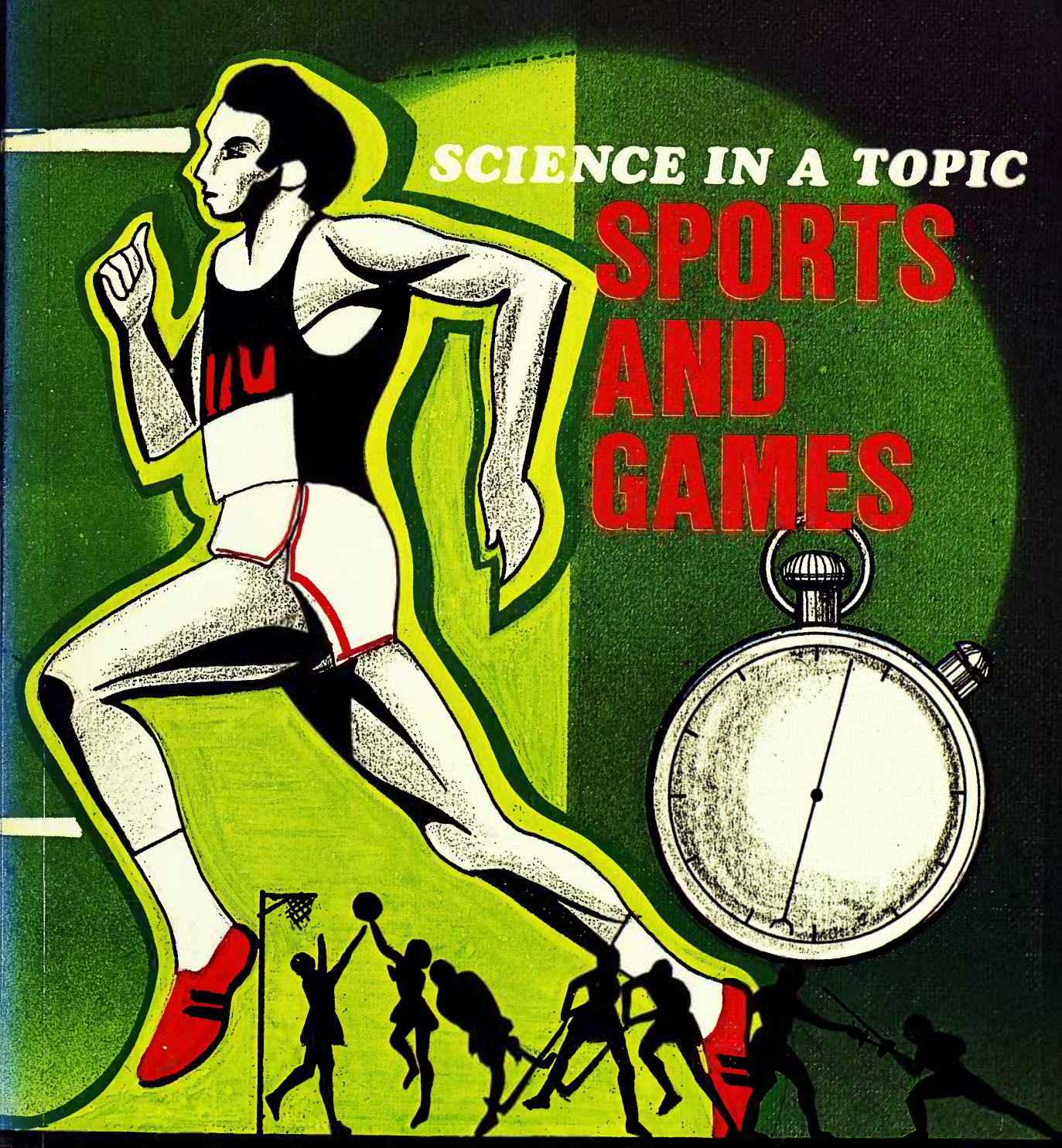
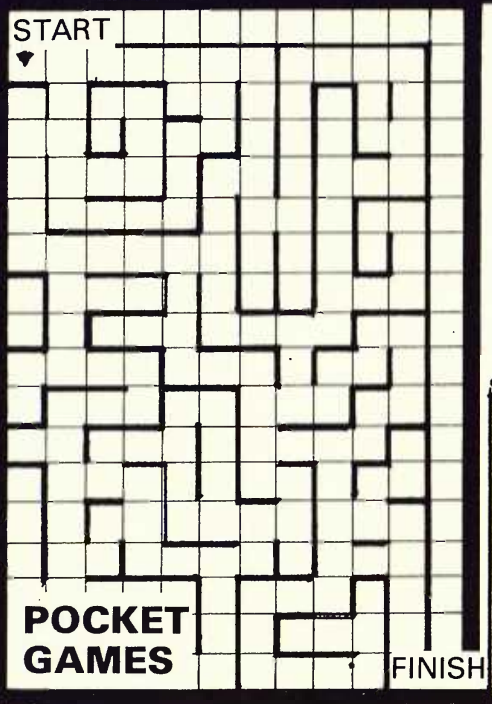
SCIENCE IN A TOPIC

SPORTS AND GAMES



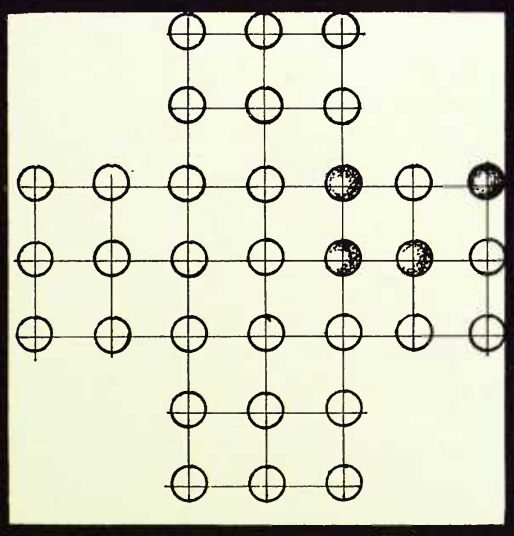
Doug Kincaid
Peter S. Coles

HULTON



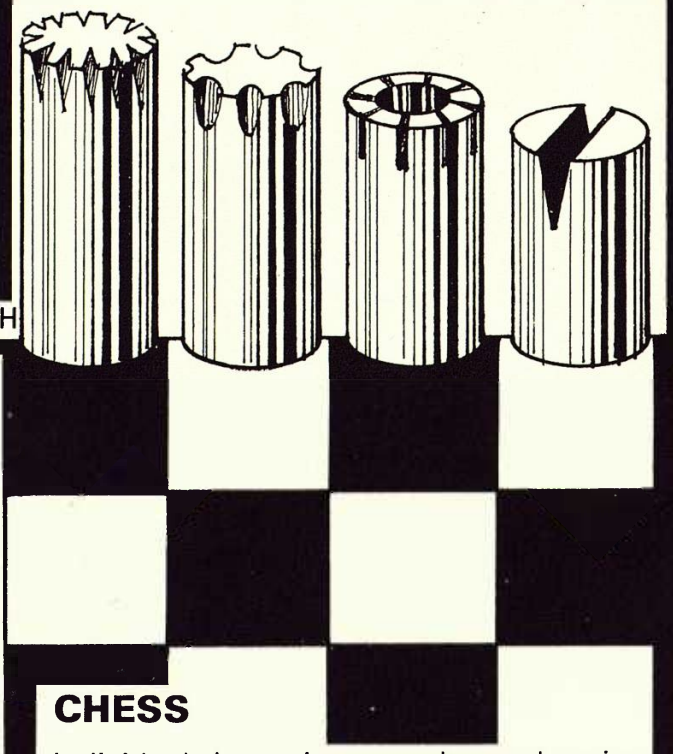
POCKET GAMES

Design and make a pocket game.
On a piece of squared paper design a maze.
Paste the finished design on to a piece of hardboard cut to the same size.
Build up the walls with thin strips of balsa wood.
A small ball bearing or bead may be used to run through the maze.
A piece of clear plastic can be used to enclose your pocket game.



MAKING YOUR OWN GAMES

You can design and make your own games. Here are some games which are quite easy to make for yourself.
Some suggestions here may help you to think of other ideas.

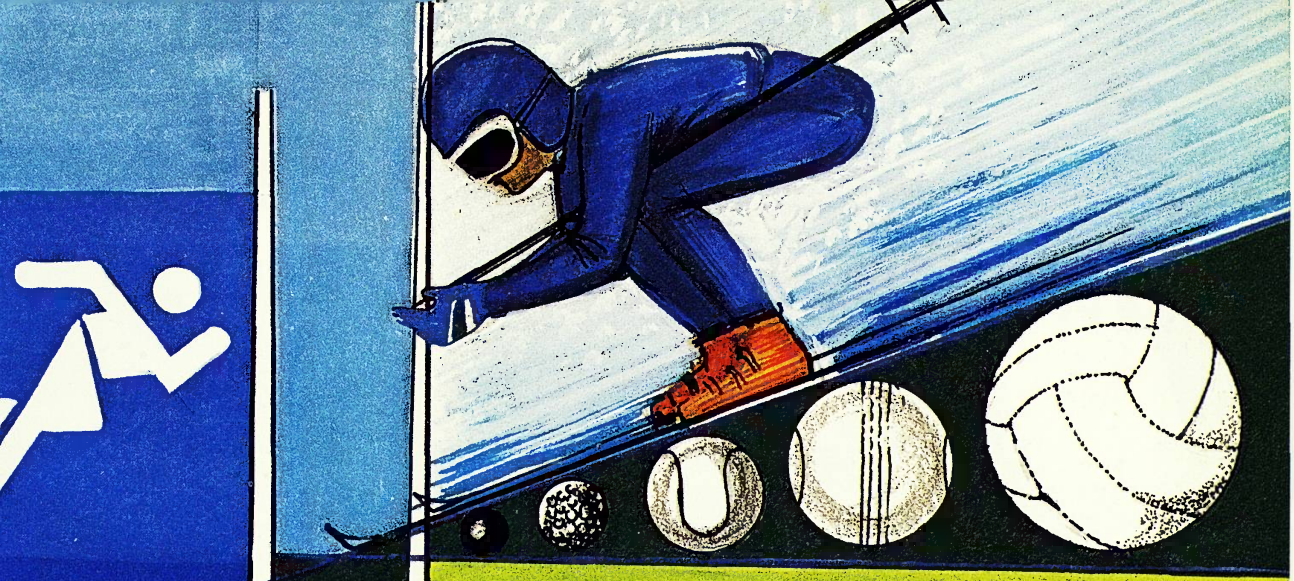


CHESS

Individual chess pieces can be made using dowel rod.
The different pieces can be sculptured using a drill, saw, and files of assorted shapes.
A chess board can be made from squares of black and white card stuck on to a base board.

CONCENTRATION

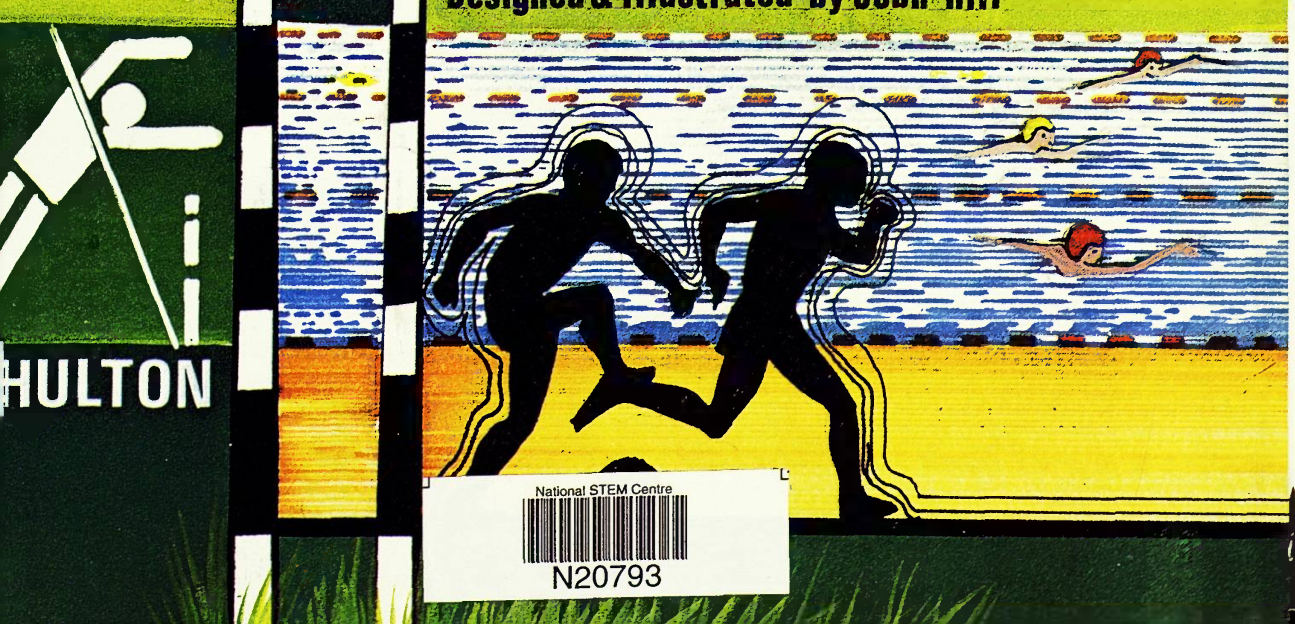
Mark out a piece of wood like this for the base.
With a counter-sink drill make holes large enough to hold a marble.
You will need 32 marbles.
The object of the game is to 'jump' over and 'take' as in the game of draughts. Try to continue until only one marble is left.



Science in a Topic

SPORTS AND GAMES

Doug Kincaid
Peter S. Coles
Designed & Illustrated by John Hill



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Science in a Topic
SPORTS AND GAMES

About this book

This book is different from most others because:

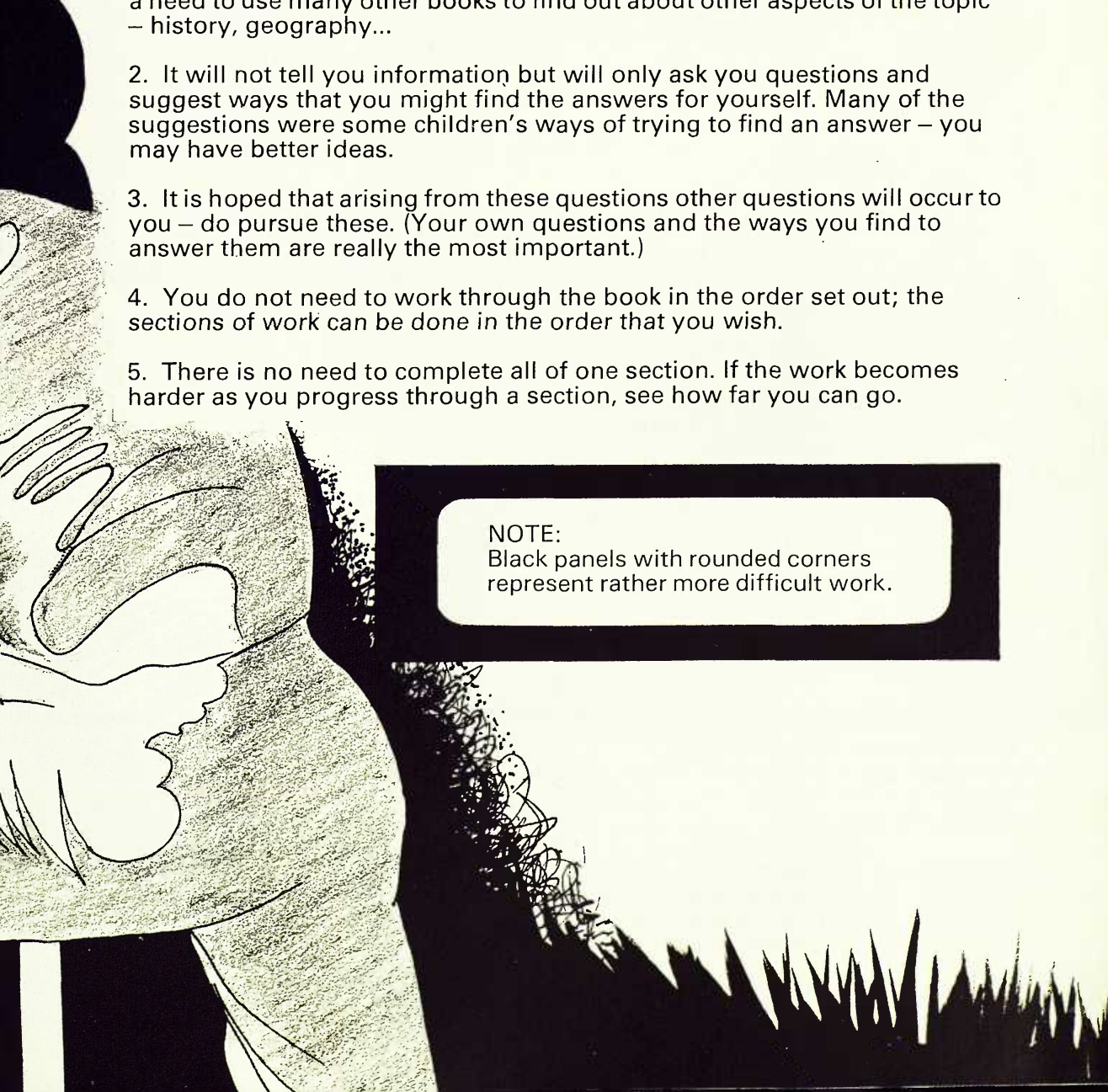
1. It is not complete, but only part of a study – the science part. There will be a need to use many other books to find out about other aspects of the topic – history, geography...

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.

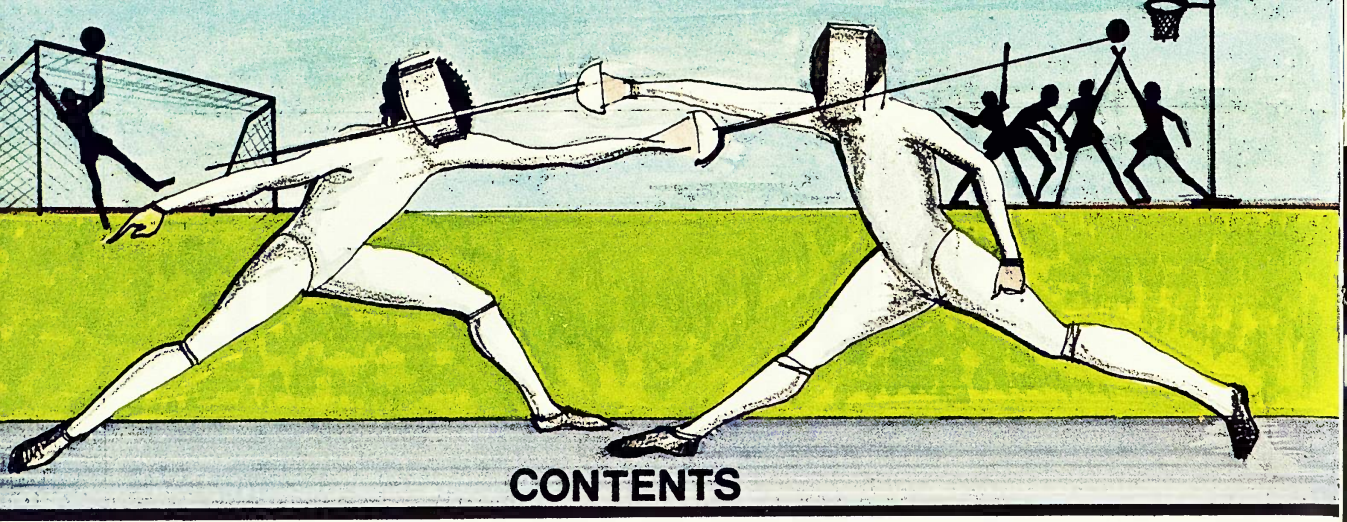
3. It is hoped that arising from these questions other questions will occur to you – do pursue these. (Your own questions and the ways you find to answer them are really the most important.)

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.



NOTE:
Black panels with rounded corners represent rather more difficult work.



CONTENTS

SCIENCE IN A TOPIC SERIES

by Doug Kincaid, County Staff Advisory Teacher, Science, Buckinghamshire, Team Member Schools Council 'Learning Through Science' Project. Peter S. Coles, B.Sc., Chief Adviser, Berkshire.

Other Titles: Ships, Houses and Homes, Clothes and Costume, Communication, Food, Moving on Land, Roads, Bridges and Tunnels, In the Air

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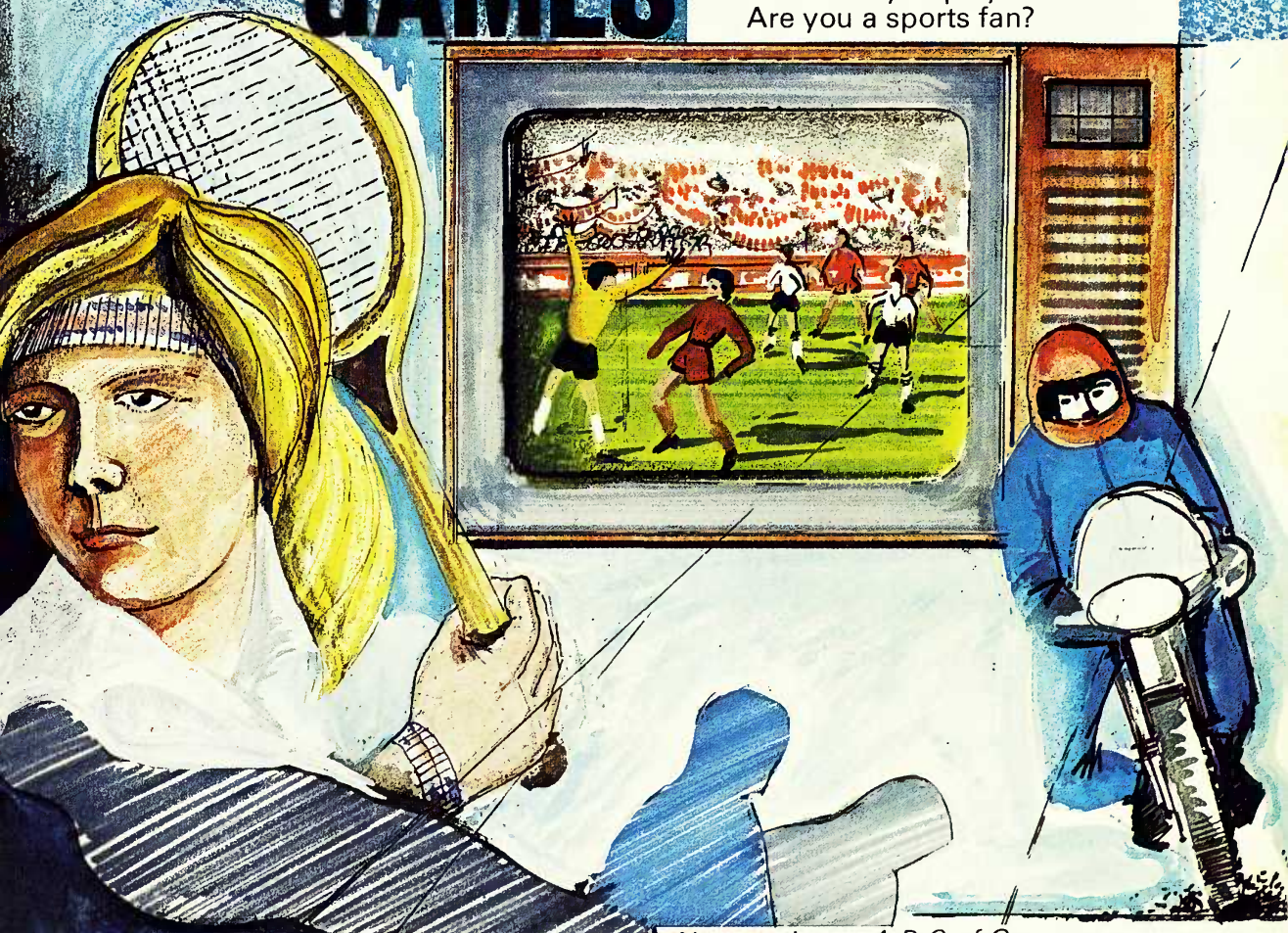
SPORTS AND GAMES

Think of as many sports as you can.

Name the team games.
Name sports where only two compete.
Name sports on wheels.
Name sports that use animals.
Which are the winter sports?
Which are the water sports?

What is your favourite game?
Which do you watch?
Which do you play?
Are you a sports fan?



