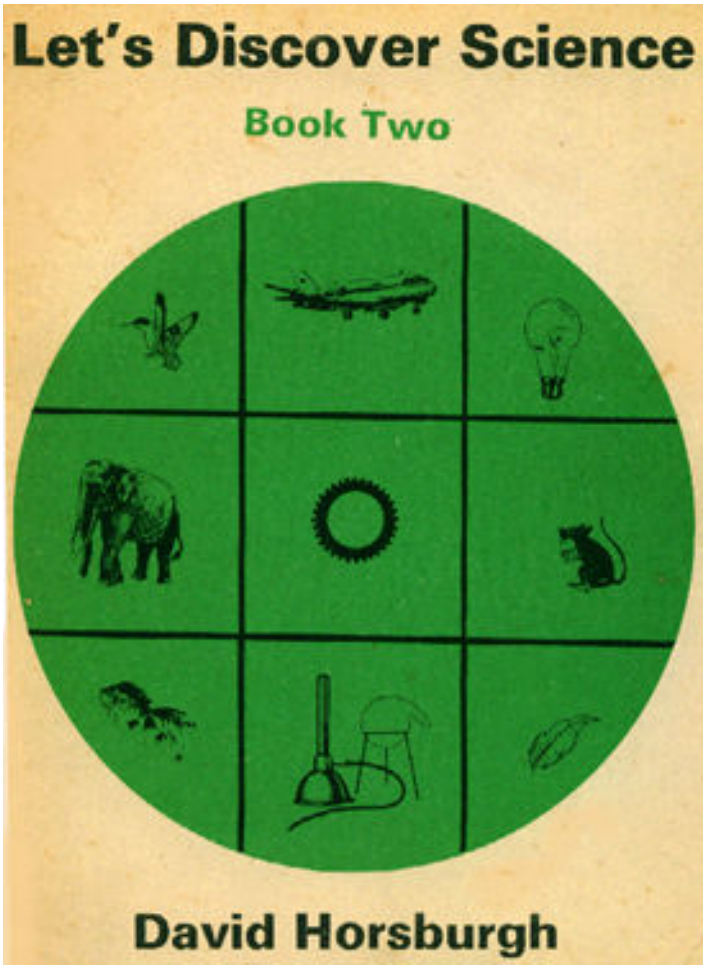


Introduction

The purpose of the *Let's Discover Science* books is to give the children sufficient basic skills to learn for themselves what they want to learn. The child should, as far as possible, be given those ideas which form the basis of scientific thought. Competition and grading can well be dispensed with in a course of this nature: the children should be encouraged to cooperate with each other in experimenting and in enjoying the beauties of scientific discovery and learning from their peers should be a normal part of everyday classroom activity.

Before the child can be led to any important concepts of science, it is important to *break down* certain concepts which already, perhaps, are making their way into his mind through ohter aspects of his education.

The first is the idea that the textbook is some kind of divine writ, to be accepted without 'question, swallowed without digestion, and regurgitated in the examination.

The next: that to every question there is one correct answer and only one correct answer, and that this correct answer must always be given in the words.of the book.

The next: that every effect is due to only one cause and not, as so often happens, to a multiplicity of causes.

How can the teacher break down some of these fallacious concepts ? By encouraging the child to ask questions, to conduct experiments *for himself,* and to make guesses. By giving children plenty of practice at suspending their judgement and being prepared to wait and observe rather than to jump to quick conclusions; and even by the teacher and pupils occasionally saying together, 'We don't know'; followed by, 'Let's find out'.

The five books in the series are designed to give children a number of skills and concepts. While the text deals, of course, with scientific matters, the emphasis must always be on learning the skills and concepts and not on learning the

information contained in the text.

Observing, recording, the analysis of such recordings, and the practical applications of such analyses, are all introduced from the earliest stages. In addition a number of practical skills have been taught: learning to draw, to copy and to trace; learning to use language accurately; learning to guess with reasonable accuracy; learning to work from printed instructions.

The pages of the book should form only the beginning of the child's quest for scientific knowledge. Children should be encouraged to apply the skills and concepts they acquire from the book to every aspect of their environment and life.

A few notes for the teacher with regard to certain pages of the text have been printed at the back of the book.

David Horsburgh

Notes for the Teacher

(Notes are only given for those pages where some difficulty may be found, either in the interpretation of the page or in the work preceding or following the work of the text.)

Page 6: It is important that the children should do this experiment for themselves rather than watch you do it.

Page 7: Children have made attempts at paper cuboids in Book I, but if there are children in the class who are new to this work, you may have to draw a large diagram on the blackboard and explain it to them. Let them make patterns for the cuboids shown at the bottom of the page by themselves if possible.

Page 9: Again get the children to do these experiments by themselves. Make sure that they obey the injunction about not burning things A to G at the bottom of the page.

Pages 10 &11: This is the sort of activity that can go on throughout the year. Perhaps the children can be persuaded to keep a book in which they can go on adding pressings and printings of different leaves.

Page 12: Get every child to make the dice, so that they can do the experiment required by themselves.

Page 13: You can, perhaps, play this game yourself with the children, but get them to *write down* all the articles on your tray, rather than telling you verbally. Then get the children to play it individually.

Page 14: You may have to deal with some of the parts of the body orally first, as the children may not have met words such as *abdomen* and *nostril.*

Page 16: Important for the children to do the experiment by themselves, as it is on page 17.

Page 18: Perhaps it will be possible to take all the children out into the playground, as the imitation of trains and aeroplanes may be a disturbance to other classes. The noises are only suggestions, and probably your children will be able to think of many more. Perhaps you can do an imitation of number 17 yourself.

We are not going to go into details of exact notes at this stage; the instructions are only to give a clue to anyone who *wants* to tune them more accurately. The sizes shown are quite good enough at this stage,

Page 19: This is a most useful skill for the children to practise, and can be adapted for use in the science class and for all sorts of work in environmental studies.

Page 21: Important that the children should make their guesses before they test with the actual shapes. The exact centre of gravity can be found by hanging each shape up with cotton attached to a number of places on the edge. The crossing of these lines on the page is the centre of gravity,

Page 22: This page might lead to a discussion about how scientific a poet is.

Page 26: Obviously this work will have to continue for a week or so. If all children are unable to bring the necessary things they will have to do it in groups.

Page 26: There is no need to ask the children to cut the pages of the book. They should trace the designs carefully

and transfer them to white paper. Thick paper is pleasant to use, but in fact all the models have been tried out, and can be made out of ordinary thin paper. If the children can paint or colour the birds according to instructions the models will look much better.

Page 29: This will give you some material for class discussion; the balance beam is dealt with later on in the book.

Page 30: If the children cannot all bring boxes and rubber bands, perhaps they can do it in groups.

Page 31: Again they can work in groups.

Page 32: Work in groups.

Page 33 & 34: As much practical work as possible of this nature can be done. It may not be possible to have more than one aquarium, but perhaps each group can produce a jar for tadpoles and keep up-to-date the chart shown on page 25.

Page 37: This perhaps can be done in groups; if children cannot get or afford cells; you will have to make do with one telegraph set made by you,

Page 38: The wind speed indicator can be set up in the playground.

Page 39: Best done in the playground.

Page 40: The work with water can easily be done in the playground, and the work at the bottom of the page in the classroom.

Page 41: If you are lucky enough to live near the sea you can have an exhibition of all the things you collect. If space permits you can perhaps have a school tortoise.

Page 42: Let the children experiment in groups with pulleys which they can make out of cotton reels.

Page 43; Most children can bring bottle tops to school (soda-water bottle tops) and see the effect of gears on each other.

Page 45, 46, and 47: Again the model bullock-cart and bullocks can be cut out of ordinary thin paper, although thin card is preferable.

Page 48: Card for the spinners can be cut out of old cigarette packets.

Page 49: Each group can have a soil sample jar.

Page 50; Perhaps you can train each group to use this beam to work out simple mathematical problems of their own. One child can give the problem orally; another child in the group can then try to visualize it and to guess the answer. Then the person who put the problem can arrange the matchboxes on the beam and see if the child has guessed properly.

Page 51: Group work.

Page 52: Group work.

Page 53: There are probably no facilities for the children to do this and you will have to do it yourself.

Page 54: Every child can do this,

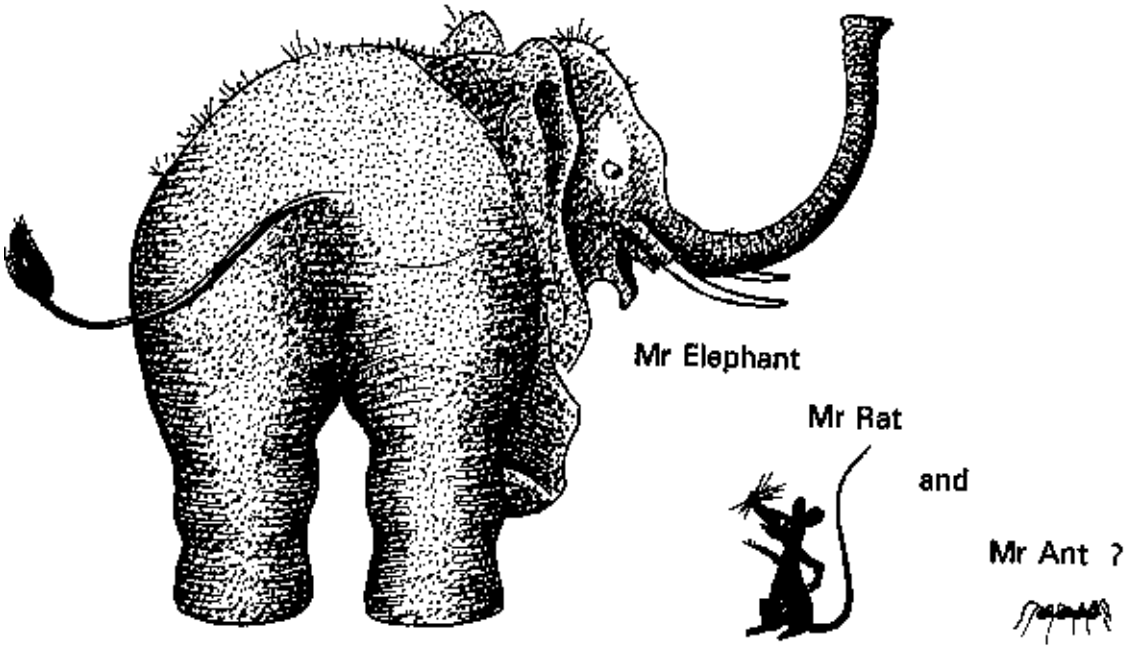
Page 55: The wind resistance machine can be set up in the playground; every child can make a parachute.

Page 56: An experiment for all.

Page 57: The diagrams on pages 59 and 61 are meant to be cut out of the book and pasted on cigarette packets. You may have to explain the rules of the game, which are basically the same as those of rummy.

Revision

What do you remember of Book I?
Do you remember



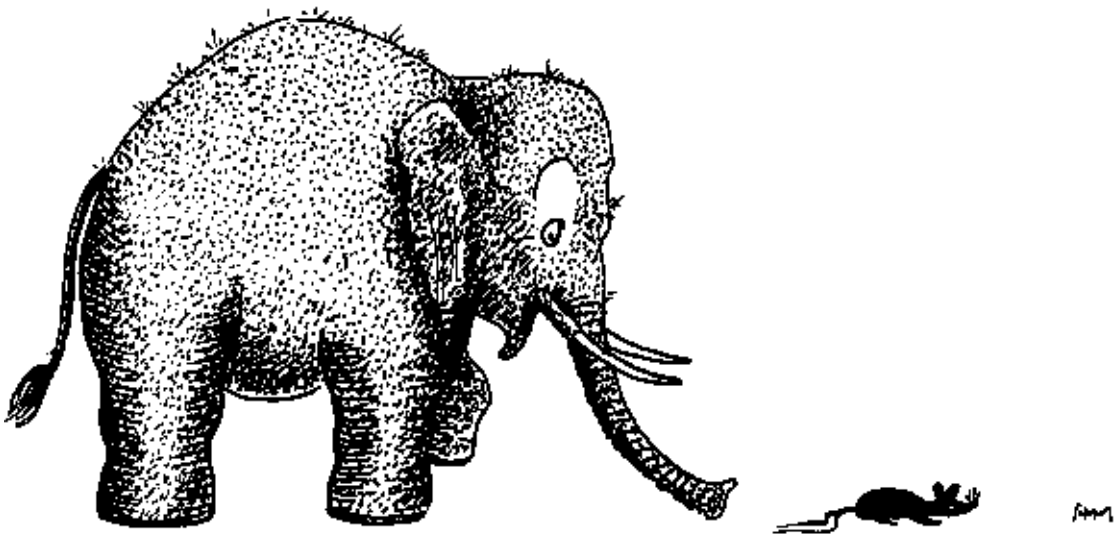
Write down in your exercise books 3 things that Mr Elephant and Mr Ant said. (heavy, big, long, tall, strong)

How many different leaves can you draw?
Can you trace this into your exercise book?

Can you make dice?
Can you play snakes and ladders?

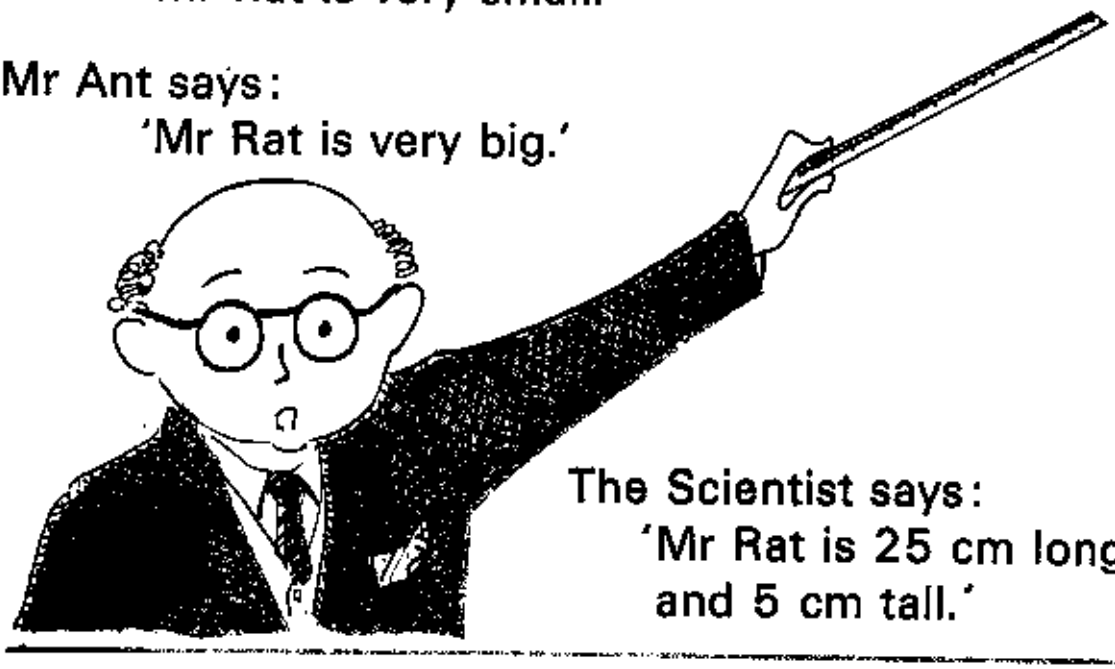
The Scientist

Look at Mr Elephant.



Mr Elephant says:
'Mr Rat is very small.'

Mr Ant says:
'Mr Rat is very big.'



The Scientist says:
'Mr Rat is 25 cm long
and 5 cm tall.'

We use the same ruler as the Scientist, so we know how big Mr Rat is, too.

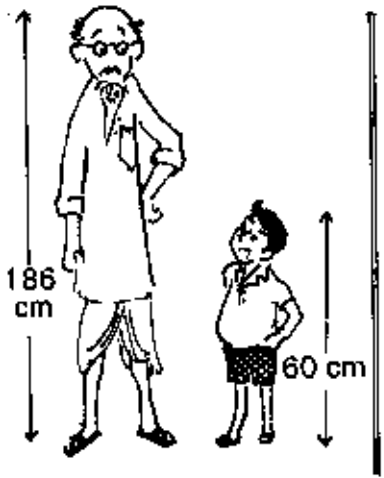
More about the Scientist

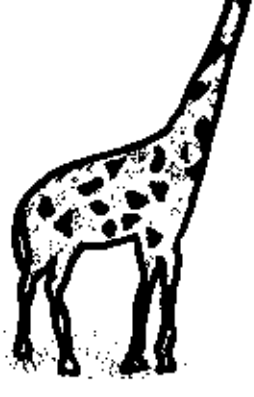
The Englishman says:
'It's very **hot**!'

The Man from Madras says:
'It's a little chilly!'

The Scientist says:
'It's 31 degrees!'

What do Mr Elephant, Mr Ant and the Scientist say about the following?





The Sun

The sun gives us light and heat.
Take three **thalis** or saucers. Put the same amount of water in each. Measure the water with a stick.

Number them 1, 2 and 3.

Put 1 in the sun.

Put 2 in the sun
with a cover over it (a piece of wood will do).

Put 3 in the shade.

Put the measuring stick into each after half an hour.
Then put the stick in after another hour.
Write what has happened in the spaces below.

1	
2	
3	

Air

Can you count? Can you count up to 100? You have a 'counter' in your body: your heart. Put your hand on your heart and count the beats. Now close your nose with your fingers. Shut your mouth tight. Keep counting. How many can you count before you have to open your mouth? Put your score here:

less than 40	50	60	70	80	90	100	120	140	more than 150

We need air in order to live. How many of the things below **need** air? Draw lines to the correct box.

Needs air.

Does not need air.

I don't know.

Air

What answer did you give about the candle on page 5? A candle does not need air, because it is not alive. Does a candle flame need air? Get a candle and cut it into two equal pieces. Light them both. Put a glass over one.


A


B

Put one hand on your heart. Feel the beats, and count in time with the beats.

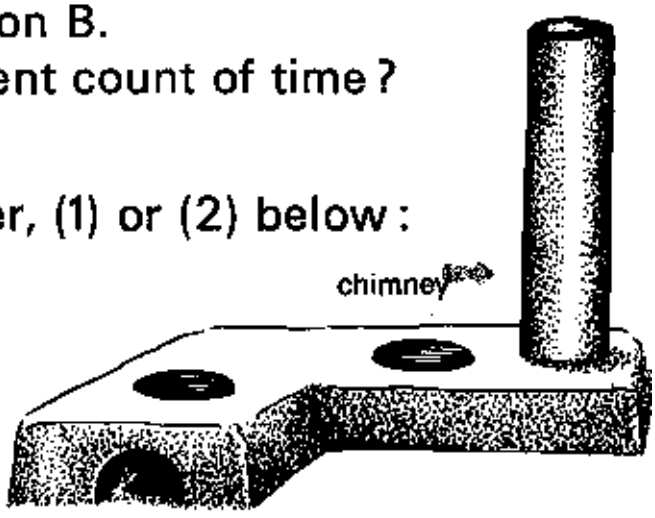
Fill in your in the chart below with pencil.
Then fill in the time with ink.

