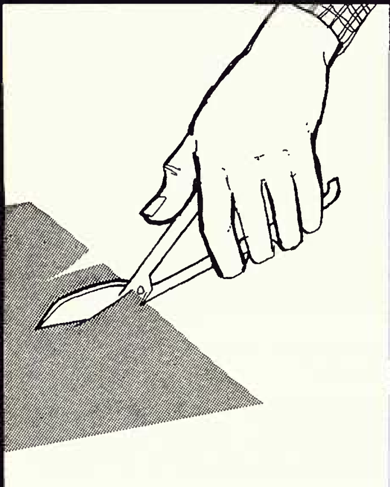


Three wood boring beetles:–
Left: Common furniture
Centre: Powder post
Right: Death watch

How many different ways can you find of protecting wood?
You could try some of these and see, for example, how they keep wood dry.

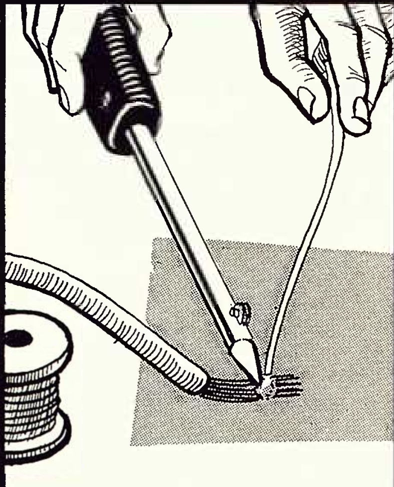
METAL Working with metal

You will find out a lot about metals by working with them in different ways.



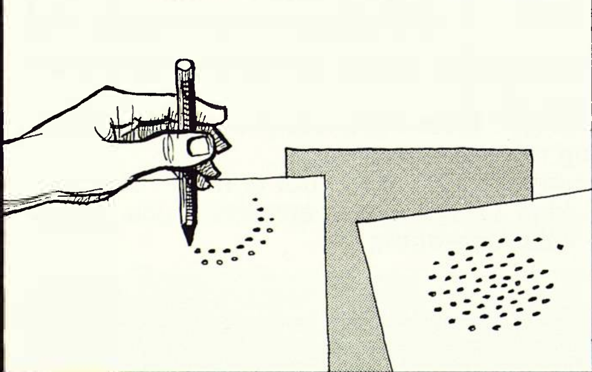
CUTTING Try creating shapes by cutting sheet metal with tin snips.

BENDING Try creating forms and designs by bending wire and strip metal.

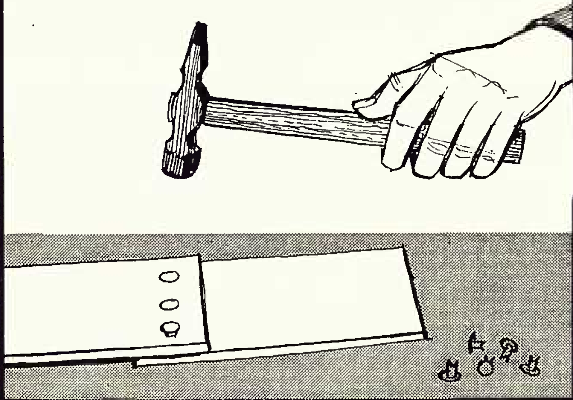


SOLDERING You could try joining metals with solder.

EMBOSSING See if you can create designs by punching on to metal.



RIVETTING This is another way of joining metals that you could try.



Look around your home and see how many metallic objects you can find. Why do you think they were made from metal?

It would be interesting to complete a list like this and bring it to school for discussion.

OBJECT	WHERE FOUND	KIND OF METAL	REASONS WHY YOU THINK THIS METAL WAS USED
Saucepan	Kitchen	Aluminium	Good conductor of heat
			Will not burn easily
			Not too expensive

How tough is metal?

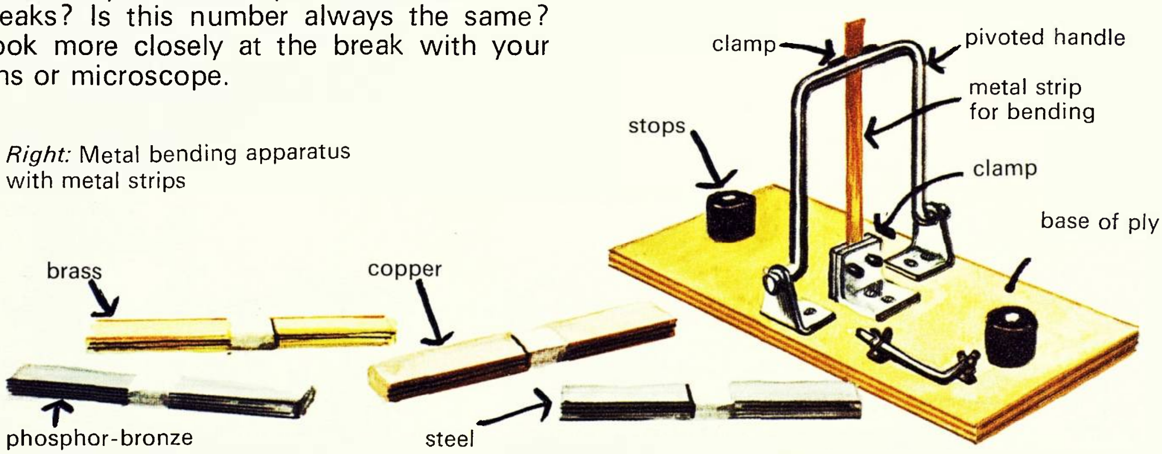
What happens if we keep bending a metal?

Open out a paper clip and bend it to and fro. How many times can you bend it before it breaks? Is this number always the same? Look more closely at the break with your lens or microscope.

This breaking of metal under constant movement is called METAL FATIGUE. Although metals in our homes are not usually broken by such strains and stresses it is important knowledge when metal is used for parts of cars or aircraft.

You could find out more about metal fatigue with a metal bending machine.

Right: Metal bending apparatus with metal strips



How hard is metal?

How could hardness be tested?

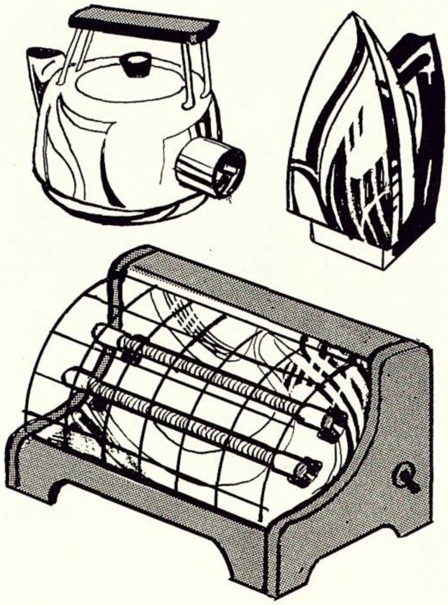
With your metals you could try a similar scratch test to that you used in testing the hardness of different woods.

Metallurgists have a hardness test using a steel ball squeezed into the various metals. Perhaps you can devise a test like this using a ball-bearing and a vice.

Right: Boy testing for hardness.

How is the shininess of metal used?

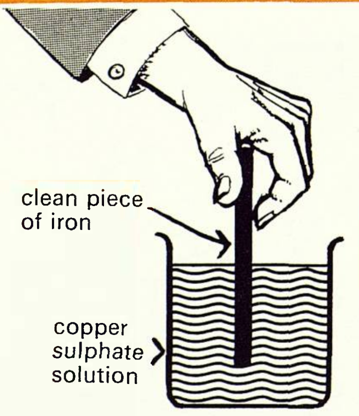
Can you polish any of your metalwork?
DO ALL METALS POLISH?
Can you find any polished metal objects in your home?
How are metals made to shine?
Can all metals be made to shine?
Experiment with your samples.
Can you think of reasons for using highly polished metal things?
Why do some metals do their job better when polished?
How do some metals tarnish (lose their polish)?



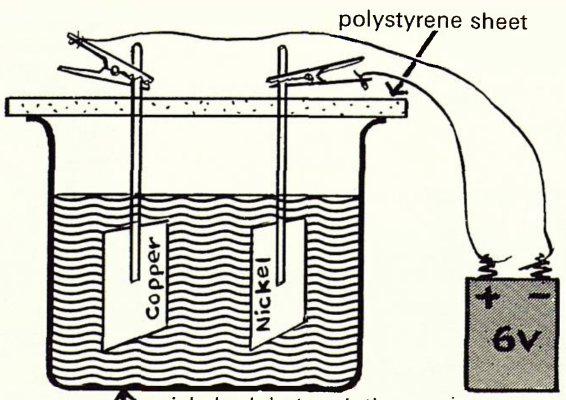
Protecting metals

Many metals are affected by their environment and need protecting. For example, iron rusts. (Rusting and its prevention is dealt with in *Science in a Topic: Ships*.)

How many ways of protecting metals can you find?
One particular way in use in your home is plating.
You could try some metal plating for yourself:–



CHEMICAL PLATING

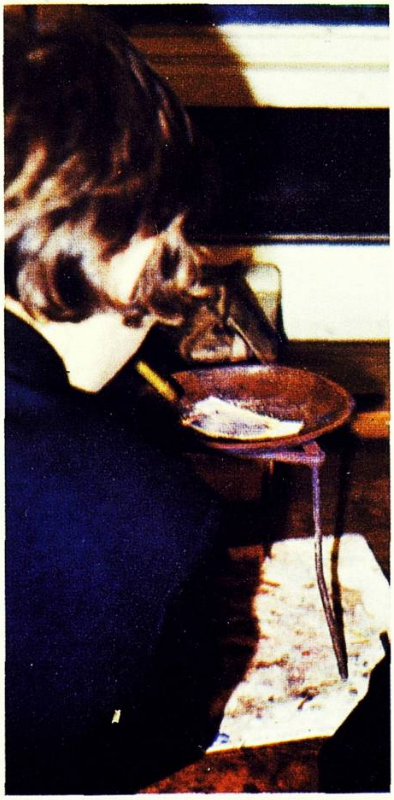


ELECTRO PLATING

How many plated metal things can you find in and around your home?

Is a tin can made of tin?
Investigate with a magnet, and by scratching and leaving to see what happens.

Most metals do not occur in a natural state but need to be 'made' from their ores.
You could test this by trying to obtain lead from its ore.
Cerussite is an ore of lead, which you could 'make' by mixing lead carbonate with a little sand. Mix a little of your ore with some powdered charcoal and heat on a piece of asbestos paper in a tin lid. Can you find any beads of lead?



Left: Heating with a bunsen burner

Below: Finding beads of lead

You could do some book research to find out about other metals, their ores and methods of extracting.

Metals have many other properties. Metallurgists use the terms: Malleability, Ductility, Tensile Strength, Creep, The Brinell Hardness Number, The Elastic Limit. You could use your reference books to find out about some of these.

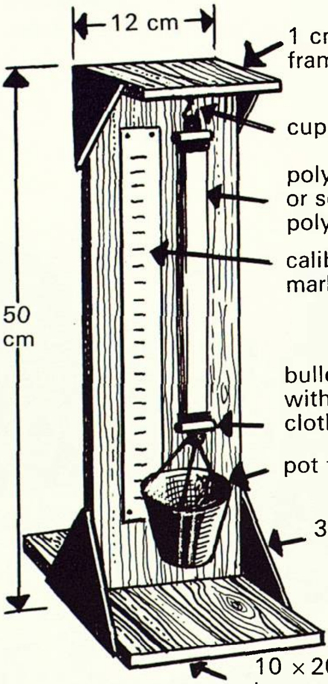
PLASTICS

Look around. Where can you see plastics in use?
(a) in your kitchen?
(b) in the bathroom?
(c) in the garden?
(d) in your living room?
(e) in the car?
(f) in your toys?

Can you name any of these plastics?

Plastics are quite new materials. What was used to make these objects before plastic was invented?

It probably replaces a natural material such as wood, metal or rubber.
Is it a better substitute?



How strong is plastic?

An investigation with plastic sheet

1 Is the plastic elastic?
(Does it return after stretching?)

2 What difference does temperature make?
(Place the strip in hot water for a period, then test again on the rig.)

3 Try thicker grades of plastic and compare strengths. (If it is only thickness you are testing, what other measurements must you think carefully about?)

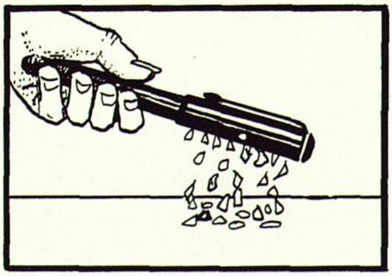
4 Try other kinds of plastics and other materials. Compare strengths.

5 Try the effect of making a slight cut in the edge of the plastic.

What happens when plastics are rubbed?

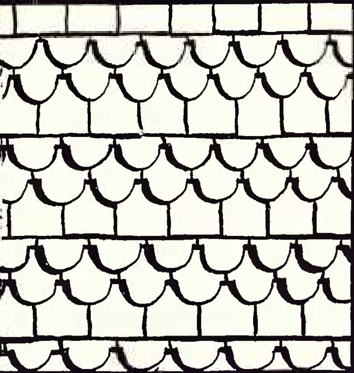
When some plastics are rubbed we can notice something interesting. You may have already seen this effect with your comb or fountain pen.

Try rubbing a selection of plastics with felt. A piece of polystyrene ceiling tile is a good one to start with.



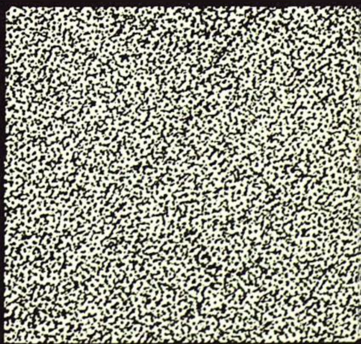
What will they attract? Experiment with small pieces of paper, tiny cork chips, little pieces of metal foil, shreds of other plastics.
What happens if you rub with another material? Experiment with nylon, silk, cotton, wool, fur, terylene.
(Further electrostatic investigations are included in *Science in a Topic: Clothes and Costume.*)

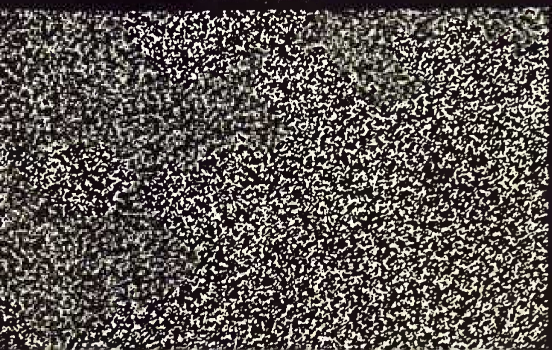
WALLS
SECTION THREE

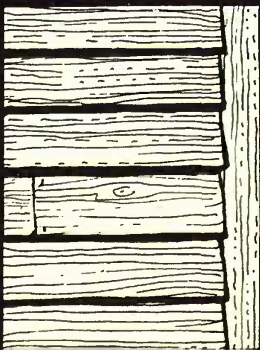


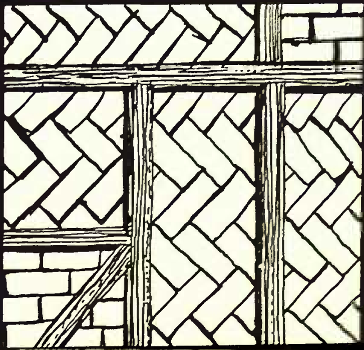
Top: **Ceramic wall**
Above: left: **a tile-hung wall**
centre: **a pargetted wall**
right: **Cotswold stone**
Below: **a flint wall**
Bottom: left: **weather boards**
right: **timber frame with brick nogging**

Our house must have walls. What are they built of? Look around you. Make a list of all the materials you can find that are used for building walls. How many kinds of bricks, how many kinds of stone and what other materials can be noted?
Can you make a wider survey, recalling holidays, school journeys and visits you have made and link building materials to regions?









FIRM FOUNDATIONS

Why does a house need foundations?

What do you think the foundations for these homes would be like?

What is used to make foundations? How wide and how deep are foundations? How does this vary according to the type of house and the number of storeys?
Does the type of soil make any difference?
Are there building regulations which control this?

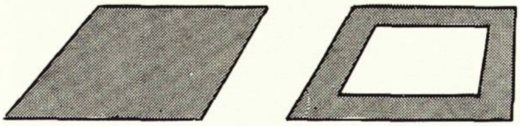
Top left: Tower blocks, Edgware, London
Bottom left: A bungalow

TRIAL BORINGS

When planning a building it is necessary to know what is under the surface soil. Trial borings are made. You could experiment on your school field, using a soil auger. You could also make a model showing how this is done.

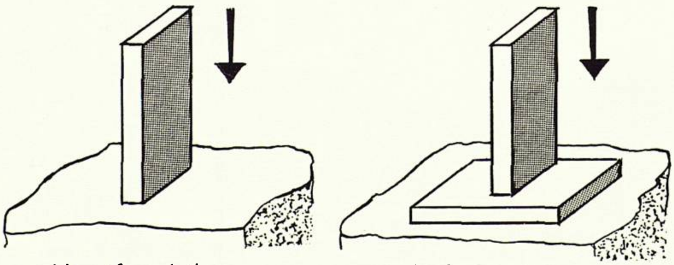
Foundations and forces

1 What is the mass of a house? You could calculate this by finding out how many bricks were used and estimating the mass of the other materials. What force would this house exert upon its foundations? Where is this downward force acting?



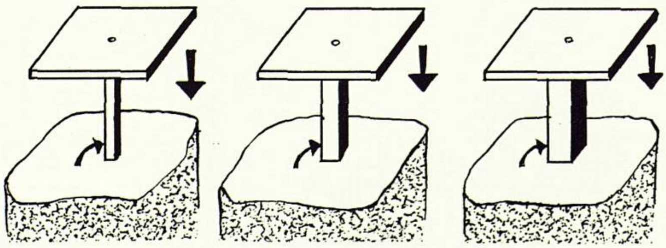
Over the whole area the house covers? or Where the outer walls meet the foundations?

2 Press a 'model' wall into sand or earth with and without foundations.
Load your wall with different masses and compare results.
(You may need to add a platform.)



without foundation — with foundation

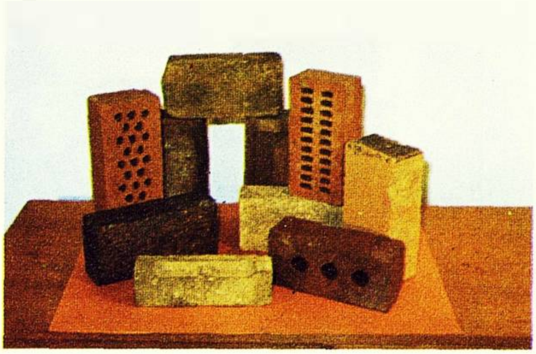
3 You could investigate further with a constant force on the platform but varying the area of the wall section.



BRICKS

During your building site visit you will have seen and collected different bricks. Can you extend your collection?

Here is an exhibition made by one class. How many different types of brick can you find?
What is each type called? How and where are they used?