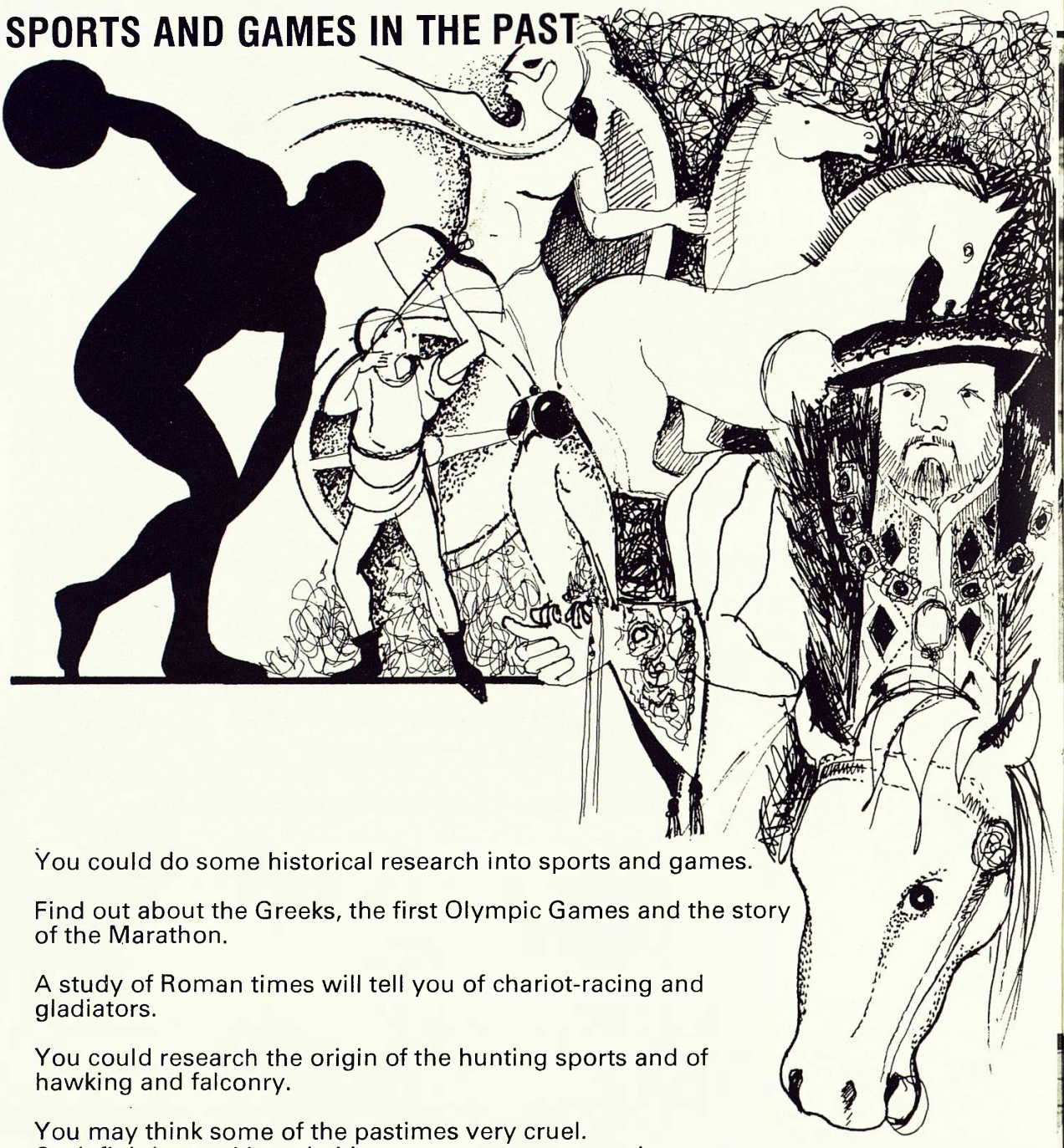
SECTION ONE

Now make an *A B C of Games*
List as many of these as you can under each letter, e.g.

A – Athletics Archery Aikido Autocross Angling
B – Bridge Billiards Backgammon Badminton Baseball Bowls Boxing

XYZ – Yacht Racing

SPORTS AND GAMES IN THE PAST



You could do some historical research into sports and games.

Find out about the Greeks, the first Olympic Games and the story of the Marathon.

A study of Roman times will tell you of chariot-racing and gladiators.

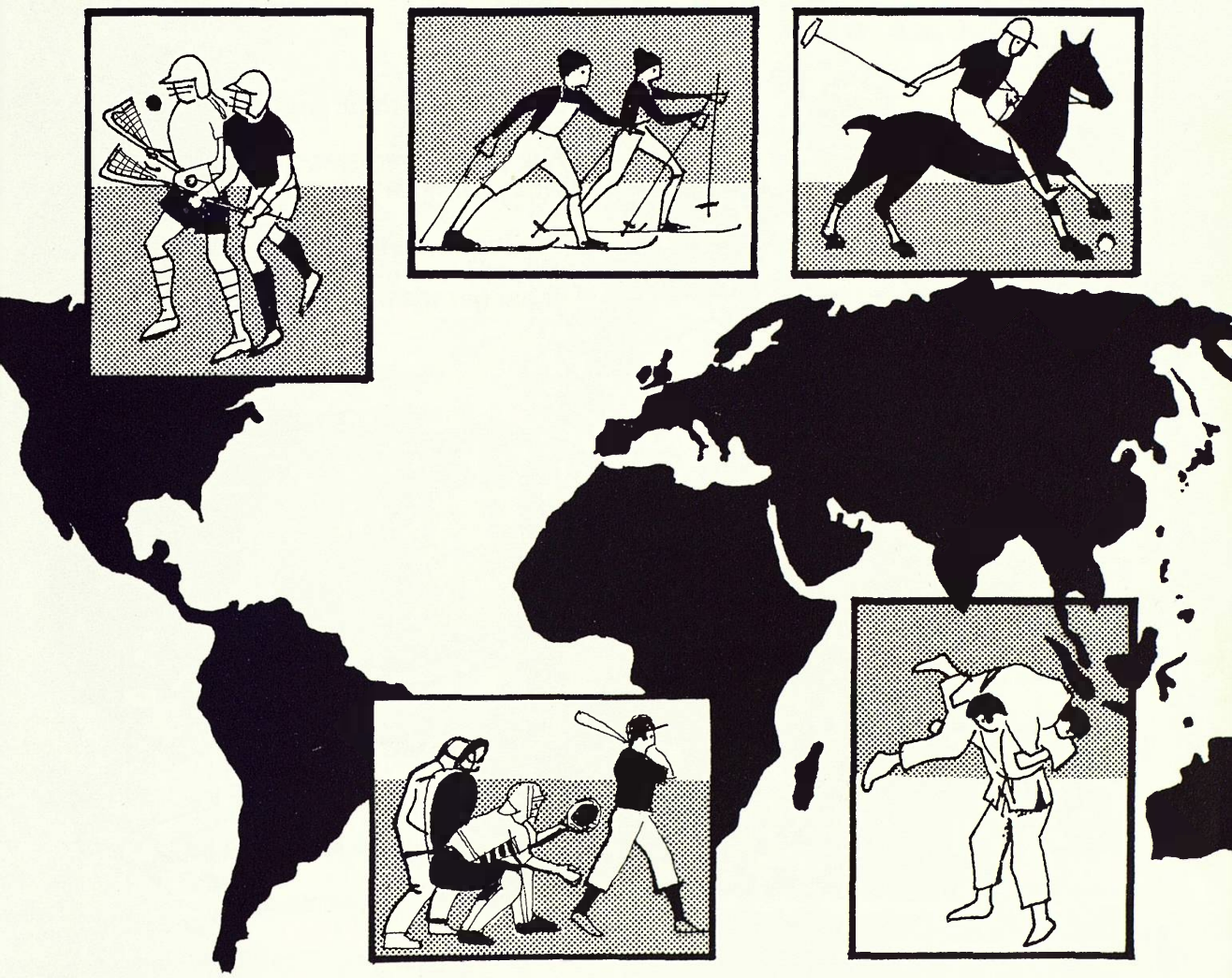
You could research the origin of the hunting sports and of hawking and falconry.

You may think some of the pastimes very cruel.
Cock-fighting and bear-baiting were once very popular sports.
Discuss 'blood sports'.
What does your group think about fox-hunting, fishing, hare-coursing and bullfighting?

Trace the story of one sport.
Find out when and where it started.
What changes have taken place in the equipment and the dress worn by the players?
Find out how the rules have changed with time.

SPORTS AND GAMES IN OTHER LANDS

Many countries have national sports and games.
Match the national sports to a world map.
Many games have spread to other parts of the world.
Where were the games in the pictures on this page first played?



Weather and climate can affect the games that are played.
Why is cricket played in England only during the summer?
Why is December all right for cricket in Australia?
Why can major skiing events only take place in certain countries?

How do your games and pastimes change with the seasons?
Do you have a season for:

- –marbles
- –five stones
- –sliding
- –skipping
- –conkers?

Can you find reasons why these games start when they do?

SURVEYS ON SPORTS AND GAMES

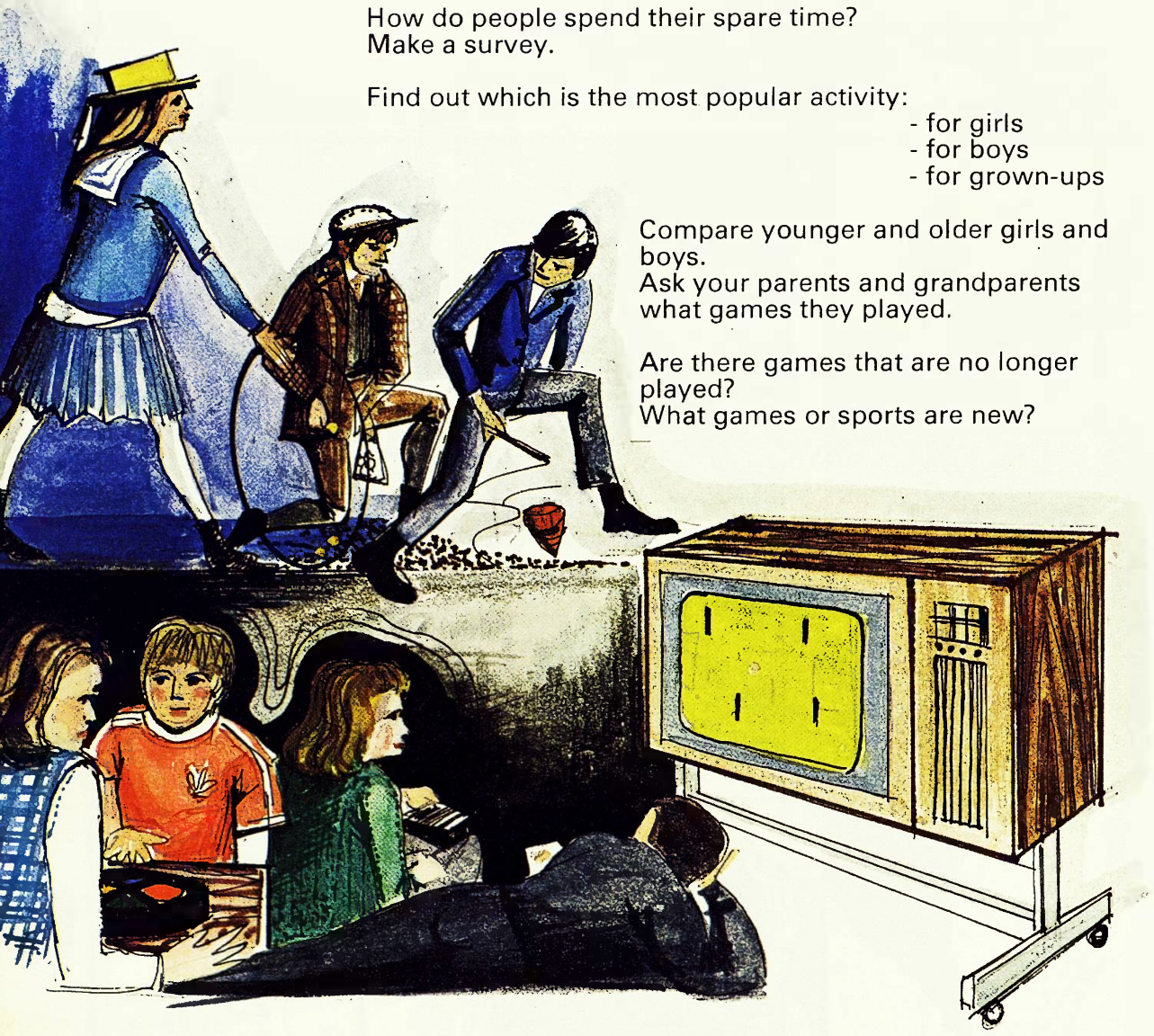
How do people spend their spare time?
Make a survey.

Find out which is the most popular activity:

- for girls
- for boys
- for grown-ups

Compare younger and older girls and boys.
Ask your parents and grandparents what games they played.

Are there games that are no longer played?
What games or sports are new?



What are your local sports facilities?
Where are they?
Make a map of your area.
Mark where these facilities are, e.g.
swimming pool, sports centre, tennis courts, athletics track, playing fields, golf course, riding school, skating rink...
What other sports facilities would you like?
Where would you site them?
Why?

BALLS AND BALL GAMES

Name the games that use these balls.

Find out all you can about these ball games.

Tennis
Real tennis
Pelota
Croquet
Polo
Bowls
Squash
Billiards
Rugby
Lacrosse
Soccer

Which of the games have famous players? Name them.
All these games use a ball.
What else is needed to play?
Where are the games played?
What special name is given to the playing area?
When and where were they first played?

Make a collection of balls.

Include balls of different games

– of different sizes

– of different makes

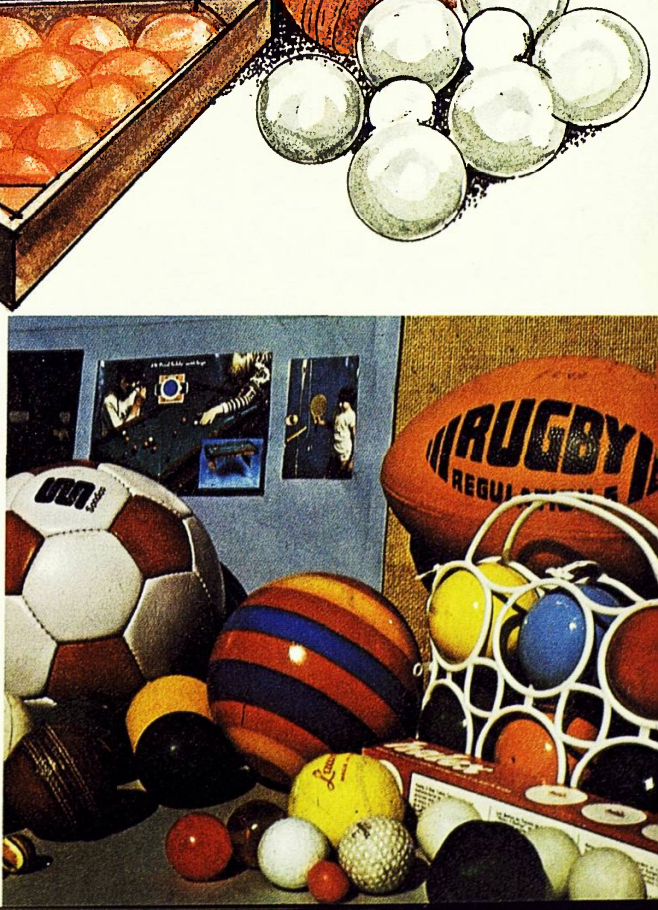
– of different materials

– of different prices

– hollow balls and solid balls.

This will make an interesting collection.

You will also need it for experiments.



SECTION TWO

BOUNCING BALLS

Use your ball collection.

Which balls bounce best?

Guess before you start your tests.

Say what you think will happen.

Arrange the balls in order. Number them from best to worst.

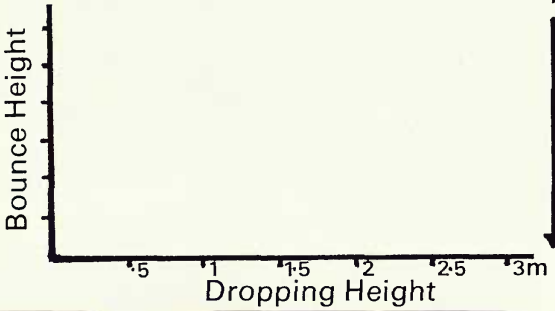
Now test them.

Make your test fair. Think about the *dropping height*.

Ball	Bouncing Height

The bounce height may be difficult to measure.
Scientists often find that they need to take more than one reading.

Look for a pattern. A graph may help.
Plot your results.



Does the dropping height change the bounce height?

Ball	Dropping Height	Bouncing Height
	$\frac{1}{2}$m	
	1m	
	2m	

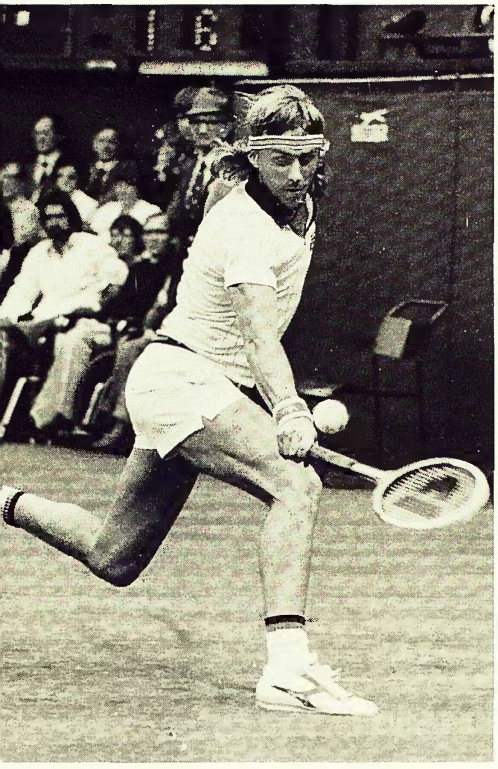
The higher you raise a ball the more **energy** you give it.
This energy is called **potential energy**.
Potential energy in this case is energy stored because of the height above the ground.

Calculate the **potential energy** you gave the ball at different heights.

1 Find its weight. (Use a force meter.)
2 Lift the ball from the ground.

Its **potential energy** is:
distance lifted (in metres) × **force used** (in newtons) = **energy** (in joules)

BOUNCING BALLS



Drop the balls on to different surfaces.

Does this change the pattern?

Ball	Surface	Bounce Height
	concrete	
	wood floor	
	grass	
	P.E. mat	
	carpet	

How do balls bounce?

1 Rub some chalk on the floor.

2 Place a rubber ball on the chalk. Look at the mark.

3 Bounce the ball on the chalk.

4 What do you see on the ball?

Does this help to explain bounce?

A surface can help bounce.

Try a ball of plasticine on some foam rubber or plastic.

What happens?

THROWING AND CATCHING

Throwing and catching are important skills in ball games.

Do some ball-catching experiments.
(You could do some of this during your P.E. lessons.)

Stand two people 5m apart.
Throw a ball to each other:
- catch with both hands
- catch with the right hand
- catch with the left hand.

Record the catches and drops for ten tries.

Name	Both hands	Right hand	Left hand
	✓✓✓✓✓✓✓✗✓	✓✗✓✓✓✗✗✗✓✗	✗✓✗✓✗✗✗✓✗✓

Try with different pairs:
- two boys
- two girls
- two right-handers
- two left-handers
- two young children
- two older people.

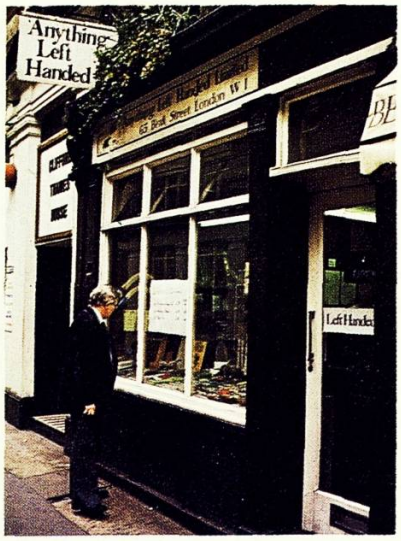
Would you expect the results to show any patterns?

Do you find the pattern you expect? (You will need to test more than one of each pair to make sure.)

Extend your experiments.
Does the kind of ball make any difference to the results?

Try:
- a cricket ball
- a large plastic ball
- an airflow plastic ball
- a small ball (golf or table tennis)
- a solid rubber ball
- a quoit or bean bag.

LEFT HAND, RIGHT HAND



Look at your results.

How did the right-handed people get on using their left hand?

How did the left-handed people get on using their right hand?

Try some other tests using each hand.

1 Throw bean bags into a bucket from 5m.

2 Write a sentence with each hand.
Compare the writing.

3 Use a bat and ball.
Keep the ball in the air using each hand.

When can it be an advantage to be left-handed?

Is it ever a disadvantage?

Are there things made that are not suitable for left-handers?
Think about tools, scissors, etc.

How many in your school are left-handed?

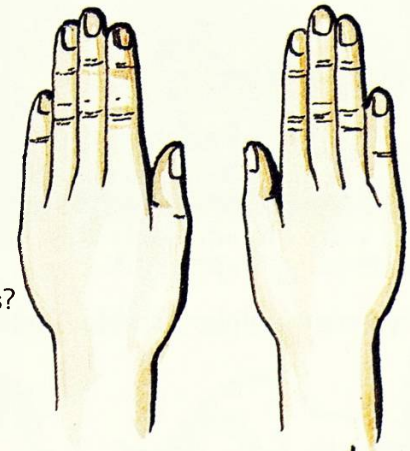
What fraction is this of the whole school?

Collect information about sports stars.

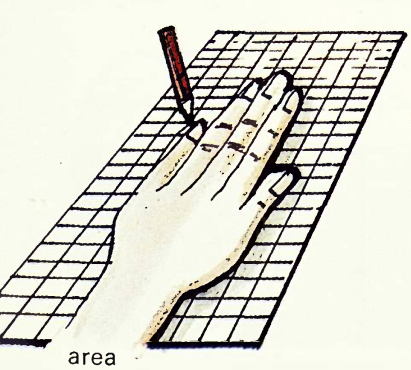
Is the fraction similar?

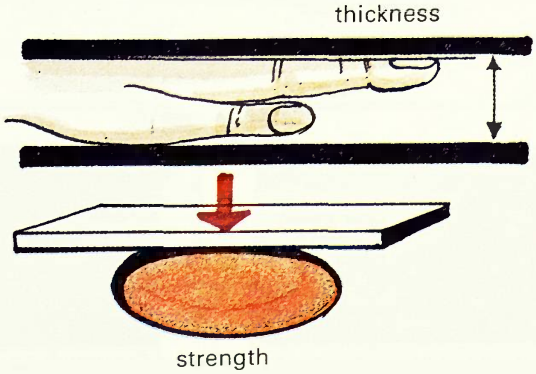
Is there a difference between a person's two hands?

Is the hand which is mostly used:
- bigger
- thicker
- stronger?

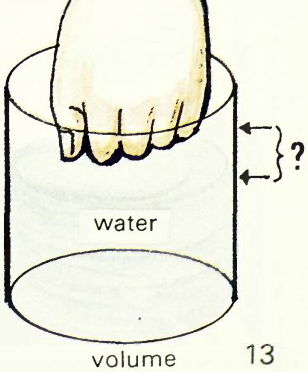


Here are some ways of measuring hands.


area



strength



volume

HIT AND MISS – COLLISIONS

The billiards or snooker player aims to make one ball hit others.

Sometimes a player uses a bounce from the side 'cushion'.

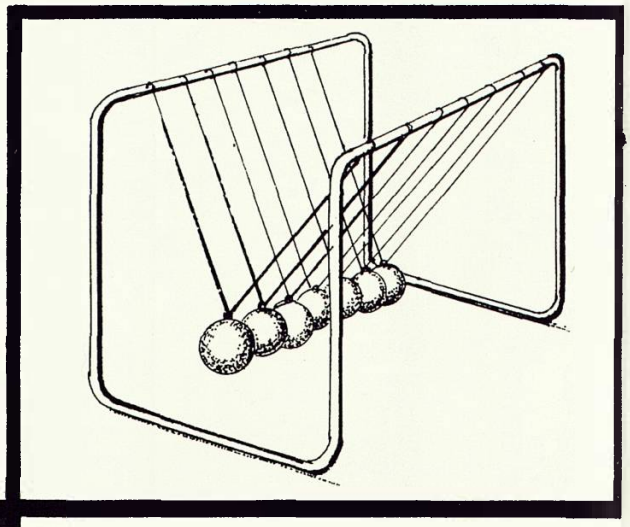
The squash player also uses rebounds.

The golfer aims to hit the ball a long way.

The croquet player tries to make collisions.

Learn about energy patterns during collisions.

Here is a scientific toy.
It is called a 'Newton's Cradle'.



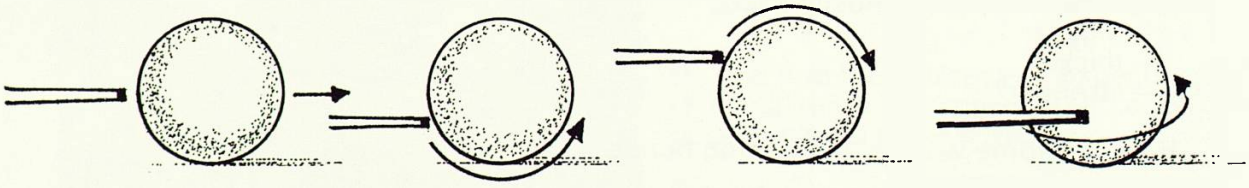
This group made their own.

They used marbles and a curtain rail.

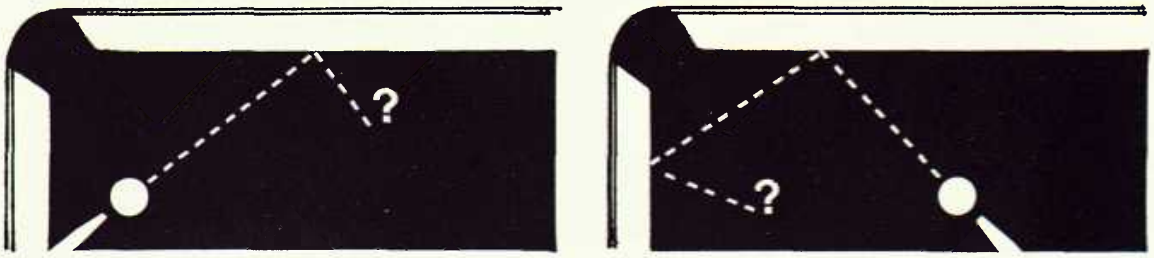
You could do this.
First take one ball to the top.
Observe what happens on collision.
Repeat with 2 - 3 - 4 balls which you let go from the top.

The work on page 10 is about potential energy. This may help you understand these collision patterns.

Try to use a billiards table. You could investigate cueing the ball in different ways.



You could also investigate rebound angles.



ROLLING BALLS

In some games the players have to roll the balls.

The bowls player tries to roll the *wood* as near the *jack* as possible.