A	burned for a count of	10	30	50	100	150	more than 200
B	burned for a count of	10	30	50	100	150	more than 200

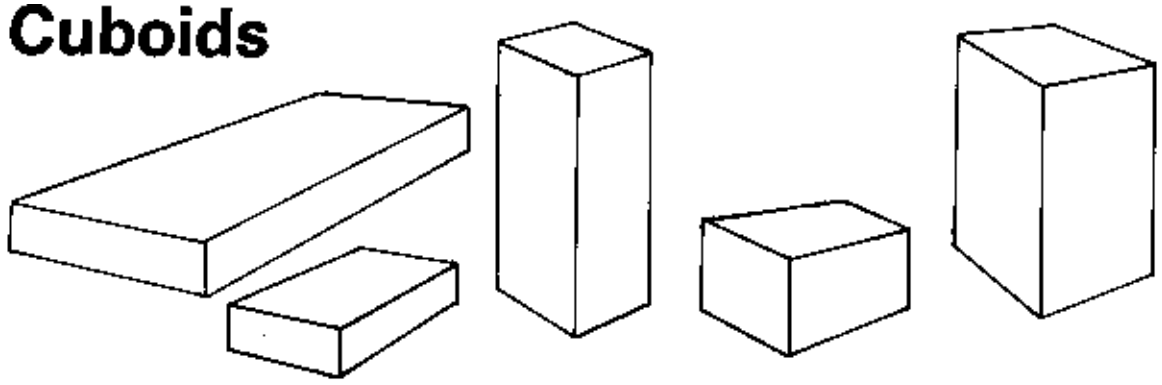
Now use a bigger glass on B.
Does it burn for a different count of time?

A flame needs air.
Which burns better, (1) or (2) below:

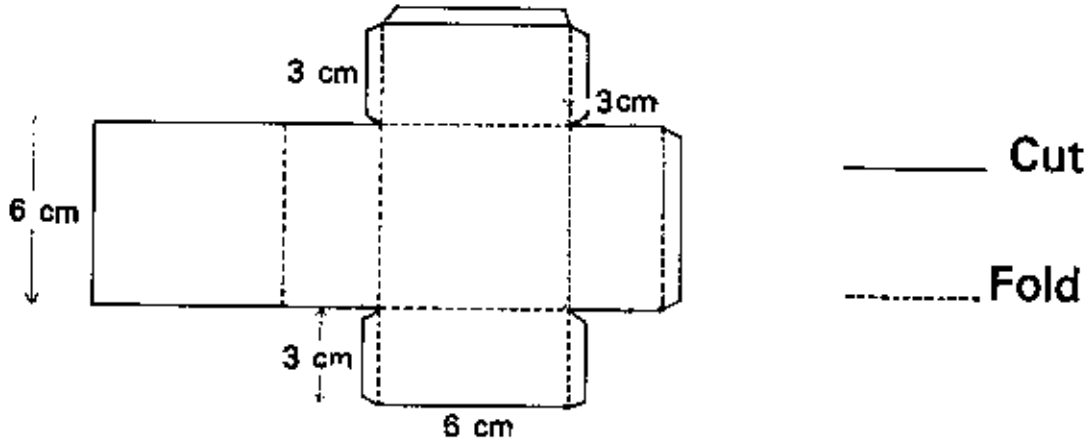
(1) 

(2) 

Cuboids

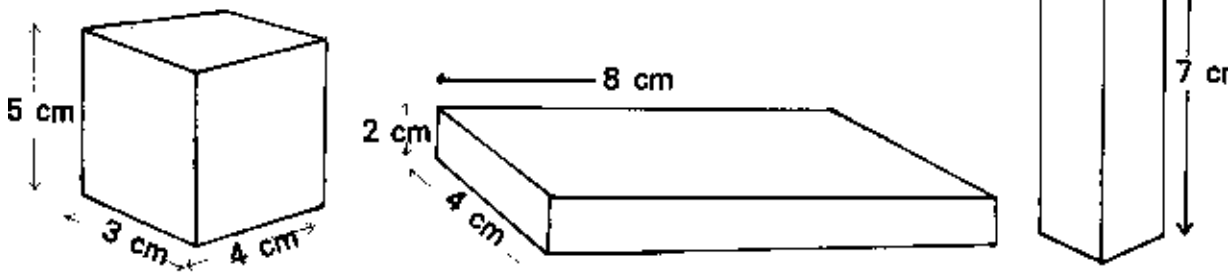


These are all cuboids. Do you remember the house you made in Book 1? Do you remember the dice? Now make some cuboids: here is one.



Copy this diagram on to thin card or thick paper. Can you make it bigger? Follow the measurements carefully.

Now make your own patterns for these sizes:



Fire

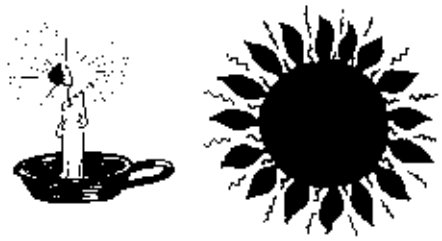
How many ways do we use fire? How many ways can you think of? Make a list here:

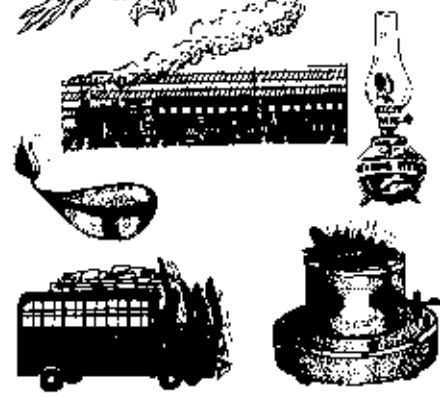
Is fire always useful? Draw lines from the pictures to the boxes:

Useful

Not very useful

Harmful





Burning

You will need a candle and a box of matches.
Light the candle and try to burn the following:

A a match B a piece of dry string C a paper-clip
D a piece of wet string E a green leaf F a dry leaf
G a hair from your head (Pull it out first.)
H a piece of damp wood I a small piece of paper
J a piece of oily string K a little salt (Throw it in the flame.) L a stone

---

Put the correct letters in the chart below:

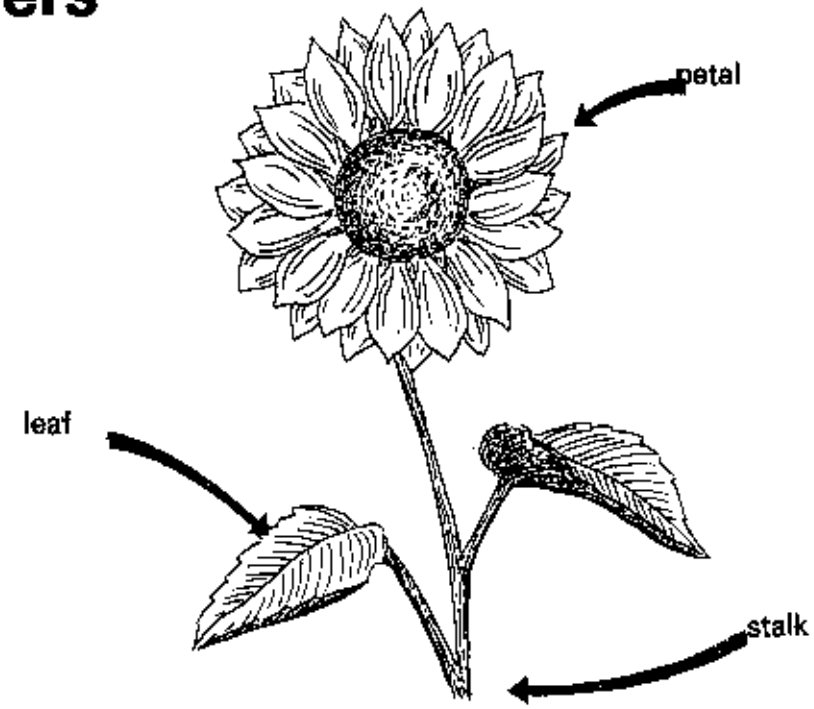
Burns well, with a good flame.	
Burns, but no flame.	
Does not burn, but gets hot.	
Does not burn, and does not get hot.	

Guess the following. DO NOT try to burn them:

A your finger B a pencil lead C a pair of scissors
D a metal cup E a spoonful of oil F a wet sari
G a plate

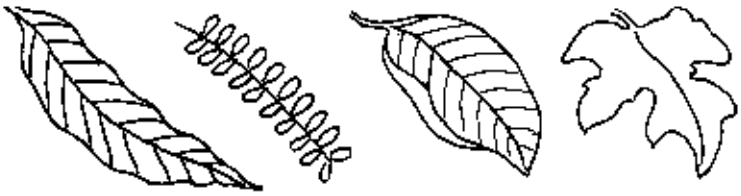
Will burn well.	
Will not burn.	

Flowers



Different shapes of leaves:

Different shapes of petals:

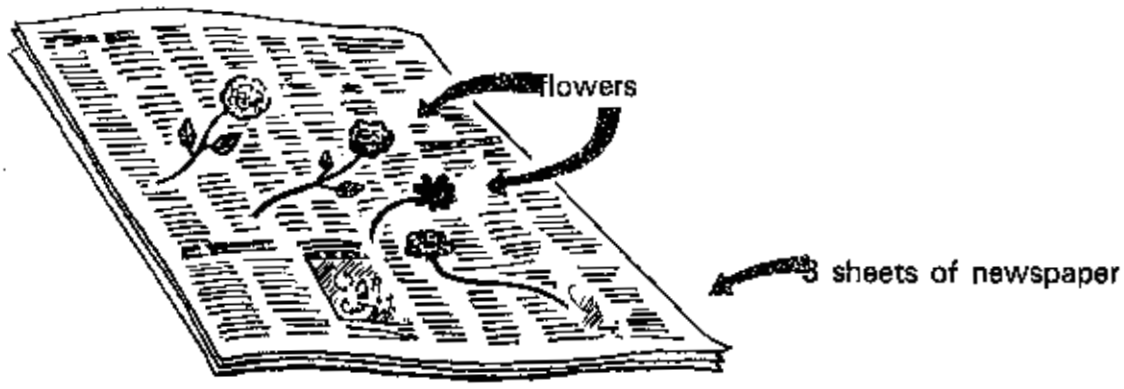


Collect as many different petals and leaves as you can.

Draw them in your exercise book.
Write the name of the flower by the side of each.
Then make a pressing and also a print. (See page 11.)

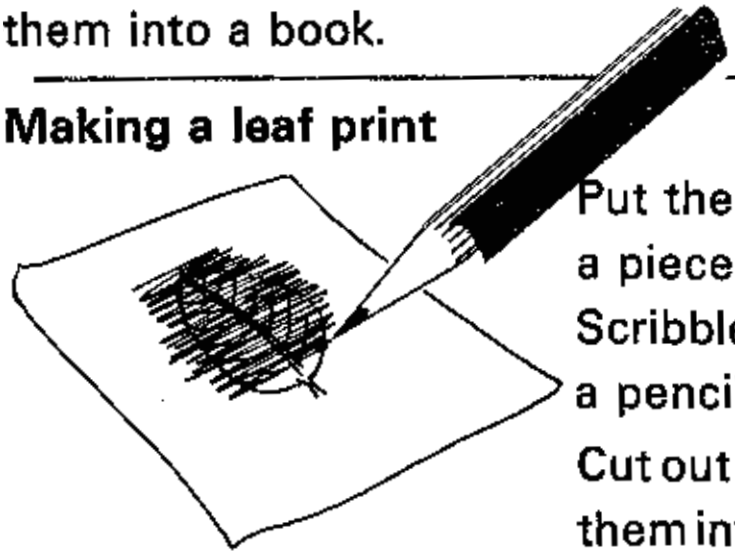
Printing and Pressing

Collect as many flowers as you can. Try to find out the name of each. Get some newspaper, and press as follows:



Put 3 more sheets of newspaper on top of the flowers. Then more flowers. Then more newspaper. When you have put all your flowers between newspapers, put some heavy weight on the top. After two or three days take out the dried flowers and stick them into a book.

Making a leaf print

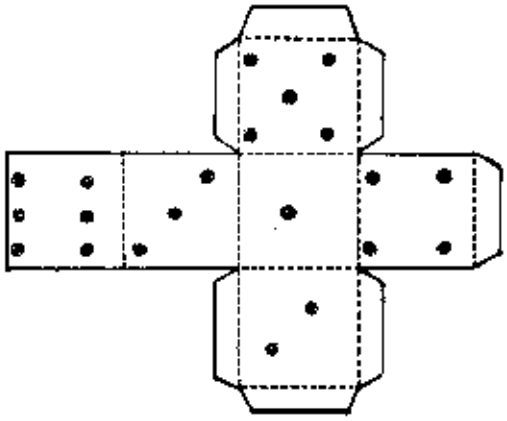


Put the leaf under a piece of thin paper. Scribble over it with a pencil.

Cut out the prints and stick them into your flower book.

Chances

Do you remember the dice you made in Book 1? If you have lost them, here is the pattern again. Make two of them.



Throw the two dice 100 times. Mark in the chart below an X for each time a particular number appears. But fill in your guesses in the chart below this one first. If you think • will come up 29 times, put 29 in col. 1.

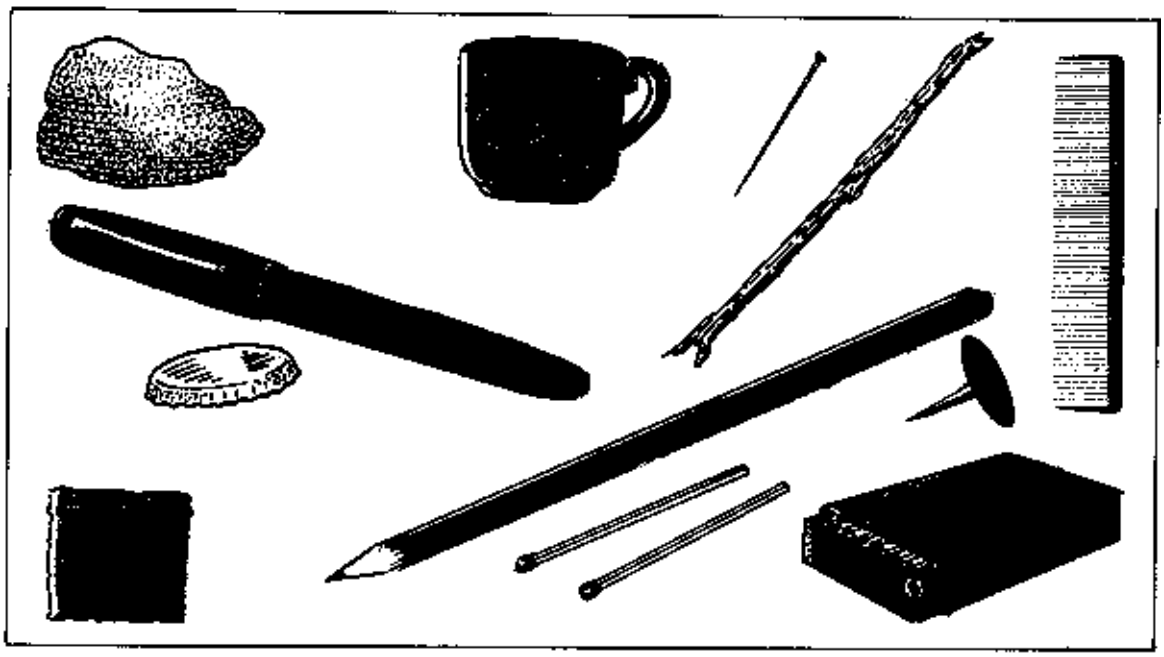
•	• •	• • •	• • / • •	• • / • / • •	• • • / • • •

GUESSES HERE

1	2	3	4	5	6

Then put dots for what actually happened.

Kim's Game



Kim was a boy in a famous story written by Rudyard Kipling. This was his game, and you can play it with your friends.

Put a number of objects on a desk. Cover them with a cloth.

Say to your friends: Ready.

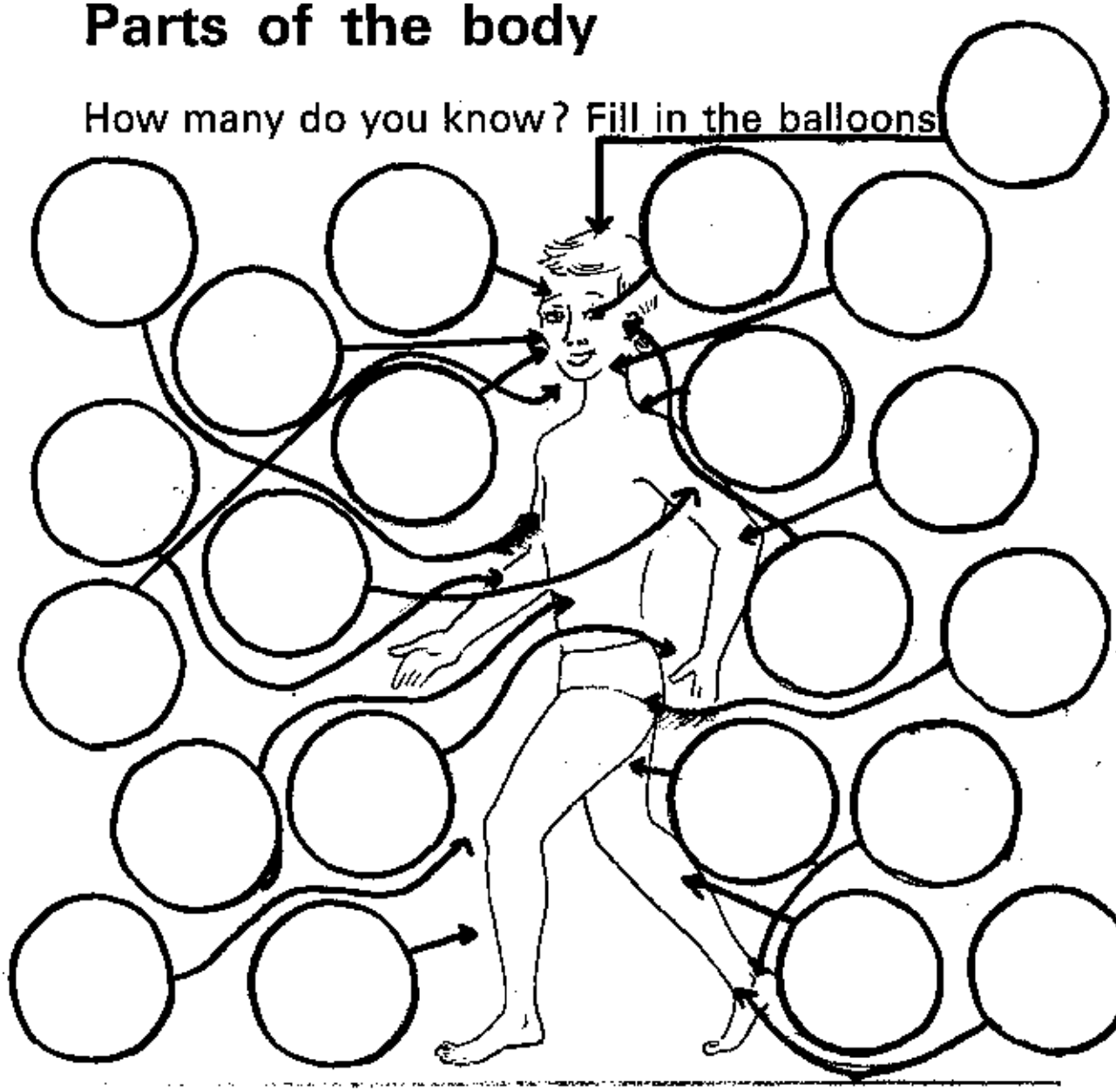
As your say this, take the cloth away.