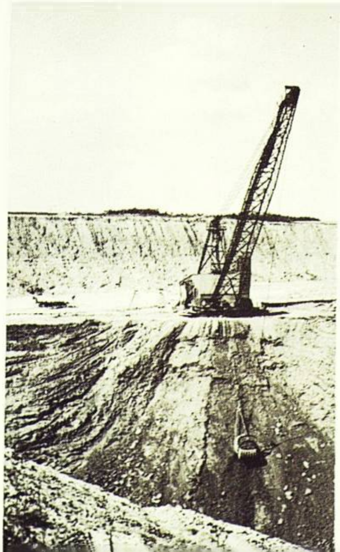


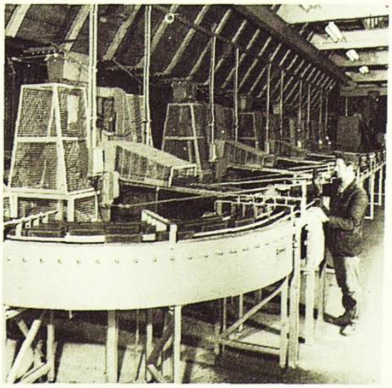
Examine your bricks **What can you find out about them?**

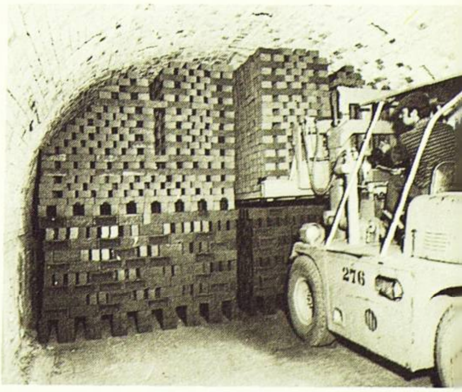
1 Are they all the same size? Why are they these sizes?
2 Have sizes changed during the centuries?
(If so, could this be a clue to dating buildings?)
3 Does the mass of bricks vary?
Which is the heaviest and the lightest brick that you can find?
4 Work out the density of each brick.
(page 12 explains *density*.)
5 How many bricks are needed to build a house?
6 What is the total mass of the bricks?
7 What is the purpose of the frog (the indentation)?
8 What is the purpose of holes?
9 Why do some bricks have neither frogs nor holes?
10 How many different colours of bricks can you find?
What makes the colour different?

How are bricks made?

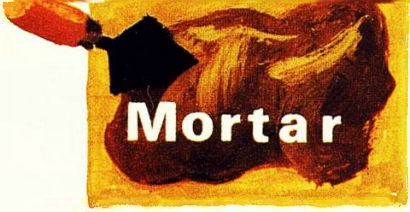
What are bricks made of? Where are they made? How are they made?

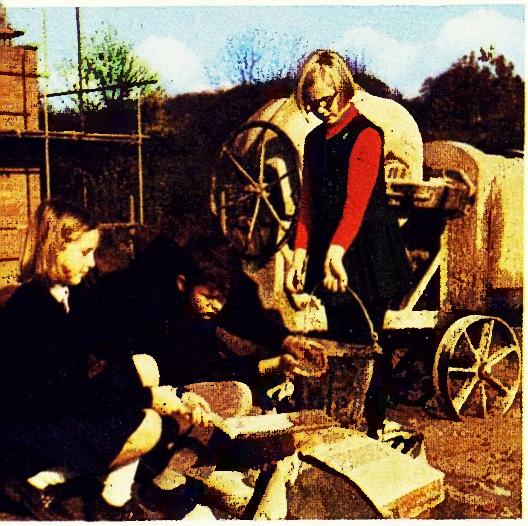






Left: Clay scooped out with a drag line and bucket
Centre: Brick presses, each cutting two bricks at a time
Right: A large brick kiln being filled with bricks





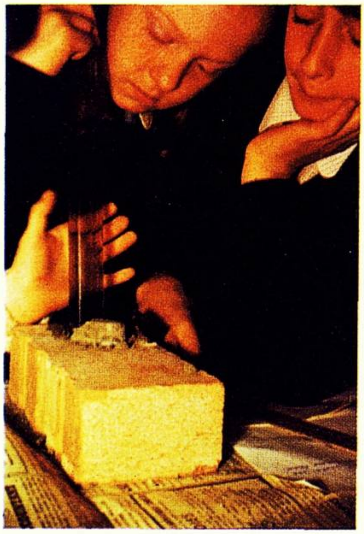
Mixing and Testing

The mixture that holds the bricks in place is called mortar. During your exploration of the building site and your questions to the builders you will have found the ingredients of mortar and the proportions of the mix. You could try mixing your own mortar and experimenting with different proportions.

Try:—

Sand	:	Cement
1	:	1
1	:	2
2	:	1
1	:	3
3	:	1
1	:	4
4	:	1

You could make your samples in the bottom of a disposable plastic cup. 2 cm deep makes a good sample for testing.

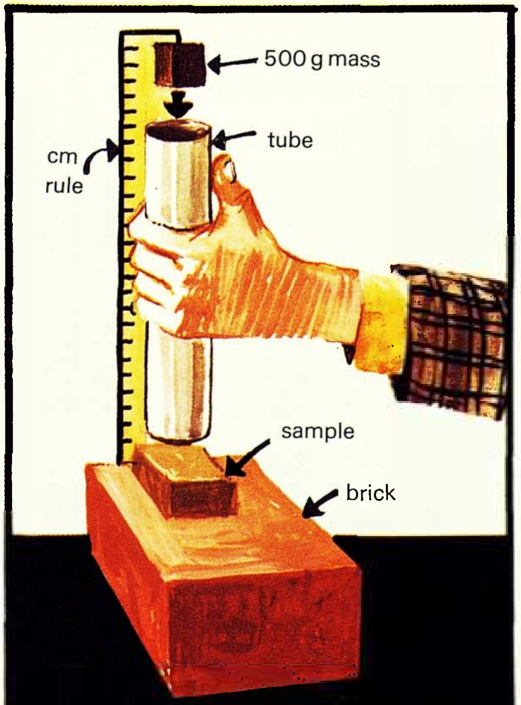


Here is one way some young scientists used to test their samples.

They dropped a 500 g mass from heights of 2, 4 and 6 cm, etc. until the sample broke.

After a few tests they decided that this was not a fair experiment, as the mass did not always drop on the same spot. In fact sometimes they missed.

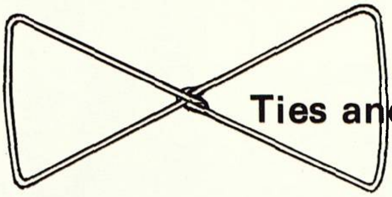
Can you see from the picture how they improved their test rig?



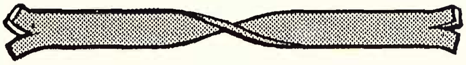
Record the results of your mixing and testing. After your experimenting, which mix would you advise a builder to use?

Some further research:—

1 Do proportions affect setting time?
2 Does age affect the sample? (1 day – 1 week?)
3 Does the amount of water used matter?
4 Try letting a sample mature under water.
5 Sometimes the builder adds detergent. Why?



Ties and joins



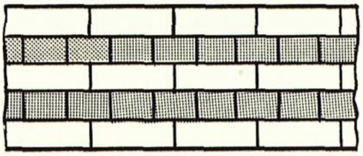
What are wall ties?

Where and why are wall ties used?
Why are the ties these shapes?
What is the reason for the twist in the middle?

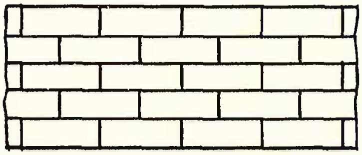
How are bricks bonded?

In what patterns are bricks joined together?
How many different kinds of these bonding patterns can you find?
Here are some to look for:—

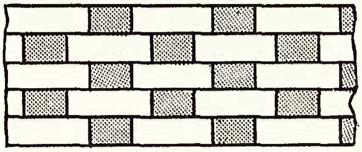
English Bond



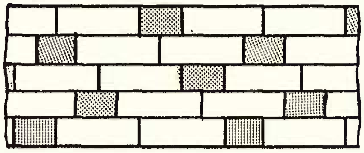
Stretcher Bond



Flemish Bond

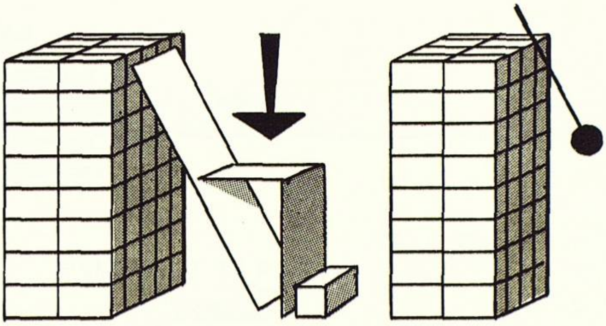


Monk Bond



Why bond bricks?

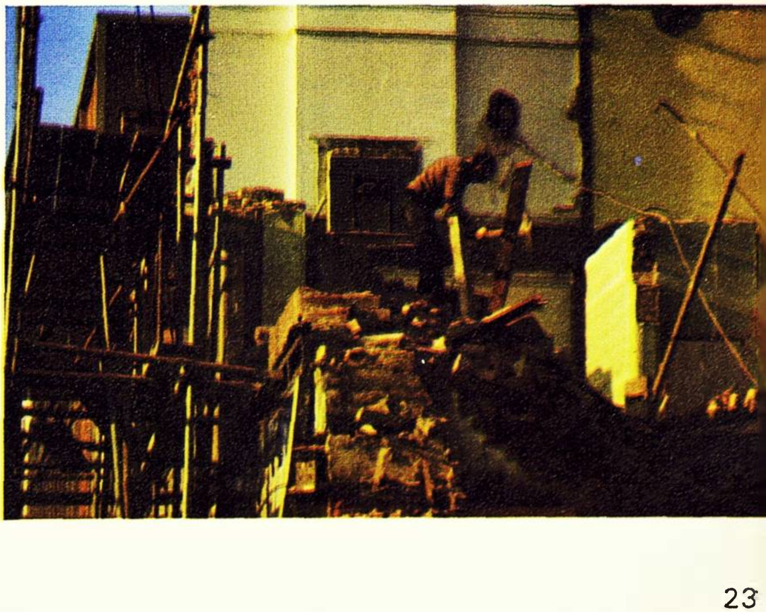
Are some arrangements stronger than others?
Build some model walls with different bonds.
(You could use: Lego, building bricks or balsa wood pieces.)



How can you test their strength?
Here are two ways that one group of children tried.

Their results showed little difference. Can you think of better ways of testing walls?

The strength of bonds is seen when walls have to be knocked down. Here are some walls being demolished so that new homes can be built.

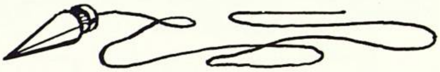


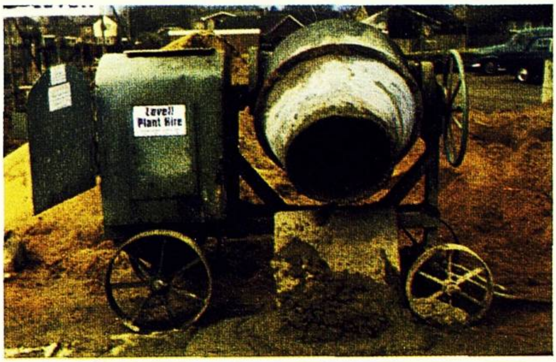
How are walls built?

What tools are used to build a wall?

The Plumb Line

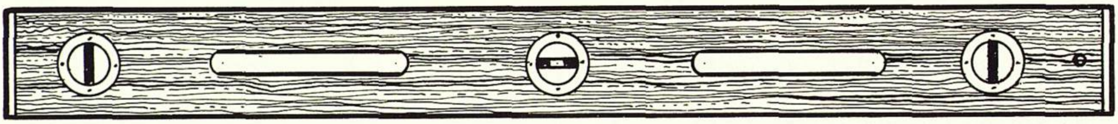
What is this used to test?
Why is it called a plumb line?
Can you make one?
Test your school and home for verticals.
Can you find a spirit level that will test verticals?





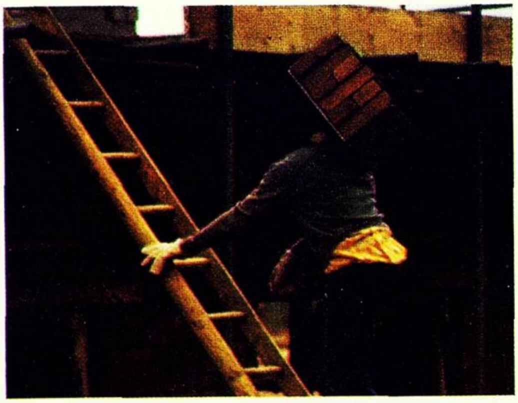
The Concrete Mixer

What supplies the energy for the driving force?
Investigate the driving mechanism.
How is the mixture churned about?



The Spirit Level

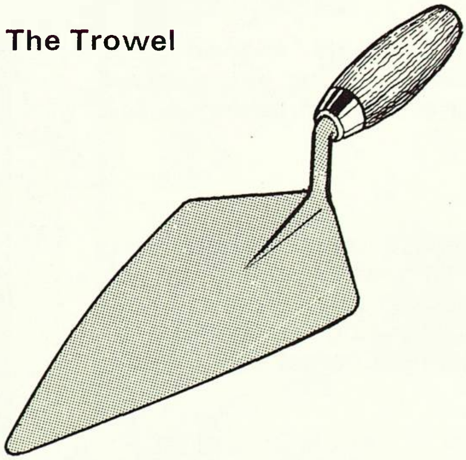
What is it used for?
Can you make one?
Test your school and home for horizontals.



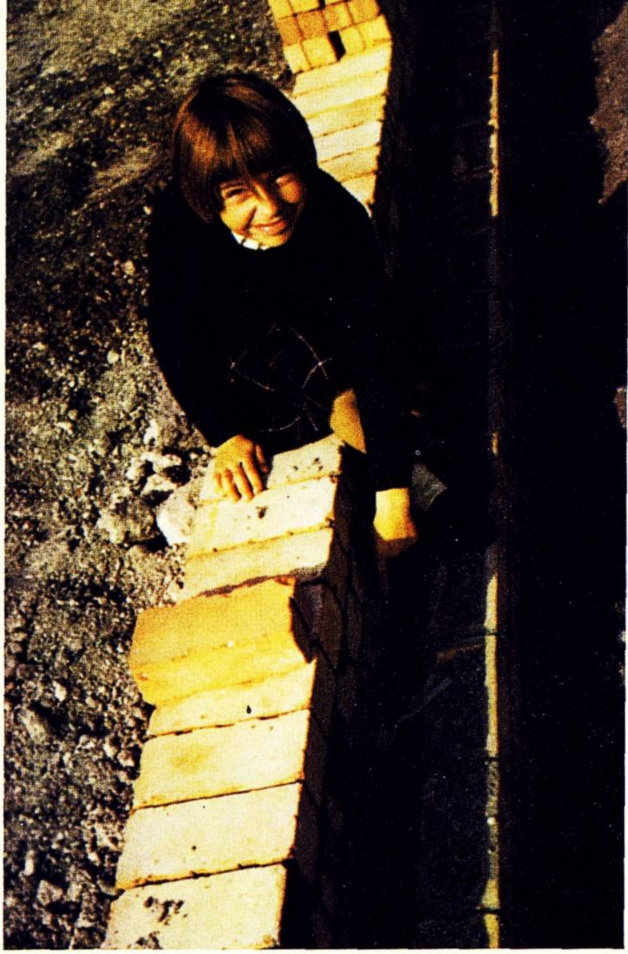
The Hod

What is carried in the hod?
How heavy is the load?

The Trowel



Why is it shaped like this?



Why do house walls have cavities?

What is the reason for the hollow space between the two walls?

Air helps to insulate.

Air helps to prevent the passage of heat.

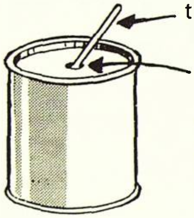
A layer of air keeps heat in. *(Winter requirements)*

A layer of air keeps heat out. *(Summer requirements)*

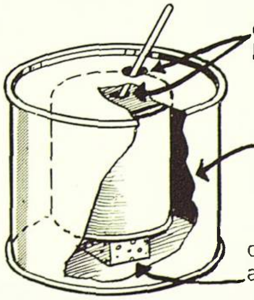
Can you discover any other examples of air as an insulating layer?

Left: A typical cavity wall

You could research into how effective an insulating layer is. Here is a suggestion:—



Take thermometer readings every five minutes.



Similar tin inside larger tin – this represents the cavity insulation

Older children could plot a graph showing how cooling takes place in each case.

A modern building idea is to fill the cavity with foam plastic. You could extend your research to find good materials for this insulation filling. You could try: sawdust, cotton wool, crumpled paper or expanded polystyrene pieces.

Some further research could be done by filling the tin representing the house with ice water and recording how it gains in temperature when placed somewhere warm.

How is wet kept out?

How much water do bricks absorb?

Find the mass of a brick. Place your brick in a bucket of water and record how the mass increases with the passage of time.

1 How long is it before there is no further change in mass?
2 Do different kinds of brick soak up water at different rates?
3 At what rates do different bricks lose the water they have absorbed?

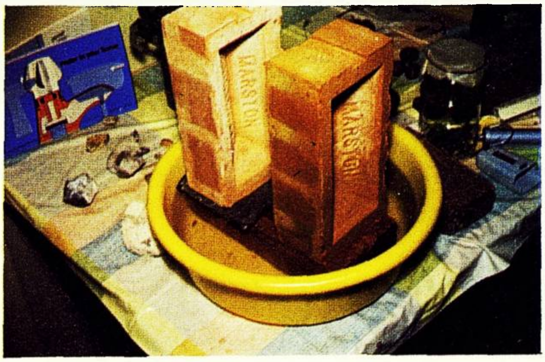
Recording the mass of a brick

The damp course

To prevent water rising through the walls of a house the builder uses a damp course.

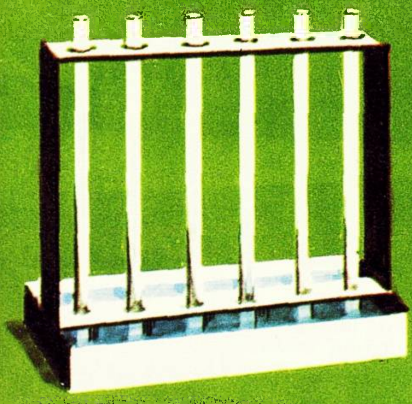
1 How effective is the damp course?
2 What material is used for a damp course?
3 Can you find other materials that would be as good?

The experiment below is testing the damp course.
A brick is partly immersed in water, two others are placed on top, one with a damp course between, one with no damp course.
What can you see has happened?
Try this for yourself.

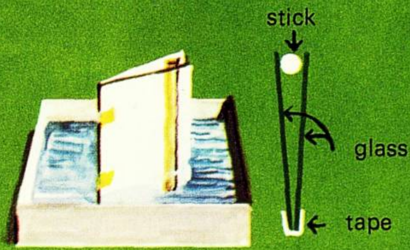


How does water rise up the brick?