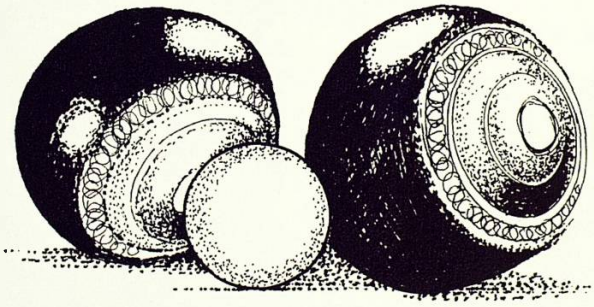
The billiards and snooker player *cues* the ball to *cannon* and to *pot.*

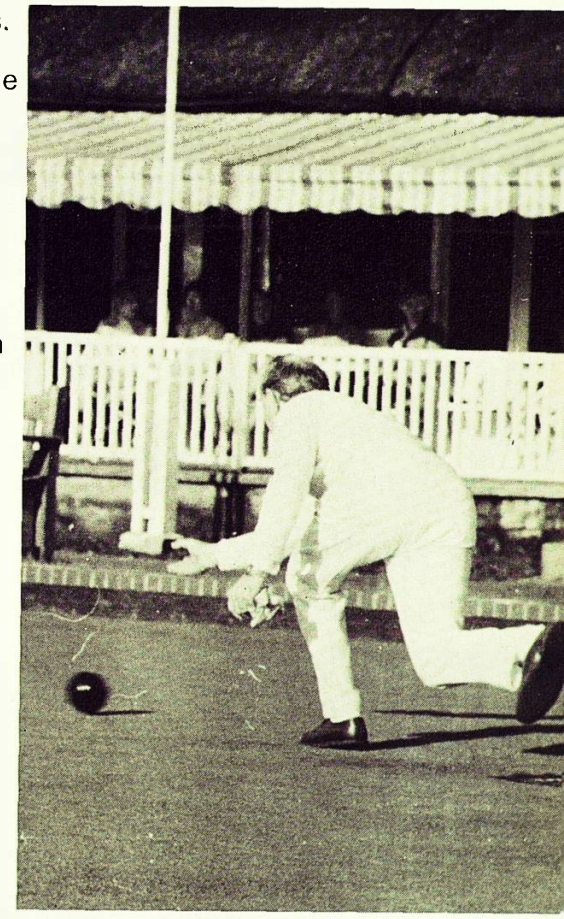
The golfer putts the ball over a smooth green to *hole* in as small a number of hits as possible.

The ten-pin bowler rolls the bowl to knock down the skittles.

For smooth, true rolling, the surface must be smooth and level. The ball must be round.

Rolling balls can be made to swerve.
It can be because the ball is *biased.*





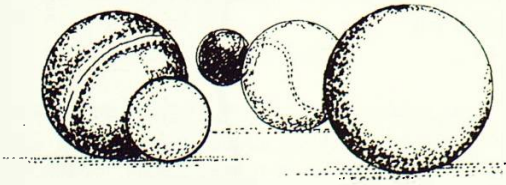
The ball can also be hit in ways that will make it swerve. (See page 27.)

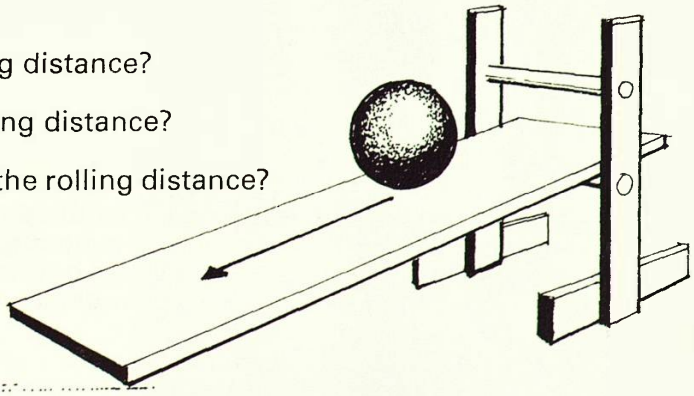
Experiment with rolling balls.
Test and compare.

How does the size change the rolling distance?

How does the mass change the rolling distance?

How does the starting *force* change the rolling distance?





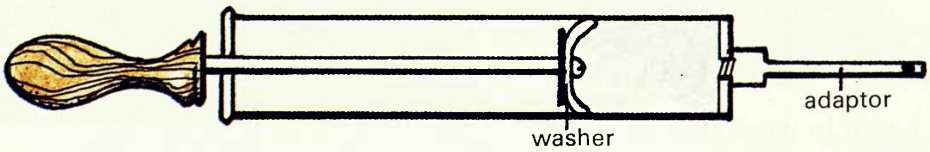
Bali	Size	Mass	Start height	Distance rolled

THE INFLATED BALL

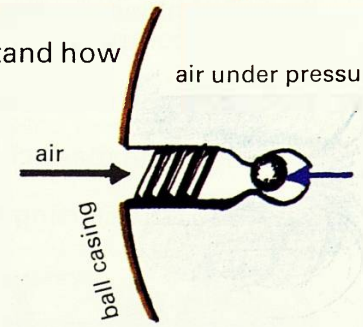
Several games are played with an inflated ball.

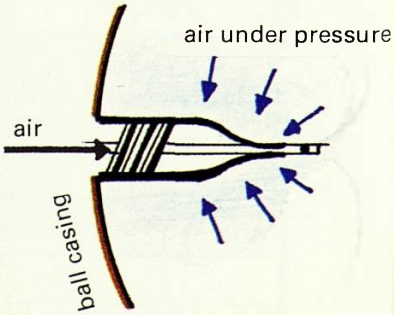
Two scientific ideas are used in blowing up a ball.
One is a pump. The other is a valve.

Take a pump to pieces and find out how it works.

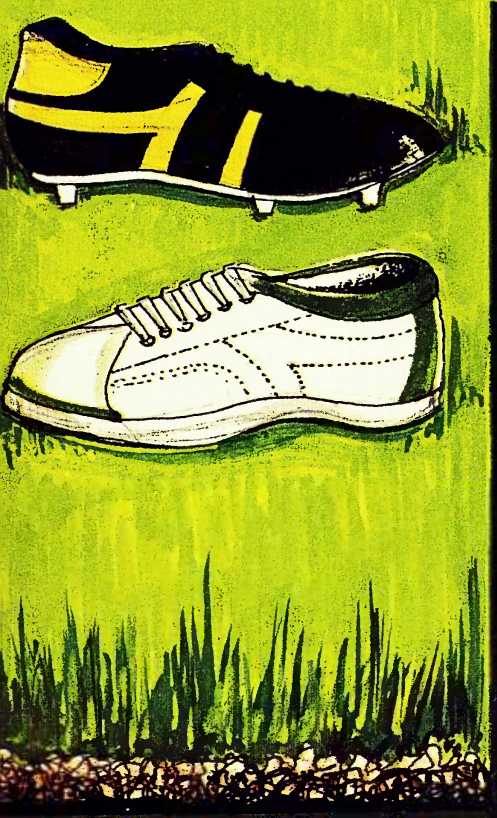


These drawings of valves will help you understand how they work.





The air in the football is pushed in by the pump. When it is squashed up in this way it is called compressed air.
How does this compressed air affect bounce?
Start with a flat ball (a football or netball).
Inflate it ten pumpfuls at a time.
Test the bounce after each ten pumps.
Drop the ball from 2m. (Page 10 will help you test scientifically.)
How does compressed air affect roll?



PITCHES AND PLAYERS

Football, rugby, netball and basketball are all team games.
The players use kicking, throwing and handling skills.
Some games allow the ball to be handled. Some allow kicking. Some allow both.
What is allowed by the rules of each game?
How many players make a team?
What is the size and shape of the ball used in each game?
What special dress do the players wear?

SECTION THREE

What is the size of the pitch?
How is it marked out?
Draw scale diagrams of the pitches.

It is easy to draw a right angle on a small-scale drawing.
The lines of full-sized pitches must also be at right angles.
How can these be set out?

This group had learned about the Ancient Egyptians. They knew how to set out large-scale right angles. They used a special sized triangle.
You try this.
Use a rope or a long tape measure. Make the sides 3m, 4m and 5m.
Use this triangle to check your own school pitches.

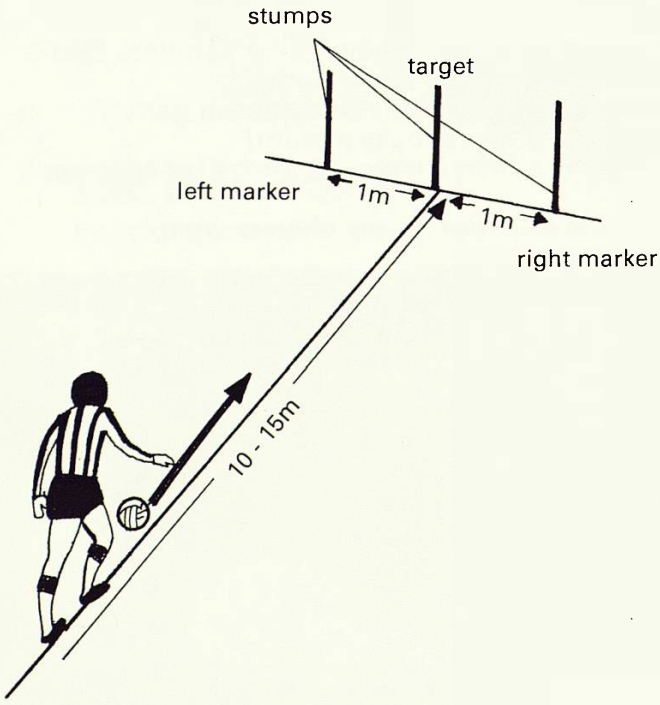
FOOTBALL SKILLS

How is your school team chosen?

Perhaps you could help, even if you are not keen on football.

Can a scientifically thought-out test help?

Here is what one group thought out to test shooting skill.



Each player has ten place kicks:

10 points for a hit on target.

5 points for a near miss.

2 points for hitting right or left marker.

0 points if the ball goes outside or does not reach.

Before you start, predict what you think the scores will be.
Record the points each player scores.

Test:
- the school first eleven football team
- the school second eleven football team
- a younger age group
- eleven who feel that football is not their game.

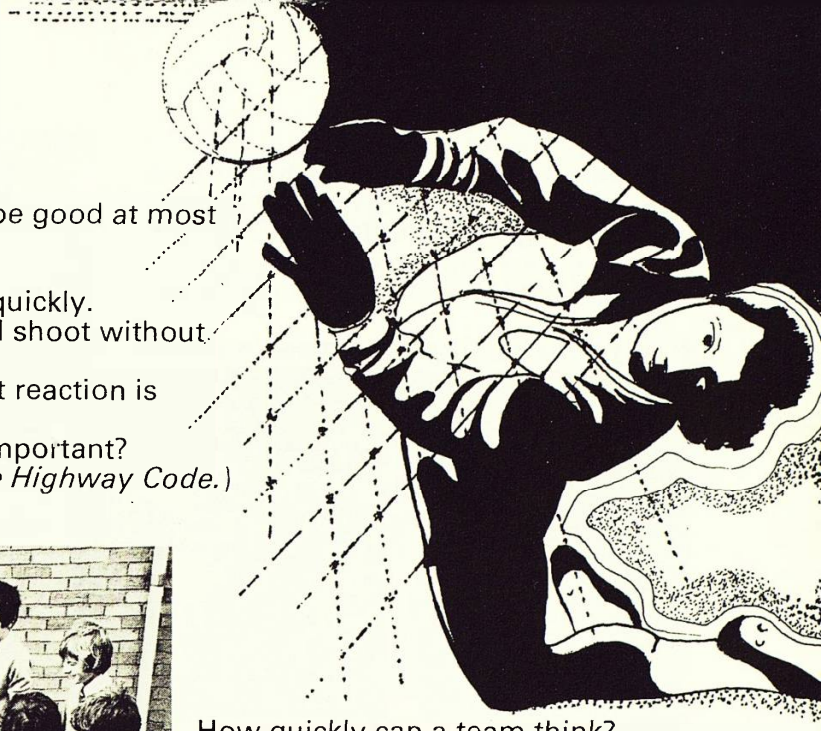
Use a chart or graph to show the results.

Shooting is not the only skill a footballer needs.
Can you think out tests for:

- dribbling
- passing
- heading
- trapping
- goalkeeping

This picture shows an idea used in one school.

SHOTS AND SAVES



You need to think quickly to be good at most sports.
You need to act quickly.
A goalkeeper needs to react quickly.
A striker also has to think and shoot without delay.
Name other sports where fast reaction is important.
Where else is reaction time important?
(Clue: Look at the back of *The Highway Code.*)

How quickly can a team think?
Try this experiment.

Let the team join hands in a circle.

How fast can a squeeze be passed round?

They could face inward, or they could face outward.

Which way is faster?

One way uses only one sense.

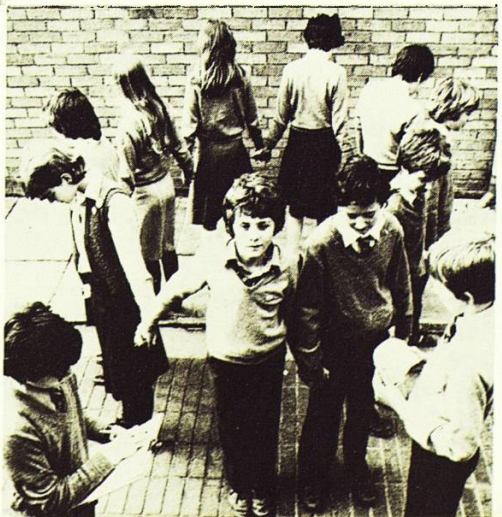
Two senses can be used in the other way.

Which way is the better experiment to test the reaction to the squeeze?

Does the team improve with practice?
Record the times for ten goes.
Which is their fastest time?
What is their *average* time for the ten goes?

Try other teams and compare:
- first elevens and second elevens
- girls' teams and boys' teams
- a team of older people and a team of young people

Can you find one person's reaction time from *this* experiment?



QUICK THINKING

The team experiment used touch.

Invent an experiment that uses sight.

Here is a way to do this.

Now try measuring one person's reaction time.

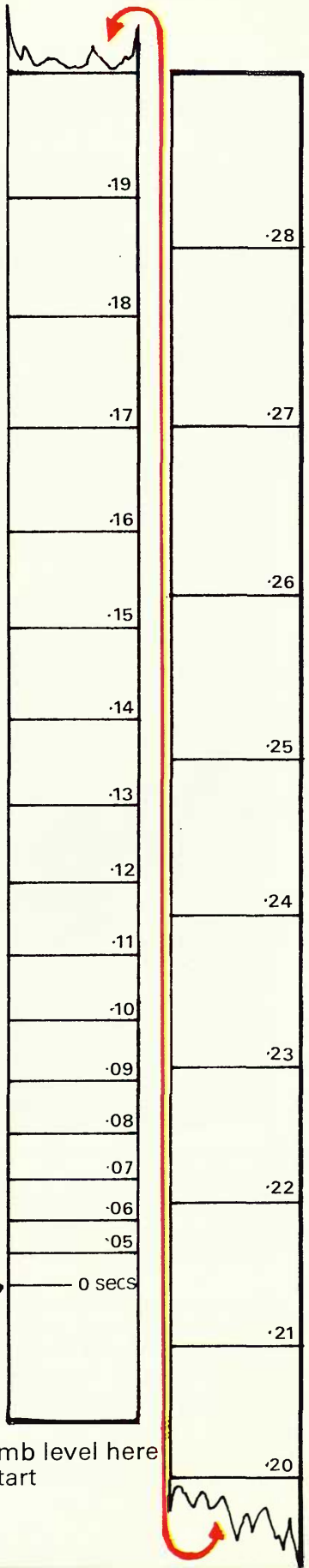
Will once be a fair test?

Which of you has the fastest reaction time?
Compare this with the team's average.

Compare times for seeing and feeling:
(a) when you see the 'stick'
(b) when the person is blindfold and the 'stick' rests gently against a finger.

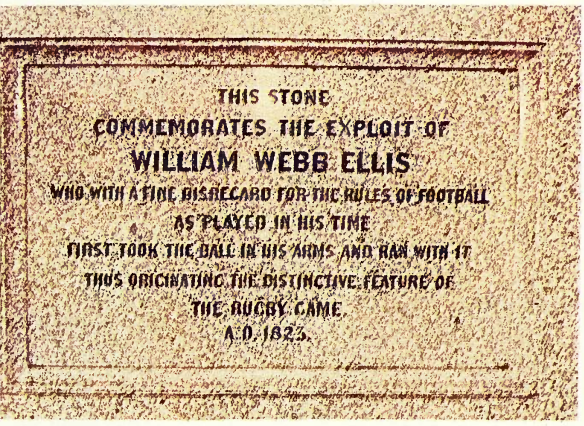
Does the time when the test is done make a difference?
Test first thing in the morning. Test again before and after lunch. Test at the end of the day.
Are we faster at different times of the day?

So that you can make your own 'reaction measuring stick' the markings are printed on the edge of the page.
This will measure in hundredths of a second.



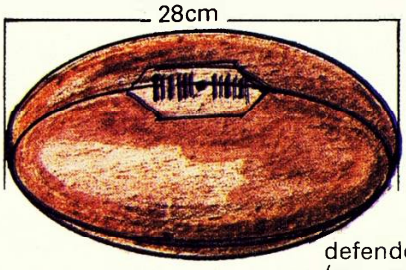
Thumb level here to start

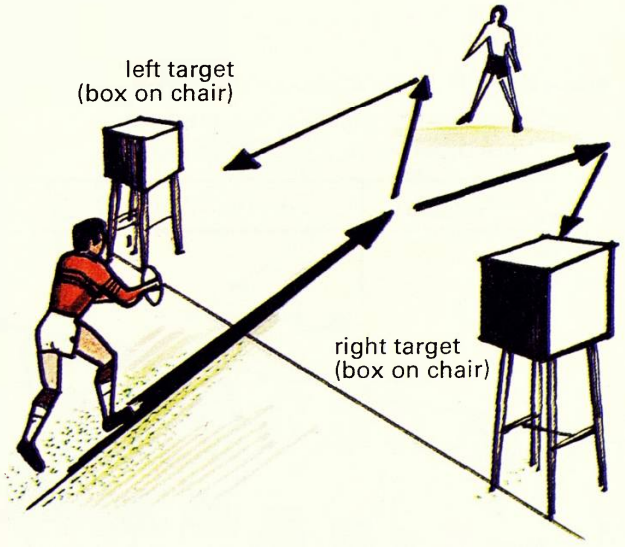
RUGBY



In 1823 the rules were broken during a football match at Rugby School. A boy named William Webb Ellis picked up the ball and ran with it.
This plaque records how rugby football started.

The new game needed a different ball. So the first rugby ball was made at Rugby.
A modern ball has this shape and size.

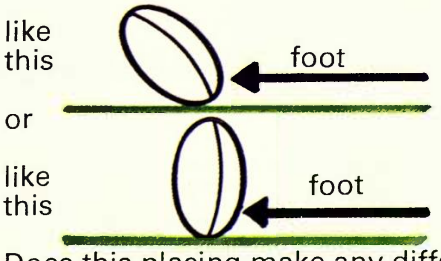




In rugby you pass the ball.
It must not be passed forward.
Try these experiments:
1 use a rugby ball
2 use a soccer ball.
Run with the ball.
Swerve to the left of the defender.
Pass the ball left and back to hit the target.
Try again, swerve right and pass back to hit the target.
Try with each of the balls.
Record hits, near-misses and misses.
Award points for each.
In which direction do you pass more accurately?
Is the rugby ball better for passing?

In rugby the ball can be kicked forward.
Try these experiments:
1 use a rugby ball
2 use a soccer ball.

Which ball can you kick further?
A rugby ball can be placed –

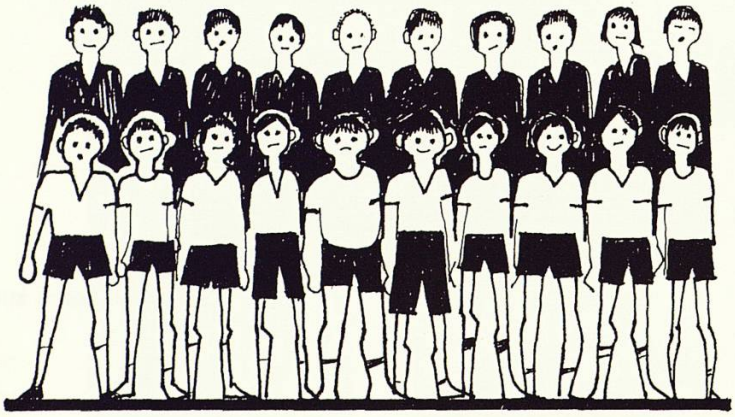


Does this placing make any difference?
Kick each.
Compare distance and direction.

NETBALL AND BASKETBALL – SHAPE AND SIZE IN SPORT

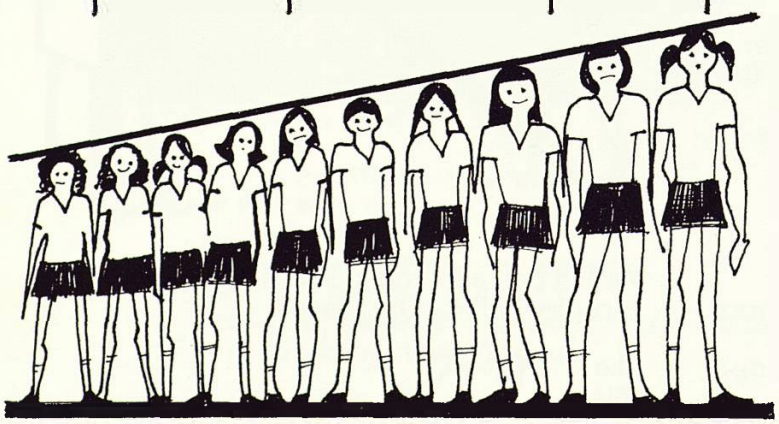
How do shape and size help us in some sports?
Is it an advantage to be tall when playing netball or basketball?
Do tall players make better shooters?

Choose ten tall players and ten short players.



Let them have ten shots each.
Record the score for each team.

Name	Tall or Short	Score



Now grade ten players by size.

Let these have ten shots each.
Record their scores.

Name	Height	Score

Does height mean more goals or baskets scored?

Find out more about shape and size in sport.

Collect pictures af sportsmen and sportswomen.
Make a display of players grouped by their sports.
Study their build.
Can you see any patterns?

Some suggestions:

- weightlifters and shot putters
- high jumpers
- basketball players
- jockeys
- boxers and wrestlers
- swimmers

KEEP OFF THE GRASS

'The match is cancelled owing to the bad condition of the pitch.'
'The goal area is just a bare mud patch!'

Why does a goal area become so bare?
Is it trampled on much more?

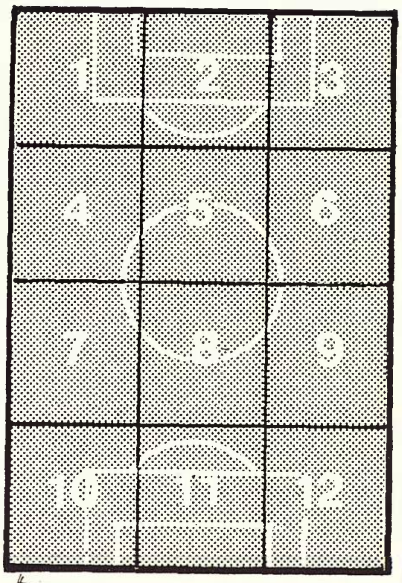
Check a match.
Record how many players are in each area.
Try to do this every two minutes.
If twelve friends do the recording, they could take one area each.
Is there any link between your numbers and the state of the pitch?

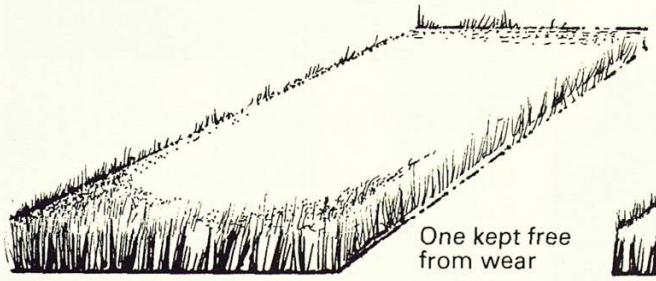
The grass of pitches, courts and greens is very important to the games.

What happens if we trample on grass?

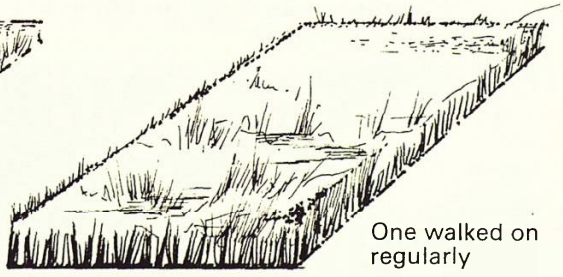
What happens if we take no notice?

Compare two grass strips.





One kept free from wear



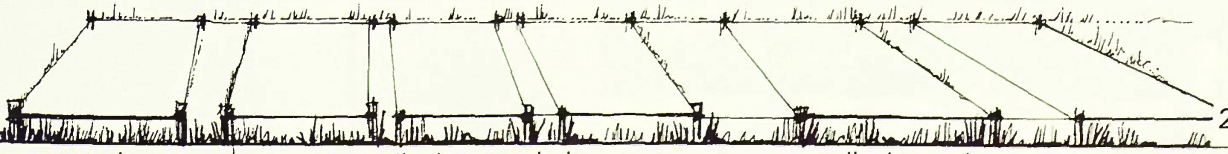
One walked on regularly

How much of each strip is bare?
Count the numbers and sorts of plants on each strip.
Measure the heights of the plants.

Check and record once a week.

You could set up some controlled experiments.
Test to find out:
- 1 if the kind of footwear makes any difference (football boots, day shoes, plimsolls, training shoes...)
- 2 if weather makes a difference.

You will need to rope off several strips to do such tests.



control
kept free from wear

walked on regularly
wearing different footwear

walked on only
when wet

walked on only
when dry

KEEP OFF THE GRASS

Why does trampling make bare patches?