Count 10 while they look at the objects. Then cover them again with the cloth. Get your friends to write down all the objects. If you don't have things to put on the desk, you can draw things on a piece of paper.

What do you learn from playing this game?

Parts of the body

How many do you know? Fill in the balloons



Answers:

skull heel forehead shin ankle calf

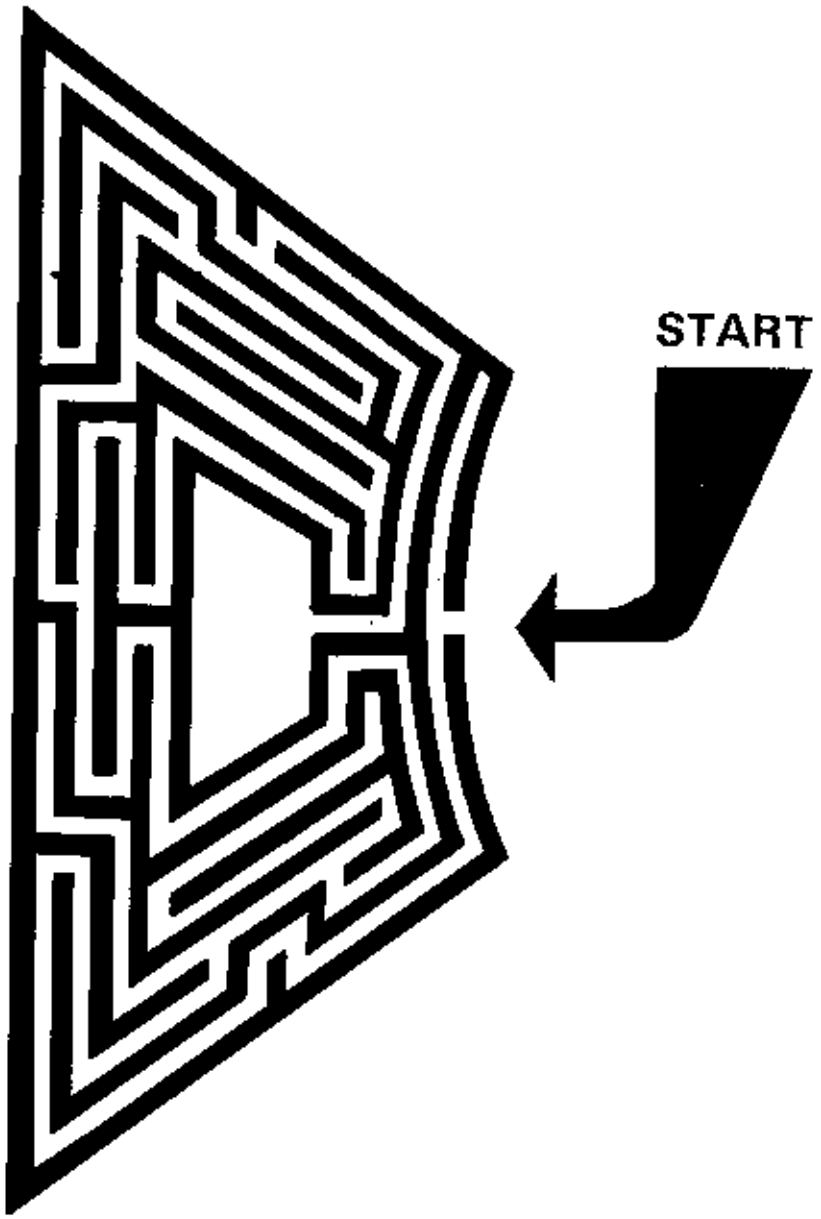
elbow eye ear nose knee buttocks

abdomen neck upper arm nostril forearm

shoulder chin thigh wrist chest

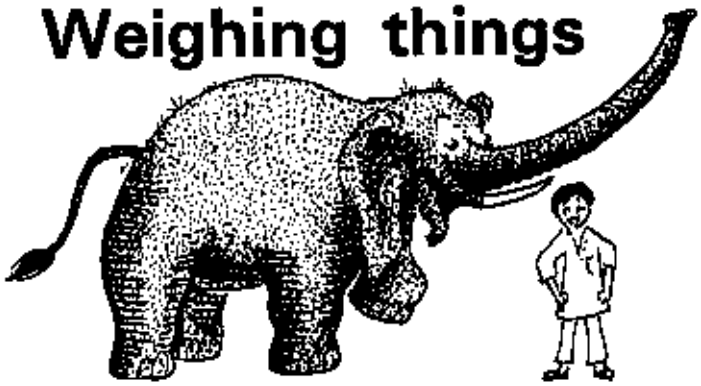
A maze

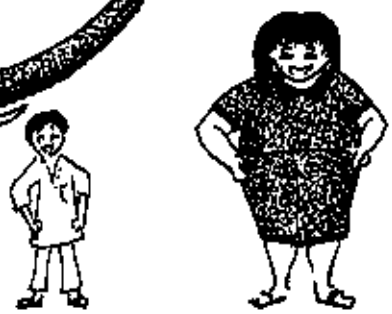
This is a copy of a famous maze at Hampton Court, in England. See if you can get to the middle.



Try to write directions to a friend. Tell him how to get to the middle. Make some more mazes for your friends like this one.

Weighing things





Lighter
or
heavier?

Mr Elephant Ravi Jyoti Mr Rat

1. Mr Rat is ..... than Jyoti.
2. Mr Elephant is ..... than Mr Rat.
3. Ravi is ..... than Jyoti.
4. Jyoti is ..... than Mr Elephant.
5. Mr Rat is ..... than Ravi.

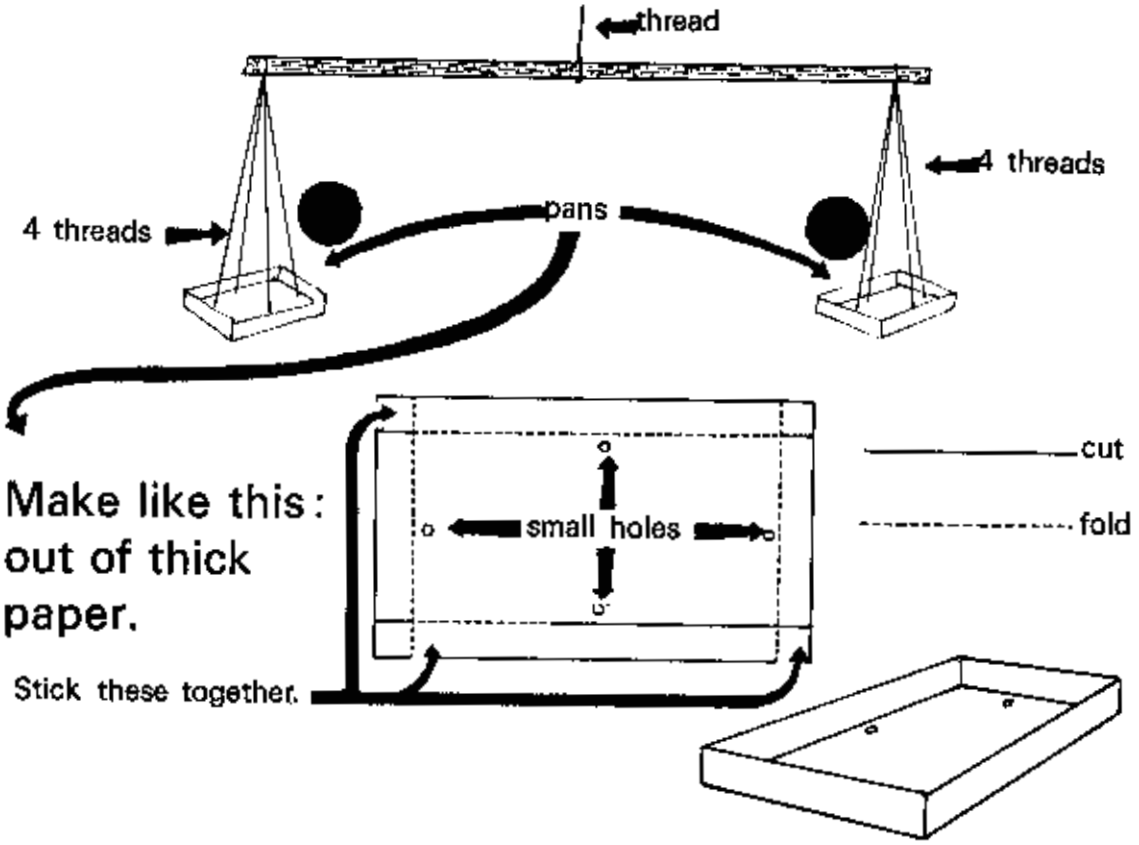
Make a weighing machine, like this:

Use cotton thread and a ruler. Put thread A in the middle. Then write sentences like the ones above, 1—5, about these things. Put something on string B and on string C to see which is heavier.

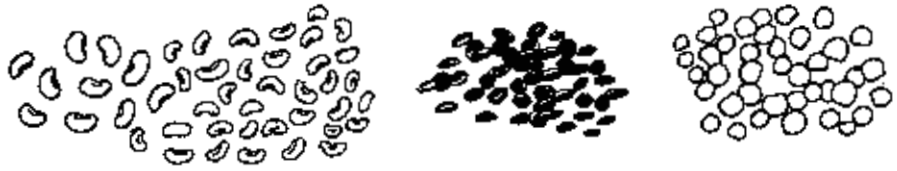
1. a small stone
2. a piece of chalk
3. nine matches
4. a small leaf
5. a pencil
6. a ten-paise coin
7. an empty matchbox
8. a large leaf

Write as many sentences as you can. For example:
A small leaf is lighter than a large leaf.

A better weighing machine



Bring some beans, or dal, or corn to school.



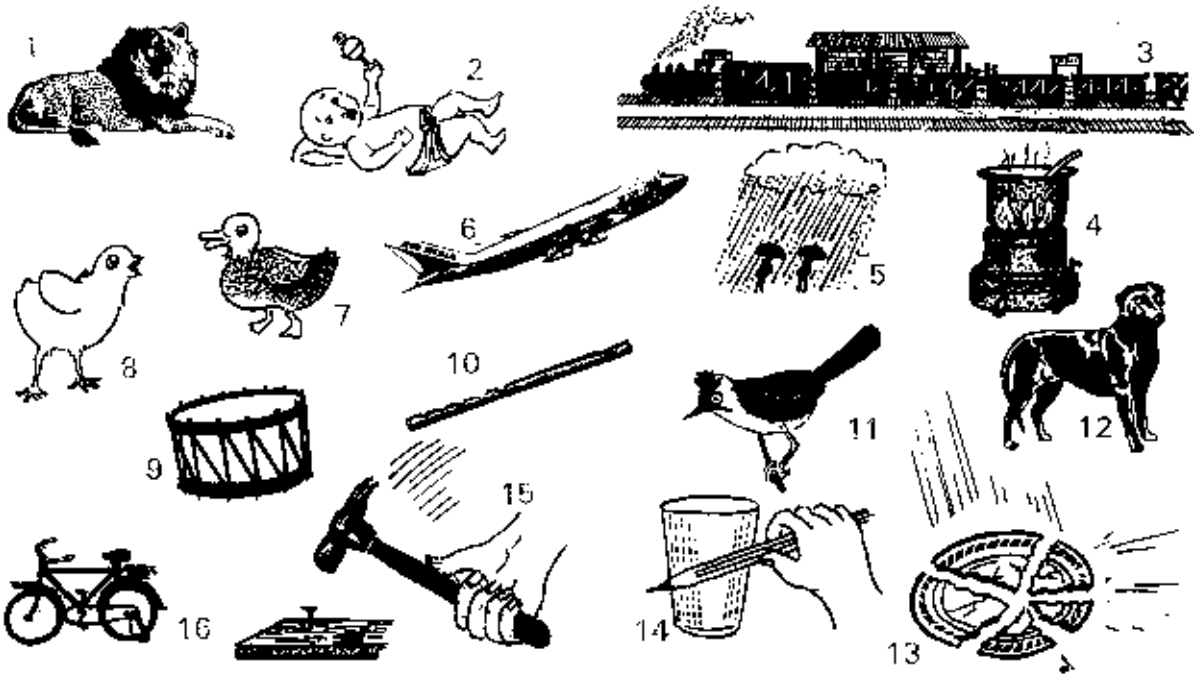
Put one of the objects listed on page 16 (1-8) on pan A. Then put some beans into pan B. Go on adding beans until both pans balance. Then write your answers in your exercise book, like this:

A piece of chalk weighs 10 beans.
Nine matches weigh . . . . . .

And so on.

Sounds

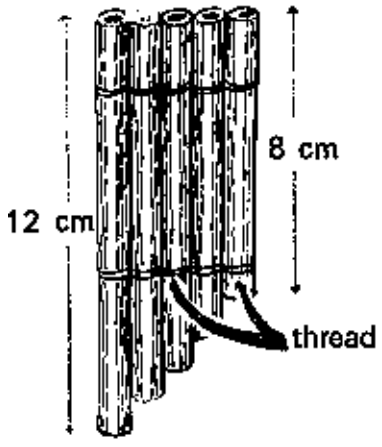
Try to imitate the sounds made by the things in the pictures. Get your friends to guess which number you have chosen.



17 an angry teacher

18 a thunderstorm

Making a set of pipes

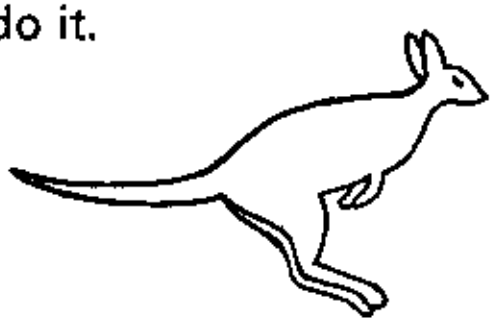


Take 5 tubes. They can be bamboo or reed or maize stalks. Cut them to the sizes shown. Bind them together with thread. Stop up the ends with mud or plasticine. Push the mud in further to tune the pipes.

Making drawings bigger

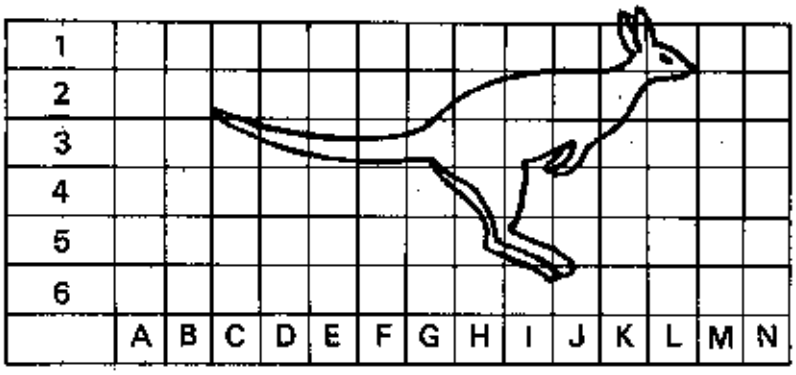
Sometimes we want to copy a drawing and make it bigger. This is how we do it.

Choose your drawing:



Next, make a tracing. (See Book 1.)

Over your tracing, draw lines, like this:



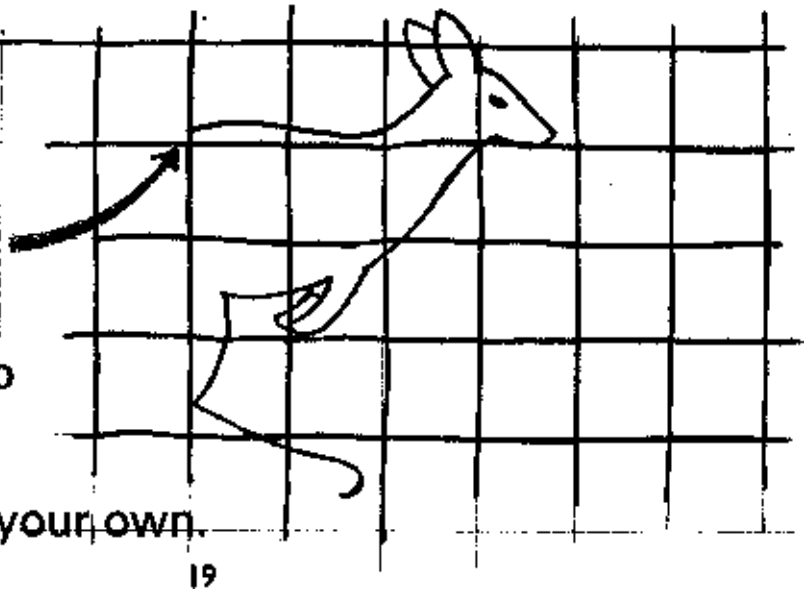
Now make a set of bigger squares. How big? You decide. How big do you want your drawing?

Now look at each square and start drawing.

Finish this one.

Then trace your big drawing on to a clean sheet.

Make another of your own.



Falling

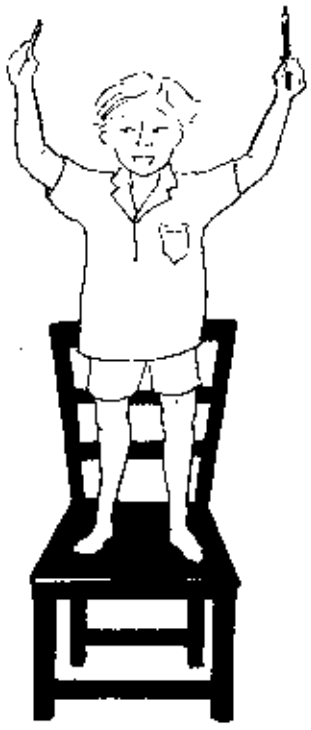
Which is heavier? **Heavier**

1. a piece of chalk or a pin? .....
2. a 2-paise coin or a 50-paise coin? .....
3. a piece of paper as big as this ☐ or an empty matchbox? .....
4. A match or a pencil? .....

If you drop the two things in 1–4 above, from the same height, which will hit the ground first?