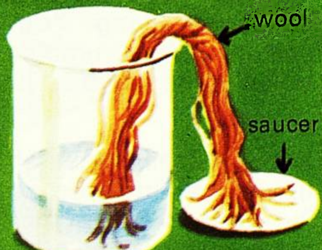
These experiments may help you to answer this question.



tubes of different bores standing in water



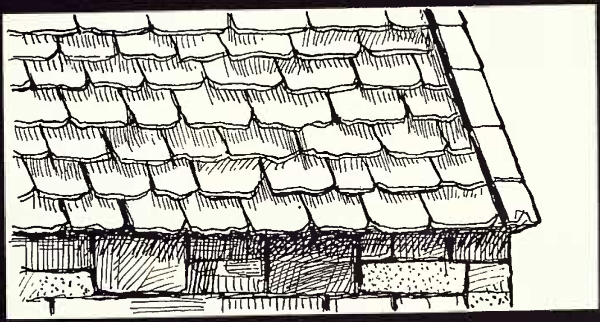
glass slides held in water



These observations are due to what scientists call capillary attraction

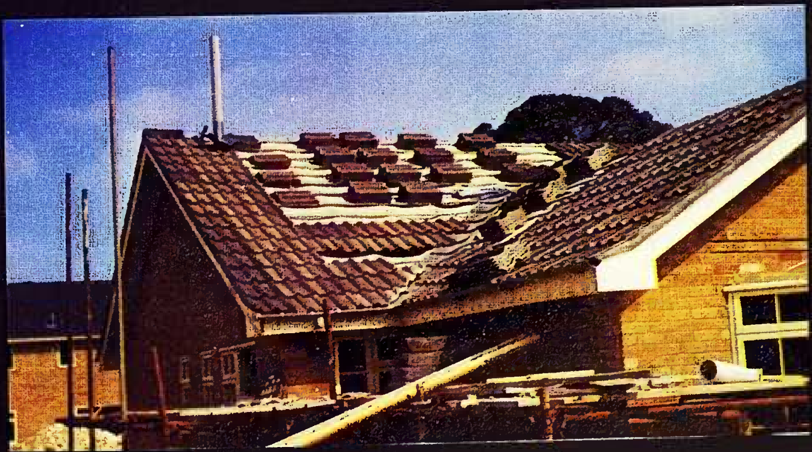
ROOFS

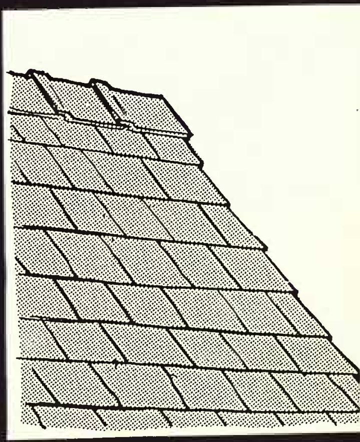
Our house must have a roof. What reasons can you think of for this?
How many different roofing materials can you find?

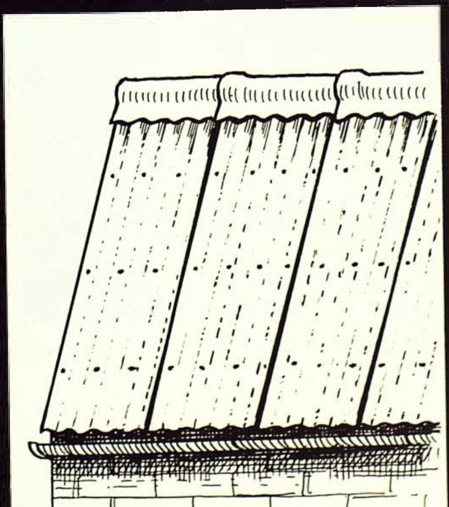


What materials are used for roofs?

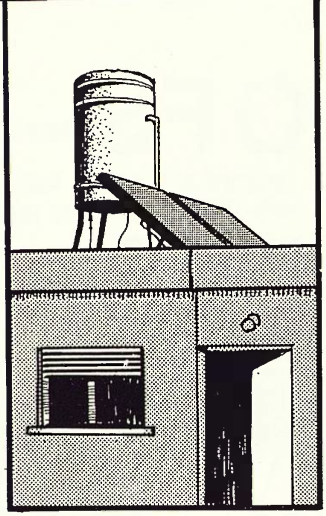
Left: Cotswold stone tiles
Centre left: Ceramic tiled roof
Centre right: Welsh slate
Bottom left: Corrugated asbestos
Bottom right: A thatched roof







SECTION FOUR



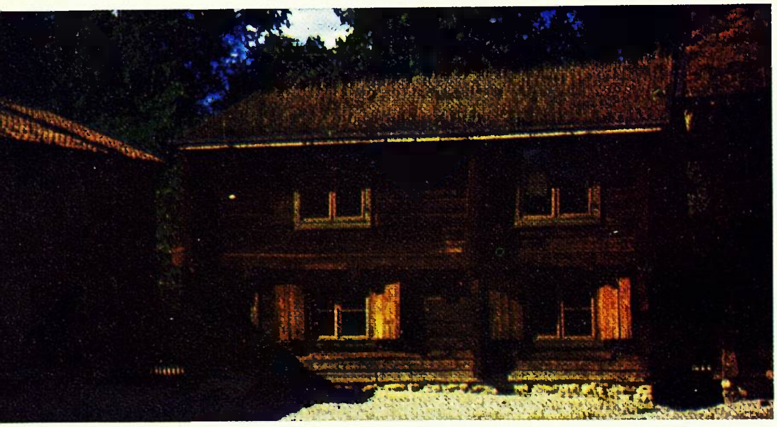
Roof shapes

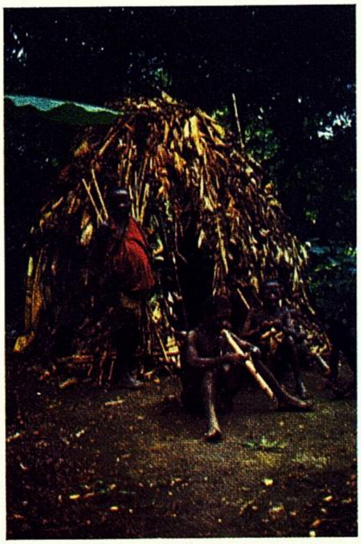
How many different shapes can you find?
Make drawings or photograph your observations.

Far left: A gable end
Left: A flat roof in Israel (A solar energy water heater is on the roof.)

Roofs around the world

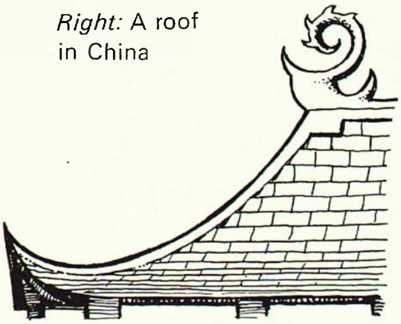
Above: Houses in Bruges, Belgium
Below: A grass roof in Sweden





Above: A pygmy dwelling in Uganda

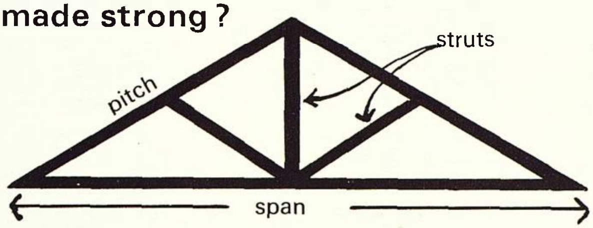
Right: A roof in China



You could link this work with your geography studies by seeing how and why different materials and shapes of roof are used in various parts of the world.

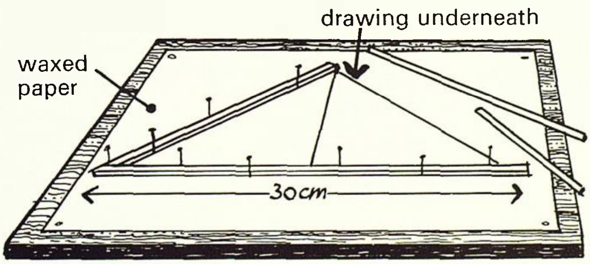
Structures and Construction

How are roof structures made strong?



What differences do pitch, span and struts make?

Model roof structures can be made from thin strip balsa wood, using the model aeroplane building technique. (A full-sized drawing is made and placed on soft board. A piece of waxed paper is used to prevent sticking and spoiling the plan.
The strip balsa wood is cut, pinned and stuck directly on to this arrangement.)

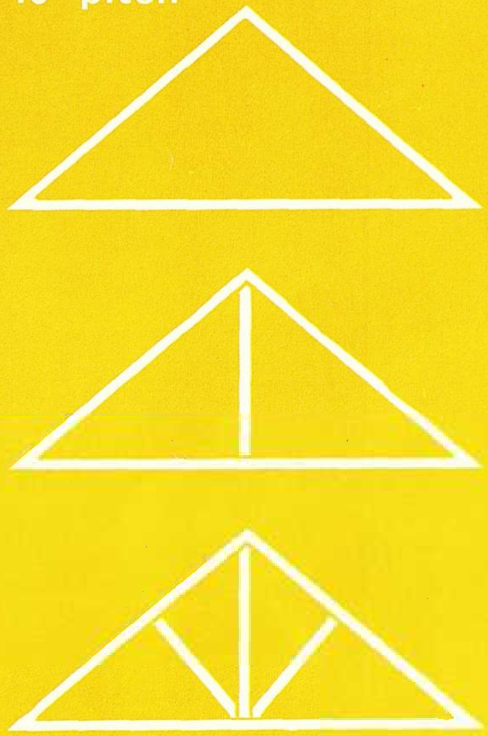


A 30 cm base line is a convenient size to use

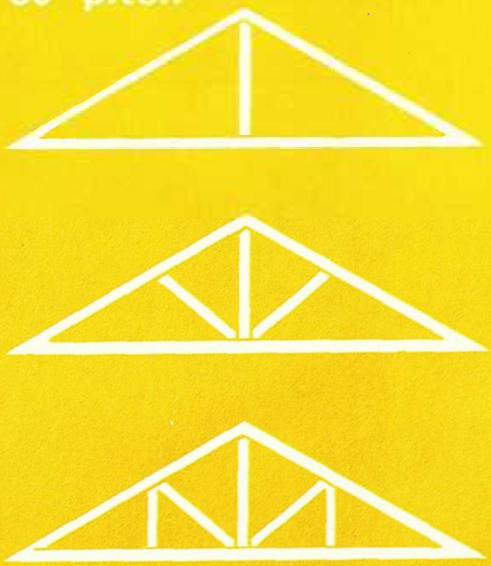
Children making roof structures

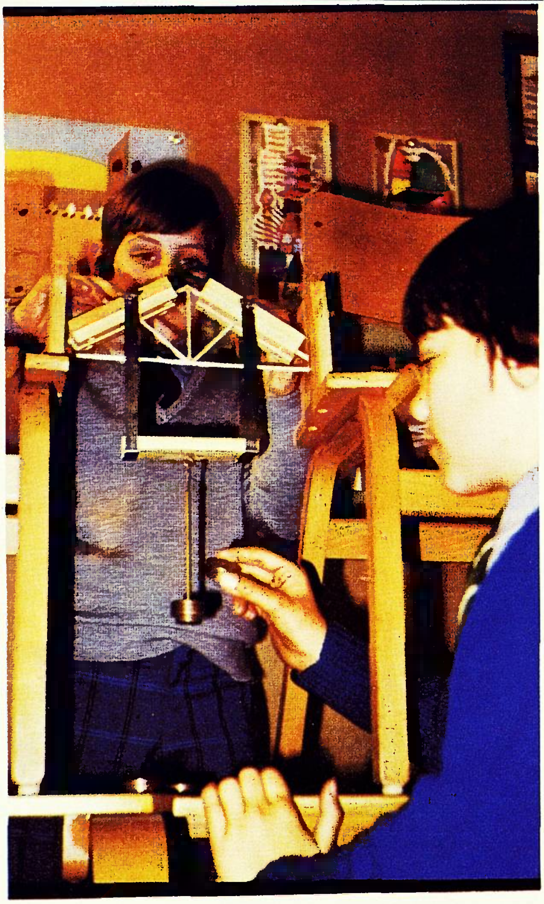
Experiment by varying the pitch and strutting.
Here are some suggestions:-

40° pitch



30° pitch

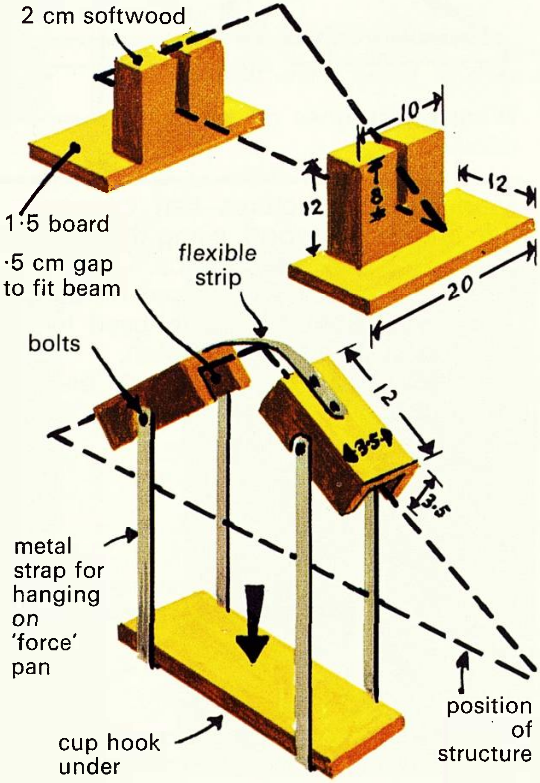




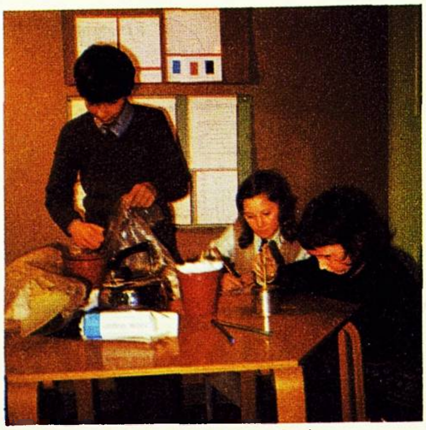
Testing

Which are the strongest structures?

Here is an arrangement which one young research team made to test the strengths of their roof structures.



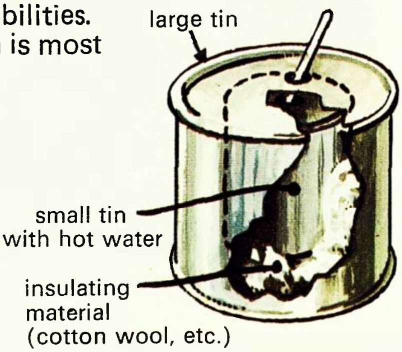
Do you think this is a fair test?
Are the forces applied similar to a real situation?
Are there other forces that roofs have to withstand?



An investigation into insulation trying various materials

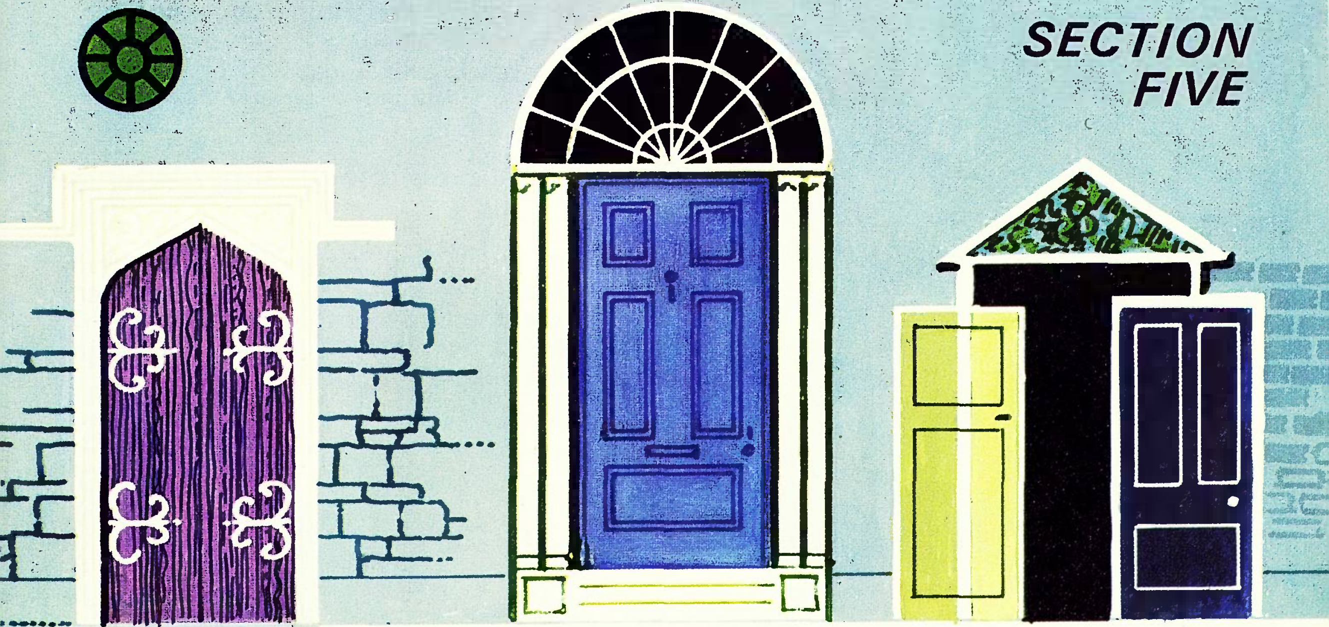
How are roofs insulated?

What materials are used to insulate the roof, so preventing the loss of heat?
Think of other possibilities.
Can you test which is most effective?



Windows, Doors & Floors

SECTION FIVE

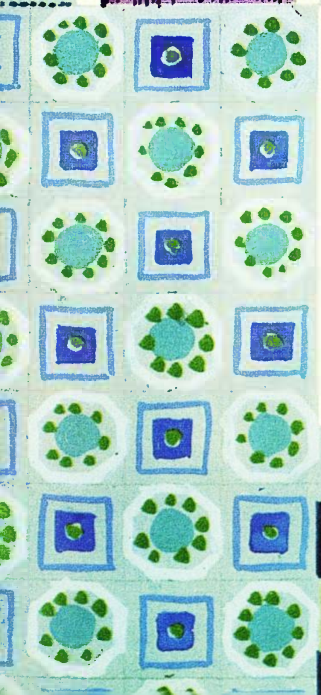


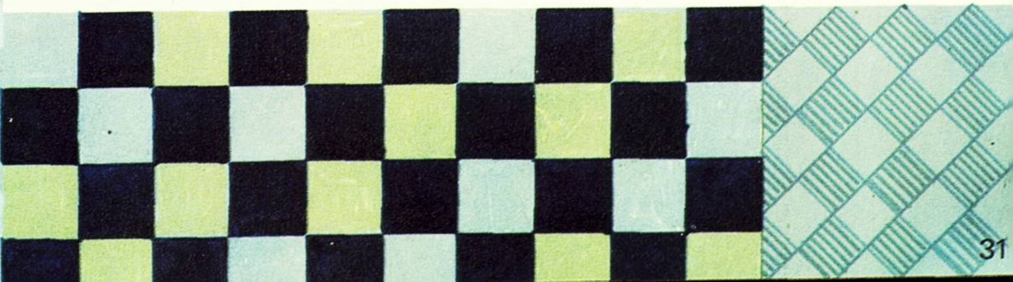
Record the different windows, doors and floors in your locality.

Windows let light into homes. Is anything other than glass ever used? Find out the meaning of *transparent, translucent* and *opaque*.

Doors close or open the passage into a home. What materials are used for making doors? How many different arrangements for opening and closing can you find?

What has been used for flooring in the past and in different parts of the world? How many different kinds of floor covering can you name?





Here is a glass exhibition made in one school.

GLASS

Other than windows what examples are there of glass being used in your home? Can you find: stained glass, 'cut' glass, glass sculpture, glass containers, glass beads, glass tubes, mirrors, lenses and prisms?

Which is the best way of cleaning windows?

When windows are cleaned, which is best: leather and cloth, rubber squeezy or window cleaning liquids?
Can you devise a test which will show the most efficient method?

What is double glazing? Why is it used?

You will find page 25 helpful in suggesting how you could devise an experiment to test the insulating qualities of two layers of glass compared with one.