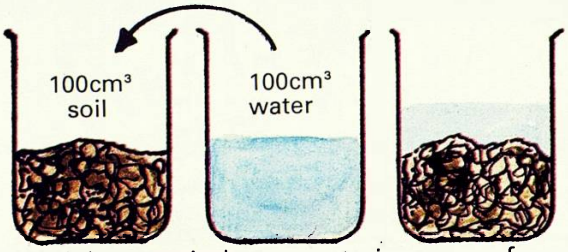
Why do the plants die?

Why don't they grow again?

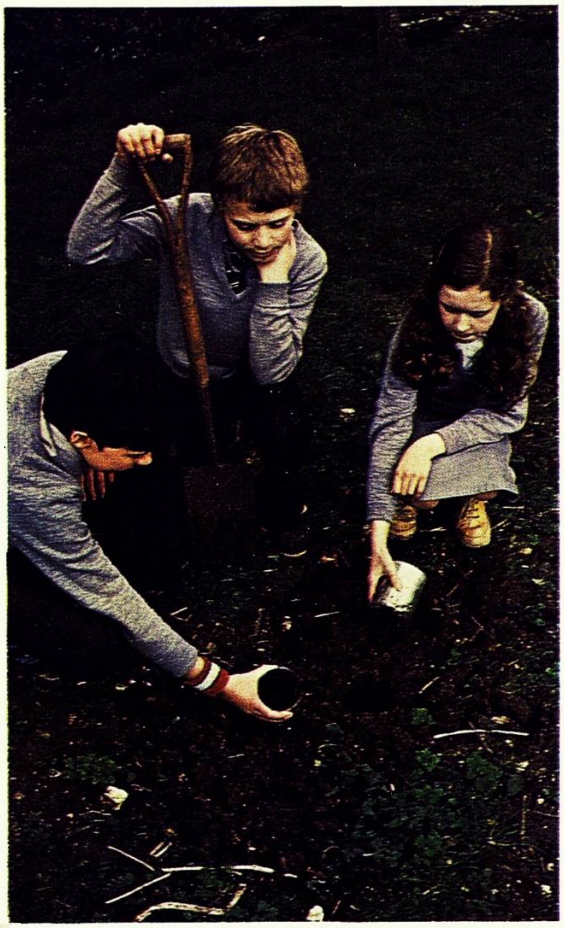
Is the soil different?

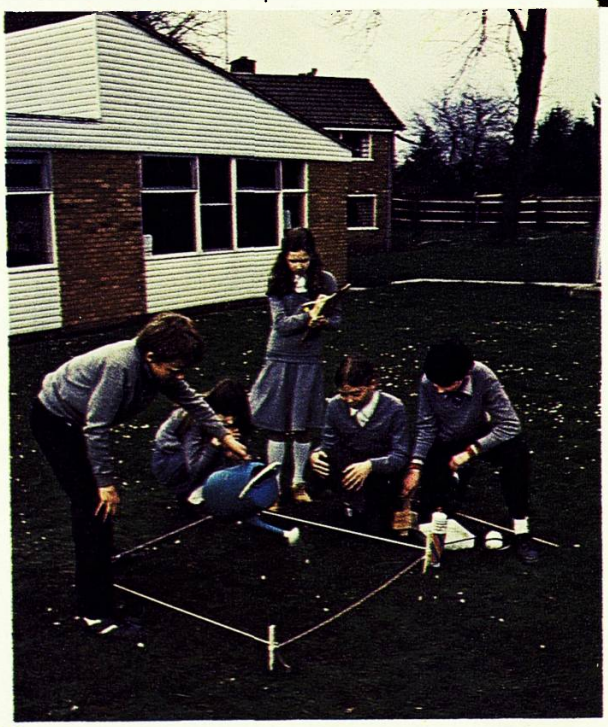
Perhaps some soil contains more air.
Test to find out.
Take samples of soil from:
- a flower bed
- a grass area
- a trampled area.

Try to take the soil without disturbing the sample.
A tin open at both ends will help.



Which sample has most air spaces for the water to fill up?





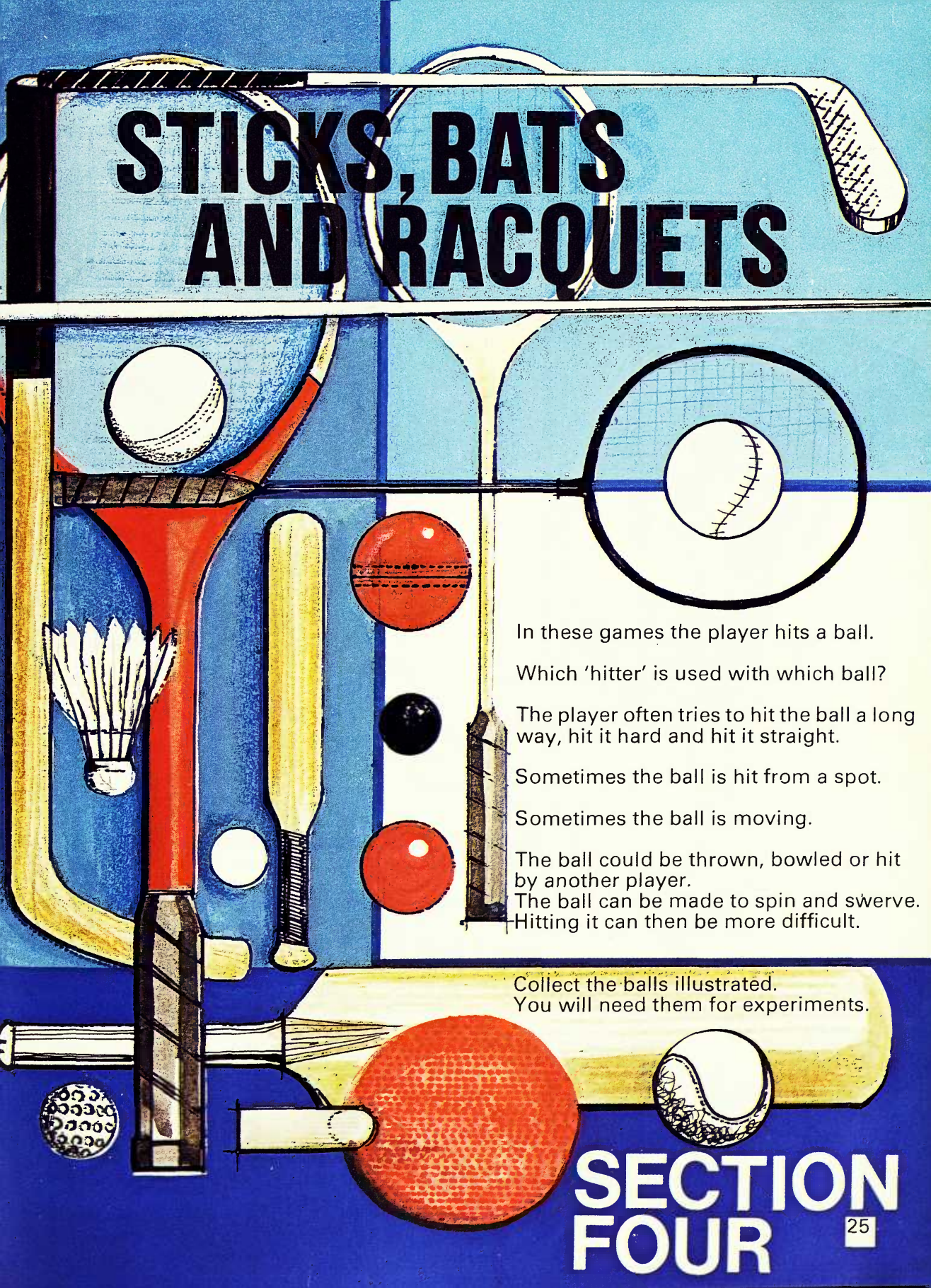
Which soil has most worms?

Mark out a square metre.
Pour on soapy water.
Count the number of worms that come to the surface.
Wash them in fresh water and return them to the soil.

Experiment with the recovery of a worn patch.
Fence this off.
What can be done to speed up recovery?
Some ideas you could try:
1 aerate the area with a fork
2 rake the surface
3 sow grass seed
4 use lime
5 use lawn fertiliser.

For any one test you will need two earth patches.
One should remain untreated as a control.

STICKS, BATS AND RACQUETS



In these games the player hits a ball.

Which 'hitter' is used with which ball?

The player often tries to hit the ball a long way, hit it hard and hit it straight.

Sometimes the ball is hit from a spot.

Sometimes the ball is moving.

The ball could be thrown, bowled or hit by another player.
The ball can be made to spin and swerve.
Hitting it can then be more difficult.

Collect the balls illustrated.
You will need them for experiments.

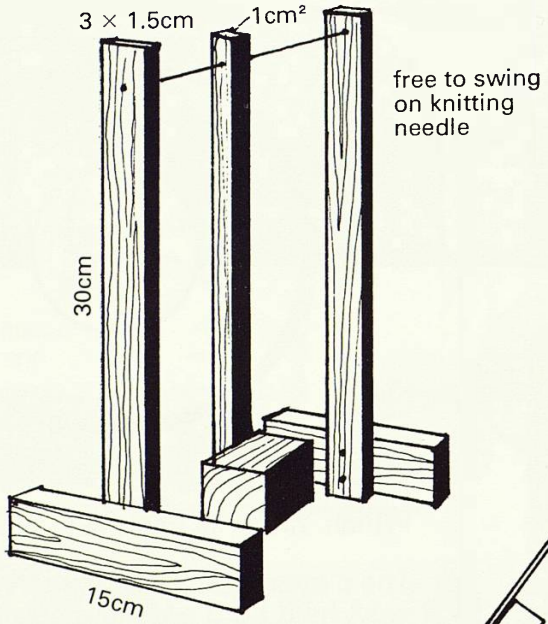
HITTING THE BALL

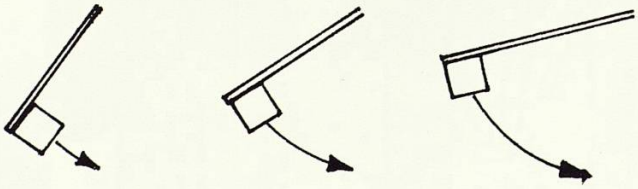
Cricketers, hockey players and golfers try to hit a ball.

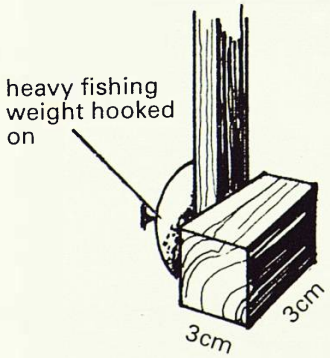
They often try to hit it a long way.

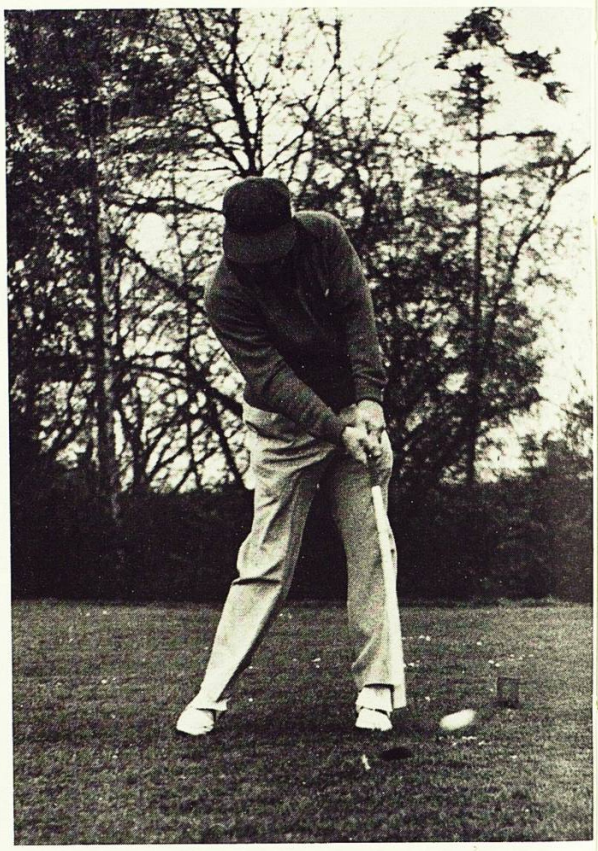
What do you think will affect how far it goes?

Make an experimental 'golf club'.





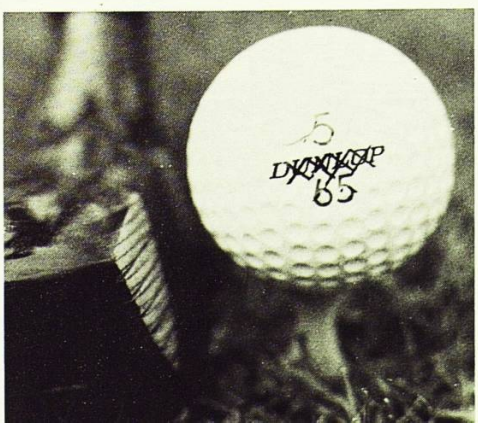




Does the speed of the club make a difference?

What happens if you use a heavier club?

Does the ball make a difference?
(Test golf balls, squash balls and table tennis balls.)



Golf ball manufacturers claim that their design of ball can add to the drive distance.

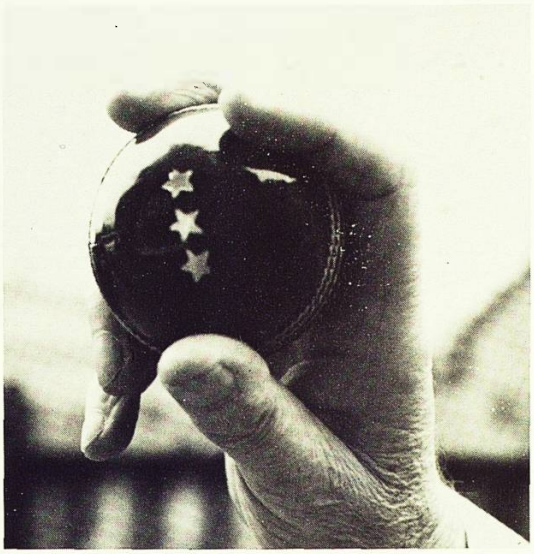
The dimples can affect the flight of the ball through the air. (See page 27.)

SWINGING AND SPINNING – CRICKET

An expert bowler can make a ball swerve in the air.

A bowler can spin a ball.

The seam of the ball and the way he holds it helps him to do this.



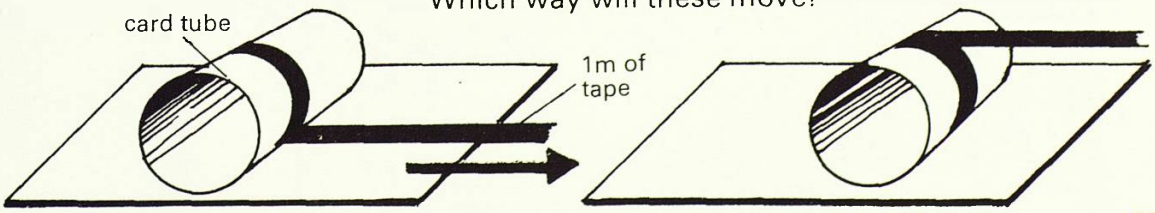
The fast bowler bowls.
Picture the air rushing past the ball.

A spinning ball makes a thin layer of air spin with it.

The air on top of the ball is moving faster than the air below. Fast-moving air has lower pressure.
The ball will move up.
(There is more about moving air and pressure in *Science in a Topic - In the Air* pages 7-9.)

Here is an experiment.
It will help to show how the faster air makes the ball move.
A tube is easier and safer to experiment with.

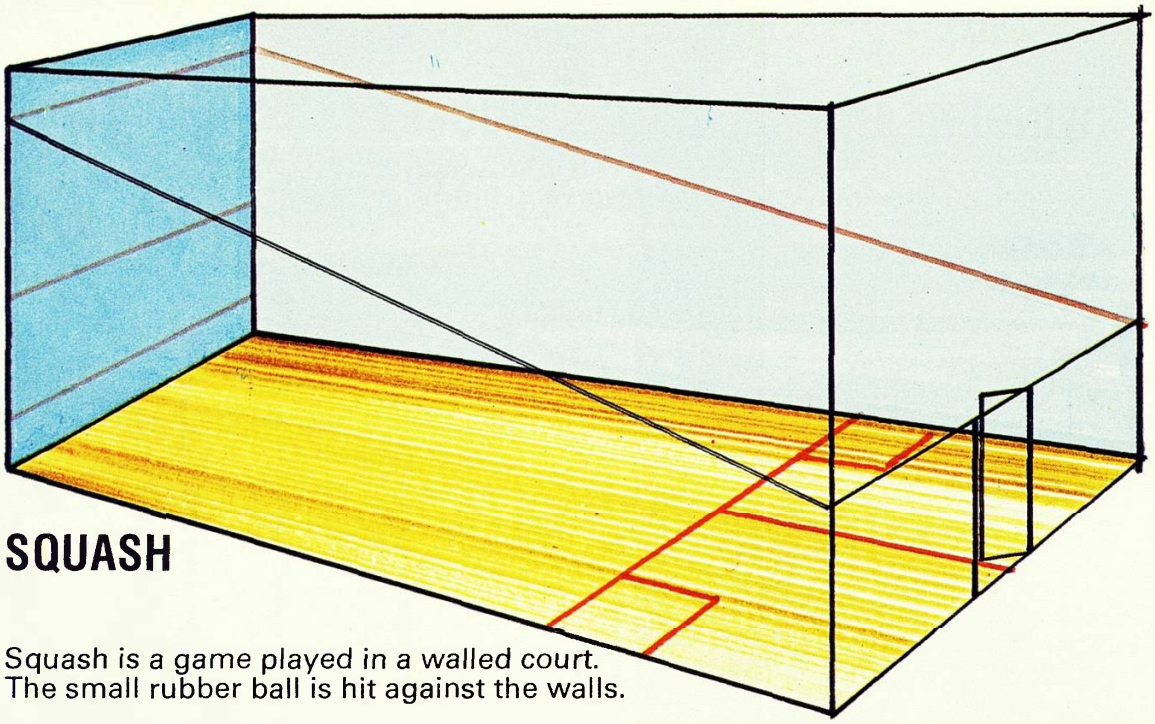
Which way will these move?



Try this way...

pull straight and sharply

...and this way.

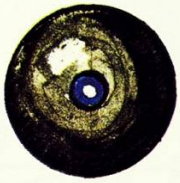


SQUASH

Squash is a game played in a walled court.
The small rubber ball is hit against the walls.

There are different squash balls.

This is a slow ball.



This is a fast ball.

This is in between. (a medium ball)

Get one of each kind.

Test and measure the bounce rebound.

Here is how one group of boys did this.

SQUASH – WARMING UP

Squash players 'knock-up'. They play a little while before starting the proper game.
They say this is to warm the ball.
Warm balls, they say, bounce differently from cold balls.
Are they right? Test this.

Start with hot water.
Put the ball in the hot water.
Drop the ball from 2m.
Measure the bounce height.
Test the ball at 80°, 70°, 60°, 50°, 40°, 30°, 20° and 10°.
(You can alter temperature by adding cold water. Lower temperatures will need water from the fridge.)
Measure the bounce height for each temperature.

Ball temperature	Bounce height

Keep the test fair.
Think about the time each ball is in the hot water.
Think about the dropping height.
Think about the need to check the bounce height readings.
Does temperature change the bounce of other balls, e.g. tennis balls?

TABLE TENNIS BALLS

Some table tennis balls are cheap.

Sports shops will charge five or six times as much for a 'three star ball'.

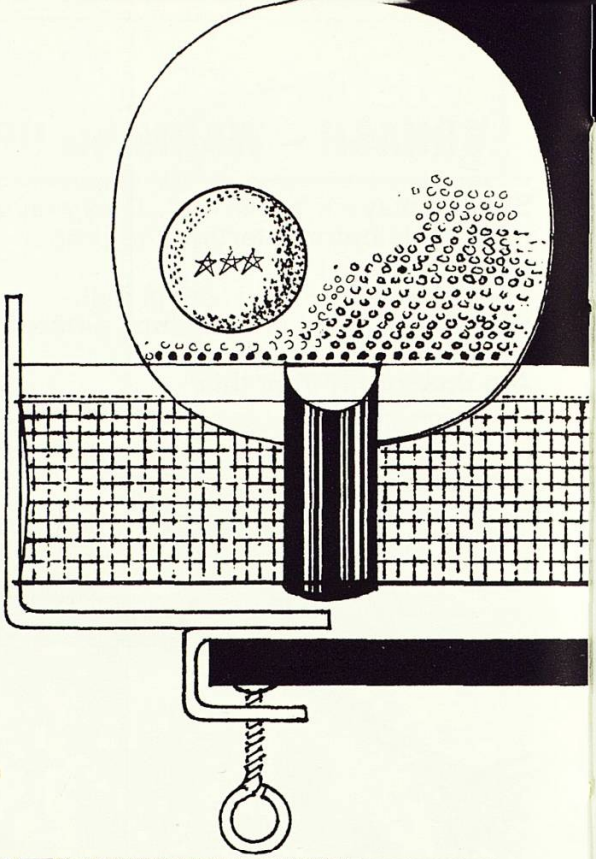
Are the expensive balls worth the extra?

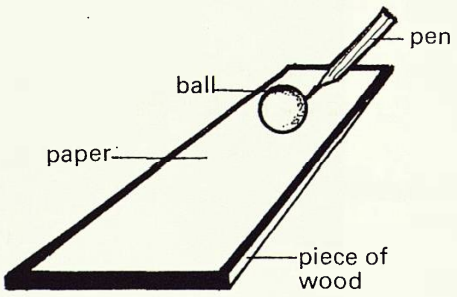
What must the ball do?

A good table tennis ball should:

(a) be perfectly round (Test 1)
(b) bounce well and consistently (Test 2)
(c) fly true (Test 3)
(d) be tough and long lasting (Test 4)

Test the cheap and expensive balls for these qualities.
Here are some young scientists' ideas for such tests.

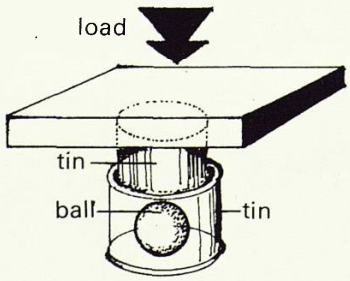




Test 1 Let the ball run down a gentle slope. Follow its path with a pen.

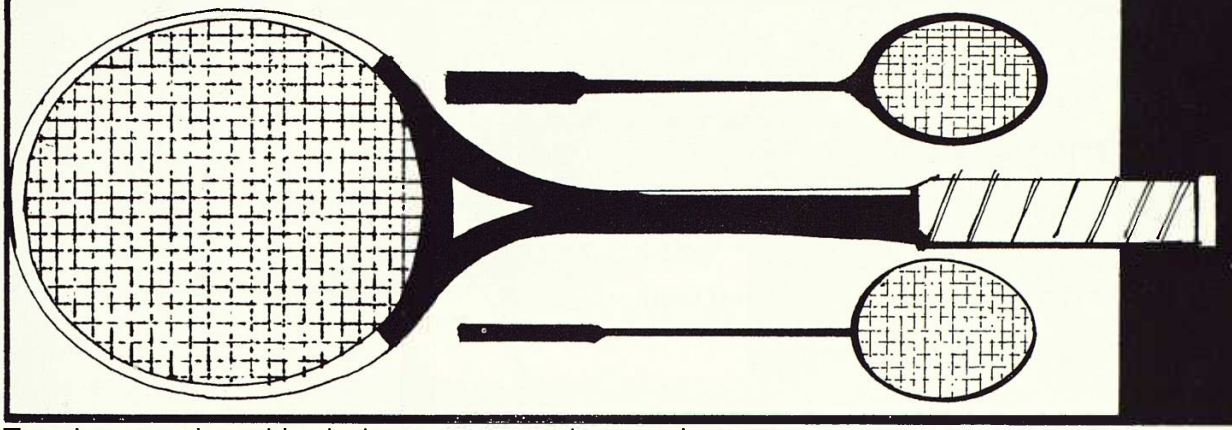
Test 2 Drop the ball. Measure the bounce height.

Test 3 Fire the ball along a straight line. Mark and measure its flight.



Test 4 Measure the load needed to squash the ball. (The last test!)

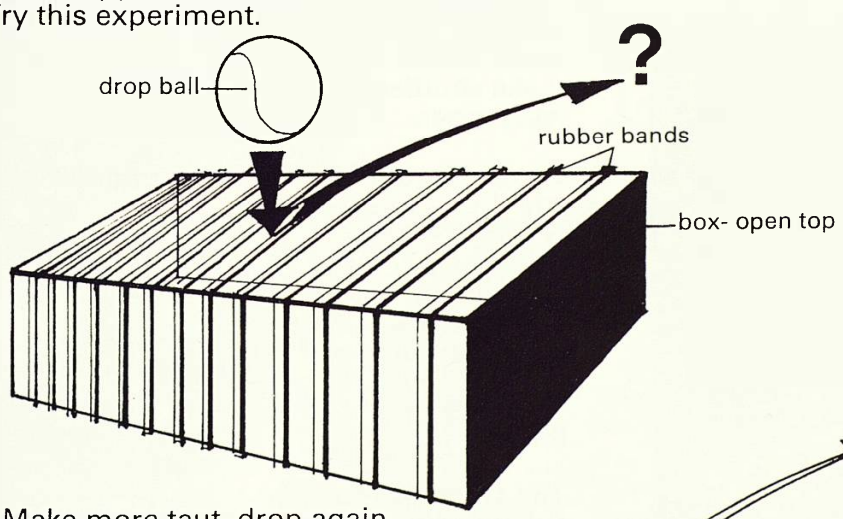
OFF THE RACQUET – ELASTICITY AND TENSION



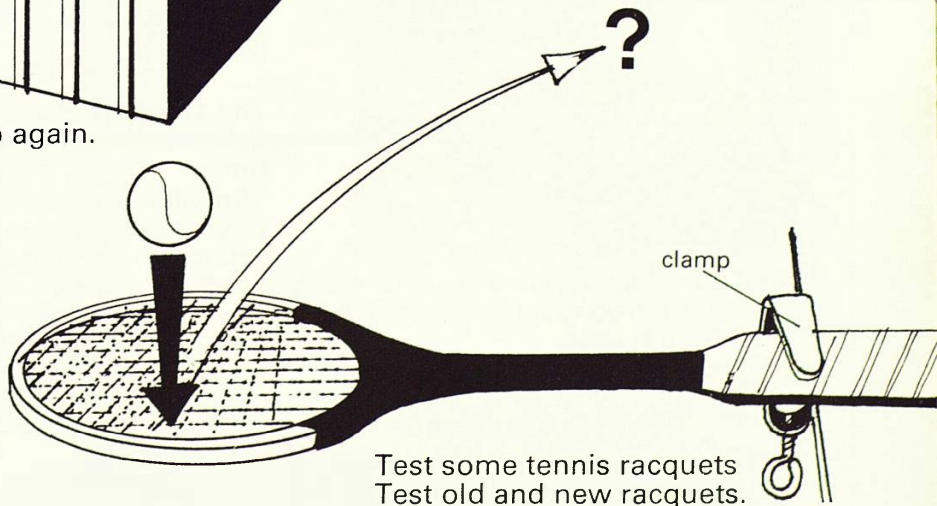
Tennis, squash and badminton racquets have strings.
The strings play an important part in the power and speed of the game.
In the past, animal gut was used for the strings.
Today, man-made fibres are widely used.