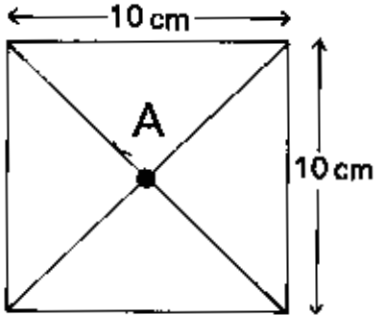
Guess

1	
2	
3	
4	



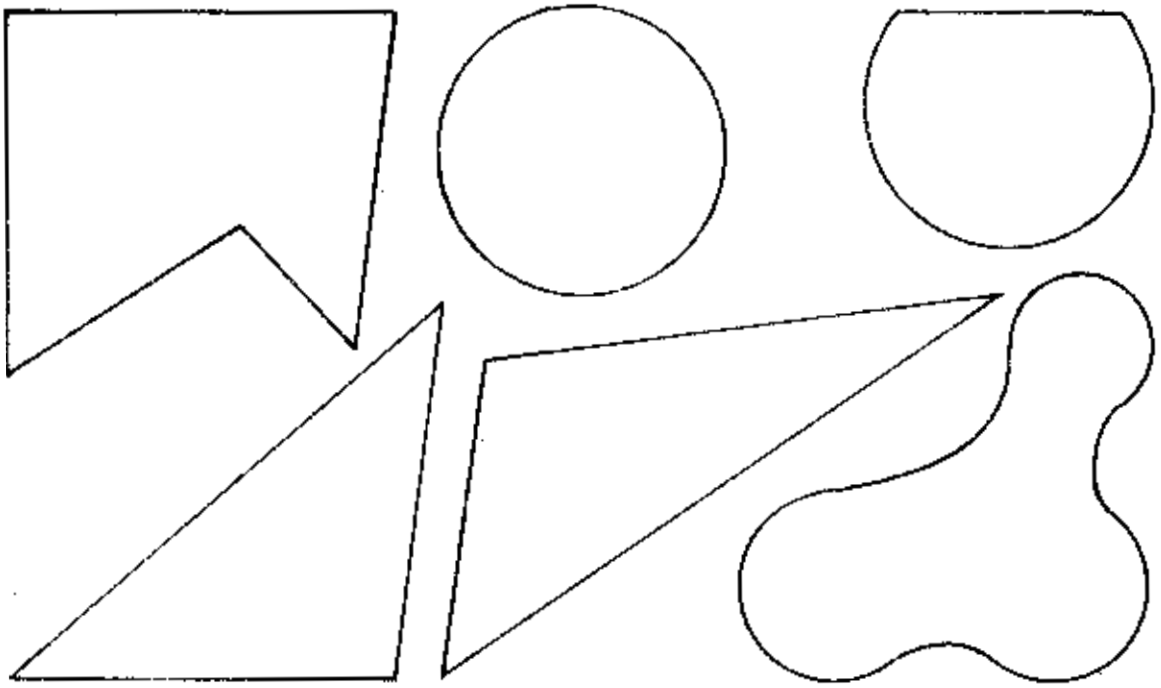
Now hold them up in turn, stand on a chair and drop them. Were you right about all of them? Do heavier things fall to the ground more quickly?

Balancing



Look at this square.
Look carefully at the measurements and then copy it on to thick paper or thin card.
Put the point of your pencil at A or put a tiny hole and a piece of thread with a knot in it. See if it balances.

Now make A on all these shapes. Put a • where you think A should be.



Now copy them on to card (larger than these).
See if your guess about point A was correct for each shape.

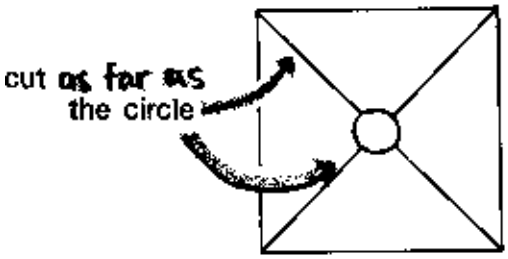
The wind

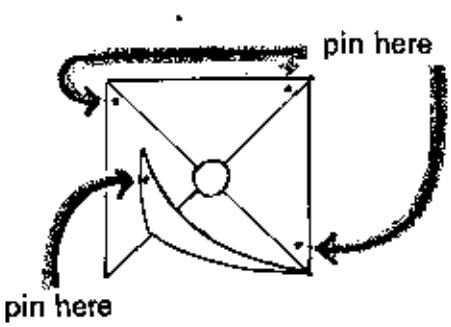
'No one can tell me
Nobody knows
Where the wind comes from
Where the wind goes.'

These lines were written by a poet; his name was A. A. Milne.

Can you find out where the wind comes from?
Make these:

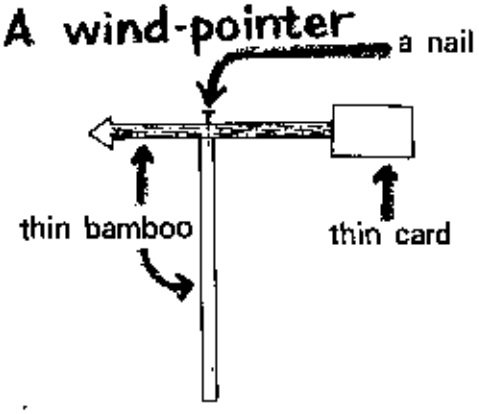
A windmill





Pin your windmill on to a stick, like this:

A wind-pointer

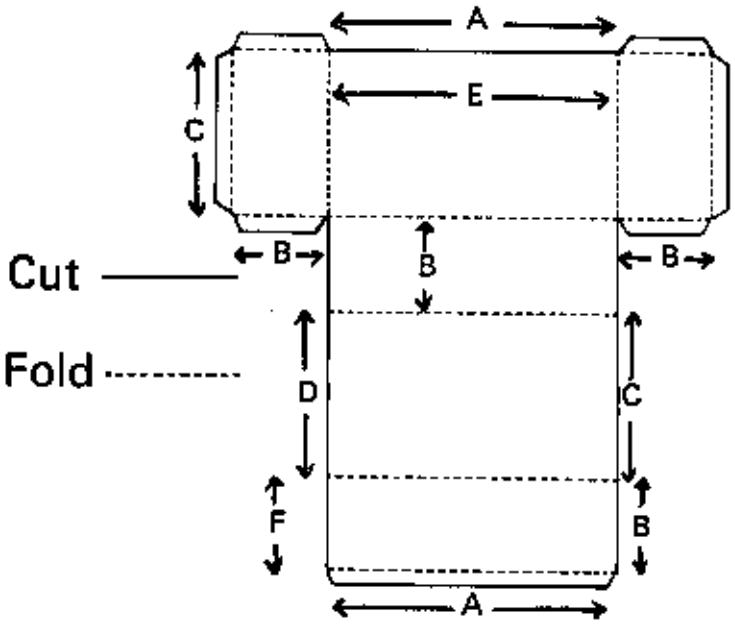


Which way does the arrow point?

Which direction does the wind come from?

Models

Do you remember the designs for cuboids you made on page 7? Make another one like this:

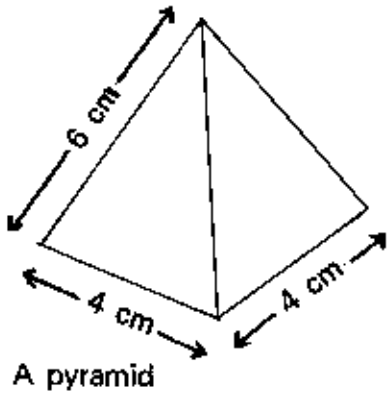


A = 9 cm
D = ? cm
D = ...

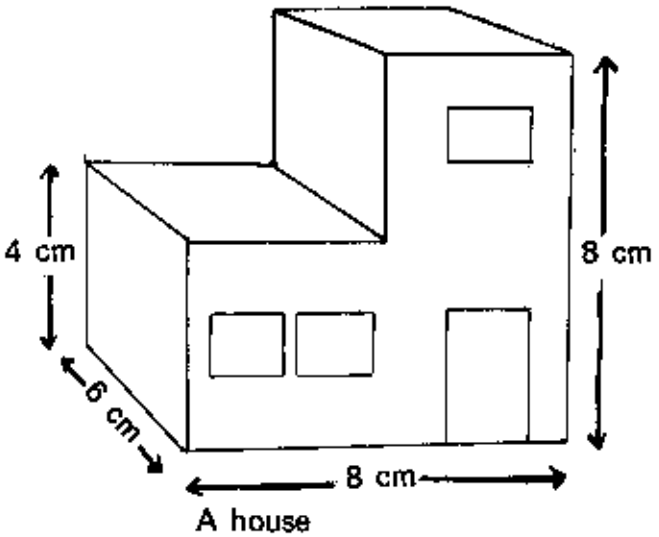
B = 3 cm
E = ? cm
E = ...

C = 5 cm
F = ? cm
F = ...

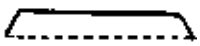
Now make designs like the one above for these:



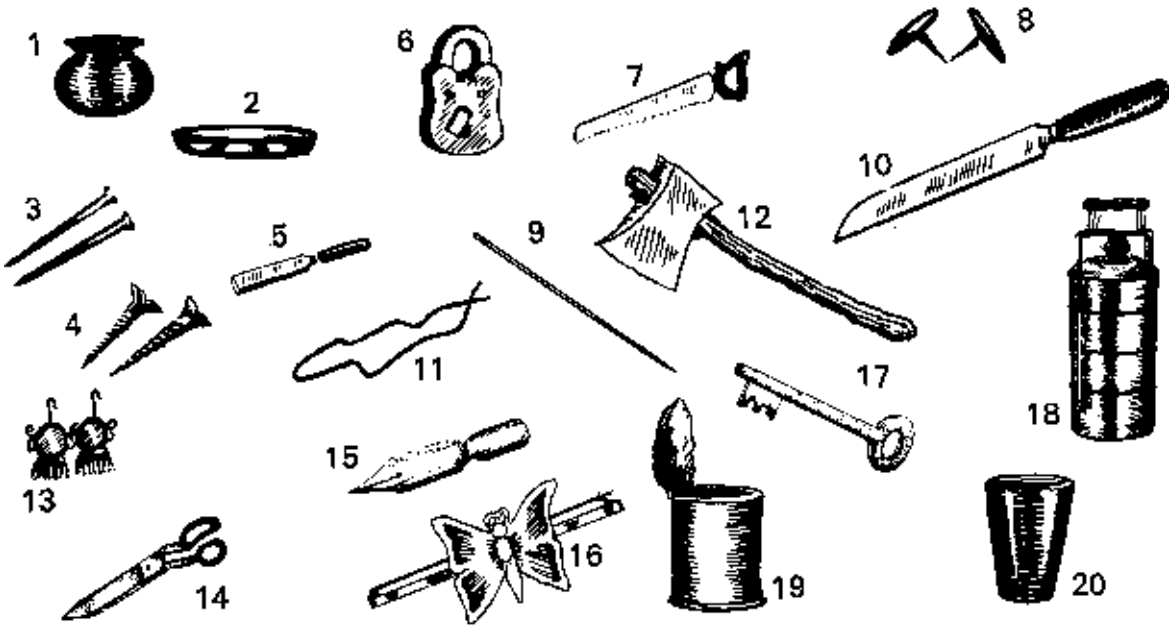
A pyramid



A house

Don't forget the pieces for sticking, like this: 

Materials: Metals



Write the headings below in your exercise books. List the things above, 1 - 20, under the correct headings.

Put as many things as you can into the lists below. Do not mention things shown in the picture above.

Gold: .....

Silver: .....

Iron: .....

Aluminium: .....

Steel: .....

Brass: .....

Write a sentence about the use of each thing you have mentioned.

Rust

You need:

1. 4 pins or paper clips
2. 4 nails
3. 4 brass drawing pins and four tins.

Put into A, one paper clip (1), one nail (2), and one drawing pin (3). The same in B, C, and D.

Note when rust starts, on the chart below:

		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
A	1						
	2						
	3						
B	1						
	2						
	3						
C	1						
	2						
	3						
D	1						
	2						
	3						

Write R (Rust) or NR (No rust) in each column every day.

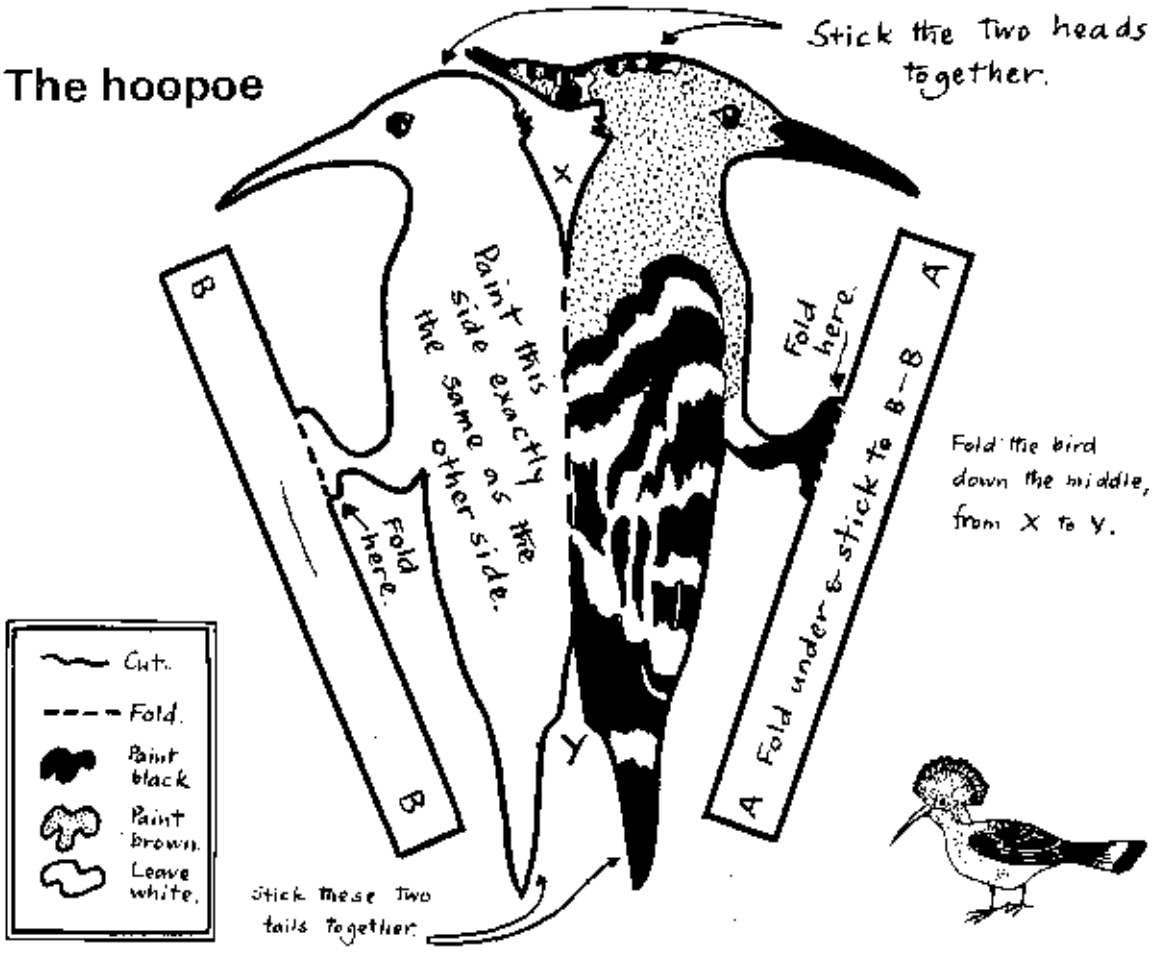
Bird models

Trace these pictures. Do not cut the book.
Then make new pictures on clean white paper.
Do not trace the numbers, or shading: the numbers and shading are to tell you what colours to use and where to stick the models.

Follow this order:

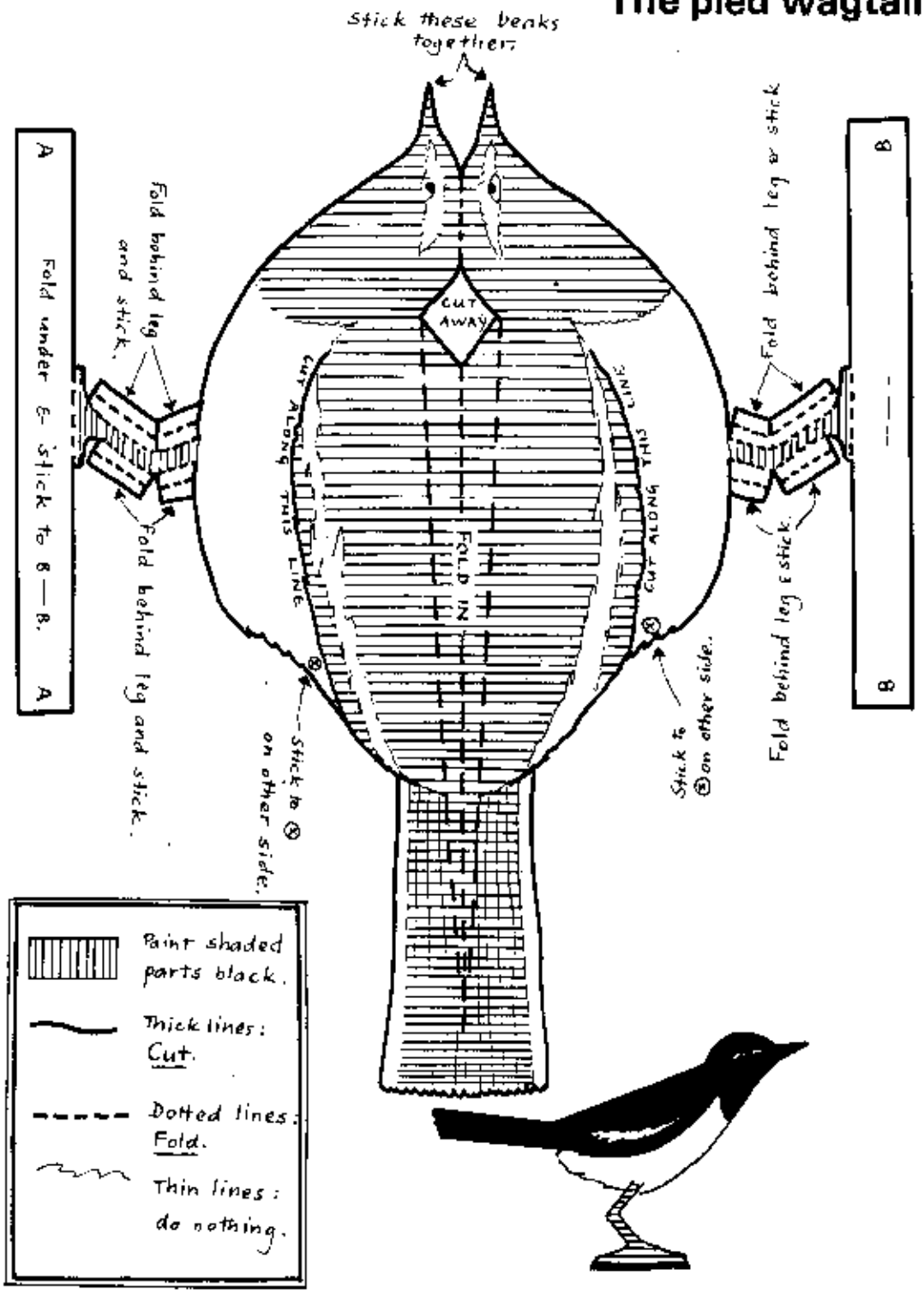
Trace. Put on white paper. Paint with the correct colours. Cut out carefully. Stick where required (use paste or cooked rice).