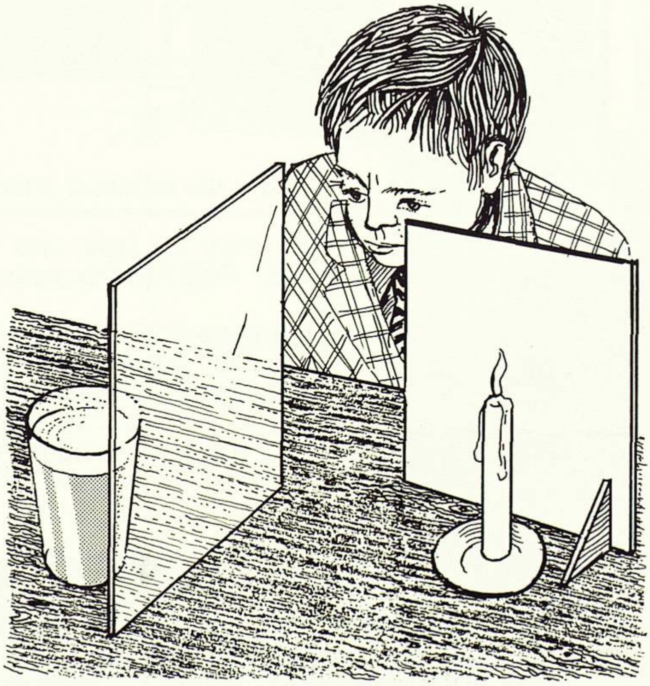
Have you noticed a window acting as a mirror?

This observation can be used to stage an amusing experiment.

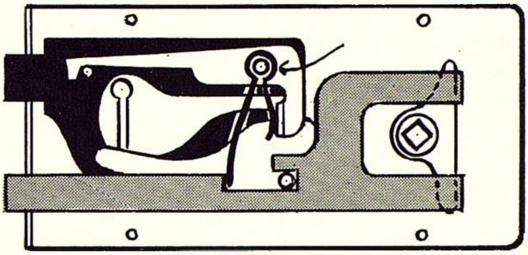
Can you make a candle appear to burn in a glass of water?

See what you can find out about 'Pepper' and his ghost.

More investigations with mirrors are suggested in *Science in a Topic – Communication*.



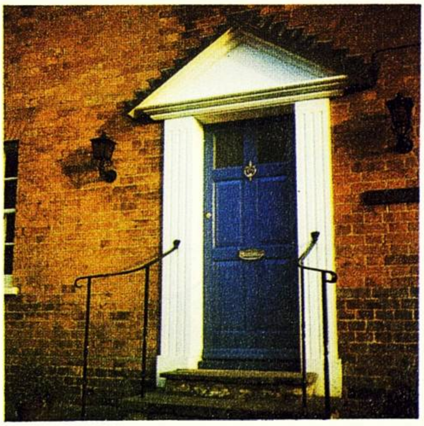
DOORS



A door lock

The black part shows the lock mechanism – the grey shows the catch worked by the handle.

Locks and keys, bolts and bars fasten doors. How many different kinds of lock can you find?

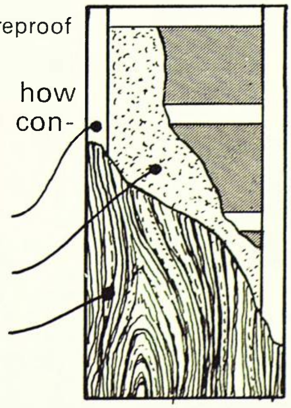


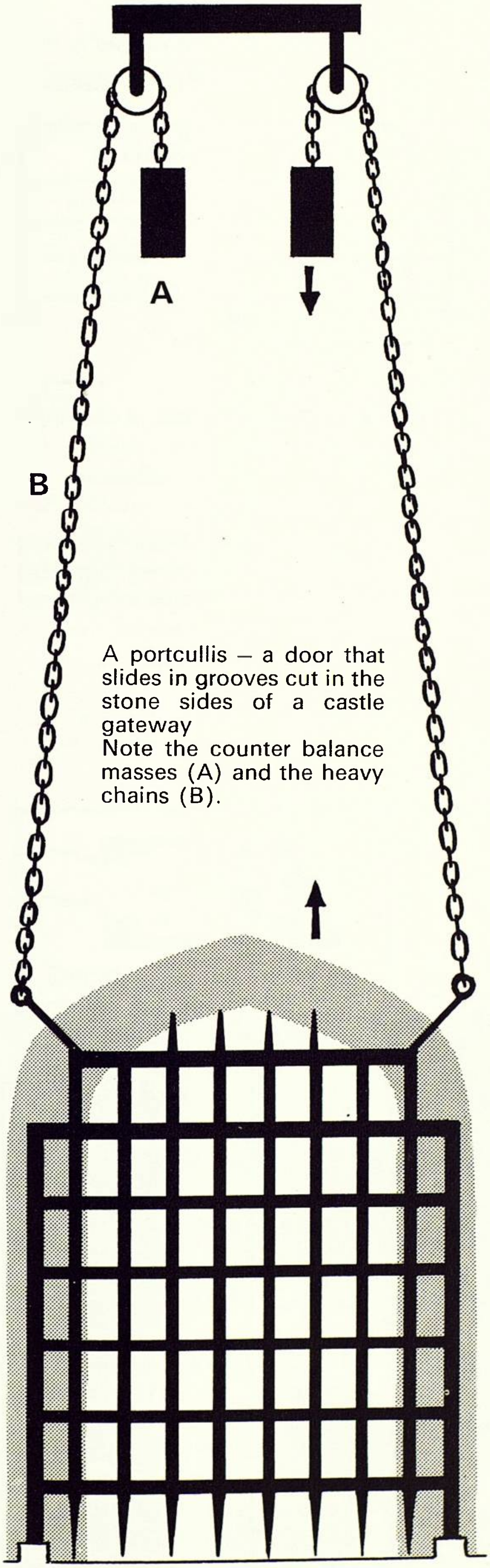
A coloured front door

What colour is your front door? Make a survey of door colours. Do particular streets have favourite colours?

A solid flush fireproof door

Can you see how these doors are constructed?





A portcullis – a door that slides in grooves cut in the stone sides of a castle gateway

Note the counter balance masses (A) and the heavy chains (B).

FLOORS AND FLOORING

What different floor surfaces are there?

What different floor surfaces can you list that are in your home and school?
It would be useful to ask your friends to help you make a comprehensive list

Flooring	Room

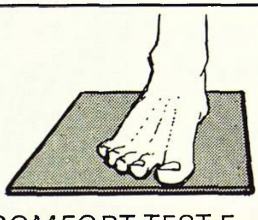
What reason could there be for choosing a particular covering for a room?

(a) resistance to dirt or staining
(b) warm to touch
(c) resistance to wear or scratching
(d) ease of polishing
(e) ease of cleaning
(f) quietness
(g) safety – non-slip
(h) waterproof

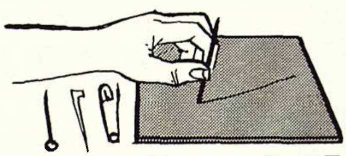
You can investigate these qualities for the different floor coverings and perhaps decide on your choice of flooring in each room of a new home.

A practical way to start these investigations is to collect samples of the various floorings in the form of tiles.
Here are some suggestions for such tests.
Record and display your results.

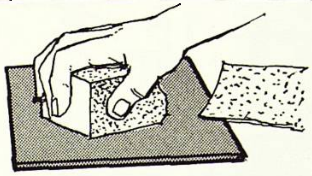
1 STAIN RESISTANCE TEST Rub on stain, dye, ink, grease, oil. Can they be removed?



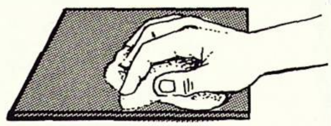
2 COMFORT TEST Feel each blindfolded with bare feet. Place in order of comfort.



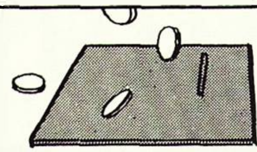
3 SCRATCH – DENT TEST Scratch – use a range of hardness (see page 11) Dent – drop a large nail.



4 WEAR TEST Rub *x* times with sandpaper or brick. Examine for signs of wear.



5 EASE OF CLEANING TEST Rub on dirt. Wipe with a damp cloth.



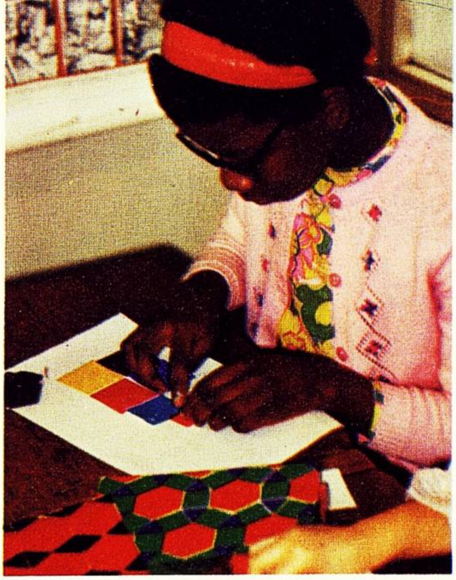
6 QUIETNESS TEST Drop coins. Which tiles are the noisiest?

7 SLIP TEST Measure the force needed to move a mass. The tile could be tilted and the angle of slide measured or a Force meter used. (Repeat with water on the tile.)

How are Shape and Space used?

How do shapes fit together?

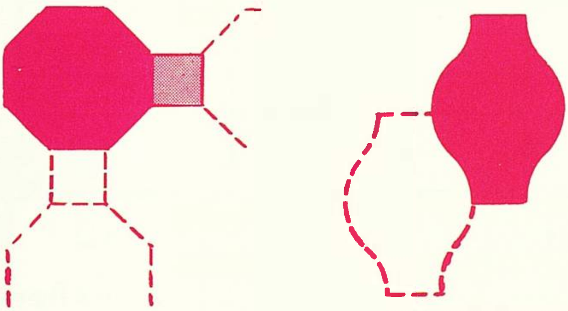
The tiles you used for your last investigation were probably square ones. Square tiles fit together easily into 'square' rooms. Can any other shapes be fitted together like this?



Working with paper shapes

Such complete fitting together to cover an area is called *tessellation.*

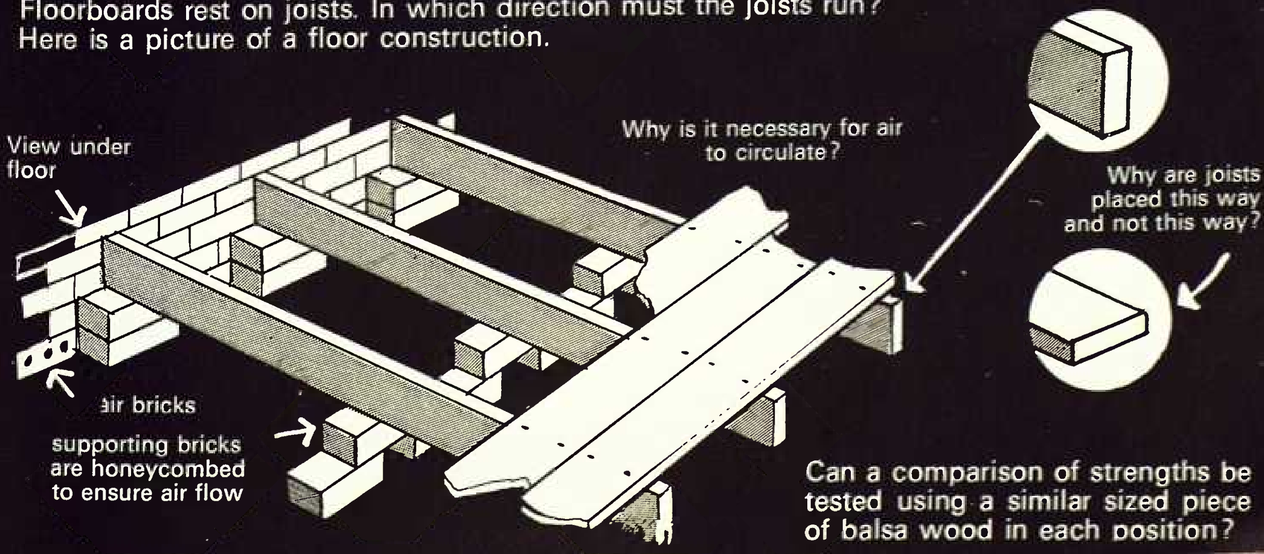
1 What other shapes than squares can be tessellated?
2 What combinations of shapes can be tessellated?
3 Can curved shapes be tessellated?



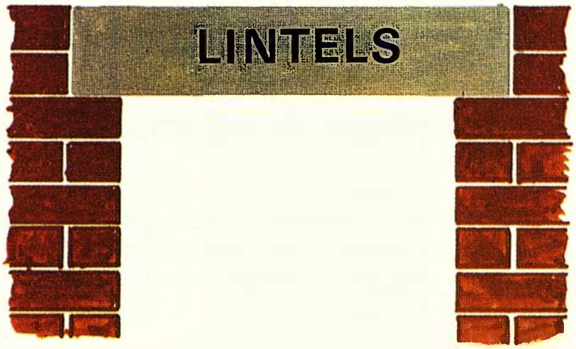
You could try out some ideas with coloured papers, or plastic shapes. Do tile manufacturers use any of these ideas? What variety of shapes is made?

What shapes and spaces are under the floor?

Some downstairs rooms are on solid concrete so there is no space beneath.
Floorboards are tongued and grooved. What does this mean?
Floorboards rest on joists. In which direction must the joists run?
Here is a picture of a floor construction.



During your observation of buildings under construction you will have noticed special concrete beams over windows and large doorways.
These are called *lintels*.
They are made of reinforced concrete.



What is reinforced concrete?

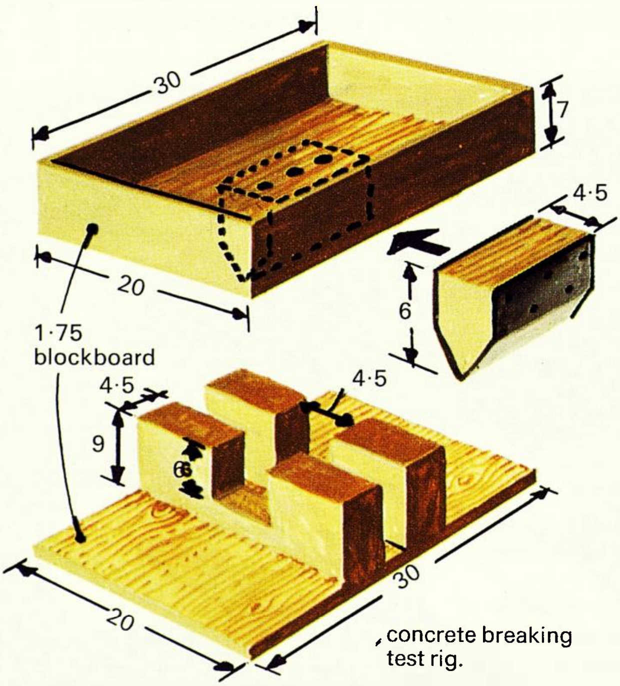
Is it much stronger than ordinary concrete?
Make some and find out.

A suitable size is 25 × 2·5 × 1 cm.
Florists' wire makes a suitable reinforcing rod.
Try 0, 1, 2, 3, 4 . . . rods.

Try making samples of ordinary concrete and reinforced concrete of different mixtures. To start with it would be best to fix the volume of water, but later you could vary this as a further investigation.

Sand	Gravel	Cement
1	1	1
2	1	1
2	2	1
?	?	?

How can we test the strength of our samples?



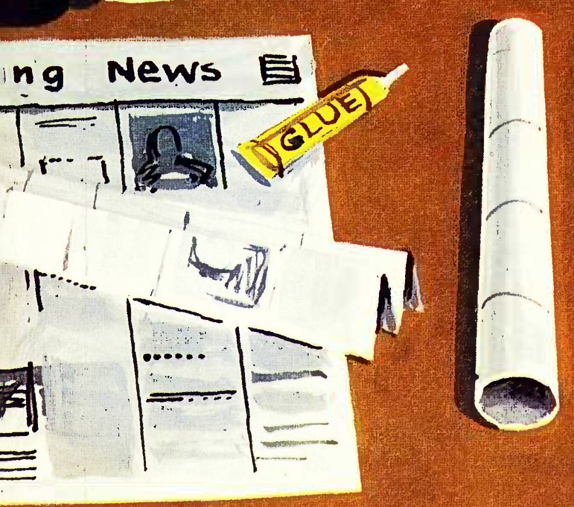
concrete breaking test rig.

Dimensions in cm

How would you record this?

One group of children found that when their loaded concrete broke the large masses dropped and this was dangerous to toes. So with their teacher' they designed this test rig.

Below: Test rig in use



BUILDING IN THE CLASSROOM

SECTION SIX

Can you build with newspaper?

Before building it will be a good idea to research into which kind of roll makes the best 'building tube'.

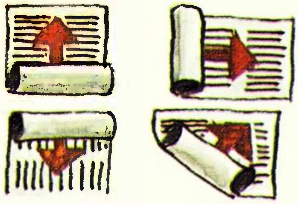
1 Does the diameter of the roll make a difference to strength?

Try rolling round a thin dowel, cane or broom-handle or upon itself.

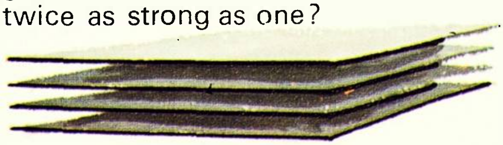
2 Do different newspapers have different strengths?

Try various newspapers.

3 Does the direction of rolling make any difference?



4 Does the number of sheets make a great difference? Are two sheets only twice as strong as one?



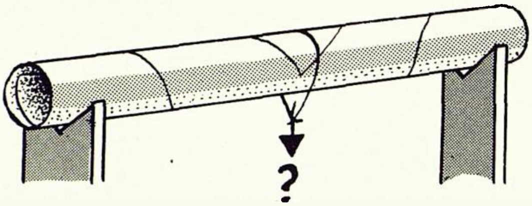
Try various numbers of sheets.

5 How can you secure the rolls?

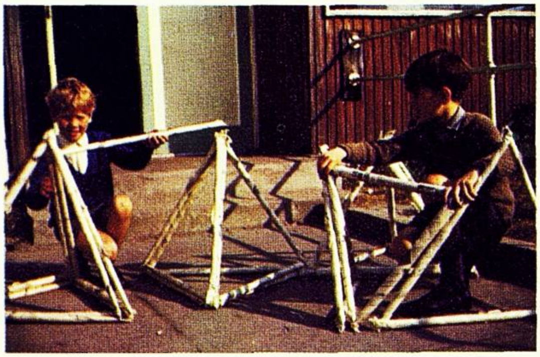
Try two or more tubes lashed together.

Building with newspaper

How could the strength of rolls be tested?




Children testing a roll.

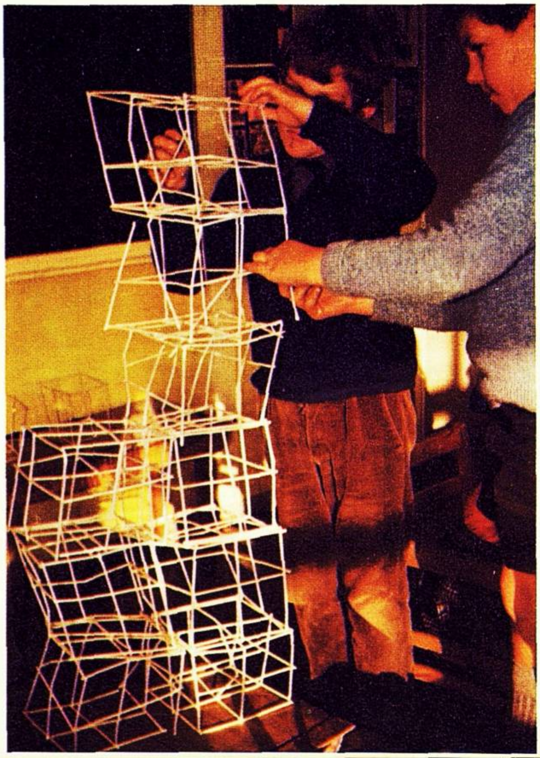

Here are some children working on their ideas.