The *elasticity* and *tension* of the strings are important.
Elasticity is how the string stretches and returns.
Tension is how tightly the racquet has been strung.

What happens if the tension is altered?
Try this experiment.



Make more taut, drop again.

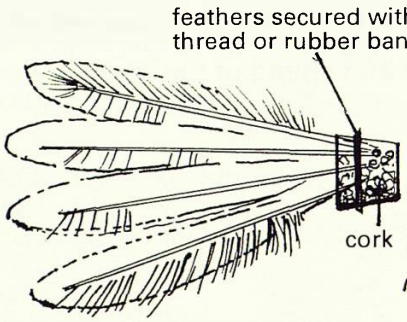


Test some tennis racquets
Test old and new racquets.

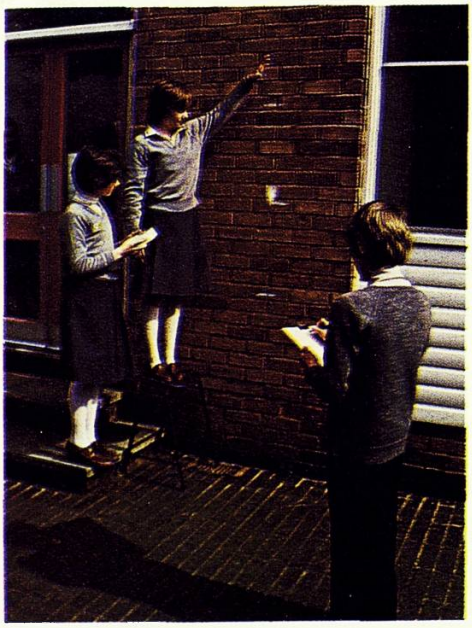
BADMINTON

Badminton is the one game in this section that does not use a ball.
It is a shuttlecock that is hit in badminton.
The first shuttlecocks were made by the Chinese, 2000 years ago.
They were made from a cork and feathers.

Make a shuttlecock like this.



A modern shuttlecock has 14 to 16 feathers. These are still fixed into a cork base. Today nylon and plastic are used to make shuttlecocks. They are cheaper and last longer.



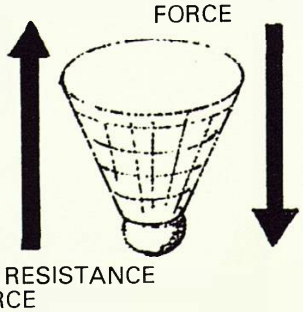
Compare your home-made shuttlecock with bought ones.

Drop them from as high as possible.
Make the test fair.
Time the fall.
A digital watch will help.

This experiment is about things falling through air.

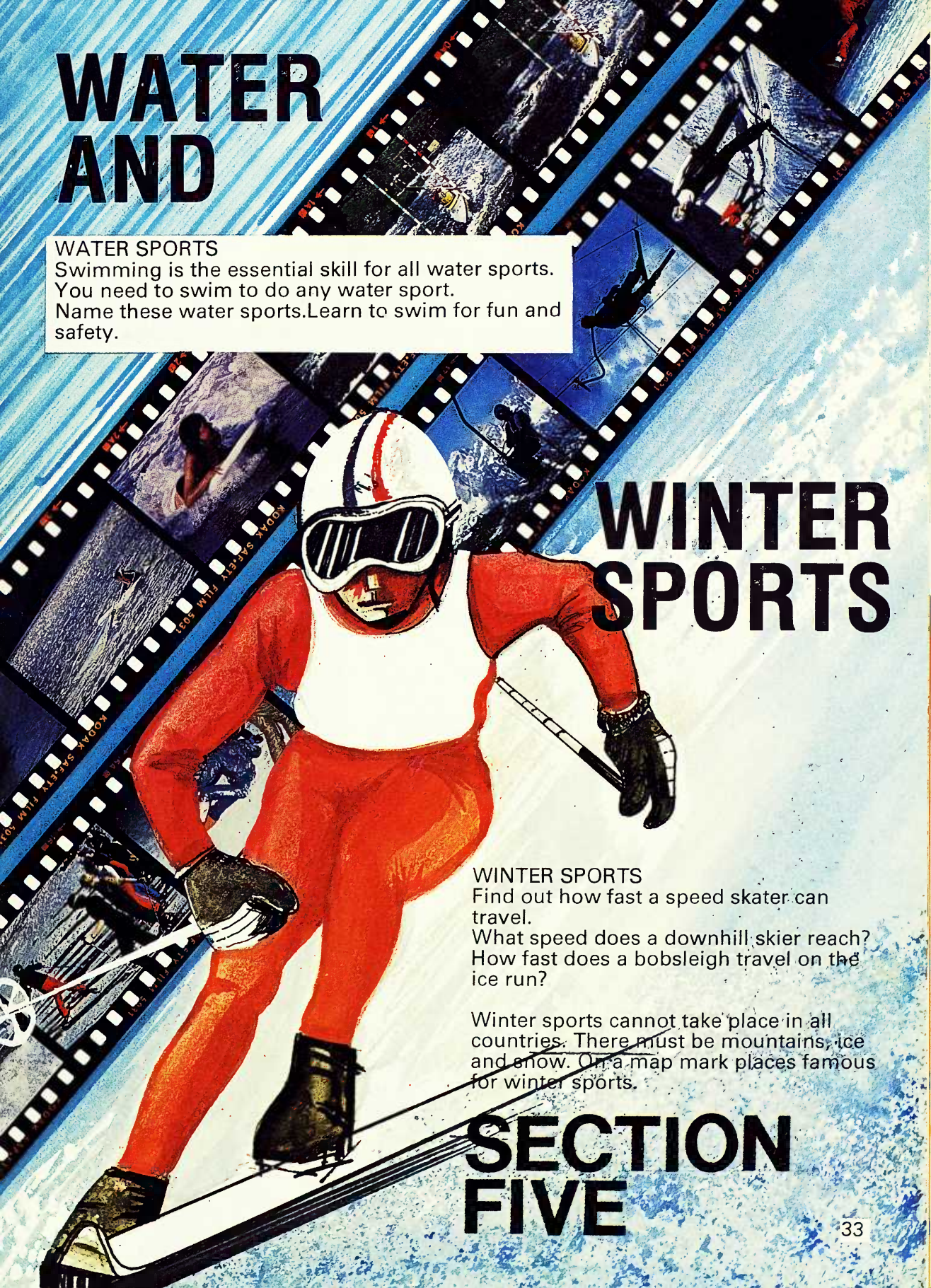
The shuttlecock is pulled towards the Earth. This pull is called the **gravitational force.**
The fall is slowed down by the air. This push against the falling shuttlecock is called the **air resistance force.**

Investigate these forces at work with your shuttlecocks.
Make them drop faster or slower.
Change the forces.
You could try: – spreading the feathers
– using more or fewer feathers
– making it heavier
– shortening the feathers
(Which forces will these change?)



WATER AND

WATER SPORTS
Swimming is the essential skill for all water sports.
You need to swim to do any water sport.
Name these water sports.Learn to swim for fun and safety.



WINTER SPORTS

WINTER SPORTS
Find out how fast a speed skater can travel.
What speed does a downhill skier reach?
How fast does a bobsleigh travel on the ice run?

Winter sports cannot take place in all countries. There must be mountains, ice and snow. On a map mark places famous for winter sports.

SECTION FIVE

SWIMMING

Water helps to hold you up when you swim.

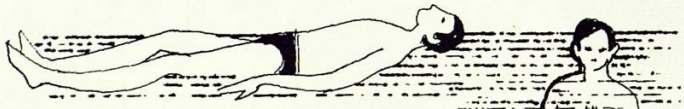
You will find floating and sinking experiments in *Science in a Topic — Ships* pages 5 - 17.

Air can help hold you up in water.

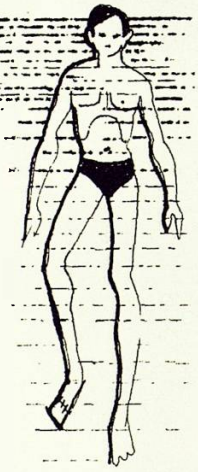
Armbands, wings, life-jackets and polystyrene floats all have air in them.

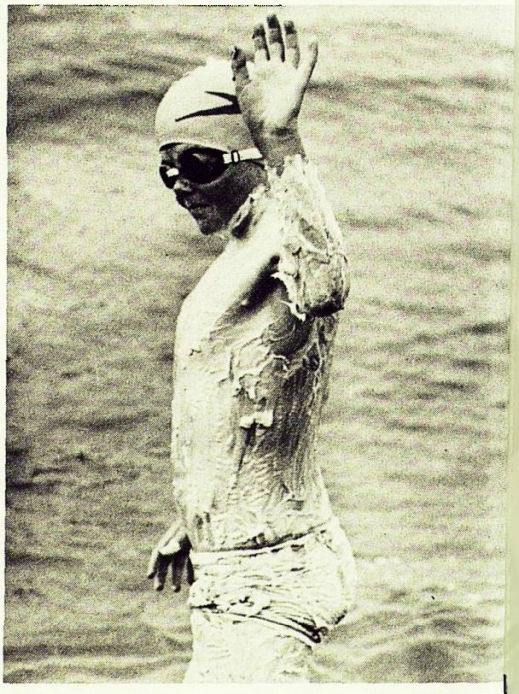
See if you can use air to make a brick float.
Tie balloons to it.
Try using polystyrene.

Is it easier to float like this:

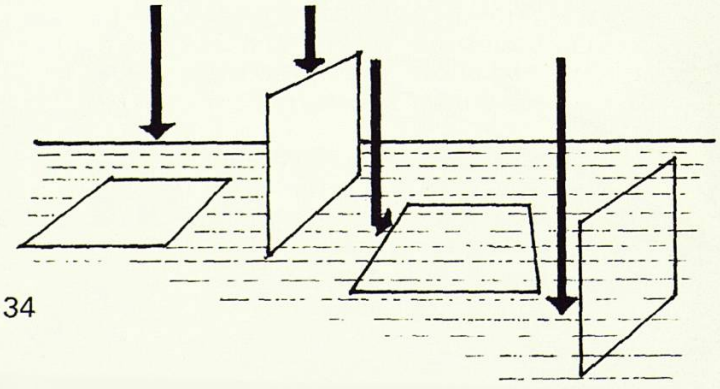


or like this?





Experiment with a piece of metal foil to find how position affects floating.
Put the foil into the water in different ways.



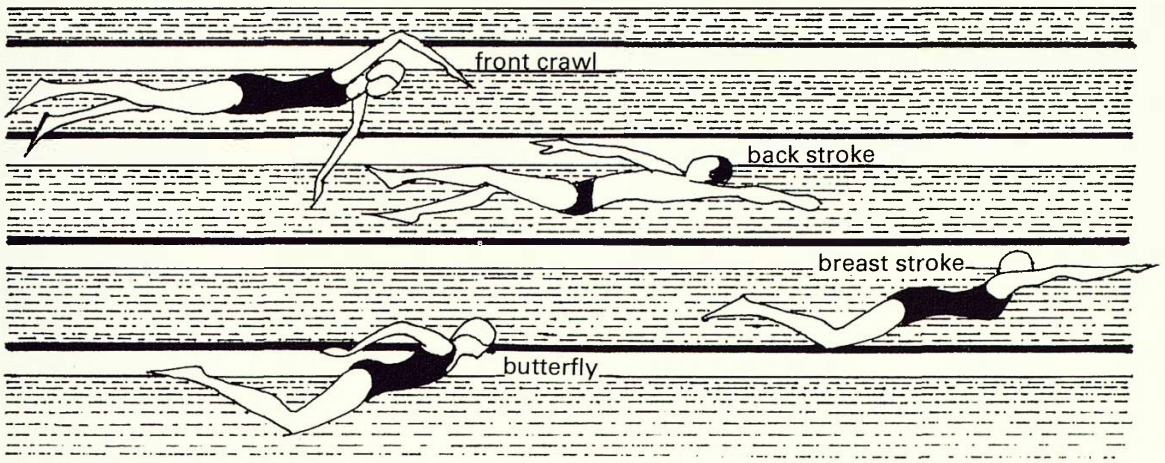
What can you find out about long-distance swimmers?

Why do they coat themselves with grease?

Who was the first person to swim the English Channel?

FOR SWIMMERS ONLY

There are four main swimming strokes.



Look up the 100m records for these.
Which stroke is the slowest?
Why do you think this is so?

How fast can you and your friends swim a length using any of these strokes?

Compare swimming with:

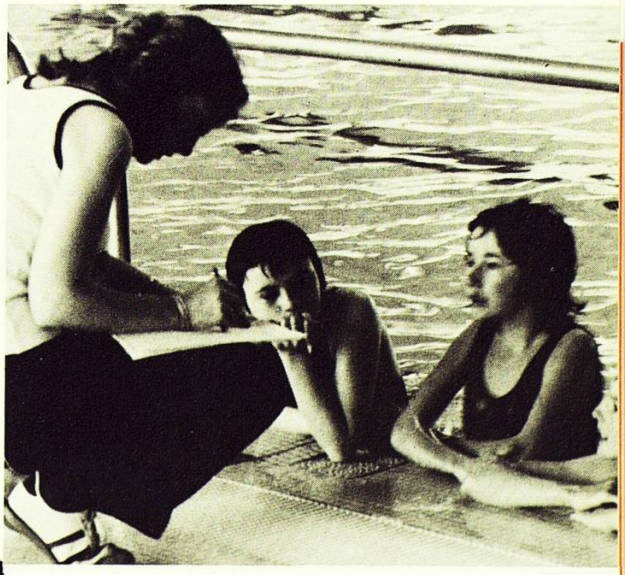
1 (a) fingers closed
  (b) fingers open

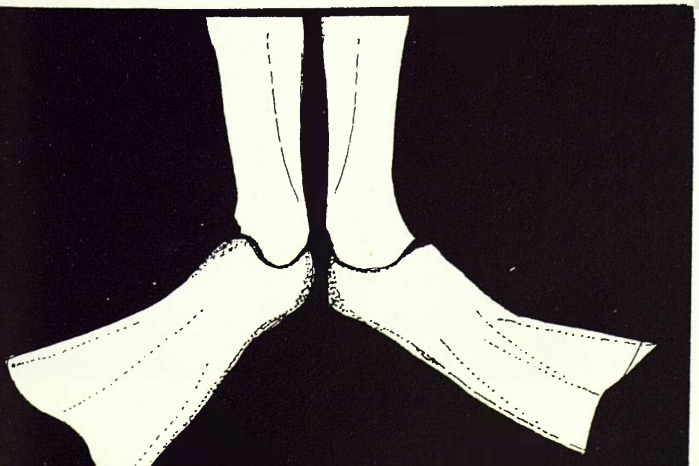
2 (a) kicking fast
  (b) kicking slowly
  (c) hardly using the legs at all

3 (a) using a straight arm action
  (b) using a bent arm action

4 (a) breathing on both sides
  (b) breathing on one side.

You could try similar experiments with the other strokes.





Swimmers sometimes use flippers.
What difference do they make?
Time a good swimmer over a length with and without flippers.

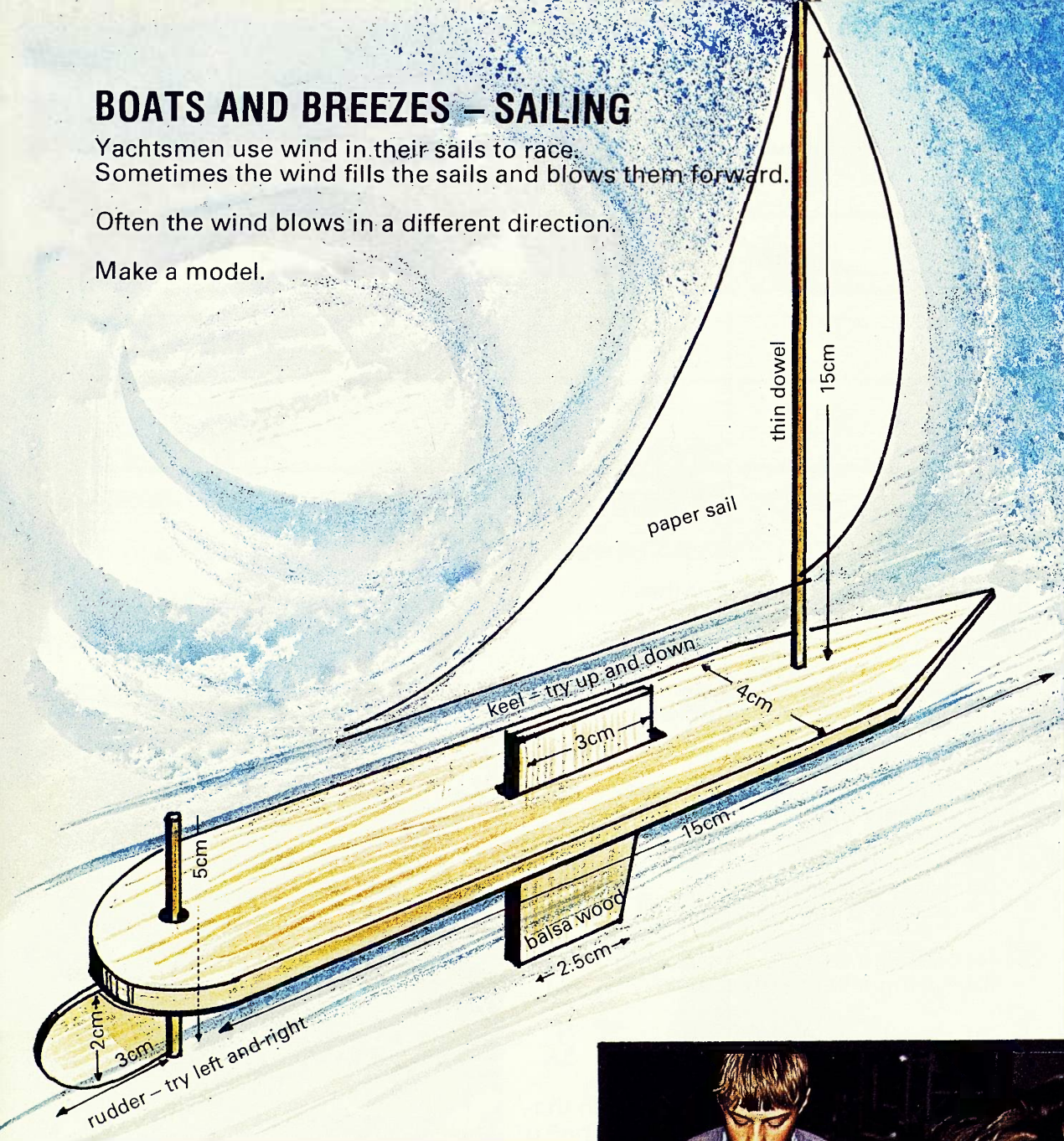
Experiments like these can help you do better in your sport.

BOATS AND BREEZES – SAILING

Yachtsmen use wind in their sails to race.
Sometimes the wind fills the sails and blows them forward.

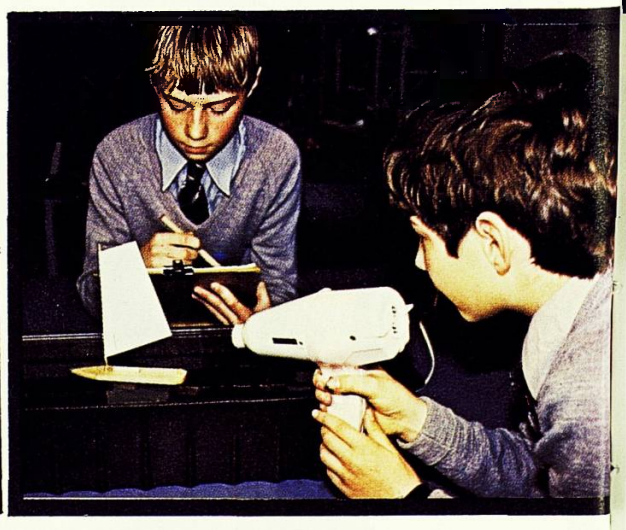
Often the wind blows in a different direction.

Make a model.

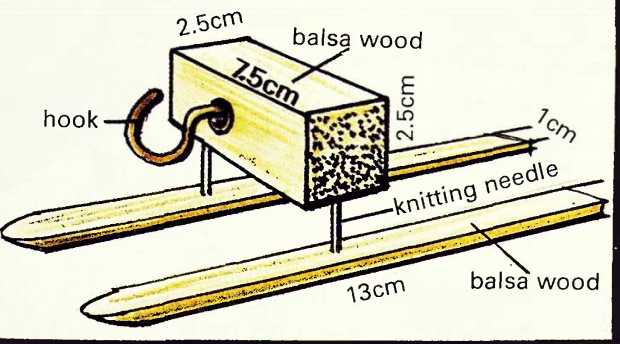


Experiment to find how a yacht can use the wind to go in different directions.

Keel – up or down	Rudder left or right	Course direction

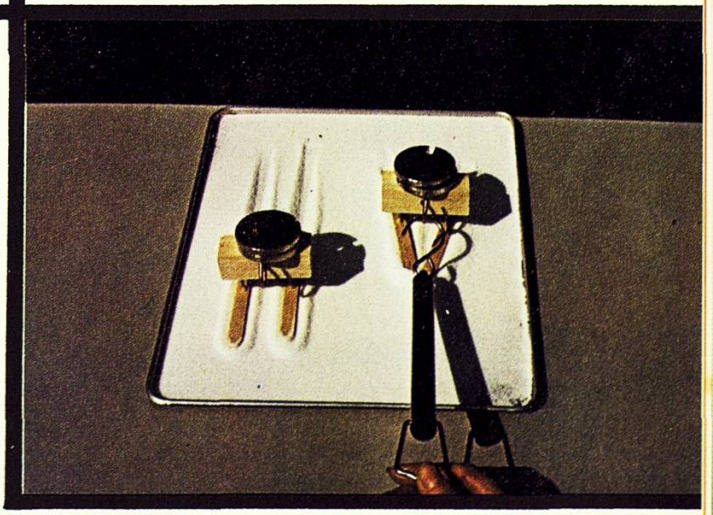


SKIS AND SKIING

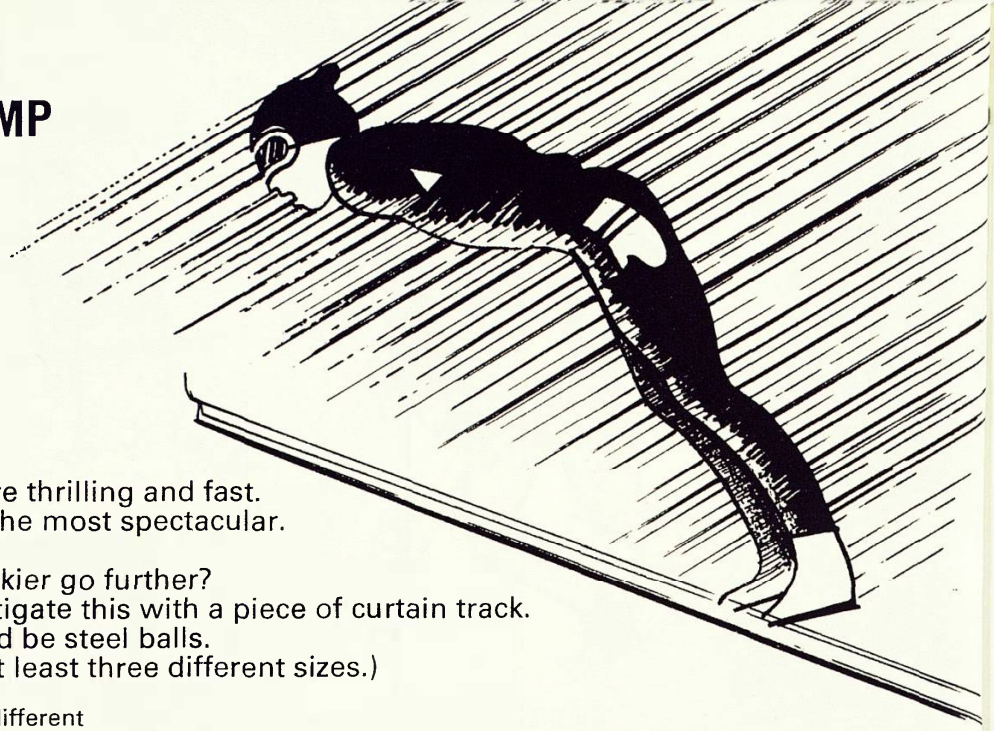


Skiing is a sport that needs special skills and balance.
The skier needs to turn, slow down and stop, as well as skiing straight down a slope.
This model will help you to see how the skier can control his run.
Use a 5mm layer of salt in a shallow tray.
This is the 'snow'.
Load the skis with a 200g mass.
This is the 'weight' of the skier.