The hoopoe



More birds

The pied wagtail

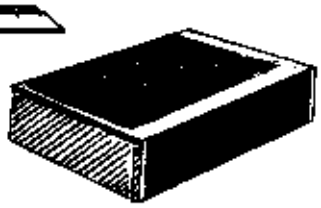


Levers

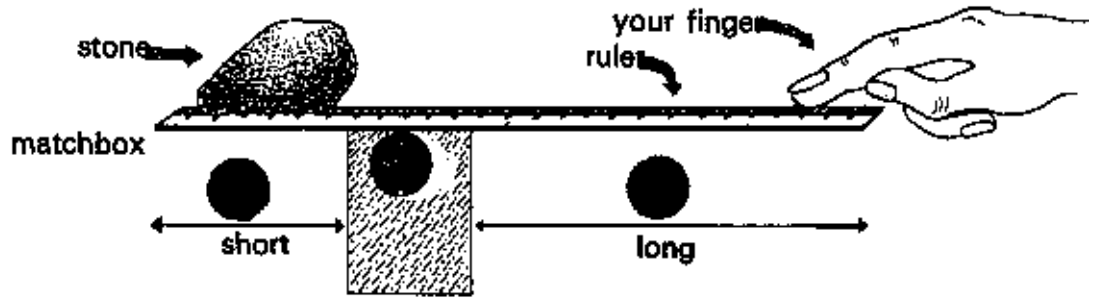
You need :

a stone 

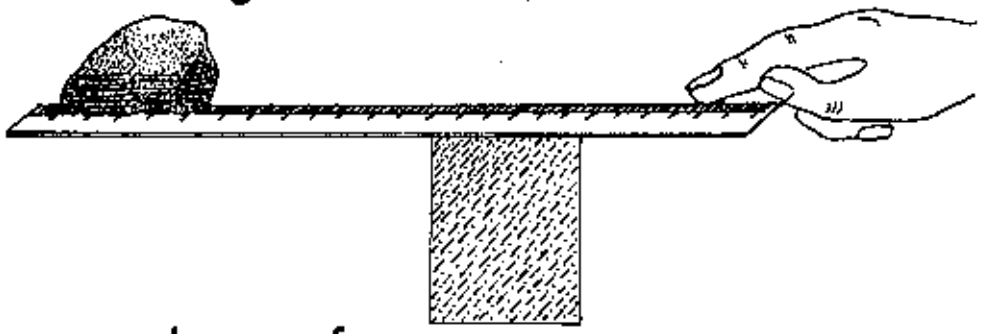
a ruler 

a matchbox. 

Put them like this, and use the ruler as a lever.



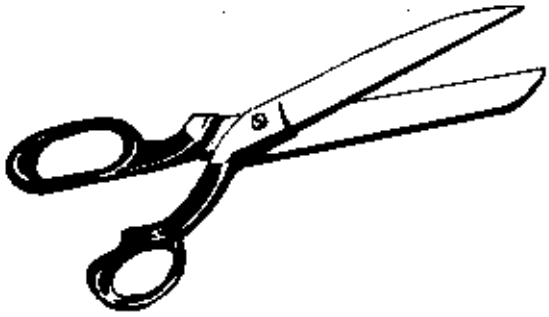
If A is short and B is long, you do not need much force to push down the ruler.
Now make A long and B short, like this:

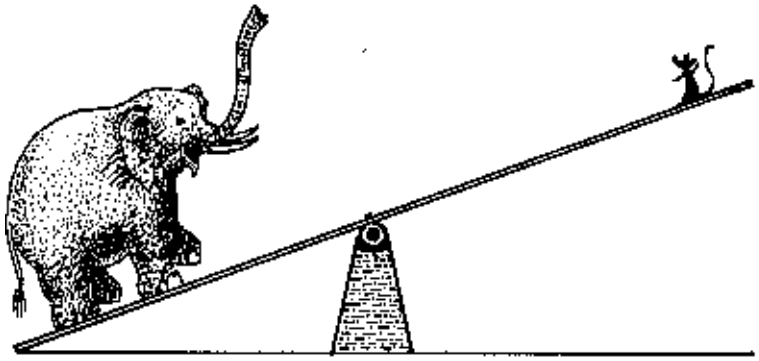


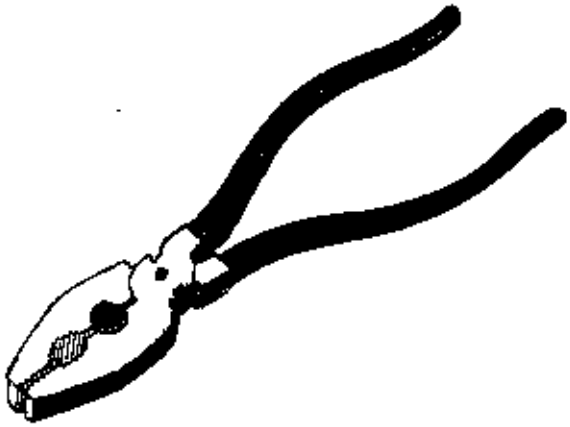
Now you need more force.
The point C is called the fulcrum.

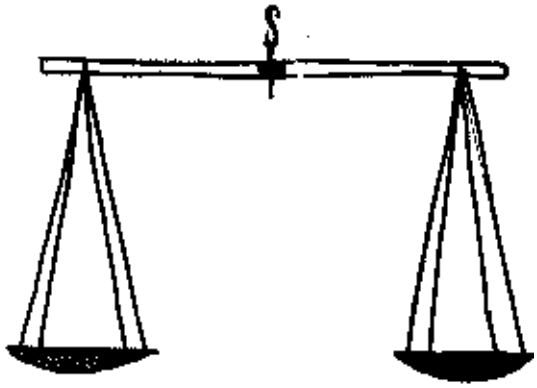
More levers

How do the following work as levers?
Make the fulcrum in each drawing.









Copy these drawings into your exercise books.

Sound and music

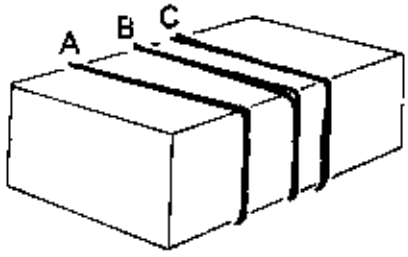
Open your mouth.
Keep your lips and tongue still.
Put your hand on the front of your neck.
Sing ! (Not too loudly.)

Can you feel any movement in your neck? Your **vocal chords** are moving. We say they **vibrate.**

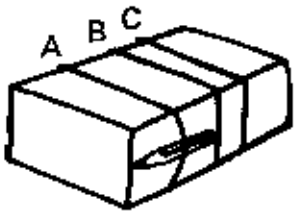
What moves when these sounds are made ?

a bird's song
the sound of a sitar
a bell ringing
the tick of a clock
a hammer hitting a nail

Take an open box and put some rubber bands across it, like this :



Pull the rubber bands. What sound do they make ? Now put in a pencil, like this :



Does A sound different now from B and C ? Put in two pencils. Then three. What differences do you notice ?

Making Music

Get 8 empty bottles,

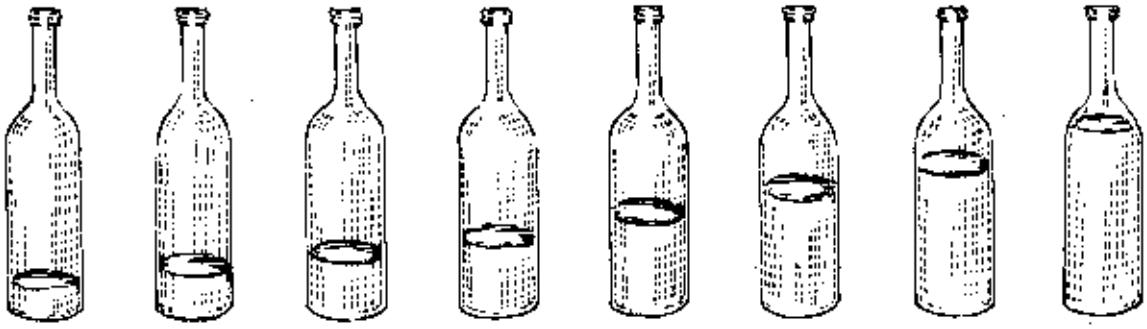
or

8 empty glasses,

or

8 empty cups.

All the cups, or bottles, or glasses, should be the same size.
Put a little water in the first, more in the second, and so on, like this:



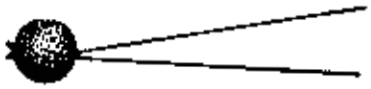
You can play tunes on them with a pencil.
Does a glass with **more** water in it give a **higher** note or a **lower** note?
Can you change the notes and make them **higher** or **lower**? How?
When you hit the glass, what vibrates and makes the noise? Ask your teacher.

Swinging

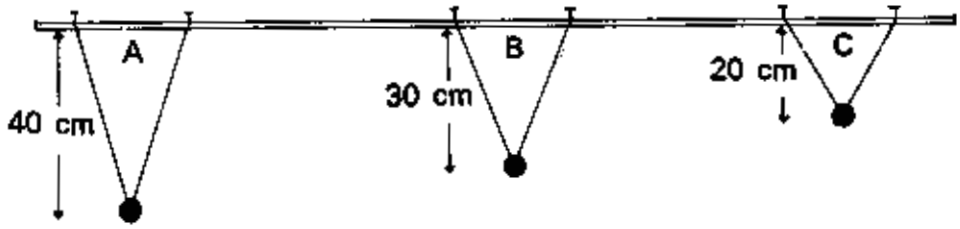
'How do you like to go up in a swing
Up in the air so blue?
Oh, I do think it the pleasantest thing
Ever a child can do.' R. L. Stevenson

Make these pendulums, like this:

Make 3 balls of plasticine or mud.
Make a hole through each when it is soft.
Put 2 threads, like this:



Tie or pin the threads on a bar, or on to your desk.



Hold them up at the same distance from the desk, and let them swing.

Which swings faster,

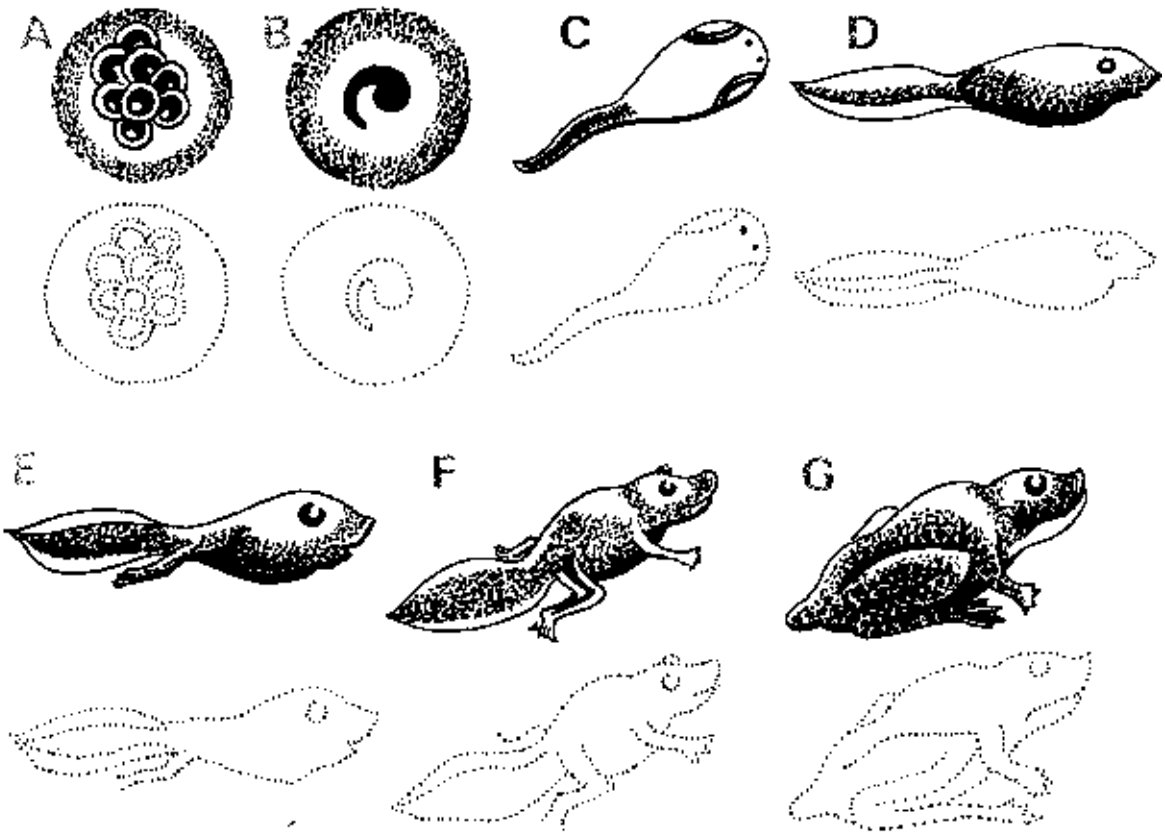
A, B or C,

or do they all swing at the same speed?

Count the speeds with a friend. He can put his hand on his heart and count in time with it. You can count the swings of the pendulum. Which stops first, A, B or C?

Frogs

Copy these pictures:



The pictures show the birth of a frog, and how it grows from an egg to a tadpole and then into a frog. Copy the pictures over the dots, and then copy them once more into your exercise books.

A Eggs B Tadpole formed inside egg

C Newly hatched tadpole swimming D Jaws grow

E Back legs grow F Front legs appear

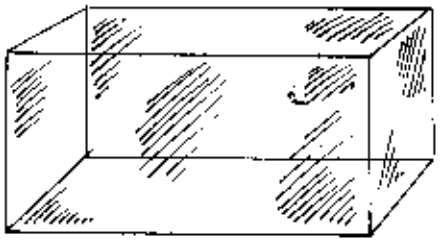
G Tail disappears and the frog leaves the water

Frogs and tadpoles

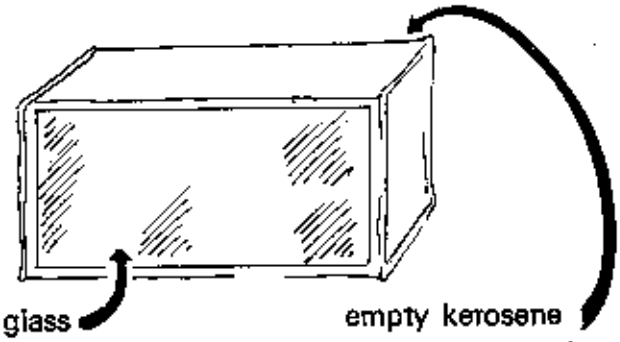
You can keep some tadpoles and watch them grow into frogs.

An aquarium

There are a number of ways of making an aquarium.

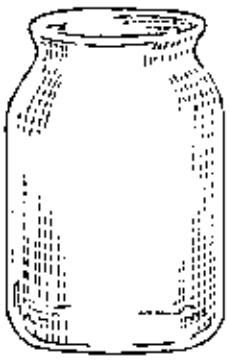


glass or plastic sheets

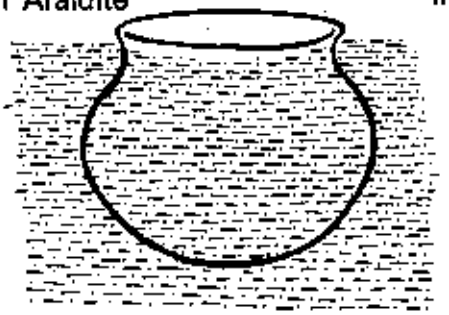


plastic or glass sheet stuck in with Araldite

empty kerosene tin, well painted inside

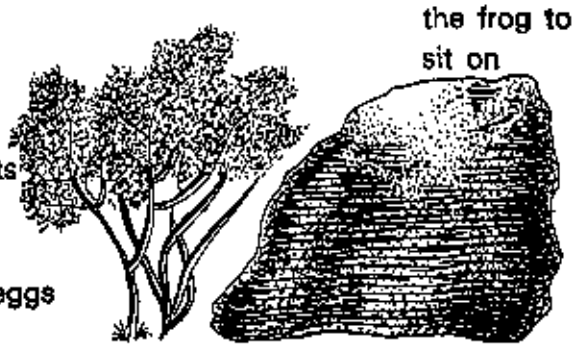


large glass jar



large mud pot, in a hole in the ground

If you are going to keep frogs and tadpoles, you will need:



a stone for the frog to sit on

water level

some water plants

some dead leaves

some ants' eggs

Frogs and Tadpoles

When you have made one of the aquariums you will have to find some frog spawn. This is a jelly-like substance with frog's eggs in it (see page 33 A). If you cannot find any, you can probably find some tadpoles. Use the net you made on page 32 in Book I, on page 32.

Watch your eggs or tadpoles every day, and make a chart like the one below.

Draw a picture every five days as the tadpoles grow.

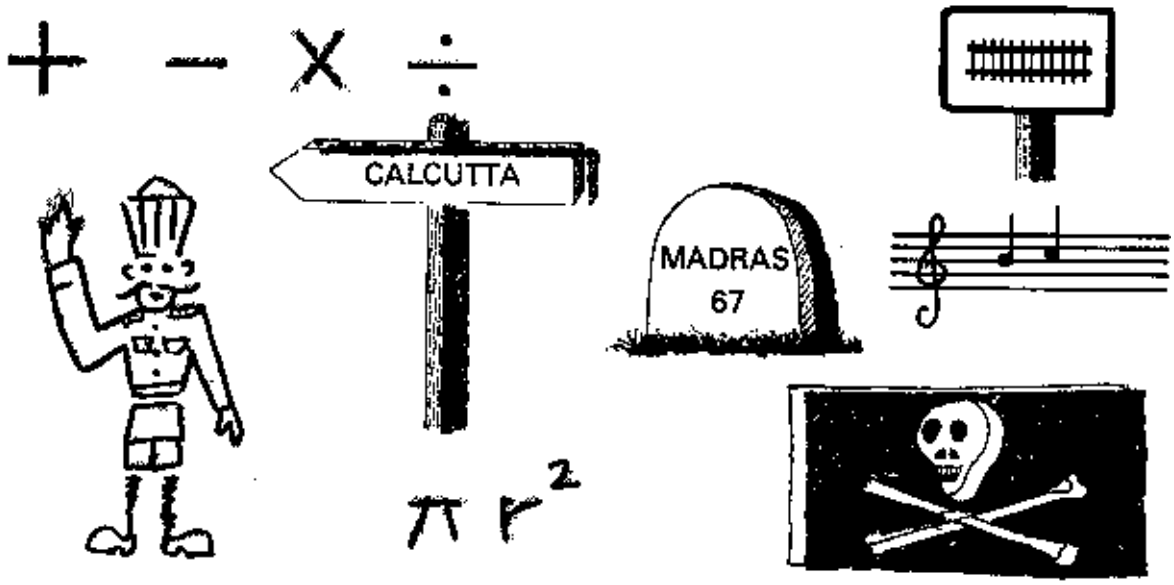
Copy your pictures from page 33; better still make accurate drawings from the tadpoles themselves.