What can you build?

1 A tower that will reach the ceiling.
2 A 'sportsdrome' – the largest roof area you can build with no supporting pillars.
3 A 'house' – how many boys and girls can you get inside?

How shall we fix our shapes?

Sticky paper, string, florists' wire are some ideas that have been tried.



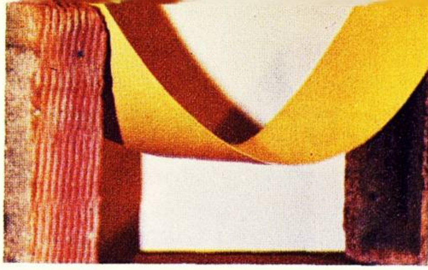
Can you build with straws?

Another building challenge would be to build the highest possible structure using straws and pins.

Left: Here is a successful pair of boys. They had set out to reach the ceiling.

Card and Canes

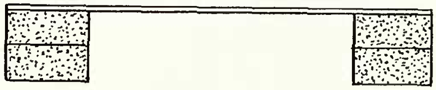
You have probably been using card to build your models. Look more closely at some of the problems of building with card.



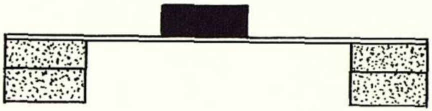
This card girder does not seem very rigid.

Can you make a girder from a piece of card?

What can we do to increase the strength of the 'girder'?
You could make your girder from stronger material.
Try using: thicker card, hardboard, plastic. Compare strengths of various materials for the same length and width (60 × 15 cm is a suitable size).



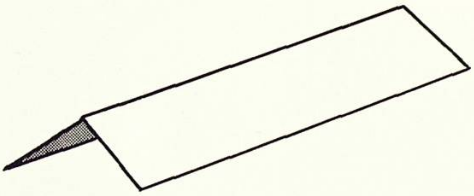
A girder made of hardboard.



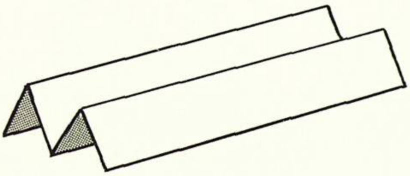
A plastic girder with load.

Does folding increase strength?

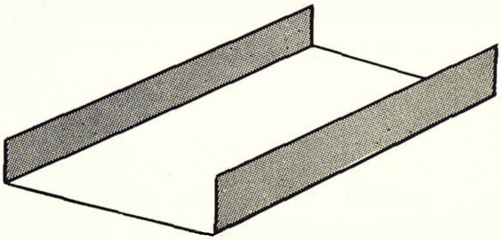
Returning to the original strip of thin card, try folding it.



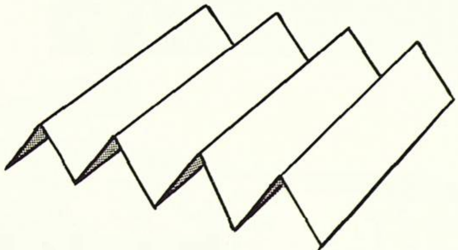
1 Fold once



3 Fold three times



2 Fold twice



4 Fold seven times

Do these seem more rigid? What load will these carry?

These are similar pieces of card but you have changed their form.
Can materials be strengthened by using them in different forms?
Can you find examples of these ideas being used?

You can work on a larger scale

It could be fun to work on a larger scale outside. Using garden canes and wire you could try to build:—

(a) a primitive home.
(b) a wigwam.
(c) a 'shipwrecked' shelter.
(d) an explorer's jungle trek shelter.

How rigid and stable can you make one of these?

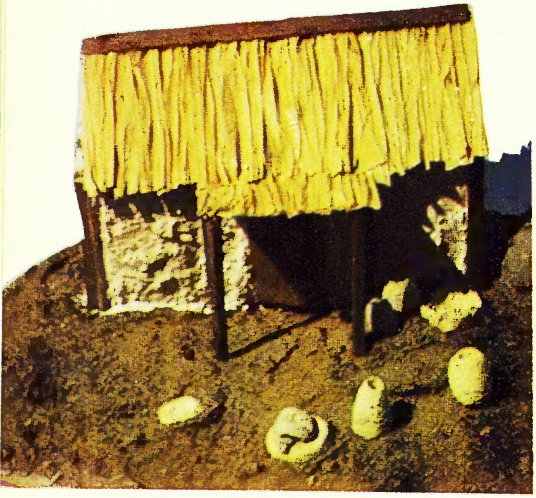
MODELLING HOMES

As part of your Homes study you will be looking at buildings from all over the world and in different periods of history.
One way of recording and illustrating your research is model making. Here are some model homes of different times and places made by groups working on this topic.
If you compare the models with some of the pictures of real homes you will notice how clever they were in simulating the actual materials used.

A Norwegian wood house

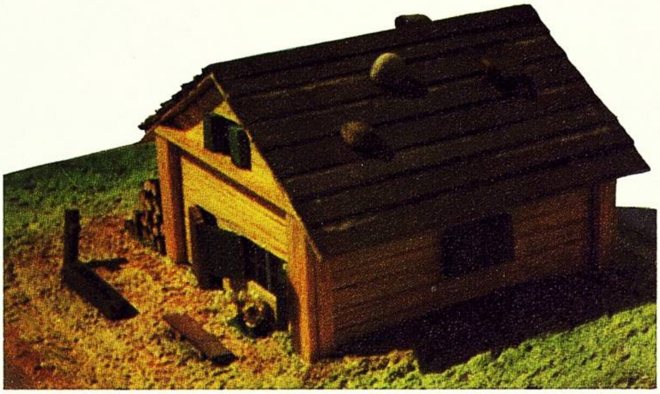
A Kirghiz yurt

A stone house in the Andes

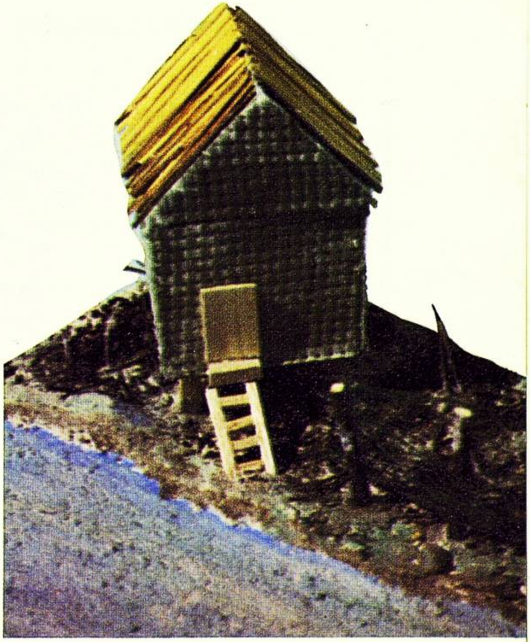


A village home in Pakistan

A Malayan dwelling



A Swiss chalet



A South Sea Island stilt house

Lapp dwellings – summer and winter

Plans for some of these models are shown inside front and back covers.

An Eskimo igloo

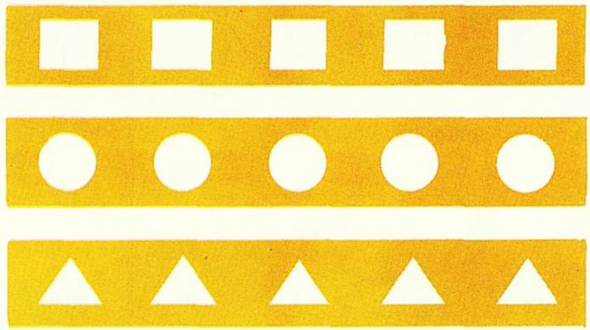
A Tudor street

Shape and Structure

With some of your constructions you may have found that the mass of the material itself was a problem. They may have started to sag or even collapse.

There would be no point in using a huge girder to hold up the roof if this caused the walls to collapse. A method of overcoming this problem is to remove material from structural shapes.

How does a beam's strength alter when some of the material is removed?



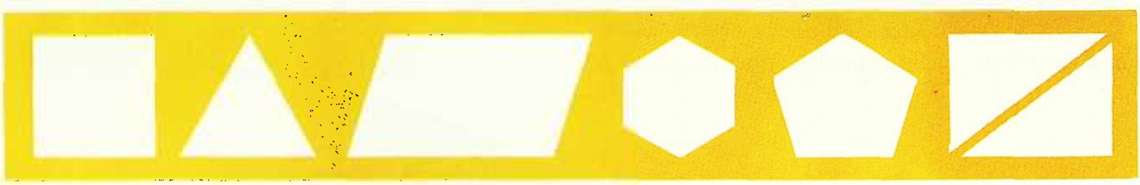
(a) Try removing different shapes.
(b) Try removing different numbers of holes.

For testing you could use the roof structure test rig suggested on page 30.

Which shapes are rigid?

Did you find any particular shapes were more rigid than others when building with your newspaper, canes or straws?

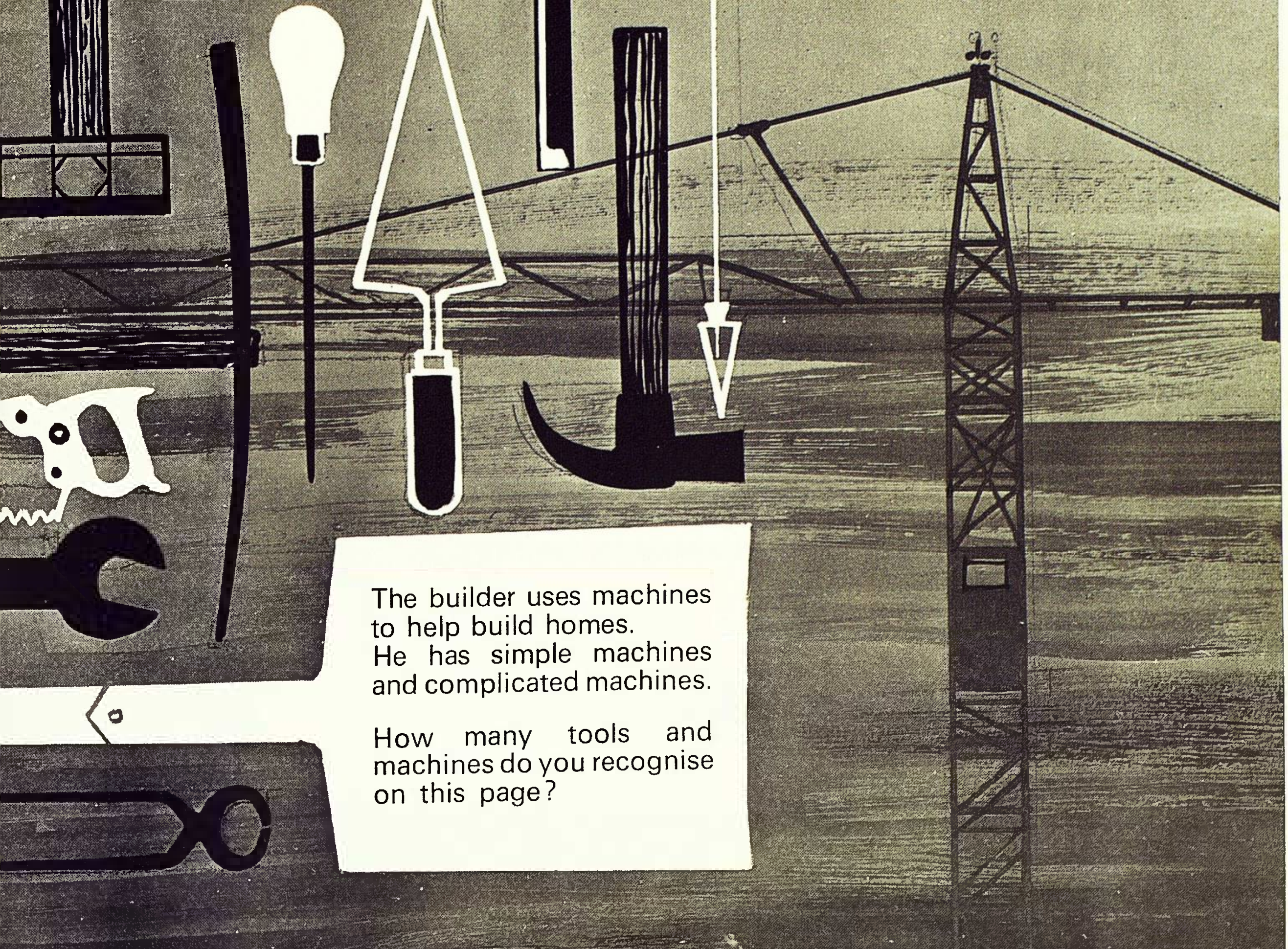
Which of these shapes are rigid?



Can non-rigid shapes be made rigid?

Here is a girl investigating this question of rigidity with a plastic Meccano set.

Some boys preferred to design a building with balsa wood blocks and create some modern architectural models.



The builder uses machines to help build homes. He has simple machines and complicated machines.

How many tools and machines do you recognise on this page?

Tools and Machines

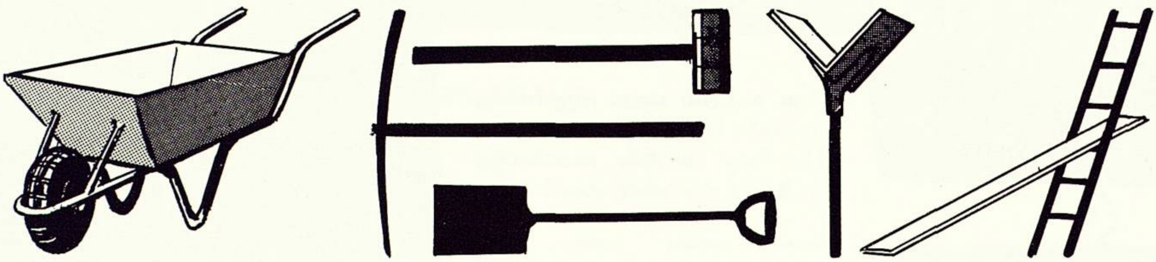
SECTION SEVEN

SIMPLE MACHINES

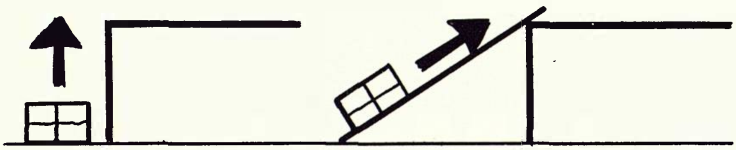
The builder uses machines to help build homes.
He has simple machines and complicated machines.

In science the word *machine* has a precise meaning 'a device to enable work to be done more easily or more quickly' (you can find out about WORK on page 56 of *Science in a Topic-Ships)*.

Not all the machines the builder uses are as big and impressive as a pile-driver or a bulldozer.
The illustrations below are *machines* as they help him to work more efficiently.



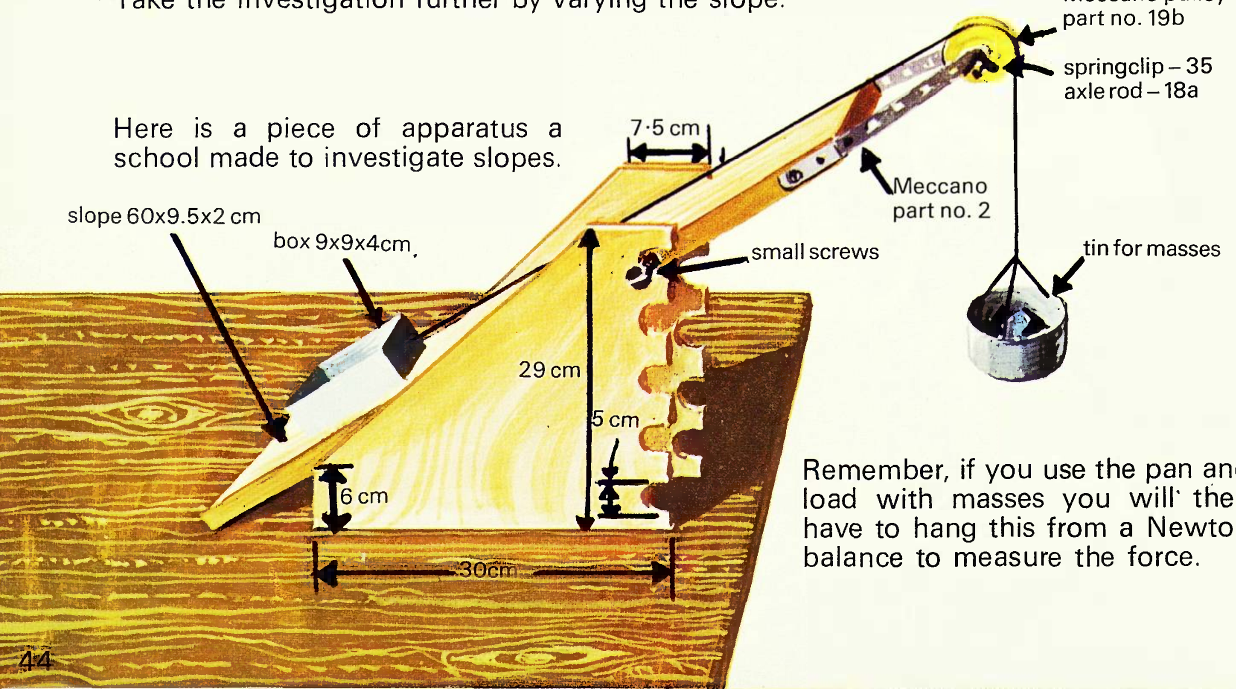
Investigate one of the simplest machines – the slope



What is the force needed to raise the load in each case?

Take the investigation further by varying the slope.

Here is a piece of apparatus a school made to investigate slopes.



Remember, if you use the pan and load with masses you will then have to hang this from a Newton balance to measure the force.

Cranes

One of the most impressive machines on the large building site is the tall crane.
Have you watched a crane at work?
It is possible you may have been so absorbed in what was happening that you did not notice all the crane's interesting features.
Study these pictures:

Can you see an anemometer on the top?
What does an anemometer measure?
Why is it needed on a crane?

Notice the heavy blocks of concrete on one part of the crane. What purpose do they serve.

A pile-driver supported by a crane.

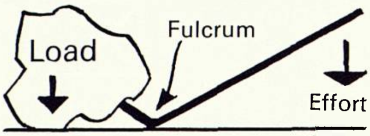
The crane is built of lengths of steel.
In what shapes are they fastened together?

Can a crane topple over?

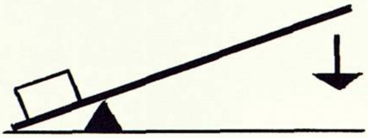
You could do some research to find out if a crane can lift equal loads at different angles.
Use your library reference books to find out how many different types of crane there are.
You can try using Meccano to build some working models of these cranes.
(The use of the pulley which is so important to the working of a crane is dealt with on page 54 of *Science in a Topic – Ships*.)

Crowbars and Wheelbarrows

The machines we have studied so far, the wheel (pulley) and the slope, are two basic machines. Another fundamental machine is the lever.



One form of lever sometimes used in building is the crowbar.



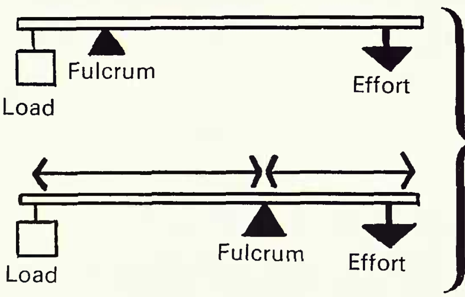
Carry out some investigations with this basic machine.