Pull the skier with a force meter:
(a) with the skis straight
(b) with the skis in 'snow plough' position.
Observe carefully.
Watch the pattern of the 'snow' tracks.
Watch where the 'snow' builds up.
Watch the force meter readings.
Note: (a) the force needed to start
(b) the force needed to keep the skier moving.
Draw and record what happened.
The skier turns by changing the weight from ski to ski.
Change the load position on your model to one side.
Pull and see what happens.

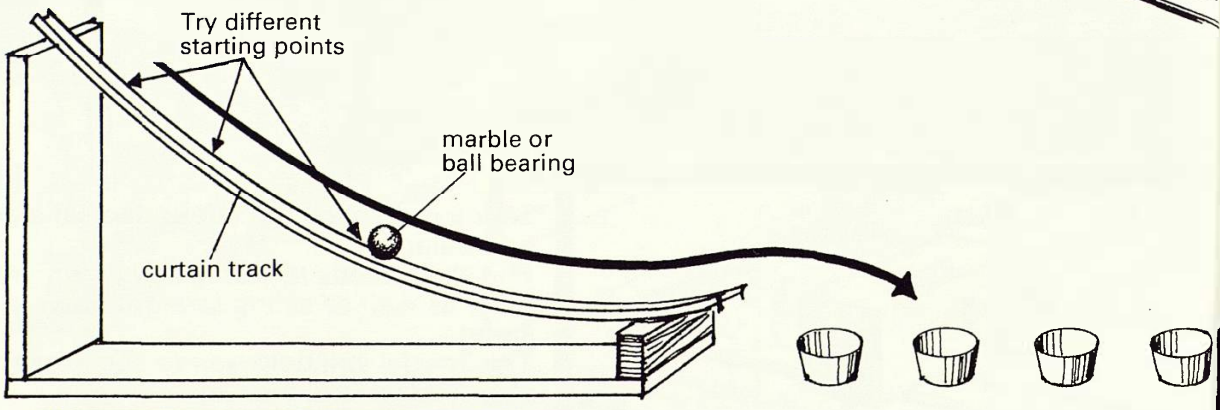


THE SKI JUMP



Winter games are thrilling and fast.
The ski jump is the most spectacular.

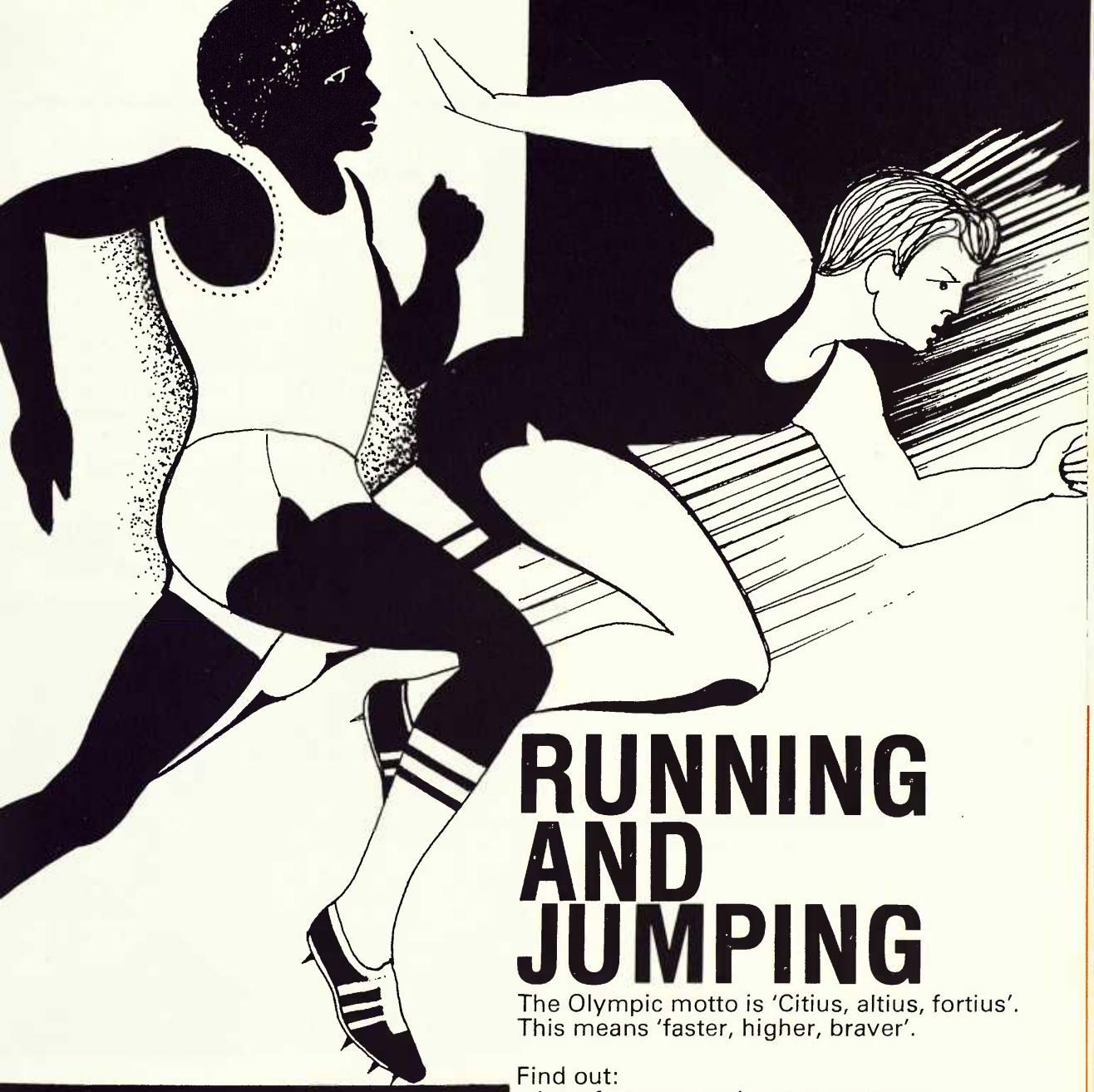
Does a heavier skier go further?
You could investigate this with a piece of curtain track.
The 'skiers' could be steel balls.
(You will need at least three different sizes.)



Which 'jumps' further –
a heavier or a lighter ball?

Try a ball of the same size but
lighter than steel (glass - plastic).

Does starting height change
distance jumped?
(To be fair, use the same ball for
this experiment.)



SECTION SIX

RUNNING AND JUMPING

The Olympic motto is 'Citius, altius, fortius'. This means 'faster, higher, braver'.

Find out:
– how fast men and women can run.
– how high and how far they can jump.
Look up world records.
Look up Olympic records.
Check your school records.
What is your own record?

Make a chart that shows the differences.

Make a scale model of a running track.
Find out the race distances that are run.
How are these measured on the track?
Find out how 'the staggers' are worked out.

RUNS AND WALKS

What distances do sprinters, middle-distance and long-distance athletes run?

What distances did these great athletes run?
- Paavo Nurmi
- Fanny Blankers-Koen
- Roger Bannister
- Emil Zatopec
- Lassi Verin
- John Sebastian Coe.

Who was Pheidippides and what great run did he make?

Find out the rules for the walking events.
What makes walking different from running?
What helps a champion athlete win:
- the length of stride
- the power of leg muscles
- determination and will to win?

Experiment with your friends.
Measure the length of a stride.
Do this in three different ways.

1 Measure one stride length.

2 Take ten strides.
Measure the distance covered.
Divide by ten to find one stride length.

3 Run 25m.
Count how many strides.
Divide 25m by the number taken to find one stride length.

Which do you think is the most accurate way?

Who has the longest stride? Is it the tallest person?
Who has the shortest stride? Is it the smallest person?

Now time them running 50m.

Record:

Name	Height	Stride length (1)	Stride length (2)	Stride length (3)	Time for 50m

Is there any pattern?
Is the person with the longest stride the fastest over 50m?

RUNS AND WALKS

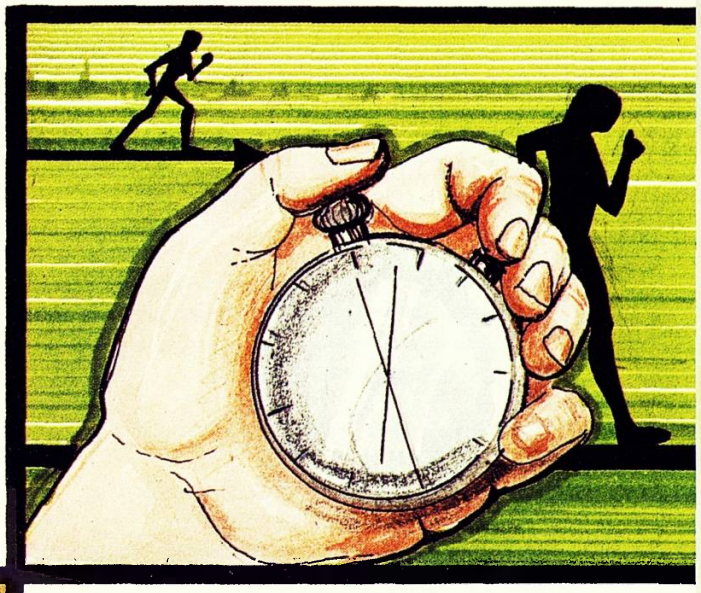
LEG POWER

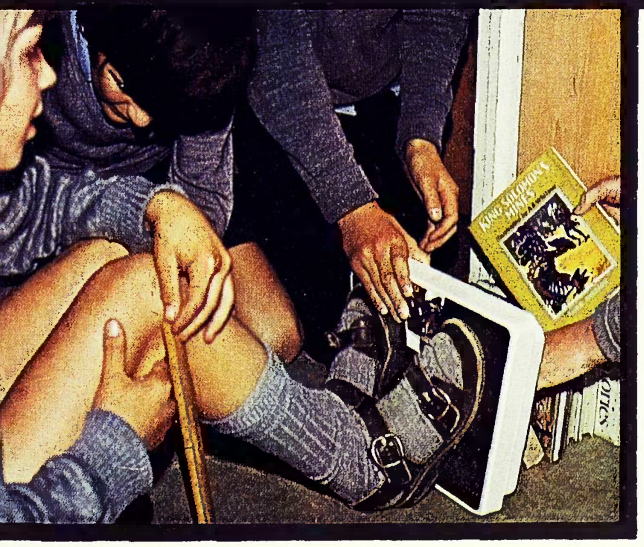
Measure the push force of runners' leg muscles.
(A force is measured in newtons. Use bathroom type scales marked in these units.)

Here is how one group of young scientists did this.

Force right leg	Force left leg

Compare this with the running times for 50m as on page 40.
Is there any pattern?





Do some timing experiments in your P.E. or games lesson.

Time how long different people take to walk 50m and to run 50m.
(Remember the rules for walking events.)

Guess the time the person will take:

to walk 100m
to run 100m
to walk 10m
to run 10m

Record your guess.
Run and walk the distances.
Check actual times and compare with your guesses.

Name	Walk 50m – time	Run 50m – time	100m walk		100m run		10m walk		10m run	
			guess	time	guess	time	guess	time	guess	time

JUMPS AND JUMPING

The jumper is using his muscles and his skill to overcome gravity.

All masses are pulled towards each other. The Earth is a very large mass. We are near to it. The Earth pulls us towards its centre. This is called **gravity**.

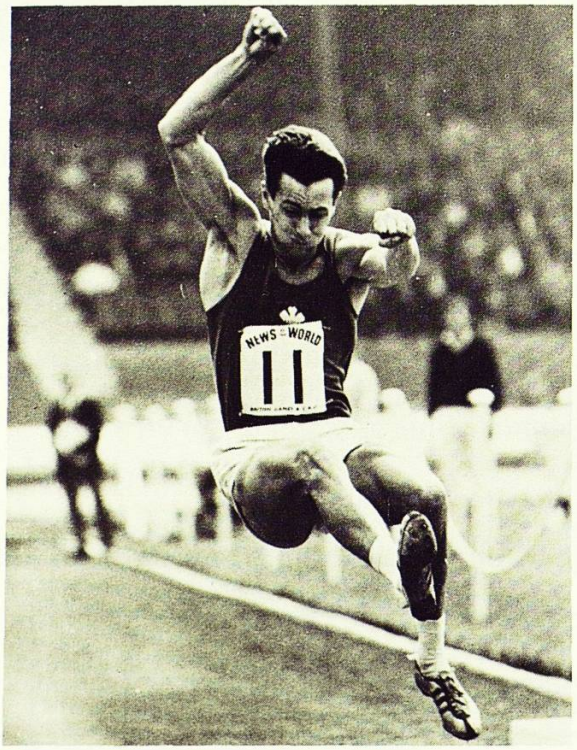
Who are the best jumpers?

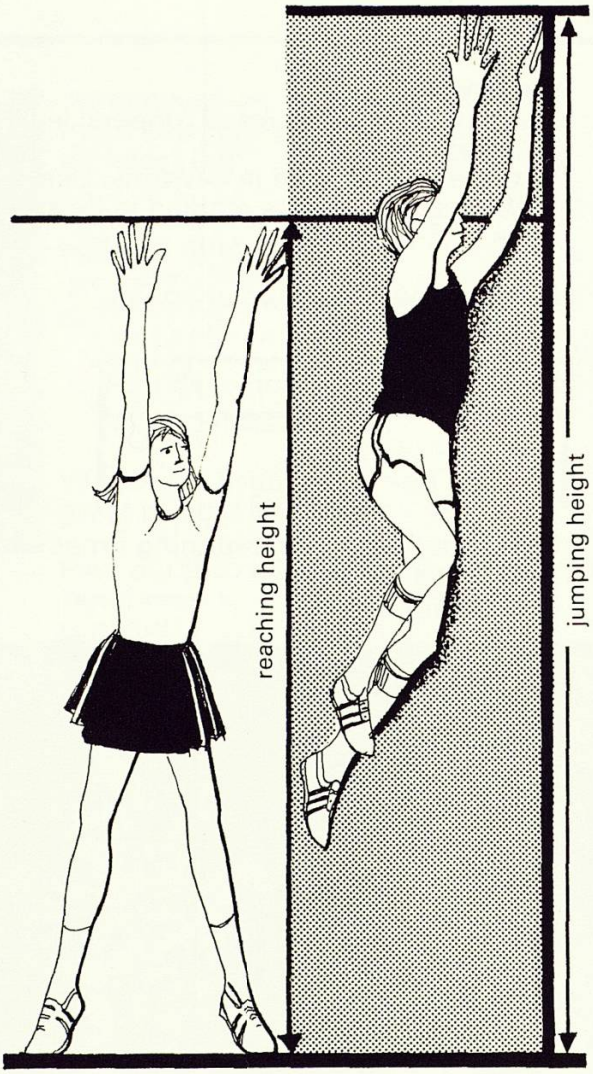
Are they tall, long-legged people?

Are they small light people?

Does heaviness make a lot of difference?

Experiment first to compare height jumped with personal height.





Mark the highest point that can be reached, standing.

Jump as high as possible. Mark the highest point reached.

Measure these heights and find the difference between the two.

Height of person	Reaching height	Jumping height	Distance between

Look at the measurements.
Is there any pattern?

JUMPS AND JUMPING

Now see if heaviness makes a difference to jumping.

Stand with toes on a starting line.

Do a standing jump.

Record:

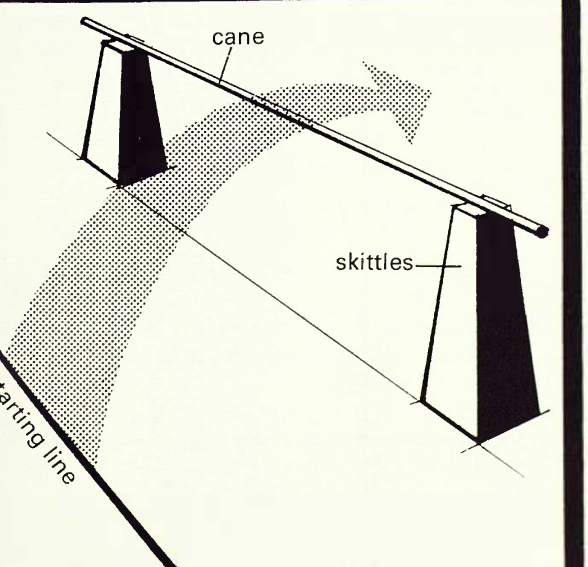
Name	How heavy	Distance jumped

Experiment to see if the jumping distance can be increased.

1 Jump without using the arms at all.

2 Use the arms to help the jump.
   (a) swing the arms forward on take-off
   (b) try holding dumb-bells (or some other weights)

3 Try making the jumper clear a cane about 0.5m in front.



Read and find out more about jumps and jumpers:

1 What are pole vaulters' poles made of?

2 What is the Western Roll and an Eastern Cut-Off?

3 Who are the Watusi?

4 What happens if there is a tie in the high jump?

5 Who first 'flopped' in the high jump?

TIRED AND WEARY

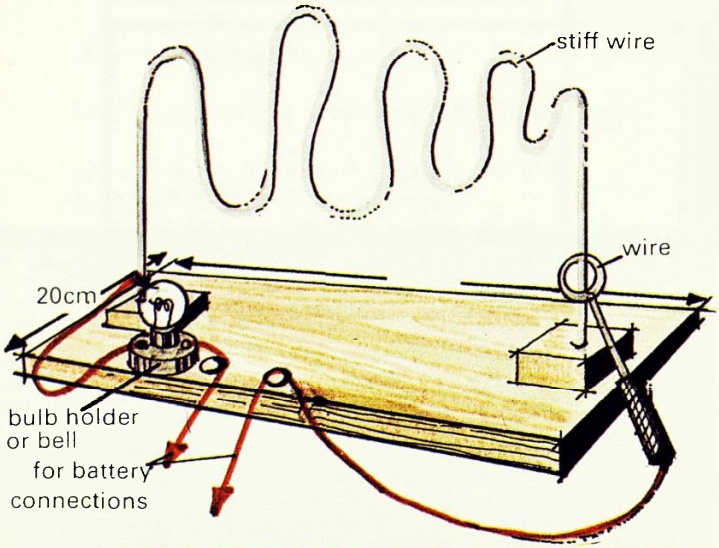
Athletes often have to fight tiredness.

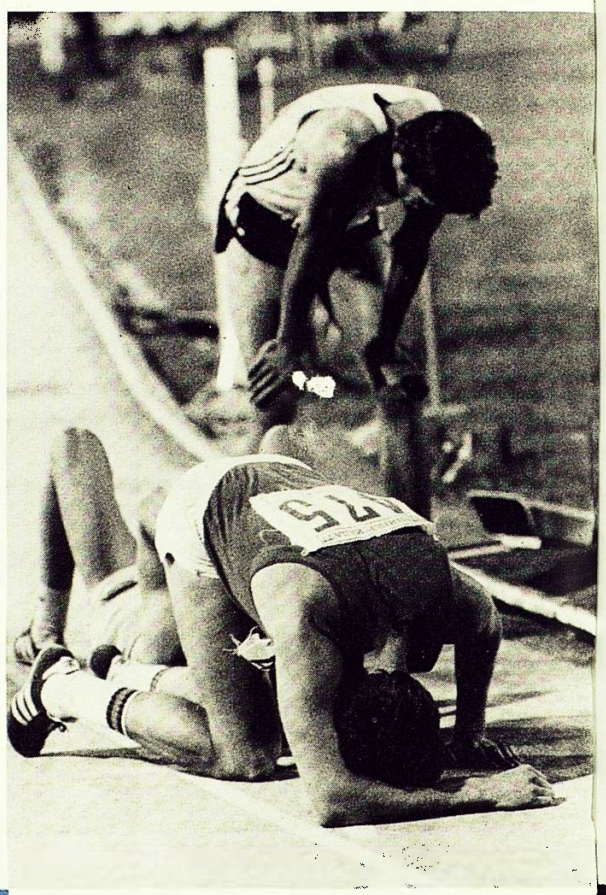
The last lap of a race, the last mile of a marathon is a battle to beat weariness.

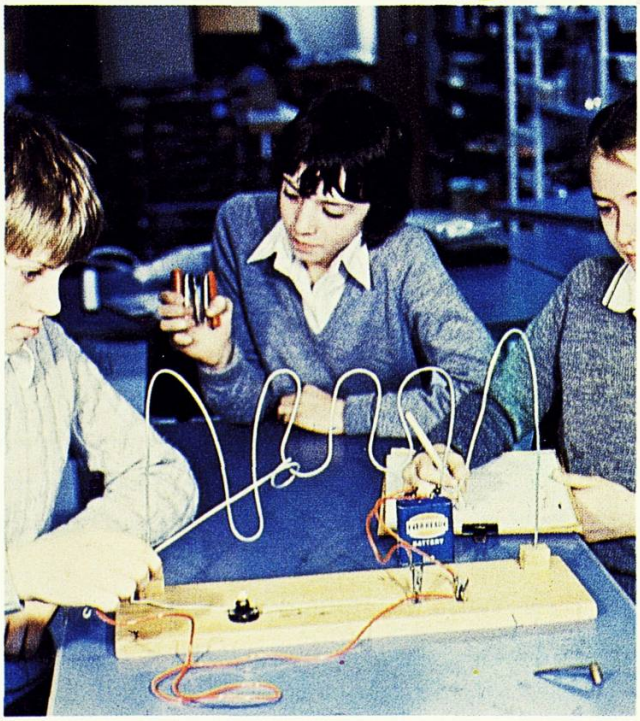
Are you as good when you are tired?

Here is one group's idea for testing tired hands.

You could make this and test your friends.







How well do they do?

Measure how far they can get without a fault.

You could also time how long they take.

You could make other rules to try to make the test better.
- Go back to the start if there is a fault.
- A five or ten point penalty if touch is made.

Test them again.

This time test tired hands.

You can use a wrist exerciser or a soft rubber ball to make hands tired.

Record your findings:

Name	Test when fresh	Test when tired

TIRED AND WEARY

Mary Peters has been concentrating for several minutes to prepare for her next jump.

Your brain can also become tired.

Often we need to *concentrate,* give all our attention to the thing we are trying to do.

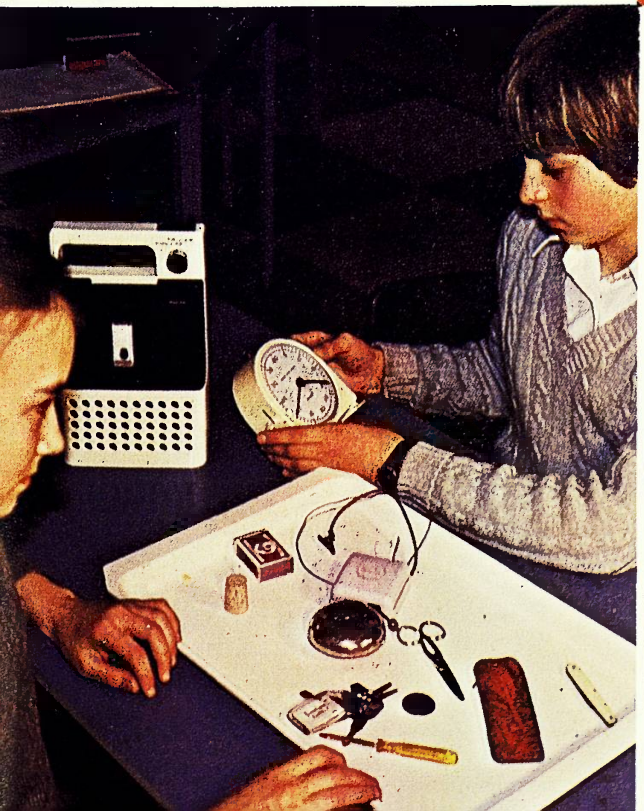
How hard is it to concentrate on more than one thing at a time?

Some people say that they can think better when there is some pop music playing.

Others say, 'Turn that noise off! I can't think!'

Can you test these ideas?

Set a task to be done:
1 in a quiet place
2 with loud music playing
3 with lots of talk going on



The task could be:
(a) hear, or be shown some figures, letters or words to be repeated
(b) some sums to be done
(c) a complicated drawing to be copied
(d) a set of shapes that have to be matched
(e) Kim's game (remembering objects on a tray).

Compare the results:

Name	Quiet		Music Playing		Talk	
	time	mistakes	time	mistakes	time	mistakes

PUFFING AND BLOWING

Many athletes are fit people who have big lungs.

They need to breathe in lots of air.

How many times do you breathe in a minute?

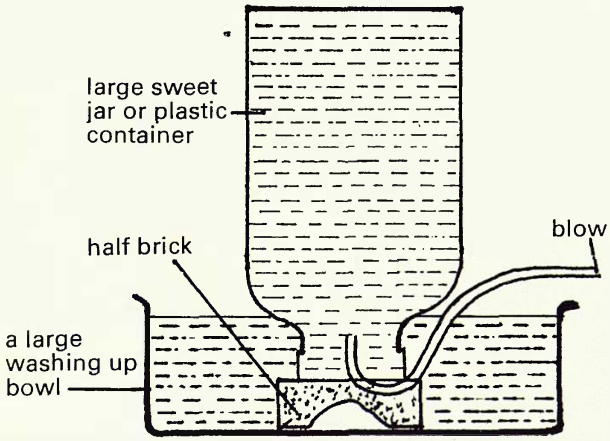
Does this alter after:
- walking
- running
- resting
- walking and then resting for two minutes
- running and then resting for two minutes?

How big are your lungs?

Here is a way to find out:

1 Fill a large jar or plastic water carrier with water.
Cover the mouth with something flat and smooth (a piece of lino tile) and turn upside down.