WEEK I	Picture and description
Monday	 Very small. 2 cm long.
Tuesday	
Wednesday	
and so on.	

Signs

Writing consists of symbols. Each symbol stands for a letter, or a sound.

Sometimes we use symbols which are not letters.
Do you know what these symbols or signs stand for?

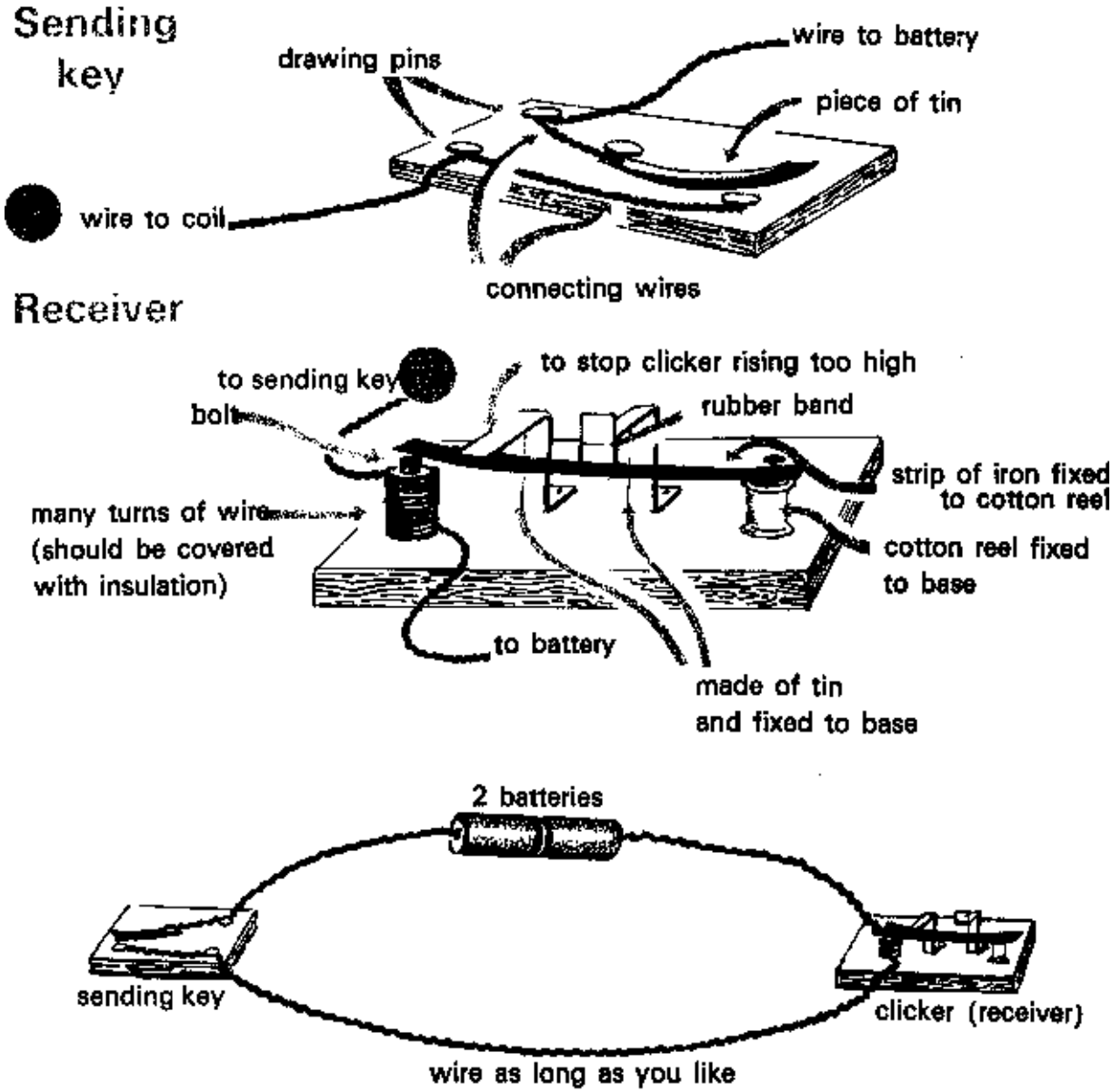


Sometimes people want to send messages by sound, but not by telephone. They use the Morse Code.

a . —	h	o — — —	v . . . —
b — . . .	i . .	p . — — .	w . — —
c — . — .	j . — — —	q — — . —	x — . . —
d — . .	k — . —	r . — .	y — . — —
e .	l . — . .	s . . .	z — — . .
f . . — .	m — —	t —	
g — — .	n — .	u . . —	

A model telegraph

For sending Morse code you need a telegraph set. You need a sending key and a receiver. You will need some wood, some wire, some tin, a bolt, a cotton reel and two batteries.



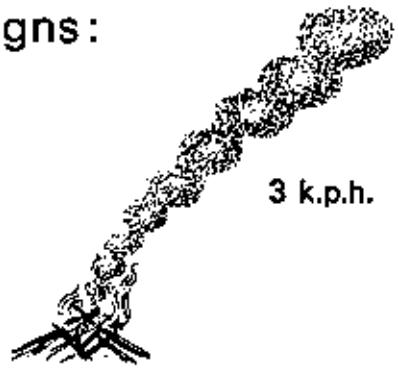
Wind-speed

Look again at page 22. Did you make the wind-pointer described on that page? Can you find out from it where the wind comes from? Wind blows at different speeds. You can tell which speed the wind is blowing at by the following signs:

0 k.p.h.

(kilometres per hour)

Smoke goes straight up.



3 k.p.h.

Smoke blows away.

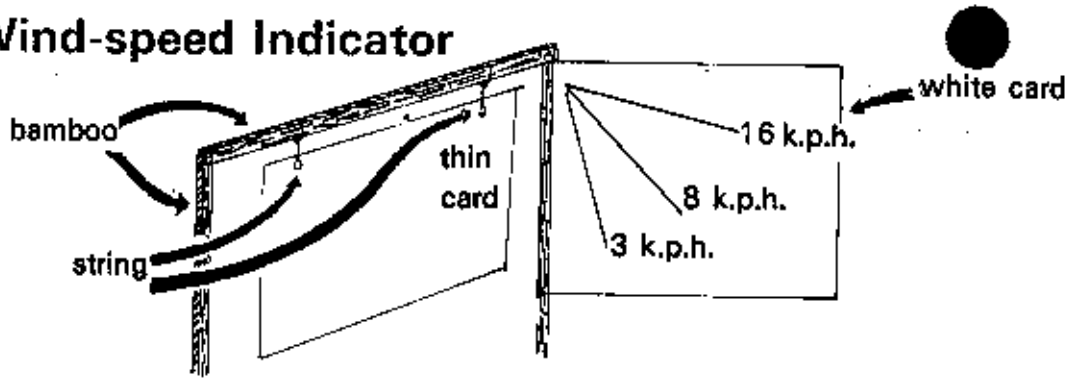
8 k.p.h.

Your wind pointer moves.

16 k.p.h.

Leaves move all the time.

Wind-speed Indicator



Mark the place on white card A. Check the speed from the signs at the top of the page.

Air

You use air every day. Read page 5 again. You cannot live without air. How many other uses of air are there? Try to write some, like this:

In motor car tyres
In balloons
In .....

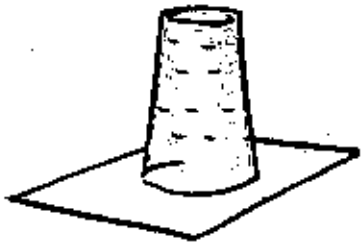
Write as many uses as you can in your exercise books.

Air presses on us from all sides.

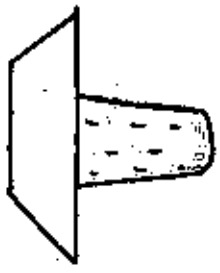
Try this experiment.

Take a glass full of water, and cover it with a card, like this:

Now turn it upside down, like this:



Now sideways:



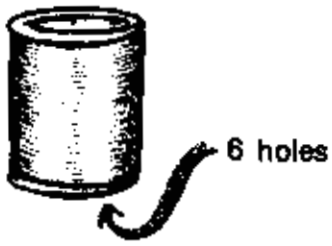
The water does not come out because the air is pressing against the card.

Air

Here are some more experiments to do with air:

If you suck on a straw in a glass of water, what happens? Why does the water rise?

Take a tin and put 6 holes in the bottom and one hole in the top. (The tin should have a tight-fitting lid).



Now fill it with water.
(How will you do that if the tin has holes in it?)

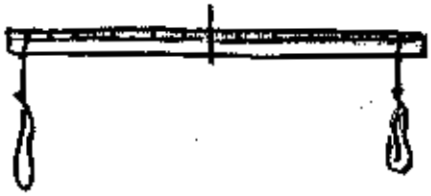
Put your finger tightly over the hole in the lid.

What happens? .....

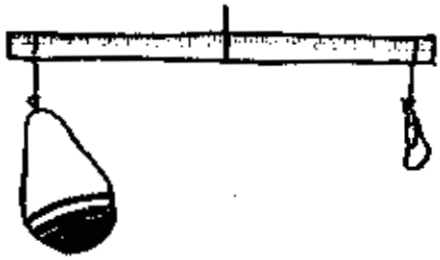
Lift your finger;
now what happens? .....

Air has weight.

Weigh it and see. Use a ruler and two balloons.



No air in the balloons.



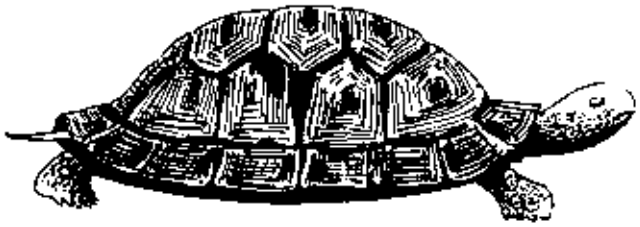
Air in one balloon. What happens?

Shells

Have you seen any animals in shells?

The Snail

The Tortoise



If you live near the sea you will find plenty of shells on the sand:

Mitre

Cone

Cowrie

Auger shell

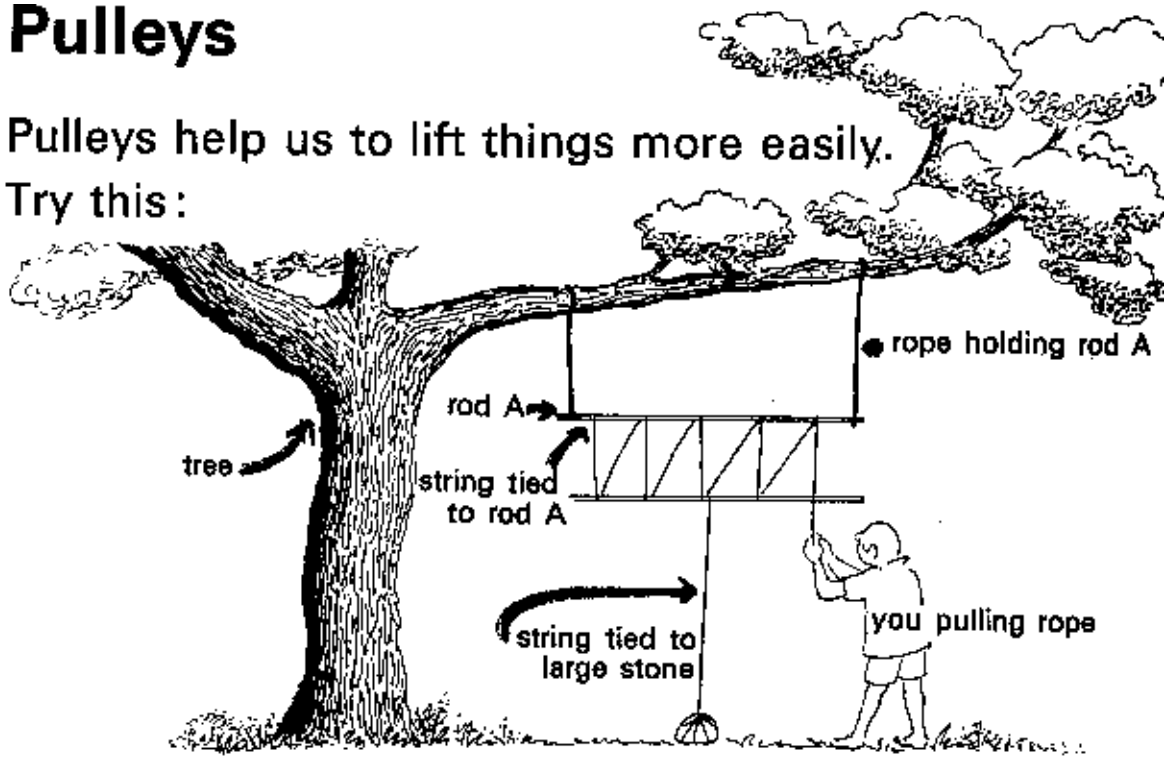
Conch

Copy these drawings into your exercise books. In olden times in India cowrie shells were used as small coins. See if you can find anyone who remembers that.

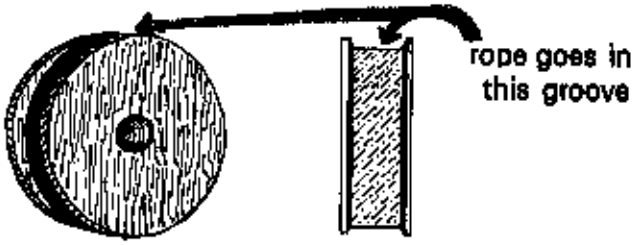
Try to find some shells. Make drawings of them. Try to find a snail. How quickly does it move? What does it eat?

Pulleys

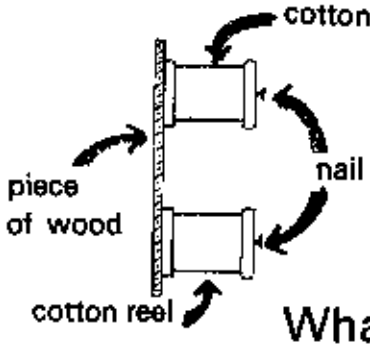
Pulleys help us to lift things more easily.
Try this:



This will show you how a pulley works. You can easily lift a very heavy weight like this. Pulleys used for lifting weights are usually made like this:



Cotton reels will do

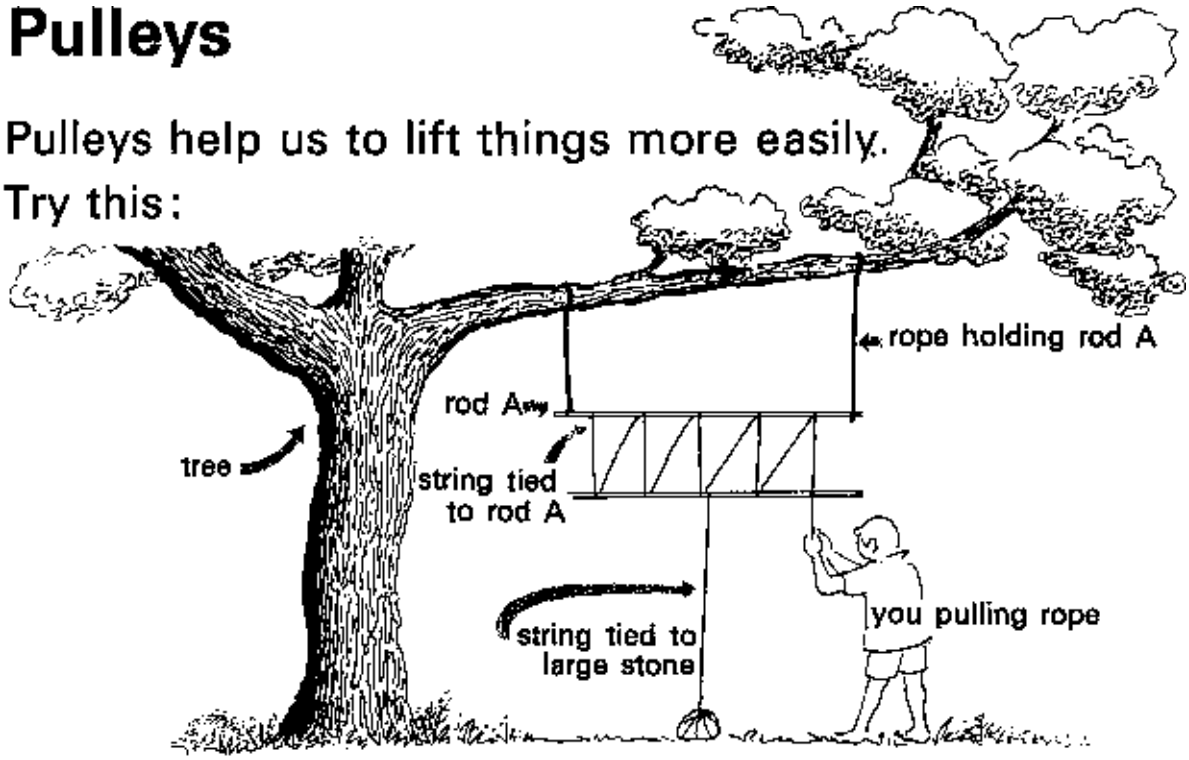


What happens when you make A turn?

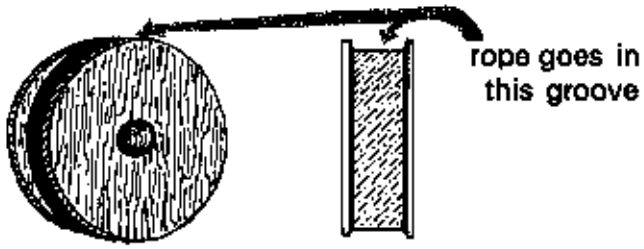
Pulleys

Pulleys help us to lift things more easily.