Vary the position of the turning point. Where is the best place for moving the load?

What can you find out about this lever?

The difference the position of this turning point makes will be appreciated if you experiment by slowly sliding the pole on your shoulder.

The Scientific word for the turning point is FULCRUM.



Find the effort needed to balance the load.

Vary these distances.

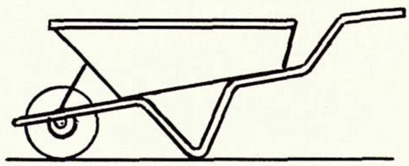
Another lever type machine is the wheelbarrow

Where is:–

(a) the load;

(b) the effort;

(c) the fulcrum.



Can you find an ideal design for a model wheelbarrow?

Which is the best place for the wheel, and what is the best size?

How long should the handles be?

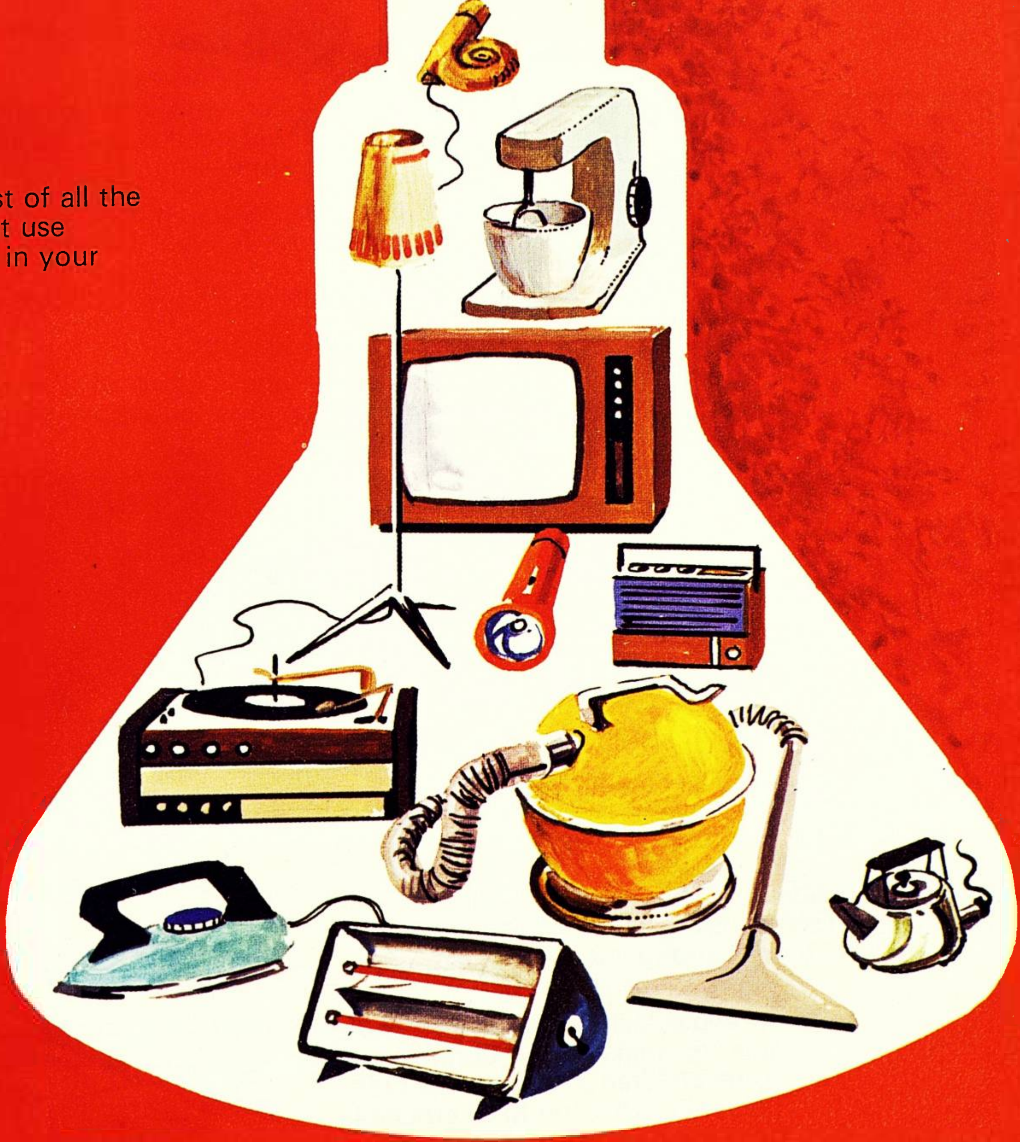
You could make some model wheelbarrows using matchboxes, card and balsa wood to illustrate your designs.

You could learn much more about this lever by doing some measurements. Make up your own table, recording your results.

LOAD	Distance from L to FULCRUM	EFFORT	Distance from E to F	L x a	E x b
(L)	a	(E)	b		

What pattern do the results show?

Make a list of all the things that use electricity in your home:—



ELECTRICITY
SECTION EIGHT

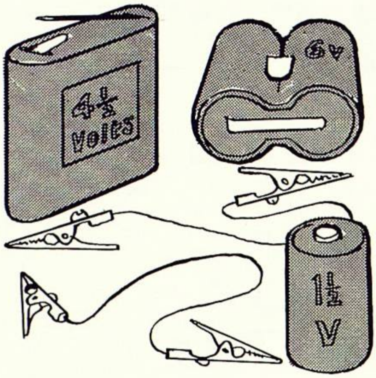
1 How is electricity made?
2 How is it controlled?
3 How is it made safe to use?
4 What is a fuse?
5 How does a switch work?
6 What are volts, amps and watts?

The best way to start finding answers is to explore with *Batteries* and *Bulbs*.

IT IS QUITE SAFE TO EXPERIMENT WITH BATTERIES. BUT DO NOT EXPERIMENT WITH THE MAINS SUPPLY. THIS IS VERY DANGEROUS

BATTERIES AND BULBS

For your first experiment you will need a battery, a bulb and some wire.



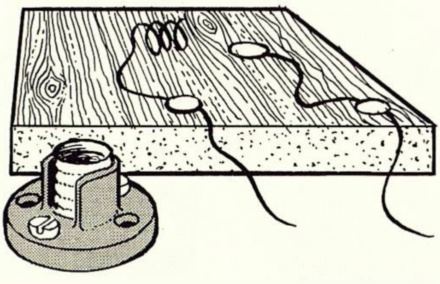
Try to make the bulb light.
Can you do this using different batteries?
Try different bulbs.
Can you light the bulb from any of the batteries using no wire?

Can you light the bulb using anything other than wire?
You should now be able to make a rule about how you can light a bulb from a battery.

You may have found it awkward holding your bulb. Can you devise a bulb-holder?

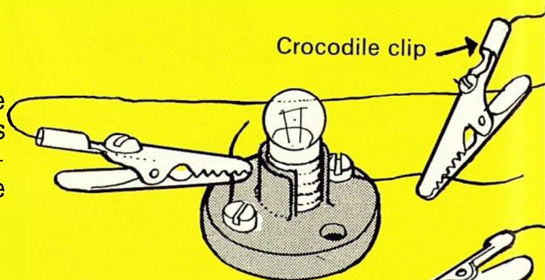
Here is one, using drawing pins and bare wire, made by a young inventor. Other inventions have used paper clips, aluminium foil and clothes pegs.

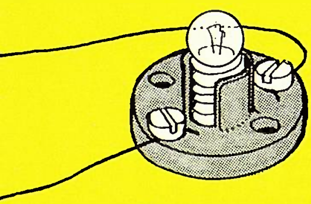
This is the bulb-holder made for the small screw-in bulb you have in school.



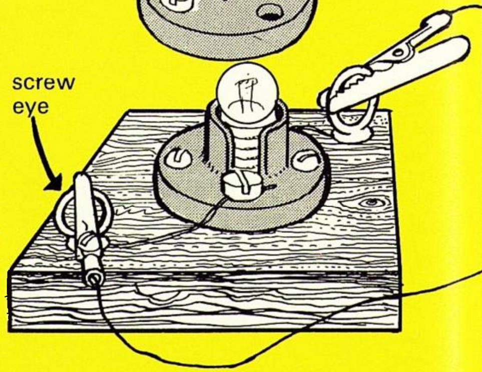
Children have soon found that an easy way of making contact is necessary if they are to try all the different arrangements.

To avoid losing screws and to be able to make easy connections some children adapted their bulb-holder like this and fixed crocodile clips to the ends of their wires.

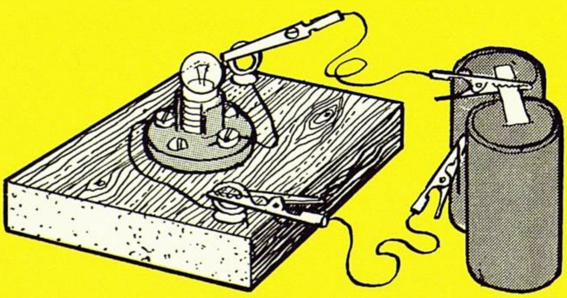




Another group fixed a length of bare wire permanently to the bulb-holder to provide easy contact



Perhaps the best way is to mount your bulb-holder on blocks with easy connecting points for your crocodile clips.



Now using your bulb, prepared bulb-holder, battery and wires with crocodile clips, connect up a *Circuit*.

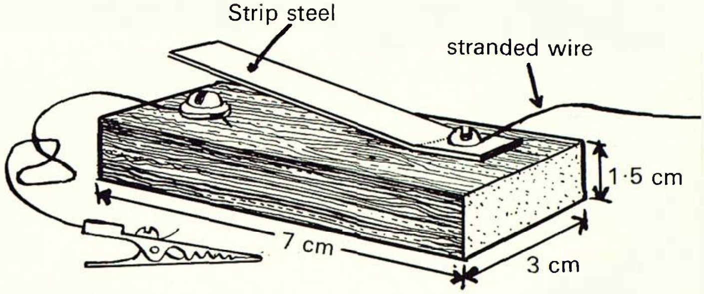
You will see that there is a complete pathway for the electricity from the battery through the bulb and back to the battery.

ON AND OFF

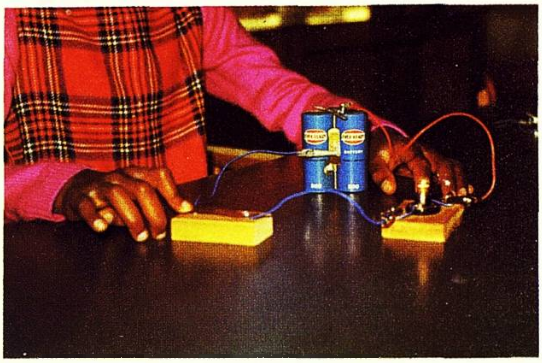
Can you make your light go out?

How many ways can you make the bulb go out?

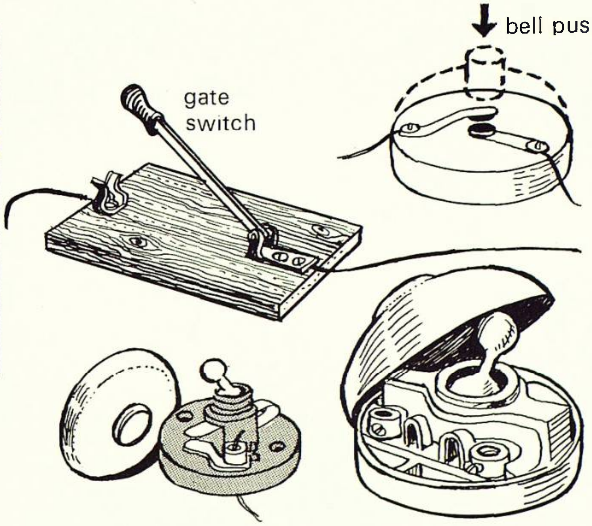
The usual way to make a light go on and off is to include a switch in the circuit.



Here is a school-made switch.



A simple circuit with switch.



small switch

tumbler switch

Try your switch in different parts of the circuit.

Examine some bought switches.

Can you see that all a switch is, is an arrangement for joining wires?

Try to light more than one bulb from one battery.
Can this be done in more than one way?
Here are two arrangements using two bulbs.

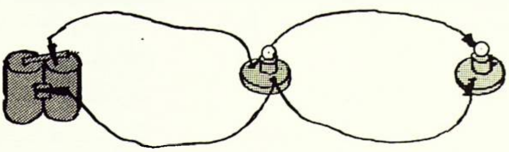


Diagram of a parallel circuit.

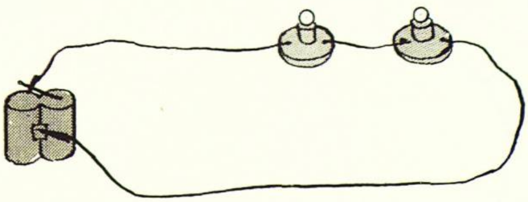
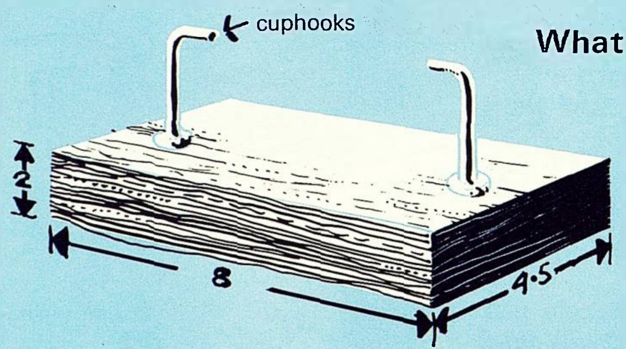


Diagram of a series circuit.

Try making circuits using first three then four bulbs.
Experiment with these arrangements.
Are the bulbs of equal brightness?
What happens if a bulb is unscrewed?

You have experimented with more than one bulb; what happens with:—
(a) more than one battery?
(b) more than one switch?

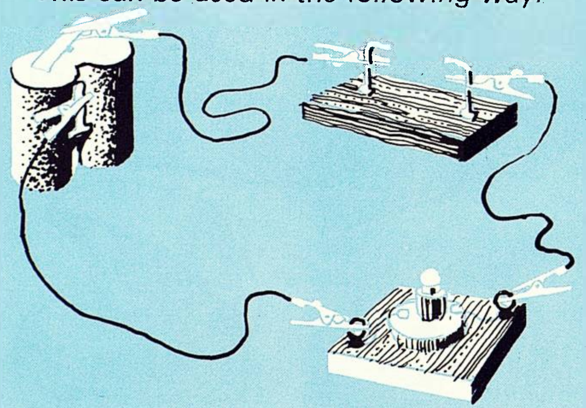
HOW DOES ELECTRICITY TRAVEL?



What will electricity travel through?

A simple but useful piece of apparatus for this investigation can be made from a block of wood and some cup hooks.

This can be used in the following way.



From your experience already you will know that if the circuit was completed the bulb would light.

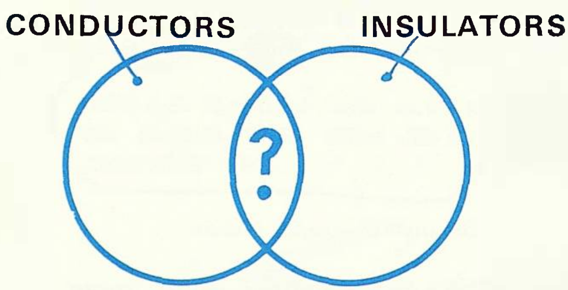
Check this with a piece of wire.

Make a collection of materials to test whether they are *Conductors* (the bulb will light) or *Insulators* (the bulb will not light).

See that your collection contains:—
steel, copper, brass, card, wood, string, plastic, aluminium, tin plate, covered wire, bare wire, carbon (pencil lead), glass, painted metal, zinc, lead . . .

Place these samples carefully across the cup hooks, making sure you have a good contact. Sort them into groups.

Record your findings



CONDUCTORS	INSULATORS

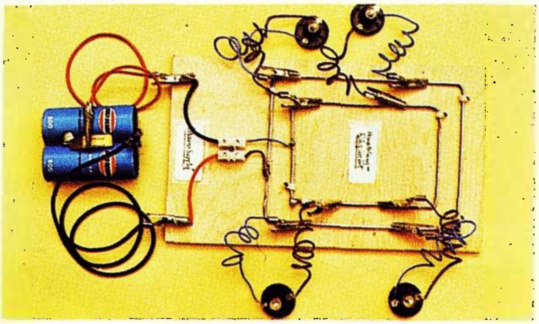
Do some samples conduct electricity better than others?
(You could do some further work with conductors and insulators if you study telephones in *Science in a Tpi* phones in *Science in a Topic — Communication.)*

CIRCUITS AND FUSES

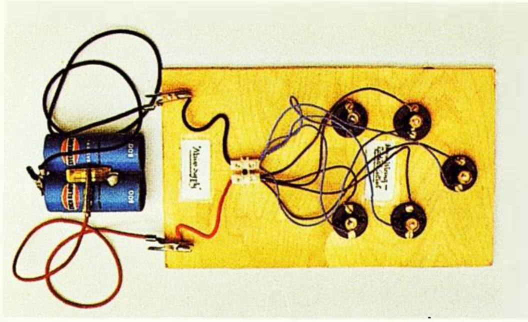
How are houses wired?

Here are two simple methods of wiring a home.

What do you think are the advantages of each circuit?



The ring circuit – new style wiring



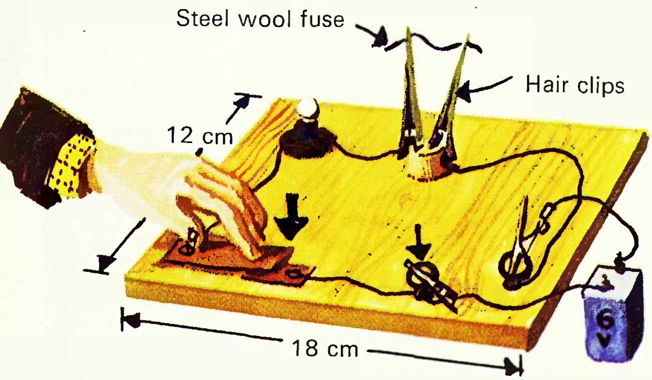
Old style domestic wiring

Can you wire similar circuits but include switches?

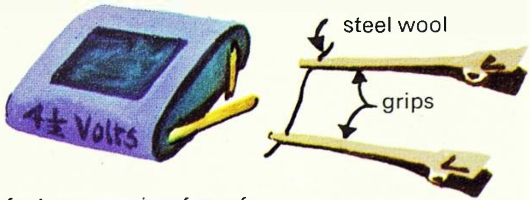
What do fuses do?

Probably during your first explorations you 'blew' some bulbs. This was understandable as you were experimenting with something new. However your teacher would not be very pleased if you continually did this. What happens in our homes?
It would not do to have expensive television sets, fires etc. ruined by such lack of understanding.
It can happen, but in our homes we have a *fuse* to prevent such dangers.

You can easily make a demonstration fuse circuit which will explain its use.

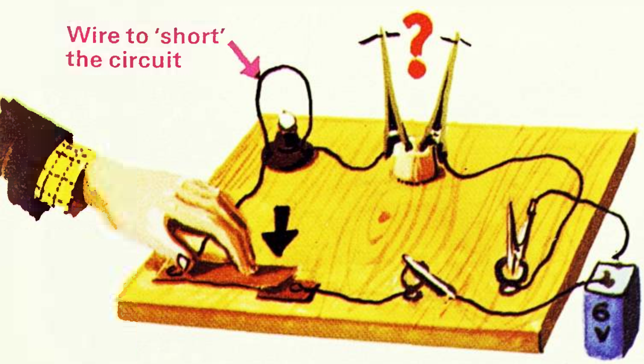


First see what happens when you put a few strands of steel wool across a battery.