2 Place in a bowl about half-filled with water. Stand on a half-brick – remove mouth cover.



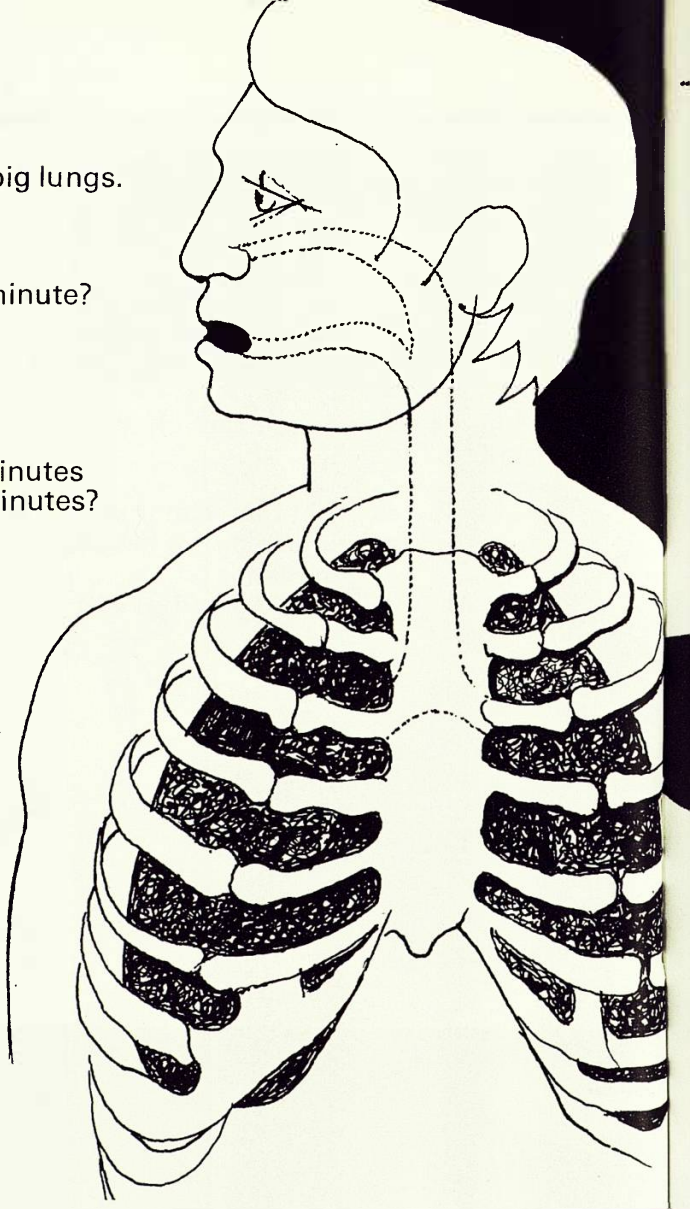
3 Poke a piece of tubing into the jar. The half-brick will help you do this.

4 Mark the water level (if not completely full).

5 Take a deep breath. Hold your nose.

6 Blow steadily (one lungful). Mark the jar again.

7 Measure the difference between the two marks.

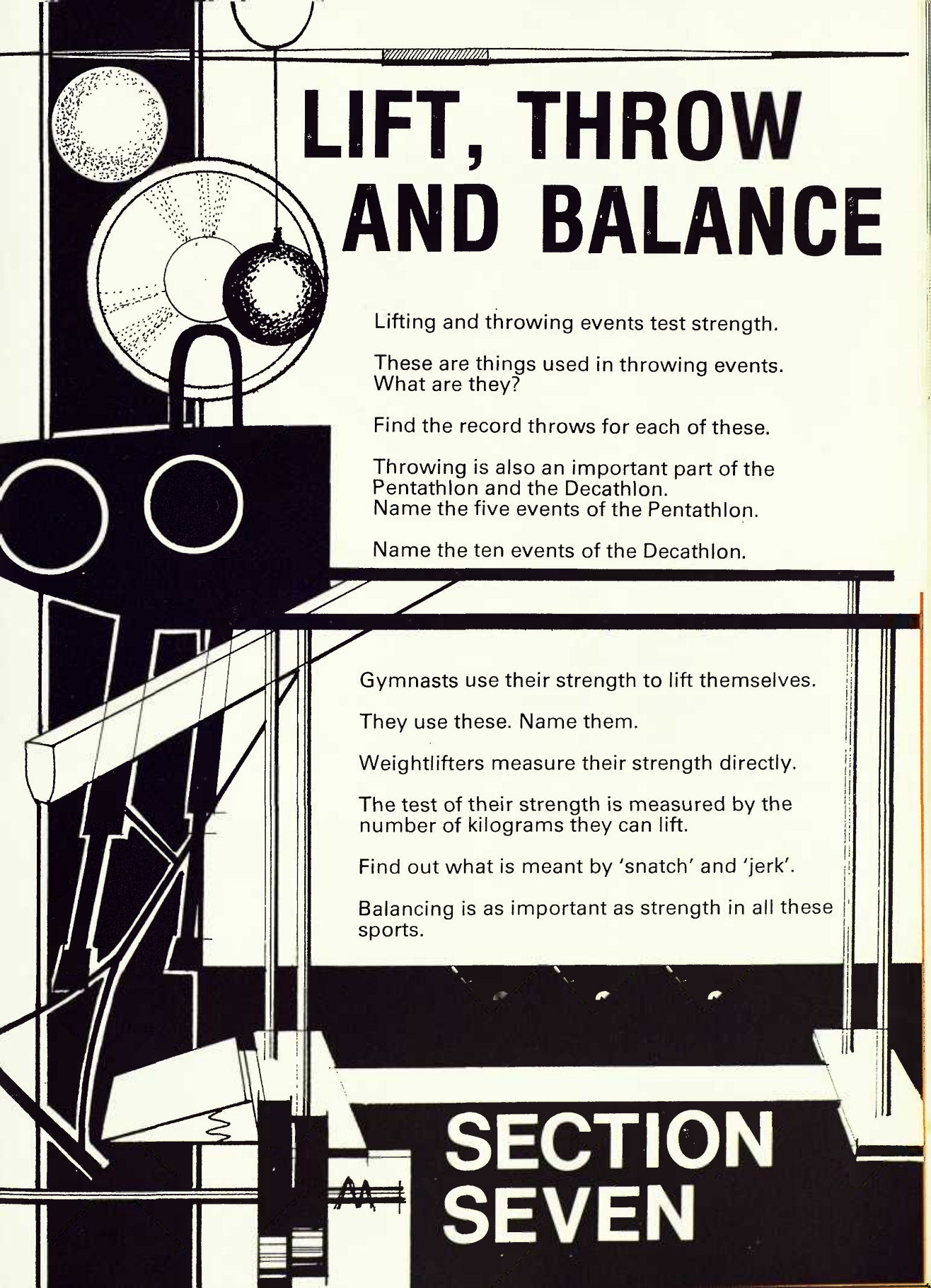


Measure the size of your chest.

Make measurements for yourself and your friends.

Chest Measurement – Normal (a)	Chest Measurement – Expanded (b)	Difference (b) – (a)	Lung Size Measured

Look for some patterns.
Do the largest chests have the largest lungs?
Is it the difference which is more important?



LIFT, THROW AND BALANCE

Lifting and throwing events test strength.

These are things used in throwing events.
What are they?

Find the record throws for each of these.

Throwing is also an important part of the Pentathlon and the Decathlon.
Name the five events of the Pentathlon.

Name the ten events of the Decathlon.

Gymnasts use their strength to lift themselves.

They use these. Name them.

Weightlifters measure their strength directly.

The test of their strength is measured by the number of kilograms they can lift.

Find out what is meant by 'snatch' and 'jerk'.

Balancing is as important as strength in all these sports.

SECTION SEVEN

THROWS, THROWING AND THROWERS

Throwing events can be dangerous. What are the safety rules for these events? Make up a safety code for throwing in a school sports.

Study world and Olympic records for the *throwing events.*

Do some countries seem to do well in these events?

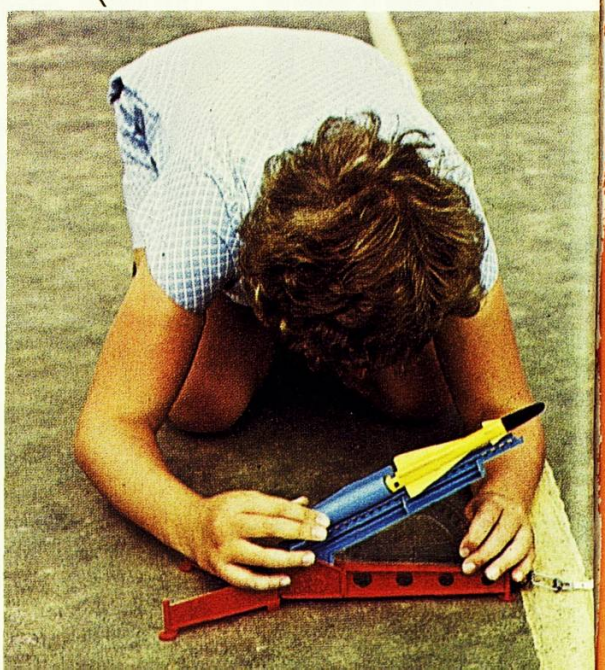
Why should this be?

Does the path through the air make a *difference to distance thrown?*

It will **not** be safe to throw things for this experiment.

It would also be very difficult to measure the **angle of flight.**

This toy will be safe
The nose is made of rubber.
You will also be able to measure the angle easily.
The spring will always fire with the same force. You may not always throw with the same force. The spring will help make a fair test.



Fire the rocket at different angles.
Try three shots at each angle.
Record how far it goes.

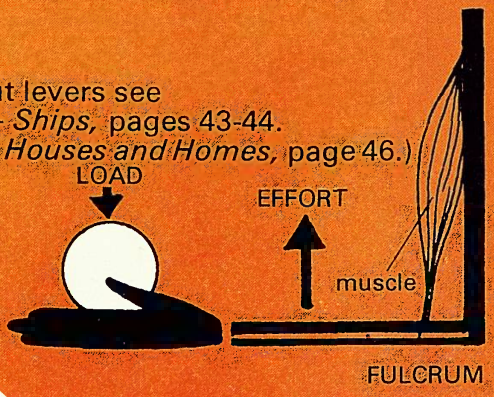
Firing angle	Distance		

Study the results of your experiment. It could help you and your friends to throw further.

THROWS, THROWING AND THROWERS

When you throw, your arm is being used as a machine.

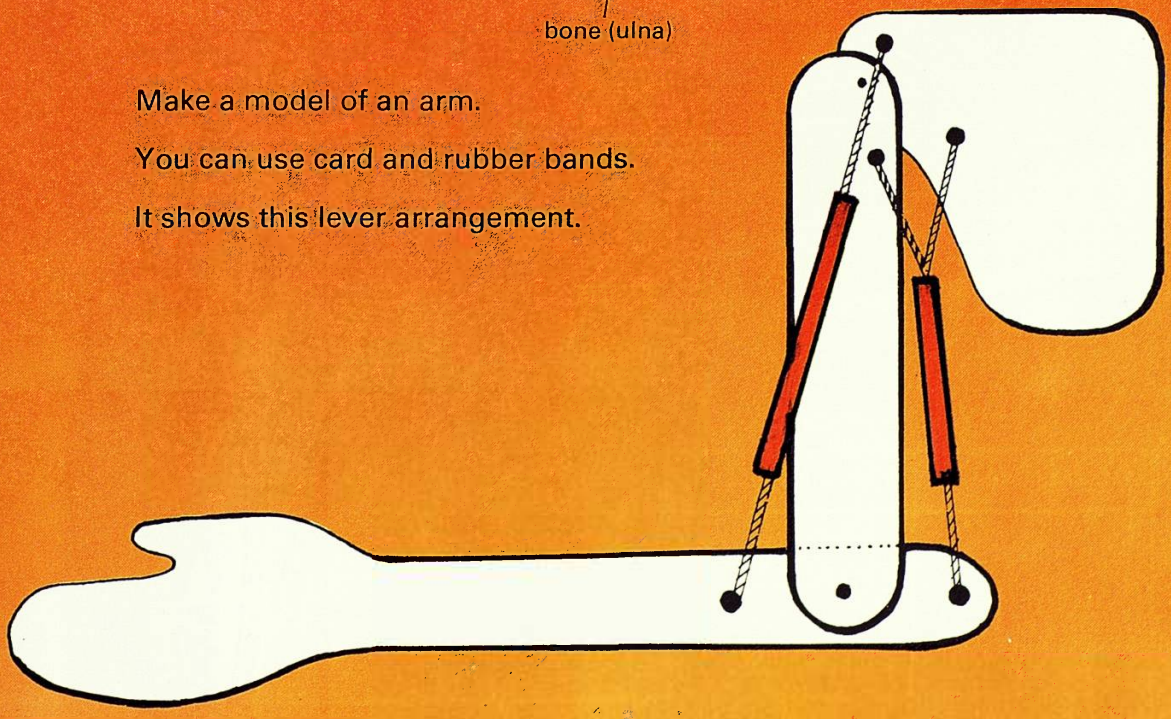
It is used as a lever.
(To learn more about levers see
Science in a Topic — Ships, pages 43-44.
Science in a Topic — Houses and Homes, page 46.)



Make a model of an arm.

You can use card and rubber bands.

It shows this lever arrangement.



On the next page you will find some more work about muscles and measuring muscle power.

MUSCLE POWER

How strong are you?

Your muscles control all your movements.

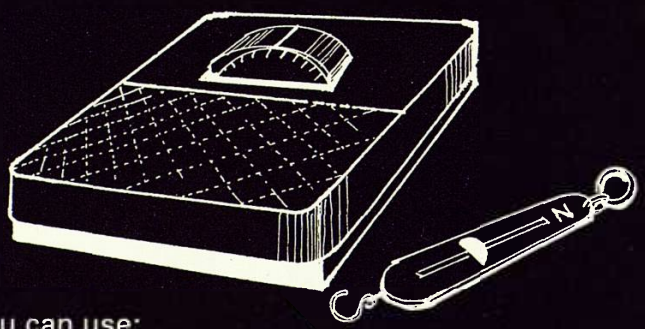
The muscle changes shape.
This pulls the tendons.
The tendons are fastened to the bones.
The bones then move.

Find your muscles.
Which one lifts the whole arm?
Which one straightens the leg?
Which one works the jaw?
Which one raises the knee?
Which one moves a finger?

Feel them at work.
Feel them change shape.
Describe these changes.

Try measuring muscle power.
How hard can you push?
How hard can you pull?

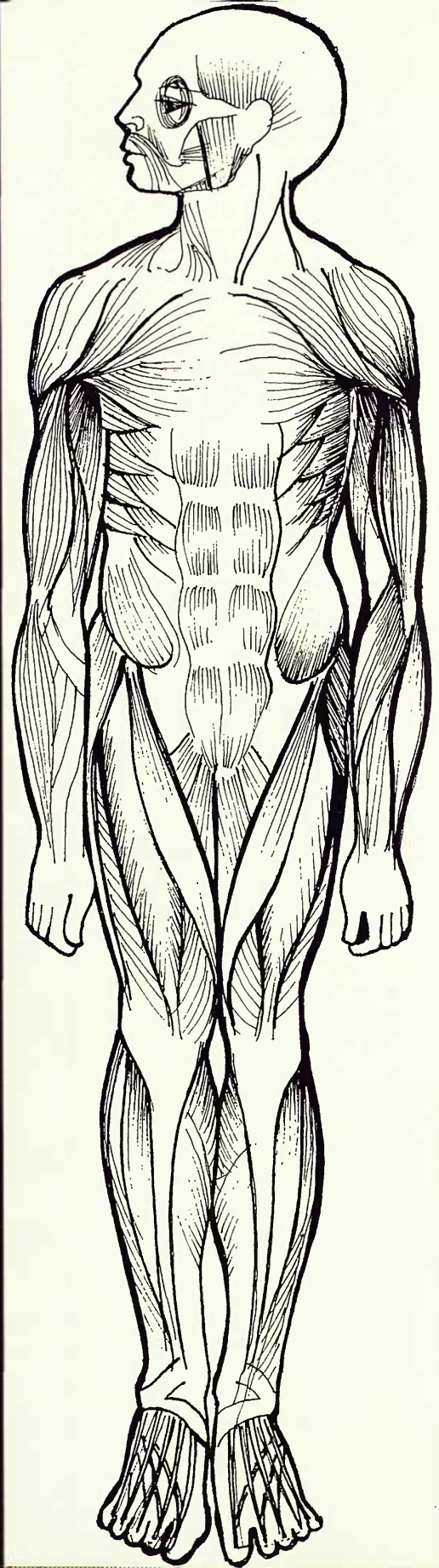
Pushes and pulls are forces. They are measured in newtons.

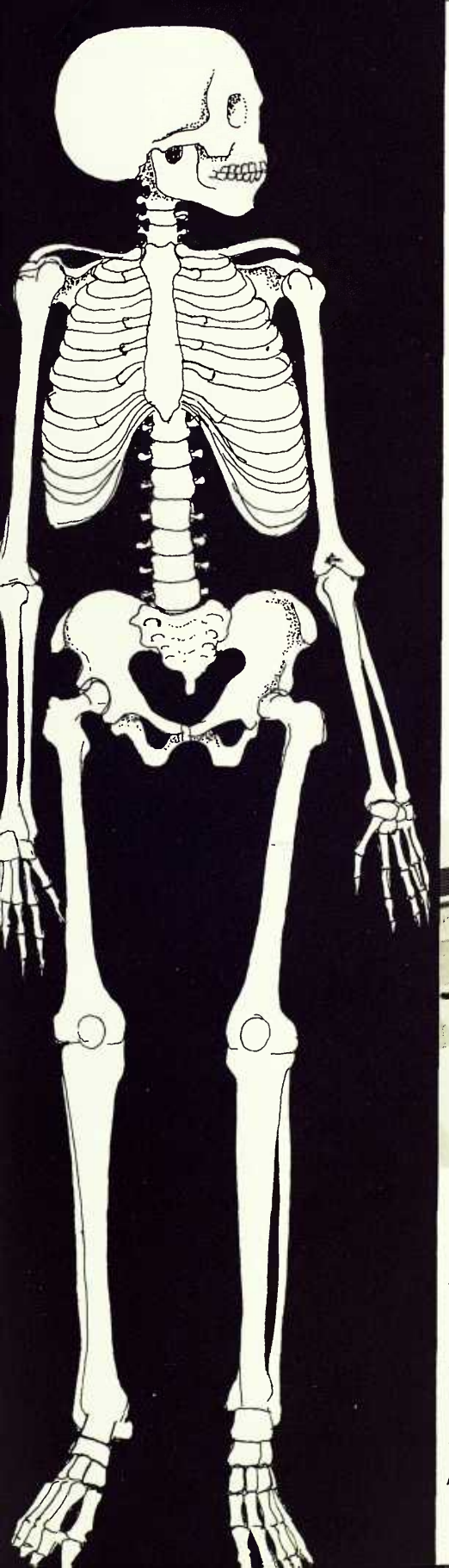


You can use:
(a) bathroom type scales
(b) spring force meters.

Muscles Used	Force Measured

Which muscles are particularly used in the lifting and throwing events?

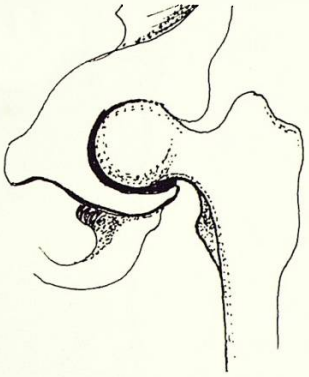


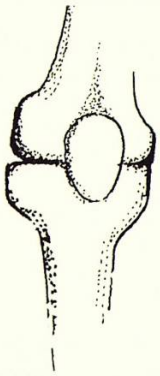


SKELETONS AND STRENGTH

Your body is built on a framework of bones.
This is your skeleton.
Your skeleton gives your body, shape, strength and protection.

In sport you lift, turn, twist, swing, push and pull.
Even everyday movements can be very complex.
Your joints make these movements possible.
There are ball and socket joints.
There are hinge joints.





Draw round a friend who is lying flat on the floor.
Mark where there are joints.
Mark which kind they are.

Sometimes in sport bones break.

On pages 21, 22 and 23 of *Science in a Topic — Roads, Bridges and Tunnels* there are some experiments which will help you understand more about shape, size and strength.

You could also measure the strength of a bone.
Use a chicken bone.

The apparatus on page 36 of *Science in a Topic — Houses and Homes* will be useful for this.

GYMNASTICS

Gymnasts need strength and balance.

This beam is only 10cm wide. Gymnasts twist and turn, jump and somersault on it.

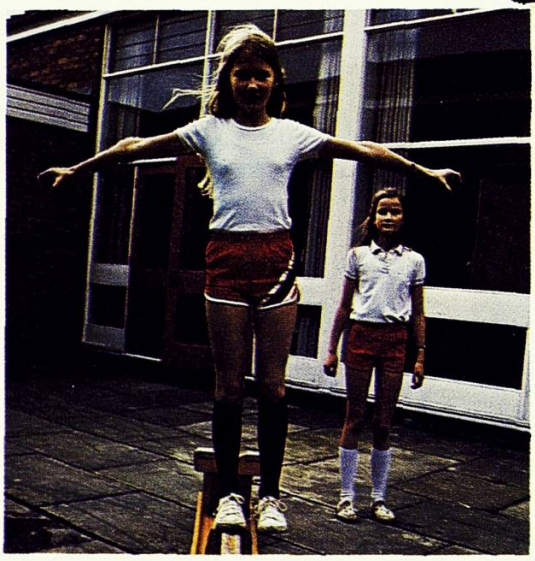
Mark out the beam shape on the ground. It is 5m long and 10cm wide.

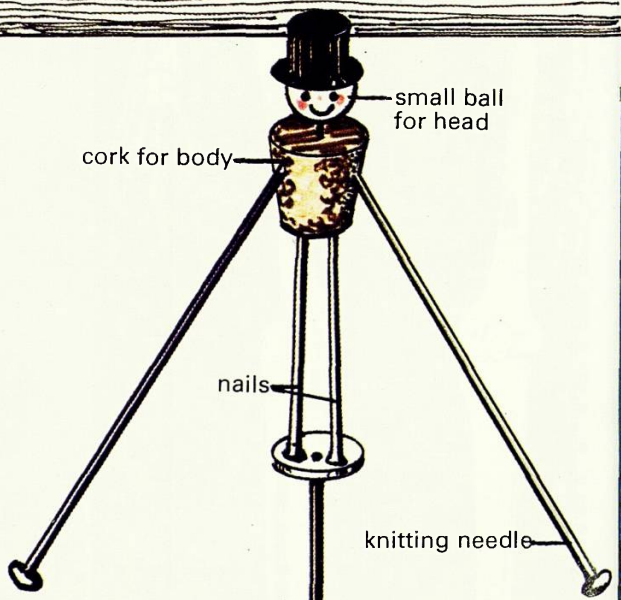
Walk along it with your arms held to your sides. Jump, land and balance on one foot. Look where your foot is. Would you have fallen off?

Do this again. This time have your arms outstretched.

Try again. This time hold a load in each hand (e.g. a plastic bottle full of sand).

Did these help your balance?





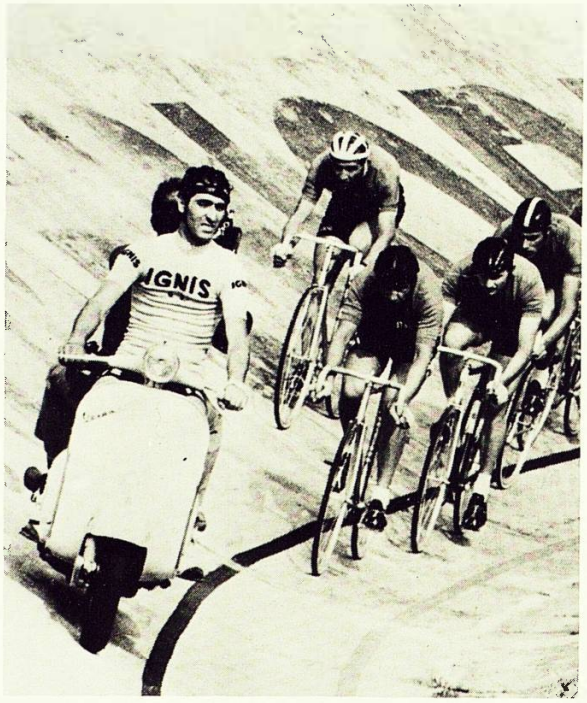
One way to balance is by moving outstretched hands or loads. The tight-rope walker uses this method.

Another way to help balance is to lower your **centre of gravity**.
(See *Science in a Topic — Ships*, pages 34, 35, 36, 37.)
Make a model 'gymnast' which can easily balance on a beam.
This model has a very low **centre of gravity.**
It is below the balance point. It is very **stable.**

SPORT ON WHEELS

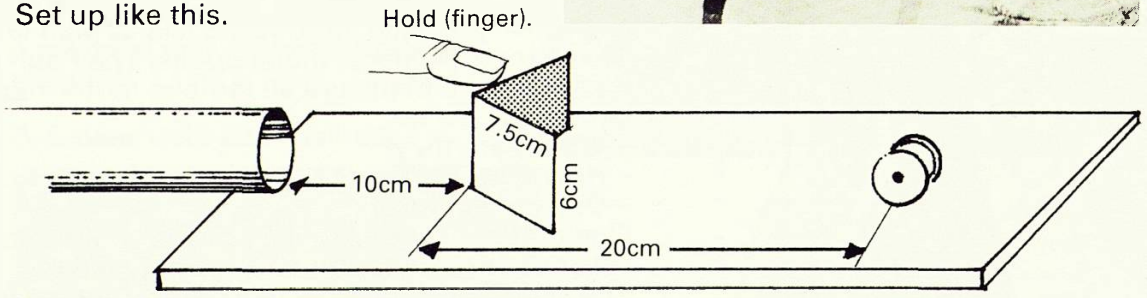
The wheels of sport can be driven by human muscle power.
They can also be powered by supercharged engines.
Roller skating, cycling and skateboarding are sports that use our skill and energy directly.
The 'Tour de France' is a great cycle race.
Find out – who wears the yellow jersey
– who is the 'king of the mountains'
– who has the 'lanterne rouge'.
For which wheeled sport is the Isle of Man famous?
Silverstone, Monaco, Indianapolis, The Paul Ricard and Le Mans are all famous motor racing circuits.
– Where are they?
– How long are they?
– Draw their shapes.
One of the most important rules of motor racing sets out the size of engine a car may have.
The set of rules for a car in a particular race is known as the *formula.*
What are the rules for:
– Formula One
– Formula Two
– International Formula Three?
Other kinds of motor racing are:
– stock car
– rally
– dragster
– karting
Collect pictures of cars used in all these events.
Make a display of these.