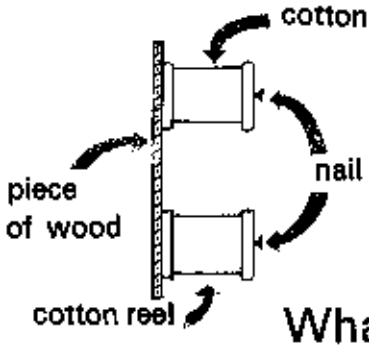
Try this:

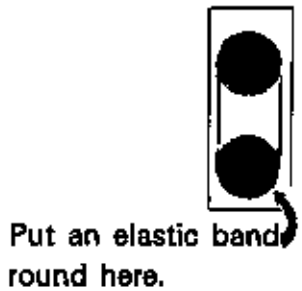


This will show you how a pulley works. You can easily lift a very heavy weight like this. Pulleys used for lifting weights are usually made like this:



Cotton reels will do



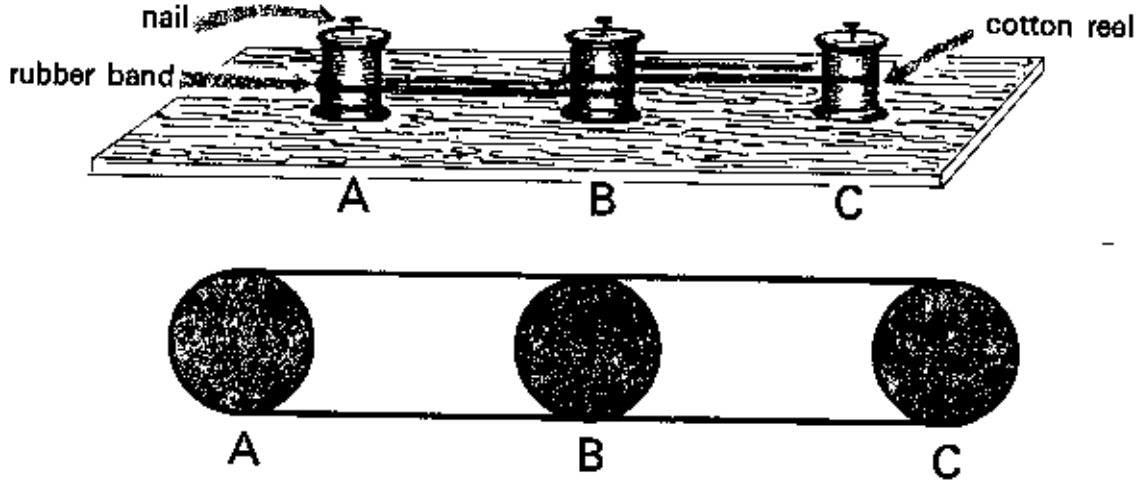


What happens when you make A turn?

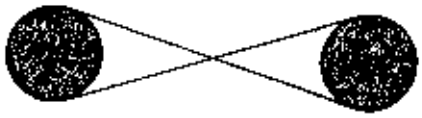
Gears

What was the answer to the question at the bottom of page 42?

You can connect up a number of cotton reels with rubber bands, like this:



What happens when you move A in a clockwise direction? Which way round does C go? What happens if you cross the rubber band, like this:

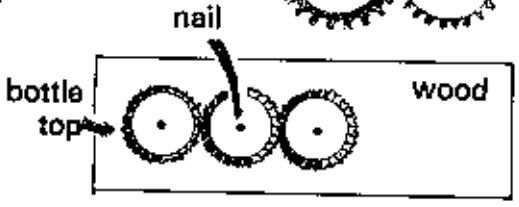


Make more of these and try this arrangement.

Gears have teeth, like this:

When A goes clockwise, how does B go?

Make some gears out of bottle tops.



Making a bullock-cart and bullocks

Look carefully at pages 45 to 47. All you need for making the cart and the bullocks is ordinary paper and paste. Paste can be made by cooking a little **maida** in water. Let it boil for a few minutes and then let it cool down.

For every part of the model use two sheets of paper stuck together. Prepare your paper first; put paste on the sheets of paper and stick them together. Put them under a book or two, to press. Meanwhile prepare your tracing. All the parts are shown in full size except in the case of A, B and C on page 47. Make the tracings carefully, pencil the backs and then transfer them on to the double sheets that you have already prepared.

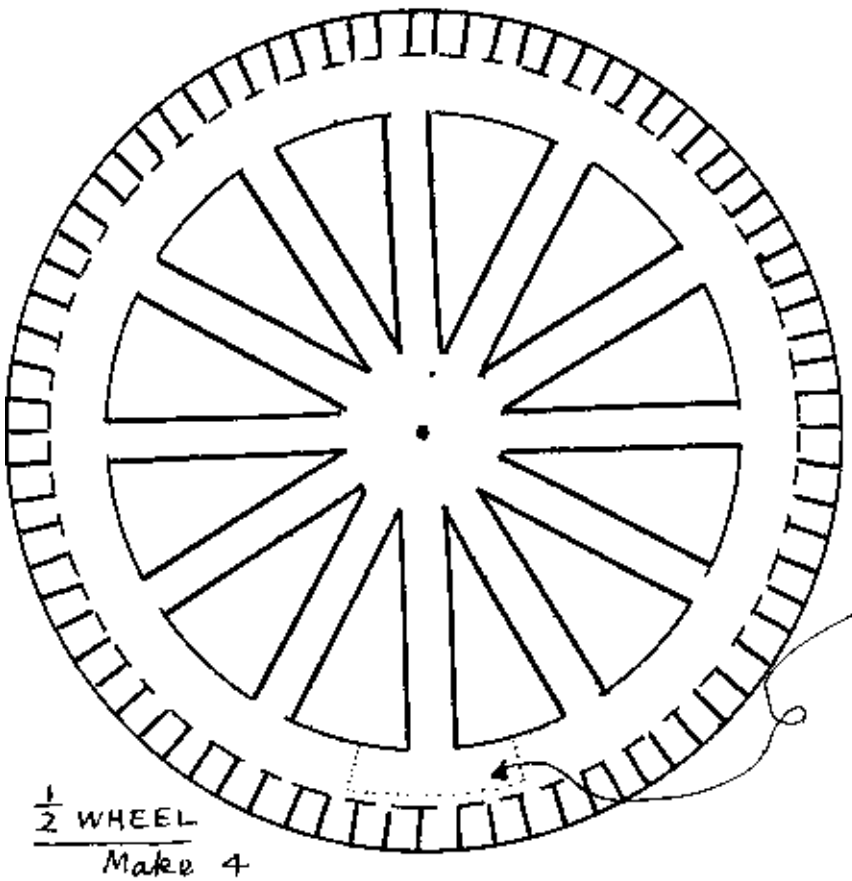
Start with the bullock-cart. Remember not to cut through the hump. The supporting hind-legs and forelegs are stuck on inside the legs of the main figures to make them stronger. The ears and one horn are stuck on last.

Now start on the wheels. Cut out four half wheels as shown, and then cut out the supporting spokes.

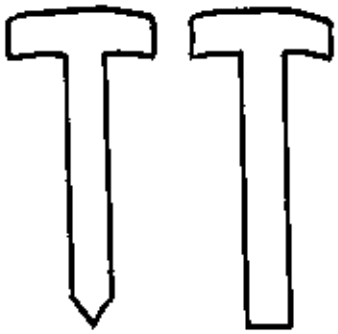
These are stuck on behind each spoke of the wheels to make them stronger. Then make the hubs. You can make these out of card cut from cigarette packets. Stick the hubs in position at the centre of each wheel and then join the wheels up by the tabs, as shown on page 46. The last thing is to paste a strip of paper on the wheels, where the tyres usually come. Do not make the holes in the wheels yet.

A, B and C on page 47 are simple cuboids; you have already made plenty of these in this Book and in Book I. Make them to the size shown; the plan of B is shown at the bottom of page 47. D and E are both given full size and you will have to trace them. Make four parts as shown in F (full size) and stick two to each end of B to make it stronger. A is now stuck in the groove in B, and the whole thing is stuck on to C. A should project from C half an inch from one end and five inches from the front end.

You can make the axle out of a thin piece of broomstick. Bore suitable holes in B and in the wheels, and the long axle will go right the way through. The cart is held on to the bullocks' necks by a round bar which is attached to the front of the bullock-cart. You can make this bar by making a small roll of paper 4 inches long, about as thick as a pencil. This is stuck on to the top of A above D. Finish the model by painting it.

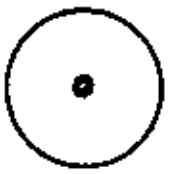


Supporting spokes

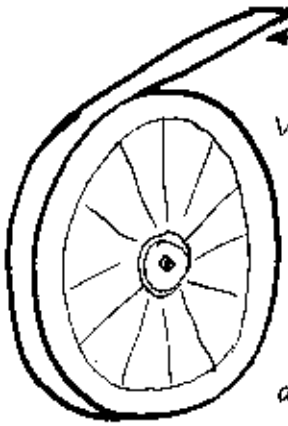


Make 24 of each. Stick 12 on inside of each ½ wheel.

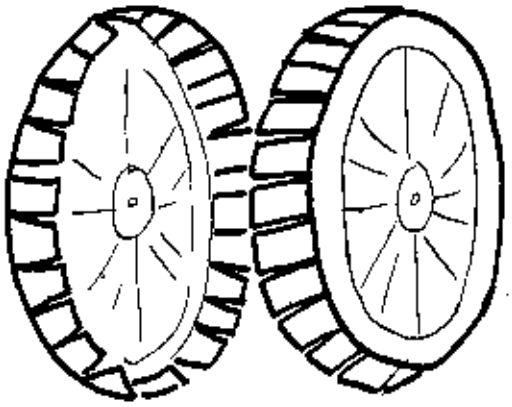
½ WHEEL
Make 4



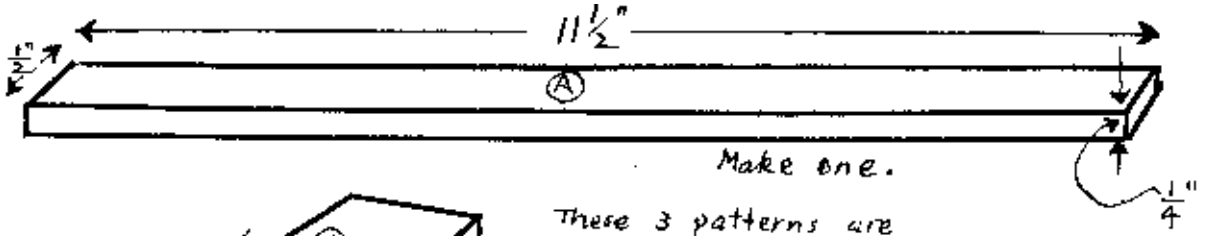
HUBS. Make 8 out of thin card. Stick one on inside and outside of each ½ wheel.



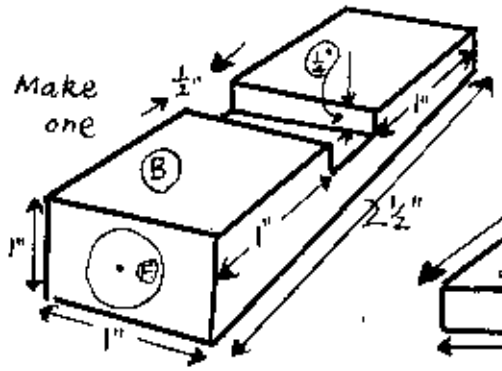
Wind strip of paper round rim of each completed wheel and stick it to tabs.

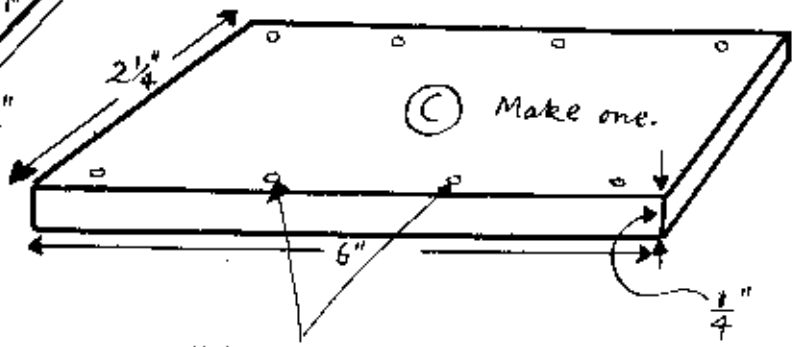


Stick 2 ½ wheels to each other by tabs, with the supporting spokes inside. This will make one complete wheel.

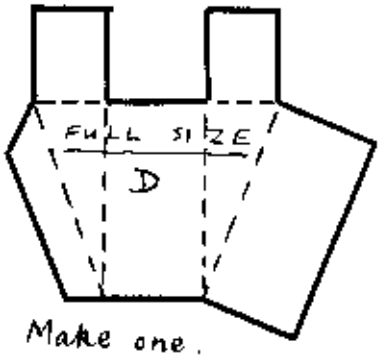


These 3 patterns are not full size.

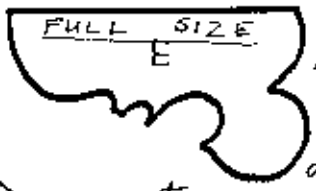




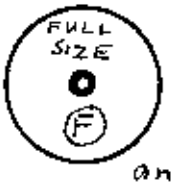
Holes to take matchsticks.



Make one.

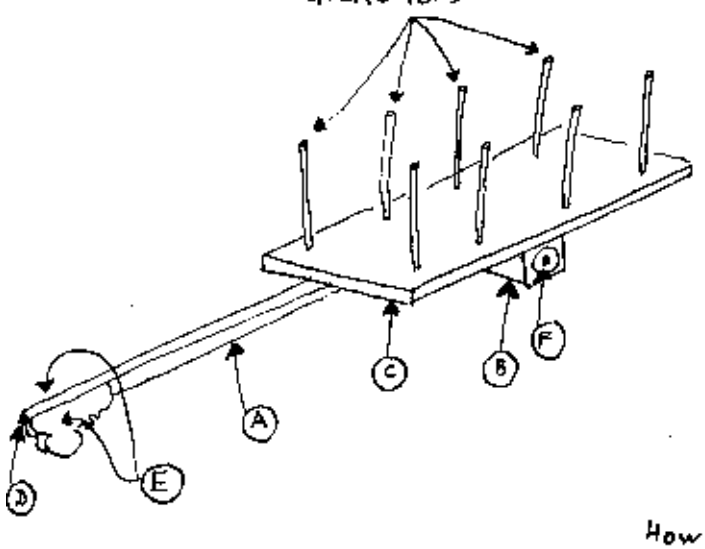


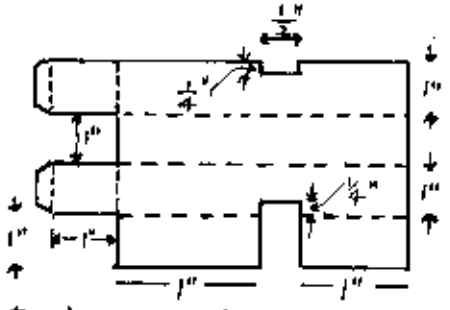
Make two and stick to sides of D, here.



Make four of thin card and stick two on each end of B.

Matchsticks

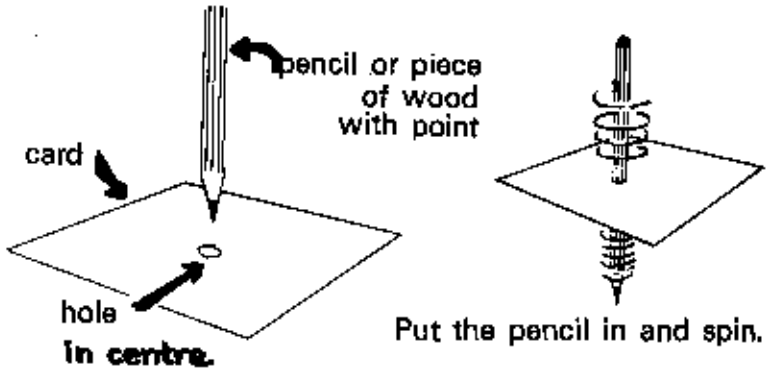




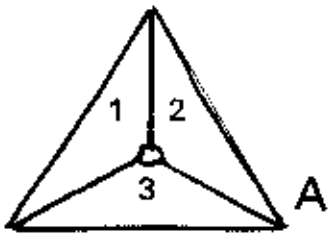
How to draw a plan of B at the top of this page. Not full size.

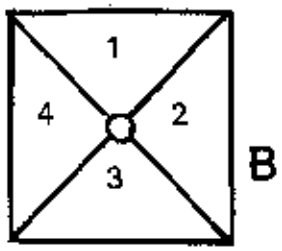
Chances

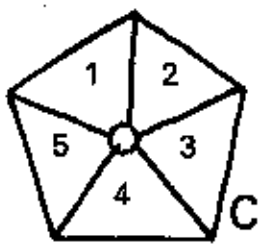
Make a spinner,
like this:

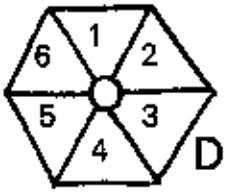


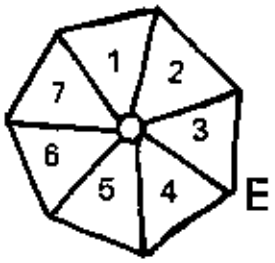
Make a number of spinners, like these, and put the numbers on each spinner.











Make sure that in every spinner **all** the sides are the same length as each other.

Spin each 50 times.
See which number rests on the table.
Write the results here. Put the number of times each number rests on the table in the correct column.

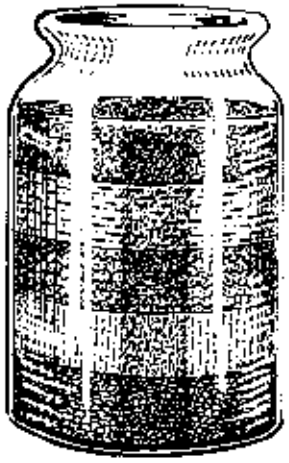
	1	2	3	4	5	6	7
A							
B							
C							
D							
E							

Rocks and soil

You will find soil everywhere. Where does it come from?

The wind and sun and rain break tiny pieces off the mountains and hills. Slowly they are brought by the rivers and the rain and the wind. Sometimes they take millions of years to do it.

Collect as many different kinds of soil as you can. Put some of each in a jar and label them.



Soils
- near the school
- my garden
- from the river bed
- .....
- .....

Take a piece of stone and rub it 200 times with a piece of sand-paper. Does any of the stone rub away?

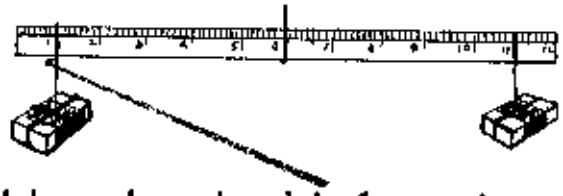
Rocks

Collect as many different rocks as you can. Scratch each with a nail. Which rock marks most easily? Which is the easiest to mark? Arrange your rocks in order of hardness. Try to describe each in your exercise book.