Left: A suggestion for a fuse investigation

Now overload the circuit



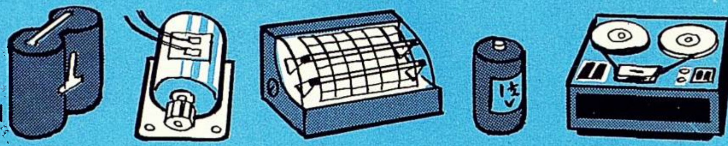
When too much electricity passes too quickly the weak link melts.

Get an adult to show you the fuses and fuse box at home.

In the electric circuits of your home there is a third wire connected to earth (the earth wire). This is not part of the normal electrical circuit but is a safety measure you will learn more about later.

SOME ELECTRICAL TERMS

WHAT DOES VOLTAGE MEAN? THE NUMBER OF VOLTS IS THE MEASURE OF ELECTRICAL PUSH



What voltage do these require or provide?

Another measure you will find marked on the lamp is WATTAGE.

THE NUMBER OF WATTS IS A MEASURE OF POWER (ENERGY SUPPLIED PER SECOND)

When examining electrical things you will also find the term AMPS.

THE NUMBER OF AMPS MEASURES A QUANTITY OF ELECTRICITY FLOWING IN A SECOND

VOLTS × AMPS = WATTS

That is to say a lamp which takes ·5 amps from a 200 volt supply would be rated at 100 watts.

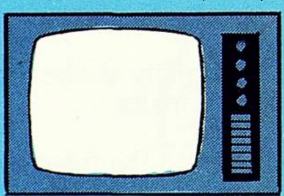
1 If an electric iron uses 5 amps when connected to a 200 volt supply, what power is this?

2 If a 3000 watt electric fire is used with a 250 volt supply, what fuse wire should be used? Should it be 5 amp, 10 amp or 15 amp?

How do we pay for electricity?

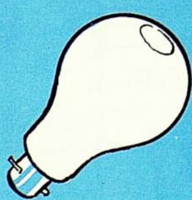
The Electricity Board sells electricity in *units (kilowatt hours)*. A unit is the electricity used by a 1000 watt piece of electrical apparatus for 1 hour.

A UNIT OF ELECTRICITY PAYS FOR:



A 250 watt T.V. enjoyed for 4 hours

A 500 watt toaster working for a total of of 2 hours

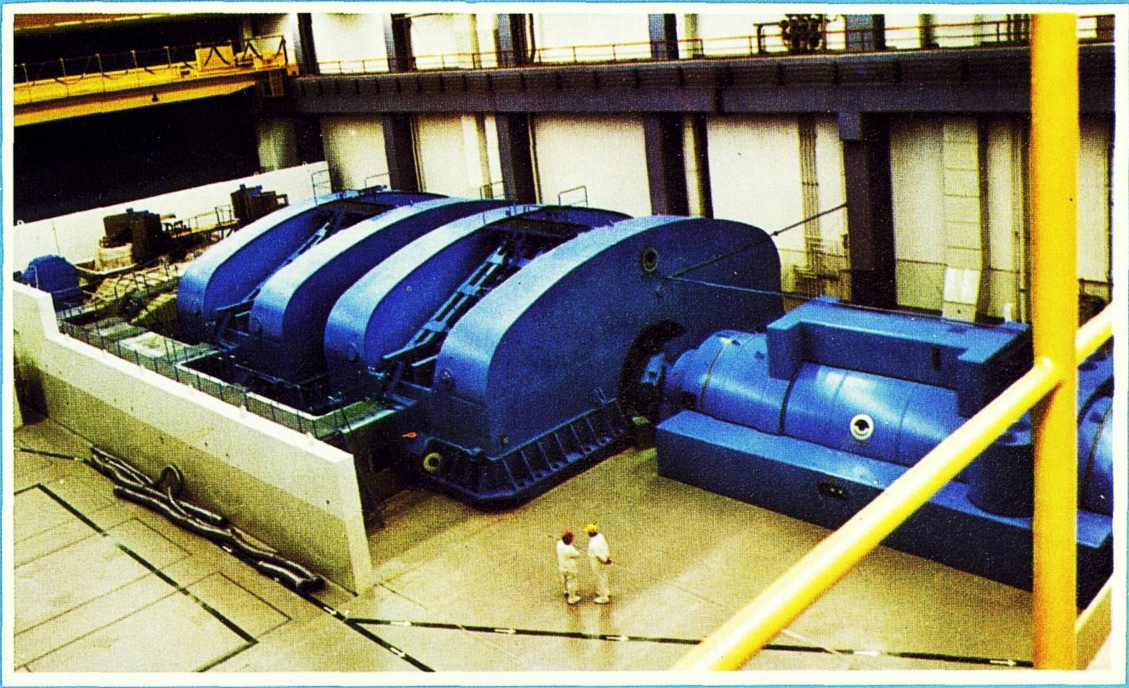


A 50 watt lamp burning for 20 hours

A 1000 watt fire switched on for 1 hour

What will be the cost of using a 2000 watt fire for 3 hours if electricity costs 2p a unit?

POWER STATION TO HOME



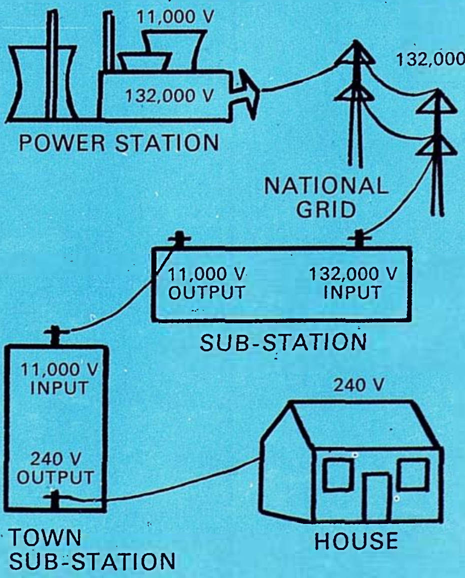
Siemens Ltd. Nuclear Power Station in Germany.

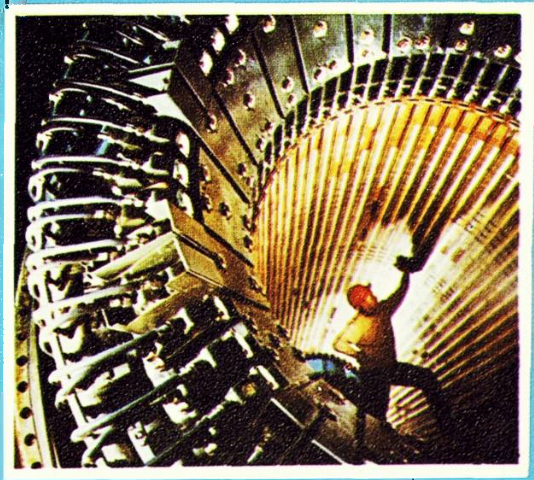
How and where is electricity made?

The electricity which comes to our homes is made at a power station.
The electricity is made by a dynamo.
What energy sources do you think are used to make electricity at power stations?

How do you think this huge dynamo is turned?

How does the electricity reach us?

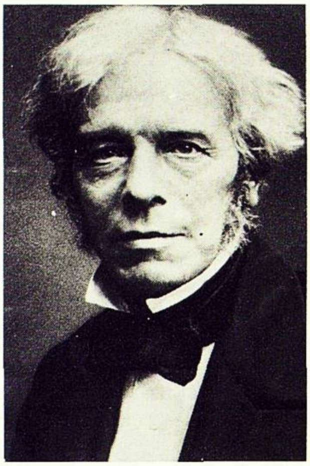




The worker inspecting the inside of this dynamo will give you some idea of the size of this great power producer.

MAKING ELECTRICITY

The Dynamo



The dynamo was discovered by Michael Faraday.

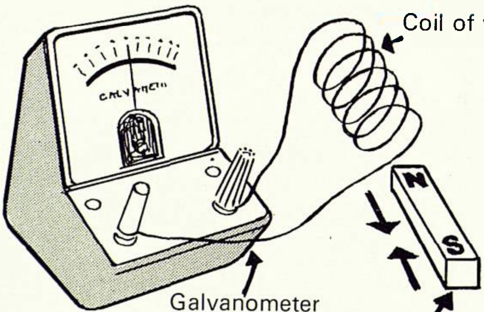
He is sometimes called 'the father of electricity'.

Try to read more about this great scientist.

Faraday knew that electricity could make magnetism. He carried a magnet and some wire with him for 15 years wondering how he could use a magnet to make electricity.

Faraday was successful. You can repeat his experiment which started the wonderful world of electricity we know today.

Photo by kind permission of The Royal Institution.



You can make your own Galvanometer from a tube, wire and a compass needle.

To make electricity Faraday discovered he needed:—
1 A MAGNET 2 A COIL OF WIRE 3 MOVEMENT

Using the hand dynamo

Continue your investigations with a hand-driven dynamo.

1 Turn the handle at different speeds.
2 Try to light more than one bulb.
3 Can you find other things that it will work?
4 While turning steadily, unscrew the bulb.
5 Try connecting a battery to the dynamo leads.

WATER

SECTION NINE

1 Which rooms have a water supply?

2 How many taps are there in the house?

3 Are there outlets other than taps?

4 How much water does your family use in a day? How is it used?

5 Is it free or does it have to be paid for?

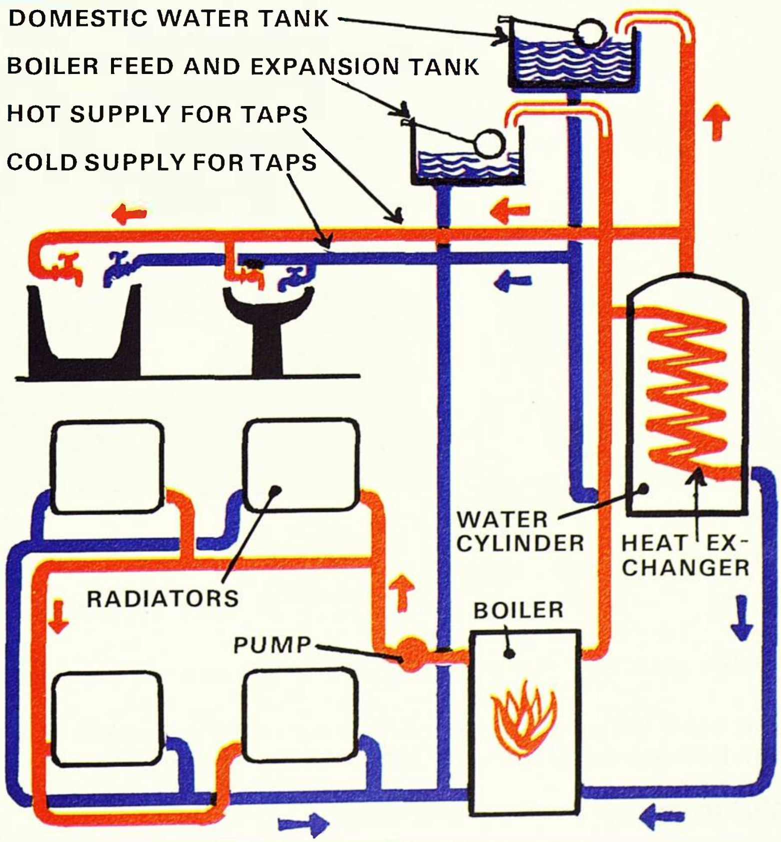
6 Where is your water stored
  - the cold water?
  - the hot water?

7 How is your hot water heated?

8 Where is your water stored before it comes to your home?

9 Where does the waste water go?

10 Where can your water supply be turned off?

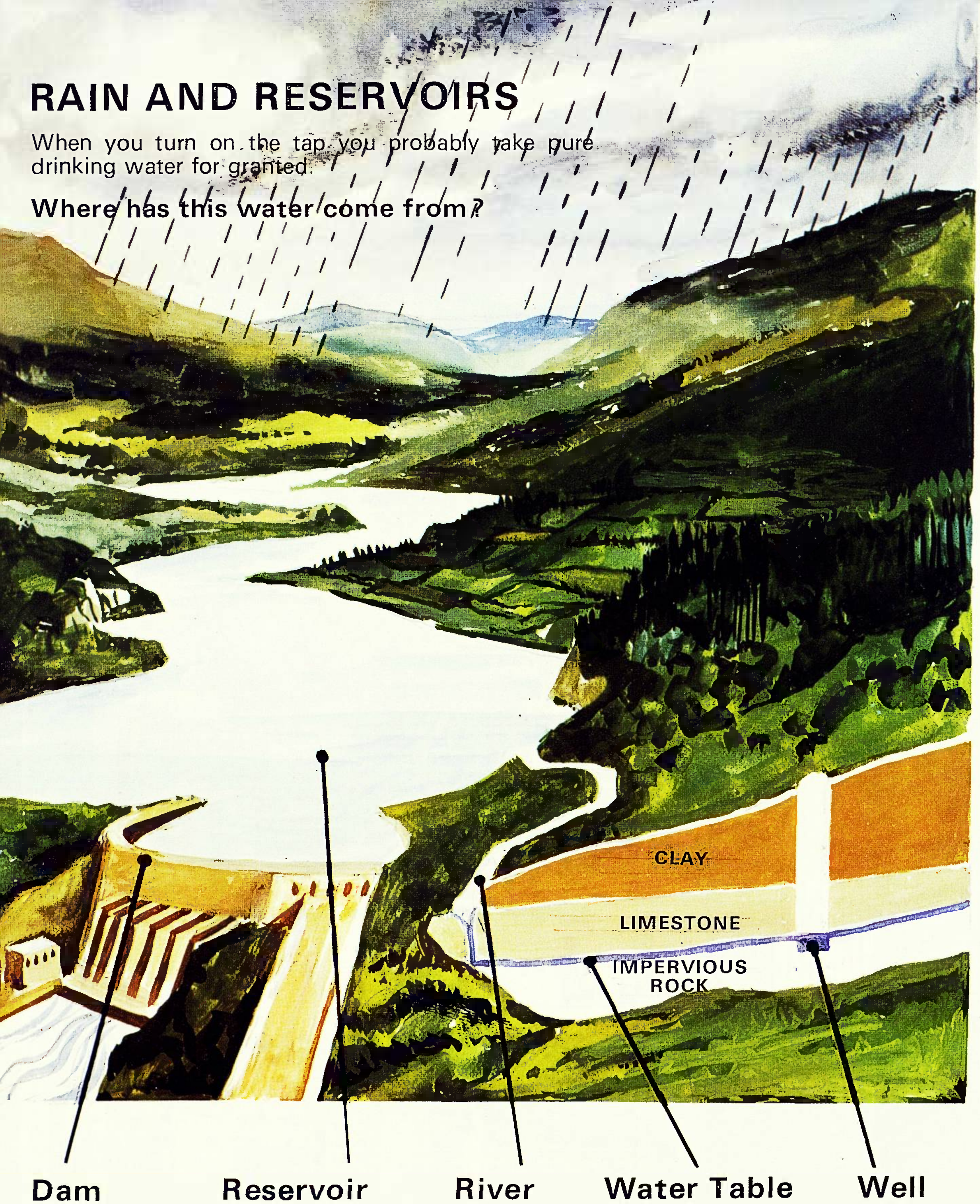


A small central heating system

RAIN AND RESERVOIRS

When you turn on the tap you probably take pure drinking water for granted.

Where has this water come from?



Which great part of the water cycle is not shown in this picture?

The earth has a fixed amount of water. It cannot leave or enter our world. Can you see how we can use water over and over again?

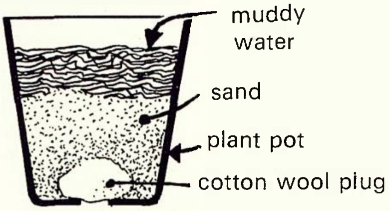
Will this water be clean and pure?

Investigate how our water is made clean and fit to drink.

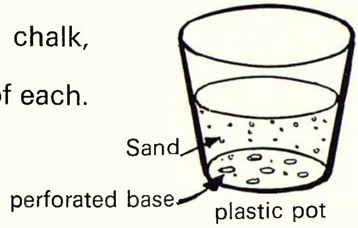
CLEAN AND PURE

How can muddy water be made clearer?

Some suggestions to try:—

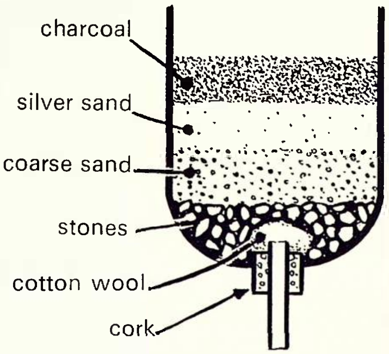


Try different materials: chalk, charcoal.
Try more layers. Try some of each.



This is called filtering

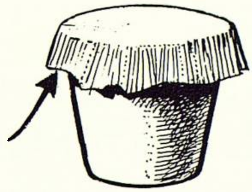
A model filter bed.



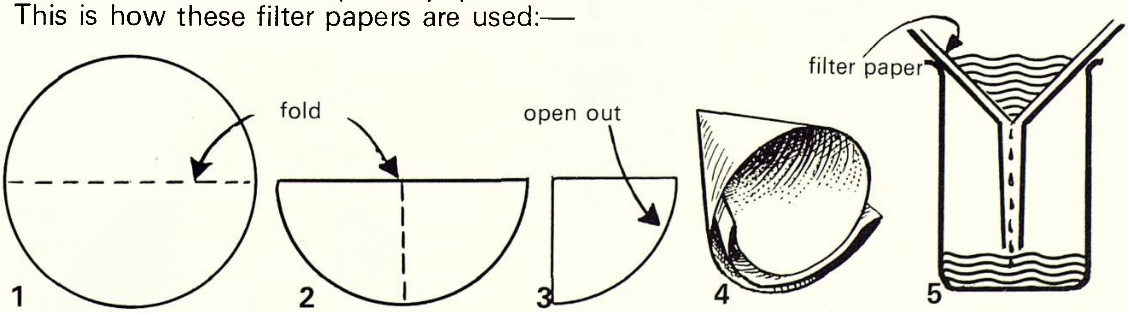
Your teacher may be able to arrange a visit to your local water-works. One of the things you will notice will be that the water is pumped through the filters

How well do other materials filter?

Try using fabrics and various papers.



In science laboratories special papers are used.
This is how these filter papers are used:—



Mix salt, mud, ink and paint powders with water.
Try filtering these mixtures.
Which are separated?
What things are left (*dissolved*) in the water after filtering?
Where else can you find filters in use?

At the waterworks not only are things taken out of the water, some things are put in. For example, a measure of chlorine is added to kill germs.

What can you find out about other additions?

DIFFERENT WATERS

Have you noticed fur in your kettle?
Have you heard of a pipe being blocked by water deposits?
Have you noticed any differences in water when you have been away from home?

Collect different waters: pond, river, rain water, puddle, distilled, tap water from your own home and other parts of the country – and world.

Can any differences be seen? Your microscope may help.

Can any differences be smelt?

Can any differences be tested? Try using Universal Indicator.
This measures the acidity of the water (pH).
(You can find out more about this in *Science in a Topic – Food.*)

Are there substances dissolved in any of the waters?
The boy below is finding out.

Some things dissolved in water make it difficult to obtain a lather with soap. This kind of water is called *hard water*.

What is hard water?

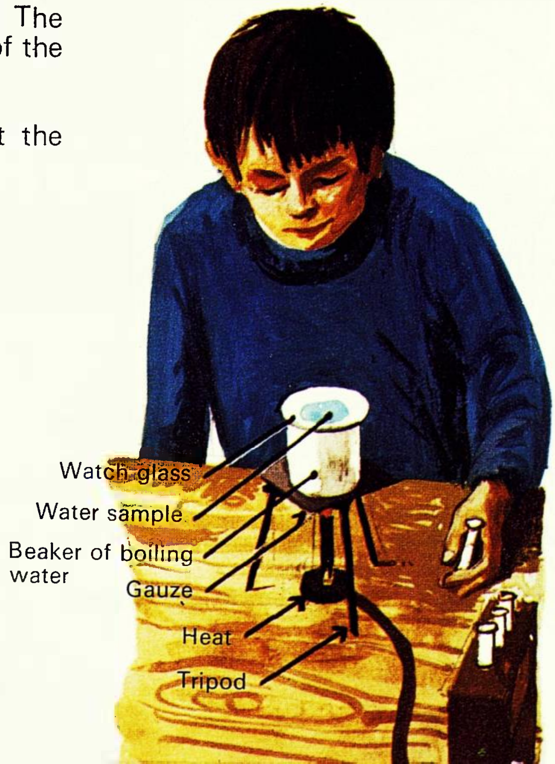
You can measure how hard your water samples are.

Add one soap flake at a time – shake – see if a head of lather will remain for one minute. The number of soap flakes added is a measure of the hardness.

To make a fair test you must think about the volume of water used each time.

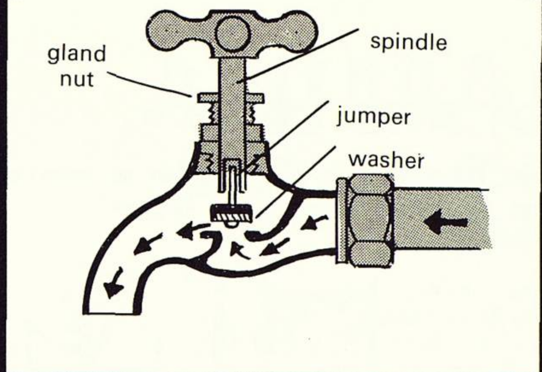
How can hard water be softened?

Try adding sodium carbonate crystals (washing soda). You could also try to obtain a sample that has passed through a water softener. Repeat the hardness test. (If you find a hard water sample difficult to obtain, you can make your own by adding magnesium sulphate, otherwise known as Epsom salts.)



TAPS AND PIPES

Do you know of a leaking tap? How much water is being wasted? Collect the drips for ten minutes. What volume of water is wasted in this time? What would be wasted in an hour – a day – a month – a year?



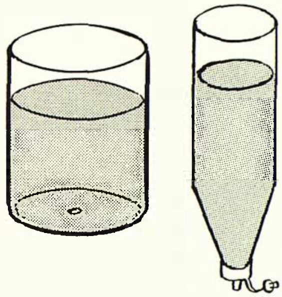
How does a tap work?

(If you cannot readily find a leaking tap, pretend by turning one on slightly.)

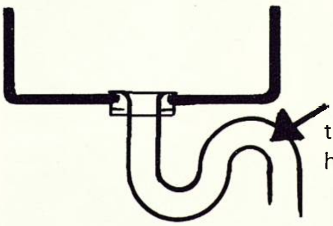
Have you noticed this beading?

You could investigate this beading out of doors, using holed tins or squeezy bottles.

Is the length of the unbroken column related to the size of the hole or to the temperature of the water?

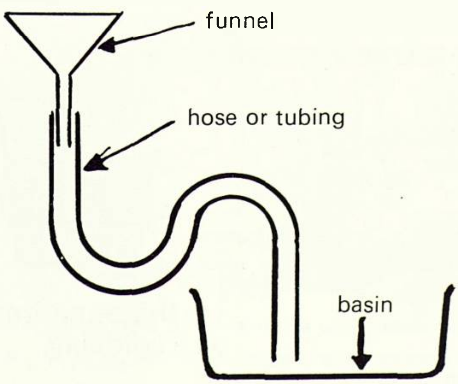


Why are there bends in pipes?

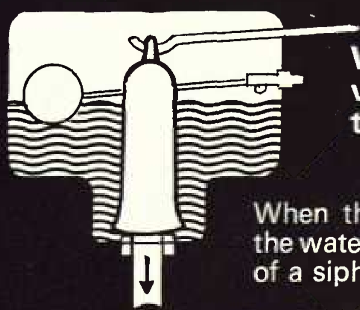


Why is this bend here?

You could experiment with some clear plastic tubing by pouring through water containing solid material.



What happens when you flush the toilet?



When the toilet is flushed the water empties by means of a siphon.

It is fun to investigate siphons, but make sure that you experiment in a suitable area.

What must be done to start the flow?
How many ways can the flow be stopped?
Try:—
(a) varying the levels
(b) experimenting with the tube
(c) sealing the upper container
These experiments should give you clues to the reason why a siphon works.

Ask an adult to show you other ways in which the water in your home is controlled.

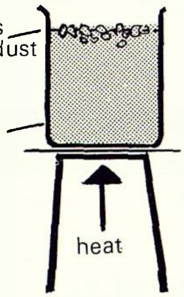
HOT AND COLD

How is your water heated?
How does a hot water system work?

What happens when water is heated?

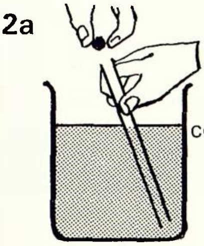
These experiments will help you to understand:—

1

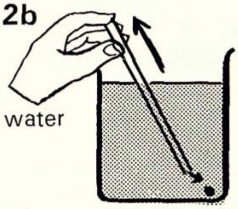


Also try applying heat to one corner.

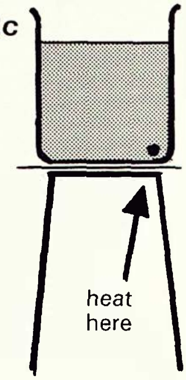
2a



2b



2c



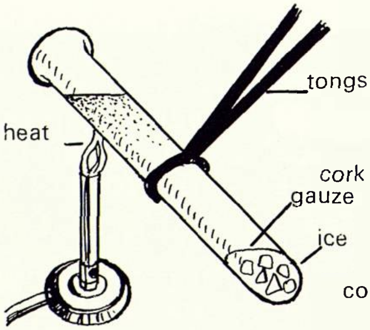
(a) tube in position cold water

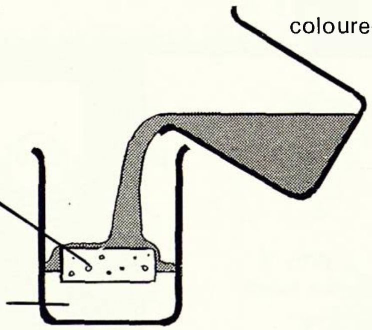
(b) finger on end of tube, crystal in water

Diagram showing stages of placing a potassium permanganate crystal to observe the effect caused by heating the water.

THE MOVEMENT OF HEAT THROUGH THE WATER IS CALLED CONVECTION.

What happens if heat is applied to the top?





Two methods of applying heat to the top

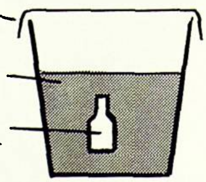
Convection is used in a domestic hot water system. There is a diagram of such a system on page 55.

Have you ever had the misfortune to experience a frozen, burst water pipe in your home? Or have you seen the results?

How can water burst a metal pipe?

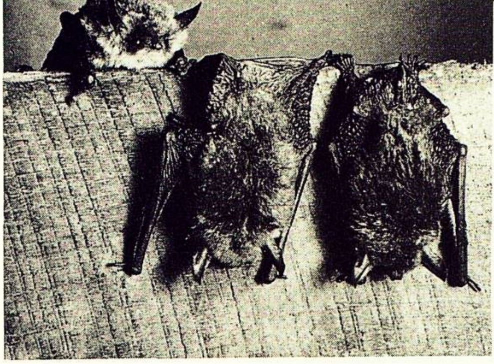
A refrigerator can be used to see what happens when water freezes.

Fill the ice tray to its brim. Freeze.
What happens?



Try this experiment on a cold day.

Left: a burst pipe frozen in winter



Natterer's bats roosting on a wood beam

ANIMAL HOMES

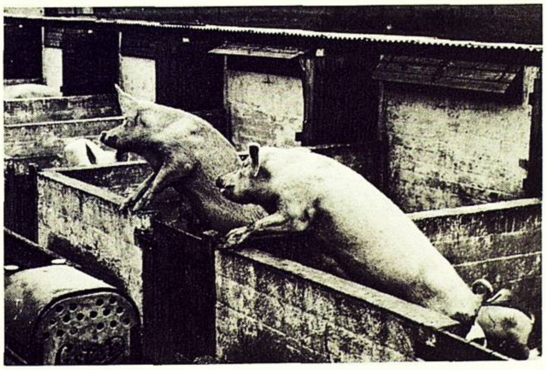
SECTION TEN

A home provides shelter, comfort and protection. Some animals need these just as we do. Here are some animal homes.

Below: A foxes' earth

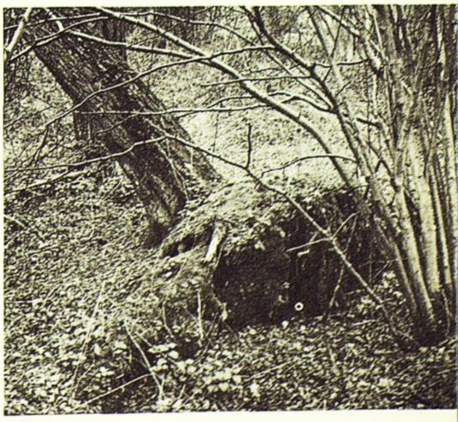
Butterfly emerging from a chrysalis – a home not required again!

A hermit crab in a whelk's shell



A piggery

A badgers' sett



Above: A nest of mice in an old flower pot

Right: A stoat's nest under the roots of a tree

Using the garden

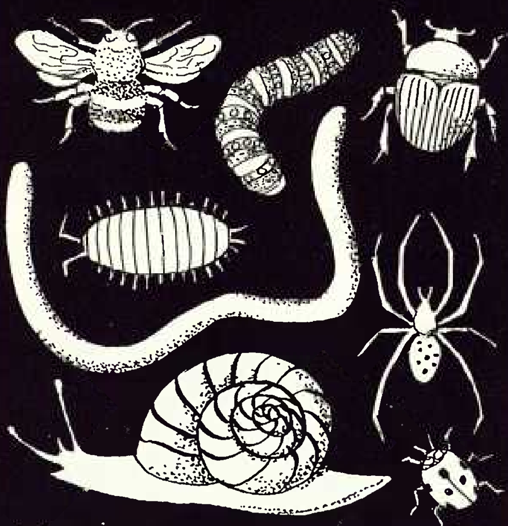
It is rewarding to investigate the animals that make their home in your own garden.

How many animals can you find living in the garden?

On these pages you can see children looking for animals.

Exploring under stones

Can you name these animals? Try to match a home for them.



You could also look: in leaf litter, under a piece of wood, under bricks, in cracks in the fence, in the compost heap and in the soil.

Can a home be made for them?

If you want to provide a home for your small creatures, study the environment in which you found them. This will give you clues as to the type of conditions they like for their homes.

Try to provide a home to match the place you found them.

Looking through the grass

Exploring a tree

Looking in flowers

Looking among the leaves

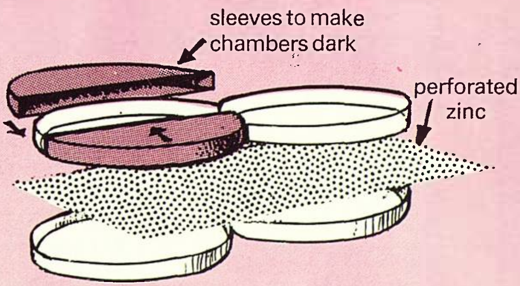
Remember, they are living animals, as wonderful in their way as the furry pets you are so fond of. They have the right to be looked after just as carefully.
Find out about feeding them.
Return them to their garden home when you have finished your study.

Testing ideas

From your observations when searching for, collecting and trying to provide a home for your garden animals, you may have wondered what conditions your animal did favour.

If it was dark and damp where you found it:
a) Is it dark only that it favours?
b) Or is it damp only that it favours?
c) Or is it both?

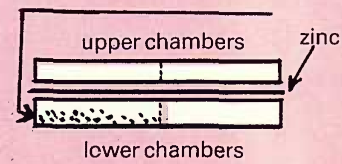
You can carry out some experiments to find out the conditions particular creatures like by providing 'choice chambers'.

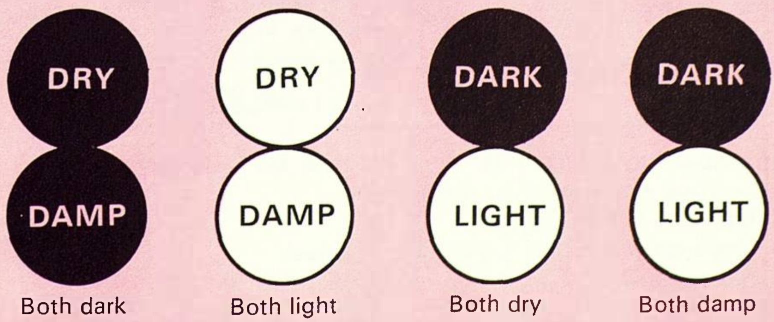


choice chambers

Woodlice are obliging little animals to start off your investigation.

To obtain dry conditions use anhydrous calcium chloride in the lower chamber.





You could also experiment varying colour background or varying temperature.

(Remember, for a fair experiment you must *vary only one thing at a time.*)

Art & Craft

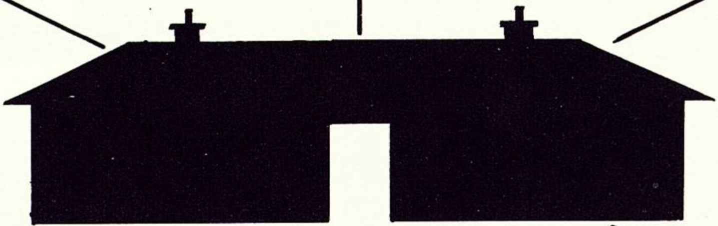
- Sketching – Houses and Streets
- Exploring Colour Schemes
- Designing Rooms
- Building Activities
- Working With Wood and Metal
- Model Making
- Planning a Garden
- Printing – Papers and Curtains

Music, Drama & R.E.

- Homes of Music
  – The Opera House
  The Concert Hall
- Homes of Great Composers
- Children's own music
- The Ark
- The Home in Ancient Palestine
- Parables of Home Life
- Houses of God
  – The Church The Synagogue The Mosque The Temple

Mathematics

- Shape and Pattern
  – Tessellation
- Scale and Plans
- Critical Paths
- Quantities and Costing
- Ratio and Proportion
- Measurement
- Graphs
- Right Angles and Levels
- House Buying
  – Mortgages and Interest
- Rent and Rates



English

- Homes in Literature
  – Anne Hathaway's Cottage
  – Milton's Cottage
- Anne of Green Gables
- Robinson Crusoe
- David Copperfield
- The New Noah
- Tom Sawyer
- The Jungle Book

History

- Cave, Pit and Pile
- Domus and Villa
- Saxon and Cruck Cottage
- Castle and Manor
- Half Timber and Thatch
- Stately Homes
- Back-to-Back
  – The Industrial Revolution
- Settlers' Homes in The New World and Australasia
- Semi-detached, Tower Blocks and Garden Cities

Geography

- Homes of the World
- Nomads and Settlements
- Climatic Influences
- Sources of Materials
- Regional Characteristics
- Maps and Mapping
- Planning and Surveying
- Local Surveys

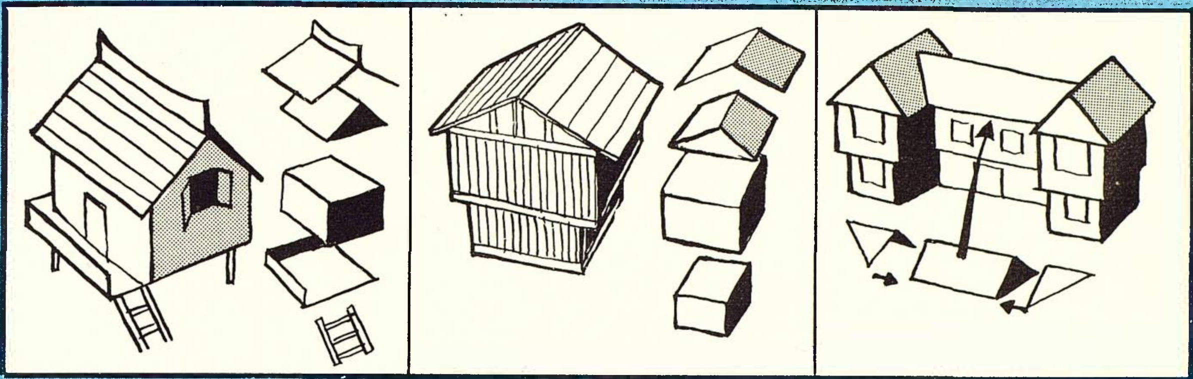
ACKNOWLEDGEMENTS

The authors are grateful to the following for permission to reproduce copyright photographs:

The Royal Institution.
The London Brick Company Limited.
Siemens Ltd.

 (see pages 40–41)

The models can be made more interesting by adding small details of the various belongings that would be found about that particular house: tools, skis, ropes, grinding stones, a sledge, boat, animals, cart, seat, fence, fishing nets, cooking utensils, stores and weapons.
These can be made from all sorts of odd materials if you use your imagination.



Dimensions for various homes given in cm

Type	*Bottom Unit* (The Box)	*Roof Unit* (Wedge Shape)
	The first card measurement is the base line.	
Tudor Small house	Card 29 × 17·5 L 7·5, B 6·5, H 4·5	Card 18·5 × 15·5 Slope 5·25, Span 7, H 4, L 7·5
Elizabethan Two storey cottage	First storey Card 29 × 12·5 L 9, B 5, H 2·5 Second storey Card 34 × 15·5 L 10, B 6·5, H 2·5	Card 17 × 16 Slope 4·5, Span 7, H 3, L 10 Chimney 10 × 6·5 2 2 2 2 2 tab 6·5
South-East Asia A house on stilts	Card 41 × 22 L 11·5, B 8·5, H 5 Platform (card or wood) 15·5 × 11 Stilts – 7 × 1 cm² balsa.	Card 20 × 16·5 Slope 5, Span 9, H 2·5, L 11·5 Roof overlay 11 × 12 5·5 5·5 12
Malayan A tree house set into a branch with a ladder Raffia-clad walls and roof	Card 22 × 10·5 L 6·5, B 4, H 2·5	Card 11·5 × 10·5 Slope 3, Span 4·5, H 2, L 6·5
Norway Walls and roofs wood planking + piles, steps and eaves	First storey Card 27 × 15·5 L 6·5, B 6·5, H 2·5 Second storey Card 31 × 17·5 L 7·5, B 7·5, H 2·5	Card 19 × 13·5 Slope 5, Span 8, H 3, L 7·5 Roof overlay 12 × 9 6 6 9
Chinese Farm Large house and small outbuilding Yellow mud-plaster walls, wood roof	Large House Card 31 × 15 L 10, B 5, H 5 Small outbuilding Card 26 × 14 L 7·5, B 5, H 4	Large House Card 16 × 18 Slope 4·75, Span 5·5, H 4, L 10 Small outbuilding Card 16 × 15·5 Slope 4·75, Span 5·5, H 4, L 7·5
	Roof overlays Large 11 × 13 5 5 11 ←1·5	Small 8 × 13 5 5 8 ←1·5 stick

SCIENCE IN A TOPIC—HOUSES & HOMES

ISBN 0 7175 0669 X