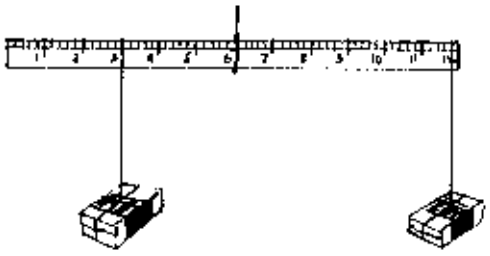
A balance

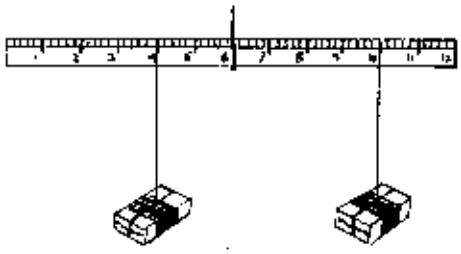
Get some sand and six empty matchboxes. Fill each box with sand and tie it up with string. Seal the cracks by sticking paper over them.

Now take a ruler. Tie thread at each end and at the middle, as you did on page 16.



Put one matchbox level with 1 on the ruler, and one level with 11. If the ruler is level, the two boxes weigh the same. Test each box like this. Now guess the following: then test with the ruler.





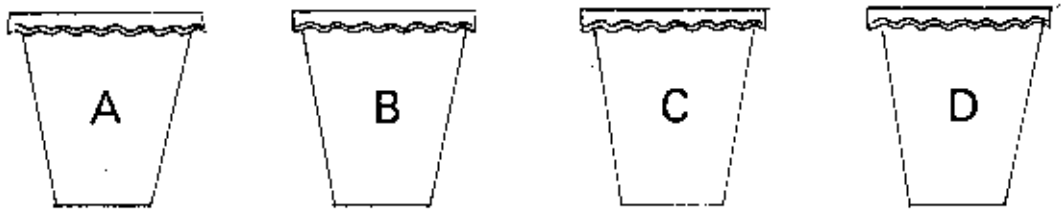
	Guess	Correct
It will balance.		
It won't balance.		

	Guess	Correct
It will balance.		
It won't balance.		

Make up more puzzles about the beam and try them on your friends. Make them guess first.

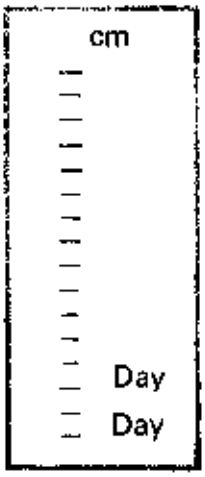
Plants

Grow some seeds. Get four bean seeds, or green gram seeds, or peas. Get four tins or jars or small pots. Put your beans in as shown below. Water as directed. Put them outside, under a tree.



A	B	C	D
Sand only. Water every day.	Sand. No water at all.	Good soil. Water every day.	Good soil. Water every third day.

Put a paper chart beside each pot, like this:
Put the number of the day on the scale, at the tip of the plant every day. Count days from the time of planting the seed.



Guess which grows best.

A , B , C or D

Check after 15 days.

Water and salt and sugar

Get four cups or glasses. Put water into them as follows:

hot water

hot water

cold water

cold water

Put a small spoonful of salt in A, and one in C.
Put a small spoonful of sugar in B, and one in D.

Which dissolves without stirring?
Which dissolves most easily with stirring?

	Guess	Correct
A		
B		
C		
D		

Put a little of each solution into a saucer.

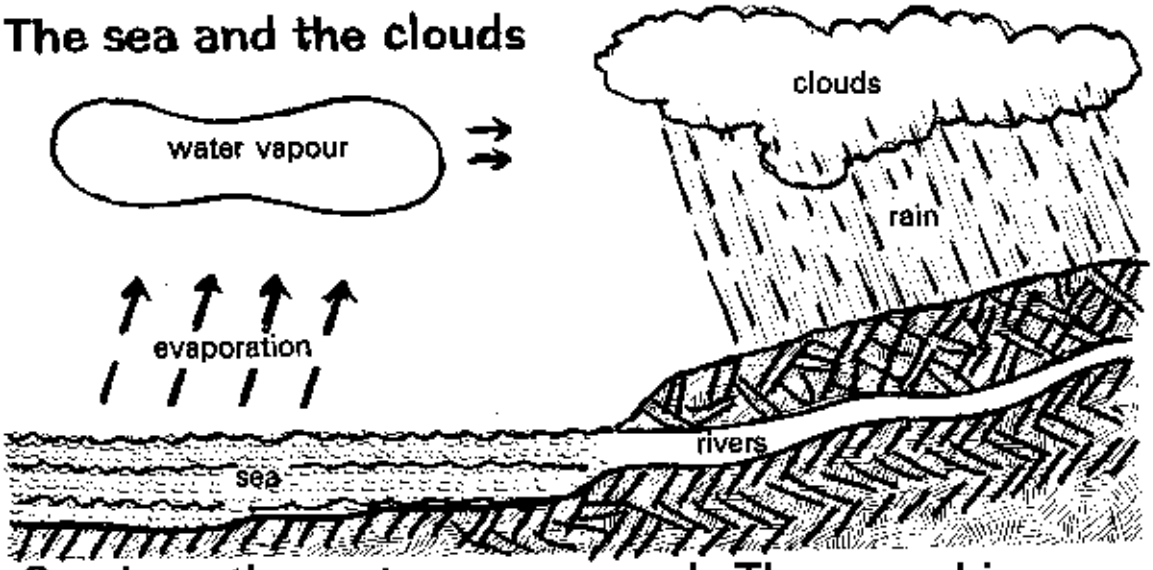
Put them in the sun.
What happens after 4 hours? .....
What happens after 8 hours? .....
What happens after 24 hours? .....

Evaporation

Put some water in a pan or a **degchi.**
Stir in some salt. Boil it.
Watch the steam.

Put a cold plate over the steam. (Cover your hand with a cloth.)
Water forms on the plate. Taste it. Is it salty?
If you go on boiling the water what happens?
What happens to the salt?

The sea and the clouds



See how the water goes round. The sun shines and the water changes into water vapour. This becomes clouds. Then the rain falls from the clouds, and flows down the rivers into the sea again. Does the salt in the sea go into the clouds?

Invisible

Do you know what **invisible** means?
It means, 'something which can't be seen'.
Write down five things which are invisible.

Invisible writing

Sometimes people want to write a message to someone which is secret. They don't want anyone else to read it.

You can write in invisible ink quite easily.

Use one of the inks given below, and let it dry on the paper. It will be invisible until you **warm** the paper over a fire.

Invisible inks

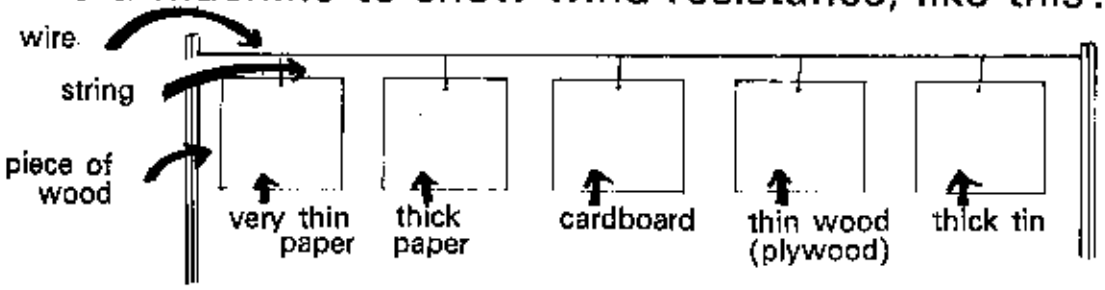
1. Use milk.
2. Use the juice of a lime.
3. Use the juice of an onion.
4. Dissolve some sugar in a little water.
   Shake the water until all the sugar disappears.

Try all the inks. You can write with a brush or with a matchstick.

Air resistance

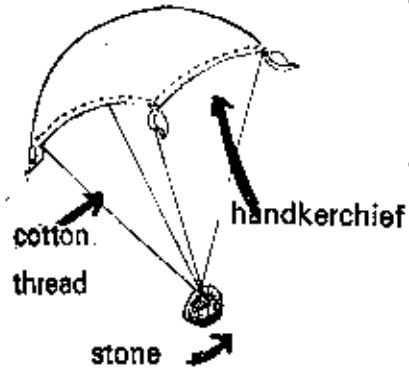
Some things resist the wind more easily than others. You can resist the wind more easily than a shirt on the washing line.

The shirt moves but you don't.
Make a machine to show wind resistance, like this:



Perhaps you can tell how fast the wind is blowing with this. How can you know the speed of the wind?

A parachute



When a man comes down in a parachute, the cloth resists the air and the man comes down slowly. You can make a parachute out of a stone and a handkerchief. Throw it high into the air and watch it sail down.

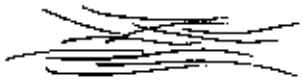
Electricity

For this experiment you need a plastic comb or a plastic fountain pen. You also need the following:

A

some tiny pieces of paper

B



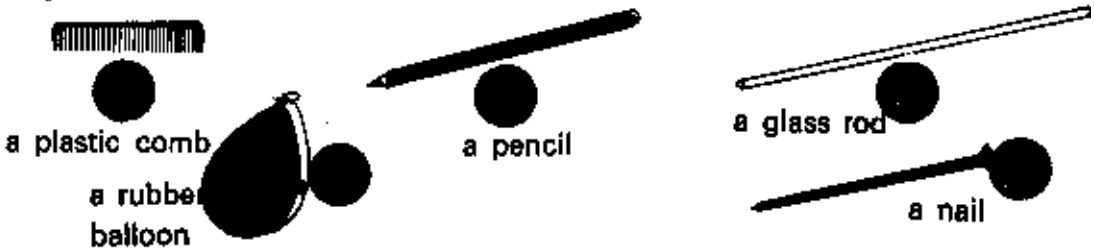
some hair from your hair (not oily ones)

C

some shavings from the lead of a pencil

Run the comb through your hair a number of times. See if it will pick up A, B or C like a magnet. Rub the pen on a piece of woollen cloth. Does it pick up any of the things above?

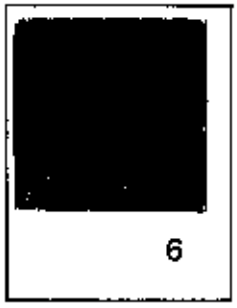
Get a piece of silk and rub the following things. Then fill up the chart below: guess the answer first.



Picks up ●	Guess Correct					
Picks up ●	Guess Correct					
Picks up ●	Guess Correct					

A game

On pages 59 and 61 you will find some pictures. Cut the pages out of the book, along the dotted line, and then cut each picture out. You will need sixty small pieces of card: you can cut up old cigarette packets. Each card should be about 7 cm by 4 cm. Stick each drawing on to a separate card. Put the number at the bottom right-hand corner of the card, like this:



How to play the game

You need at least two players, and not more than six. Mix up the cards, and give each player eight. Put the remaining cards face downwards on the table, and turn up the top card so that people can see the picture on it.

The object of the game is to make two sets of four cards. Each set may contain:

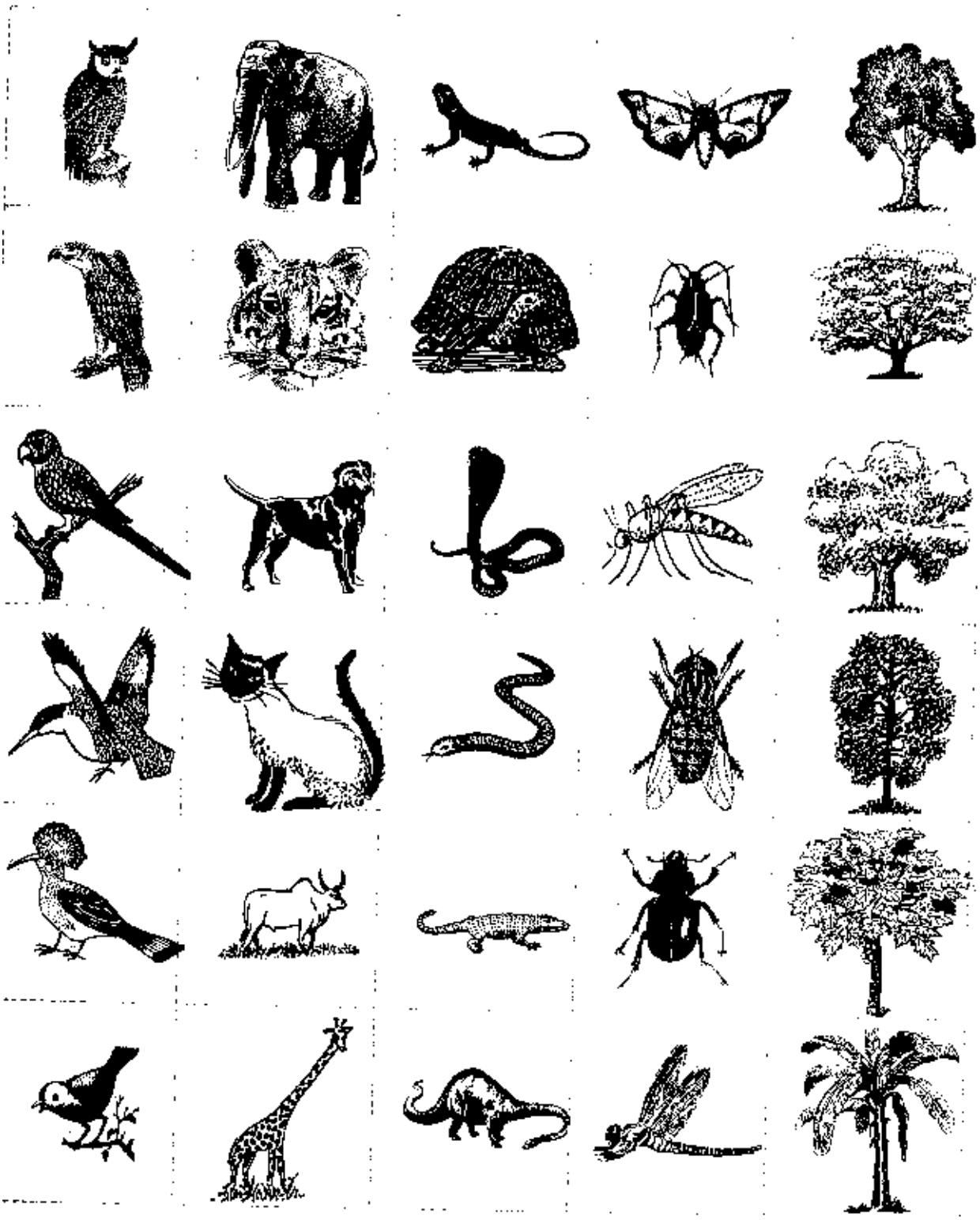
4 birds, 4 animals, 4 reptiles, 4 insects, 4 trees, 4 vegetables, 4 fruits, 4 flowers, 4 water-dwellers, 4 things.

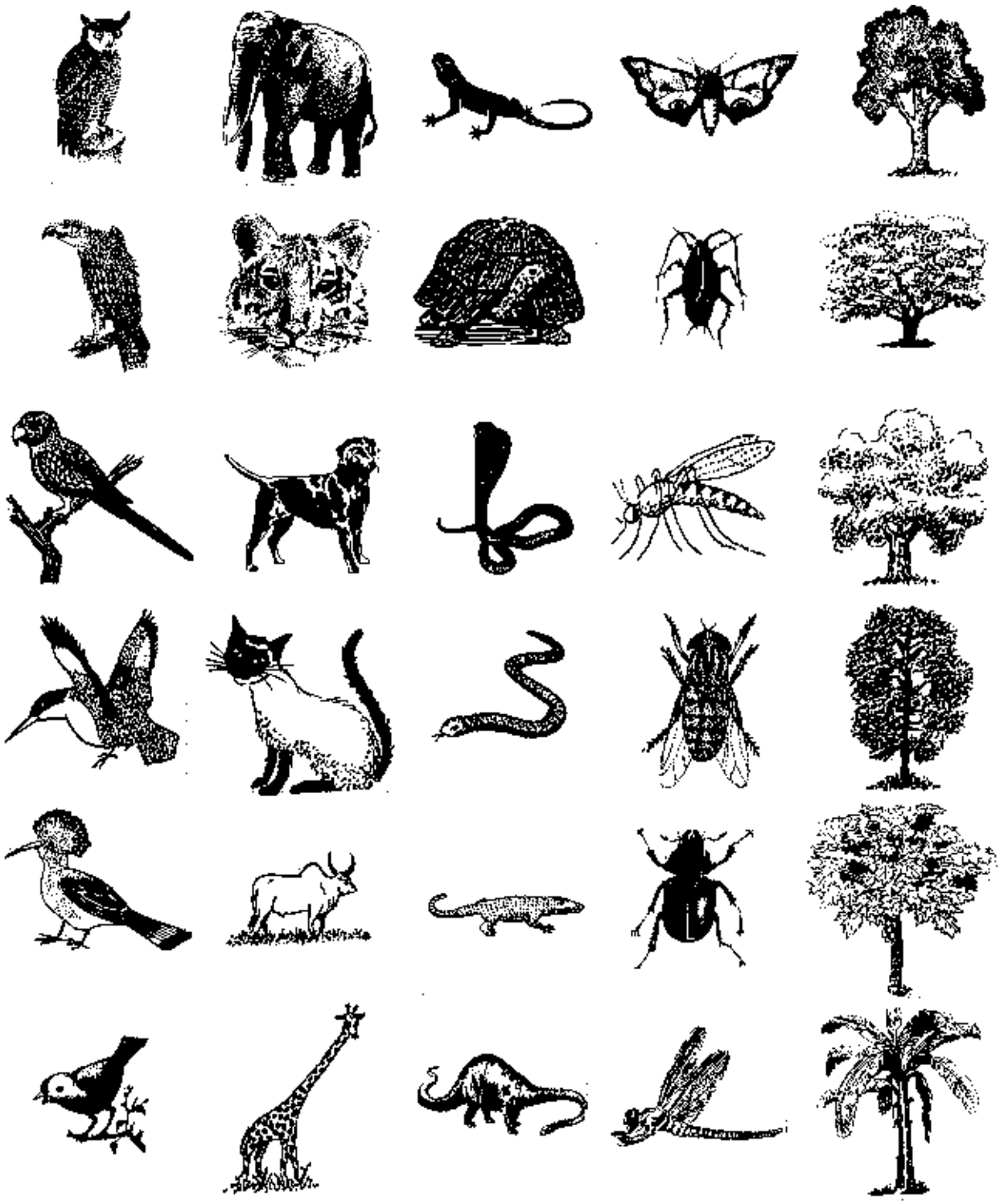
There are, as you can see, six of each in the sixty cards.

When you have a set of four, put them down in front of you.

When anyone has two sets on the table they are out. All the players count up the numbers on their cards in their hand (not on the table) and that is their score. The person with the lowest score wins.

The first player can start by picking up the card face upwards on the pile in the middle of the table, or he can take the top card from the pile. He must not look at the card before he takes it. Then he has 9 cards. He must now put one of his cards (any one which will not help him to make a set) face upwards on the pile. Then the next player plays, and so on until one player has put down 2 sets (4 cards each).


1 2 3 4 2 3 1 2 3 1 2 3 1 2 3
4 5 6 4 5 6 4 5 6 4 5 6 4 5 6



cut here

1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
4	5	6	4	5	6	4	5	6	4	5	6	4	5	6