CYCLING



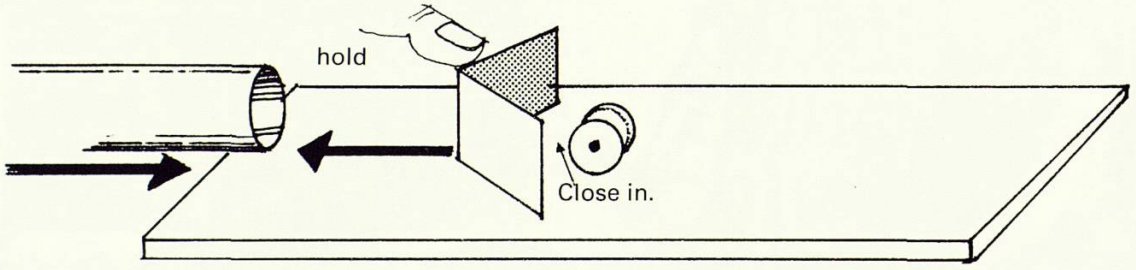
In some cycle racing pacing is allowed.
Sometimes the pacer is another cyclist.
The pacer can also be a motor cyclist.
This means the racing cyclist gets in close behind the pacer.
He is then in a slipstream.
Try this experiment to understand what happens.

Use a plastic cotton reel or film canister to represent the cyclist.
Use a piece of card 15cm × 6cm folded in half to represent the pacer.
We cannot easily watch the cyclist move through the air.
It is much easier to make the air rush past the cyclist.
Use a hair dryer to make the 'rushing wind'.
Set up like this.



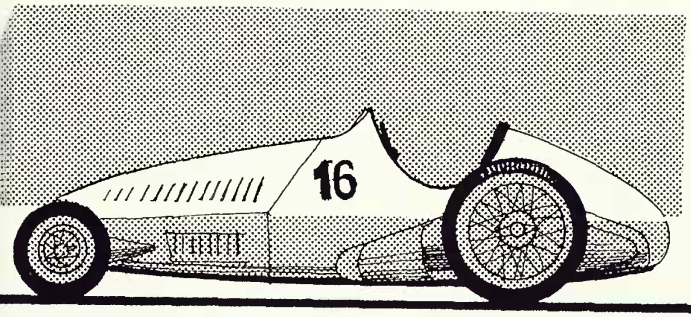
Start at 20cm.
Place the 'cyclist' at points – gradually 1cm nearer the 'pacer'.
Record what happens.

Now set up like this.
Slowly move the 'pacer' towards the 'rushing wind'.



Try to imagine and then draw the pattern of the air moving round 'pacer' and 'cyclist'.
These observations should help you understand about 'slipstreaming'.
There is further work about cycling in *Science in a Topic — Moving on Land,* pages 30 and 32.

You could try different sized 'pacers'.

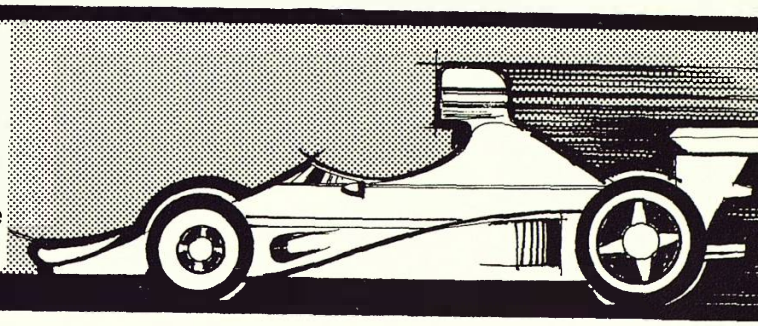


MOTOR RACING

With the invention of the motor car a new sport was born.
Races could be faster than ever before.
Science has helped the sport of motor racing.
Look at these pictures of early and modern racing cars.

Notice:

1 how the shape has changed
2 the change in the size and shape of the wheels and tyres
3 that the modern body is slung much lower down.
4 the aerofoil wing shape on the modern car.

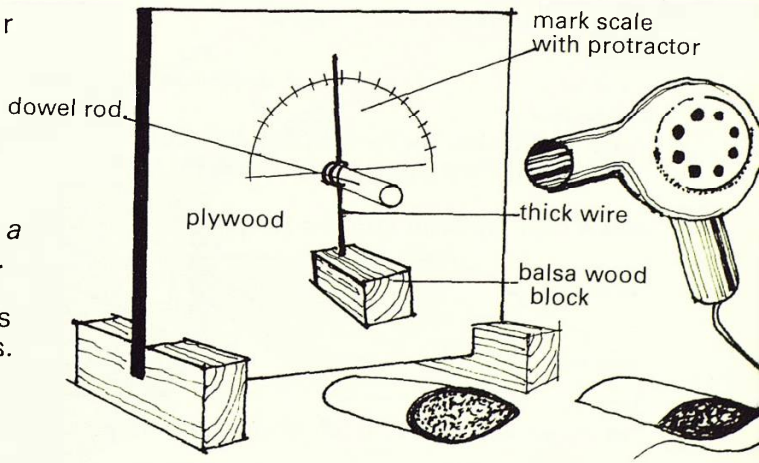


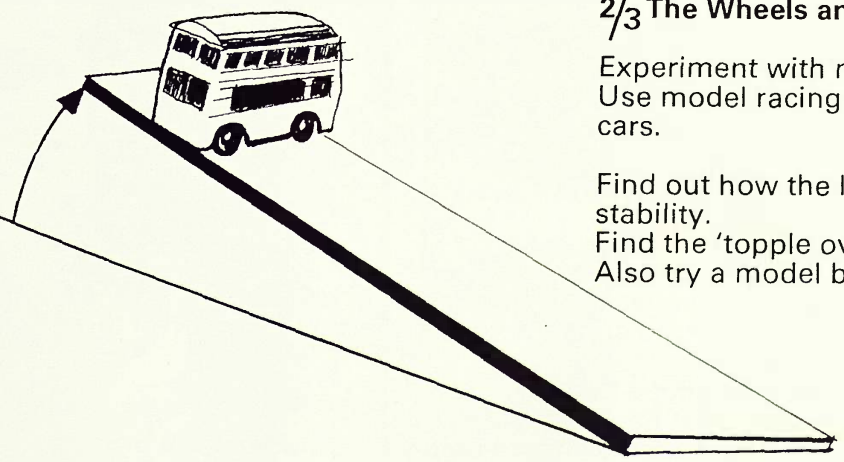
Experiment to find the reasons for these changes.

1 The Shape – Streamlining

There is some work on this in *Science in a Topic — In the Air* pages 40 and 41, and in *Science in a Topic — Moving on Land* page 35.

Here is another way to test shapes in the air and *measure* differences.



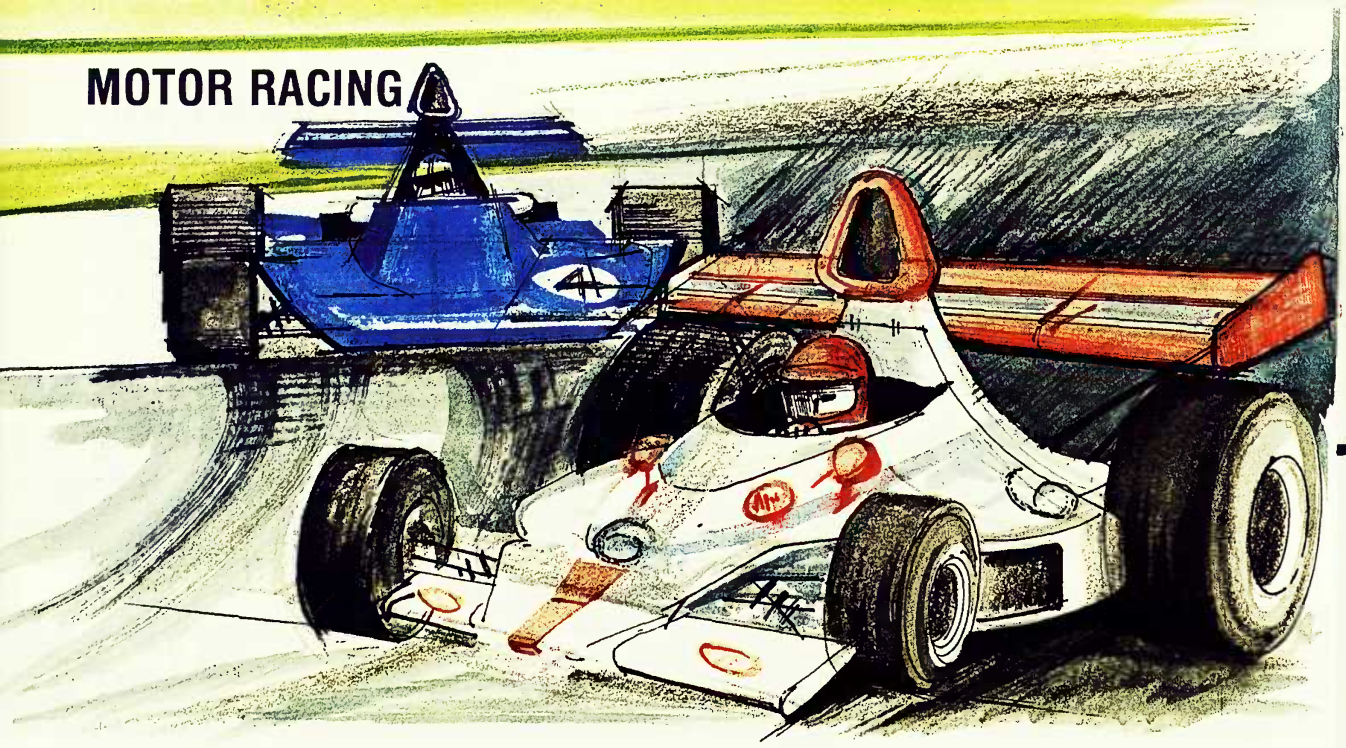


2/3 The Wheels and Body Position

Experiment with models.
Use model racing cars and ordinary model cars.

Find out how the low-slung, wide axles help stability.
Find the 'topple over' point.
Also try a model bus.

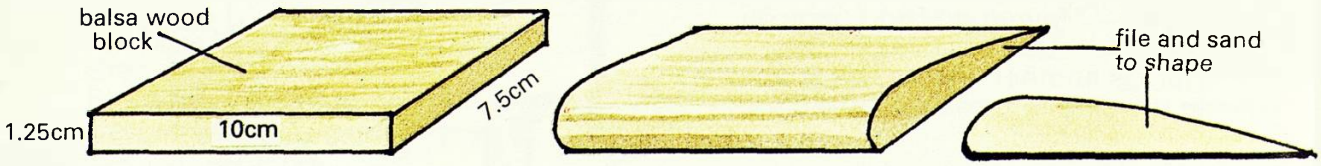
MOTOR RACING



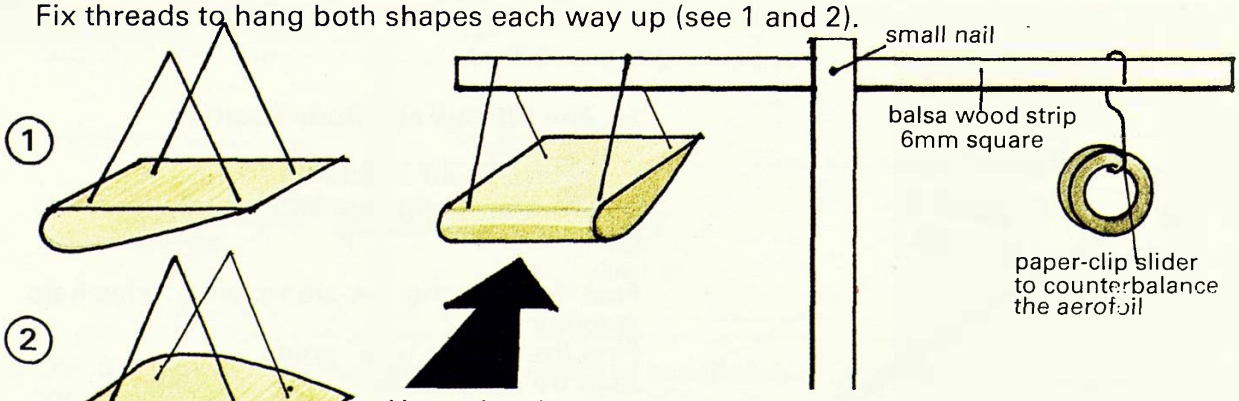
4 The Aerofoil Wing Shape

A racing car's performance depends very much on how the tyres grip the road surface.
They could use extra weights to help push down and gain grip.
(Why is this not such a good idea?)

Make two aerofoil shapes to experiment with.



Fix threads to hang both shapes each way up (see 1 and 2).

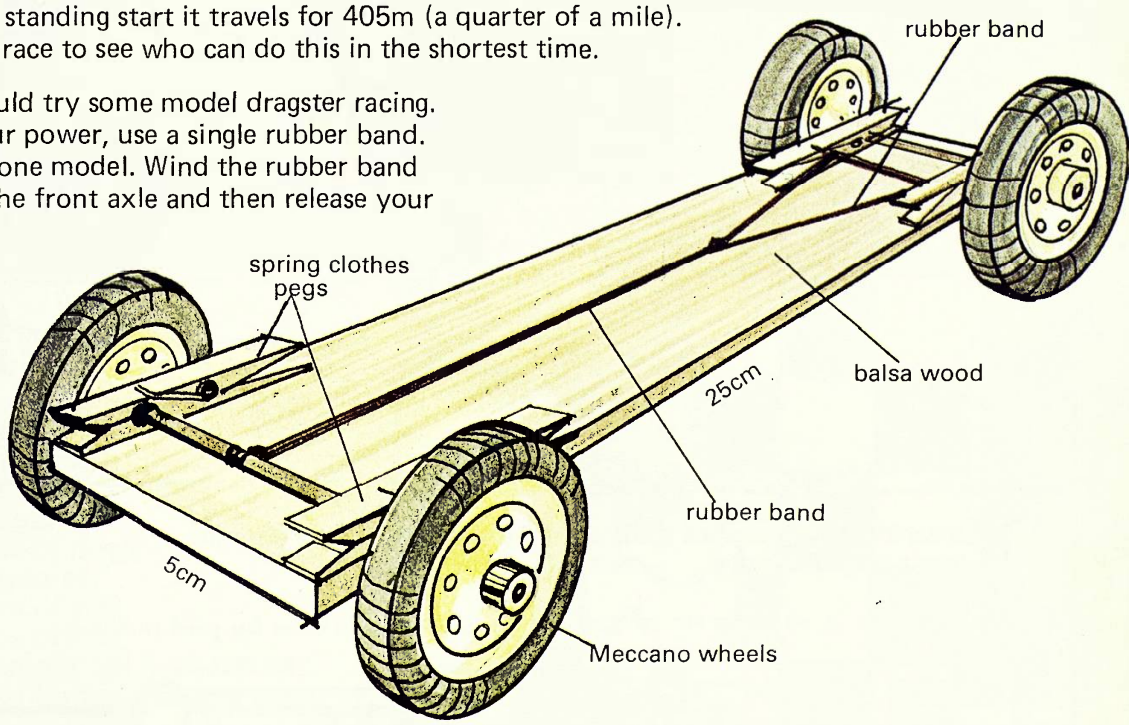


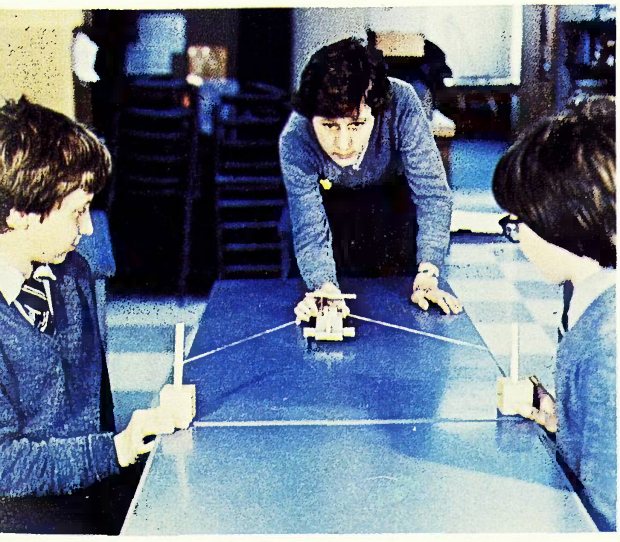
Hang the shapes on a 'balance'.
Use a small fan or hair dryer to blow an air stream at the shapes.
Use each shape in turn.
Record what happens.
Your experiments should help you to understand how the aerofoil uses the air pressure to increase tyre grip.

DRAGSTER RACING

This strange-looking racing car is called a dragster.
From a standing start it travels for 405m (a quarter of a mile).
Drivers race to see who can do this in the shortest time.

You could try some model dragster racing.
For your power, use a single rubber band.
Here is one model. Wind the rubber band round the front axle and then release your car.





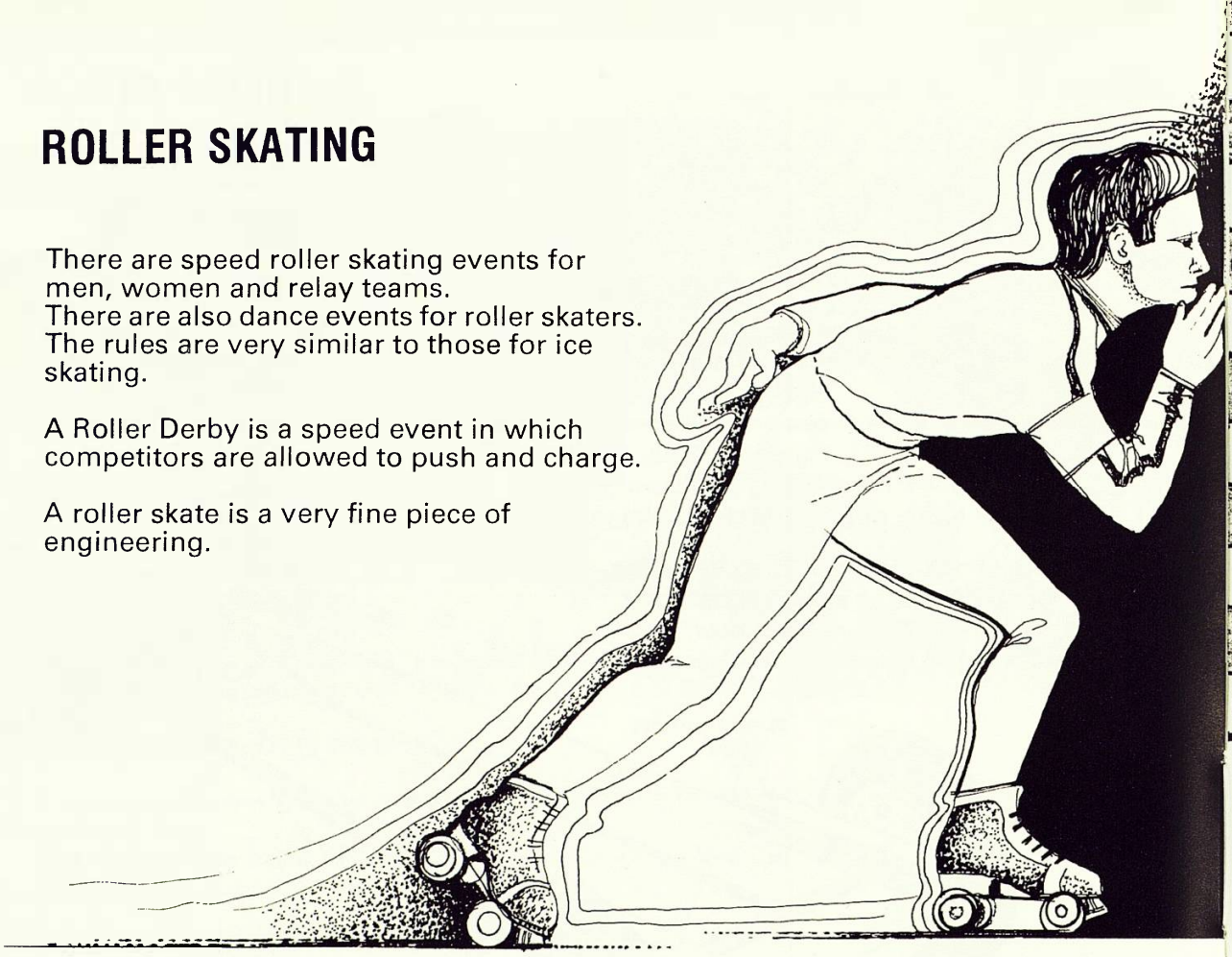
Friends could try other ideas.
Who can get their 'dragster' to travel furthest – fastest using the single rubber band?
Here is an idea this group used.

ROLLER SKATING

There are speed roller skating events for men, women and relay teams.
There are also dance events for roller skaters.
The rules are very similar to those for ice skating.

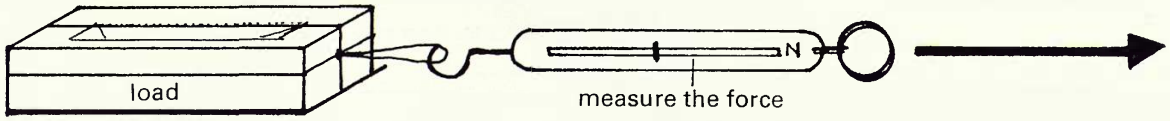
A Roller Derby is a speed event in which competitors are allowed to push and charge.

A roller skate is a very fine piece of engineering.

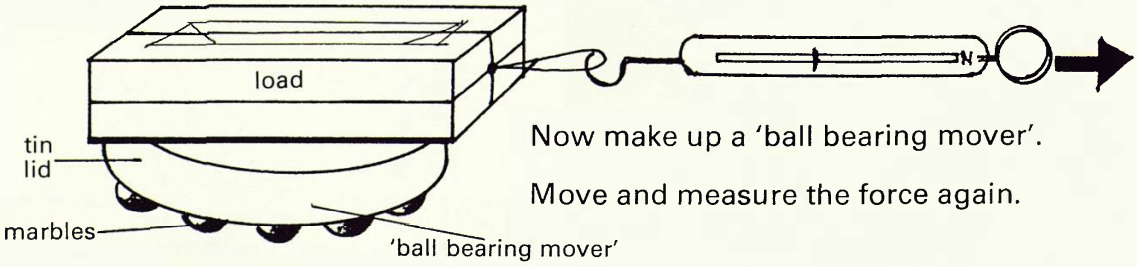


Ball bearings are used to make the wheels move more easily.
Try these experiments.

Move a load (a brick, a tin of sand) over a hard surface by just pulling.



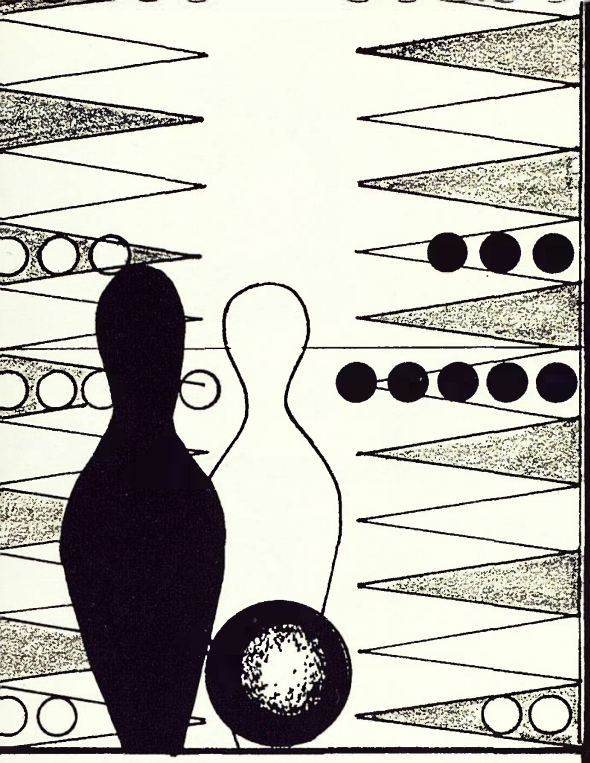
Measure the force needed to make it move.



Now make up a 'ball bearing mover'.

Move and measure the force again.

Experiment further to find if the number of marbles under the tin makes any difference.
Are big marbles better than small ones for a ball bearing mover?



INDOOR GAMES

There are hundreds of different indoor games.
Can you think of twenty-five?

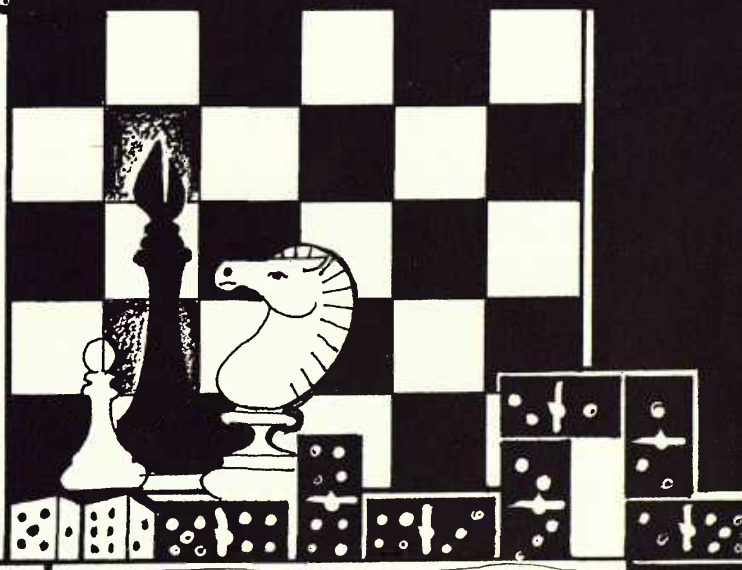
Here are some you may not know:

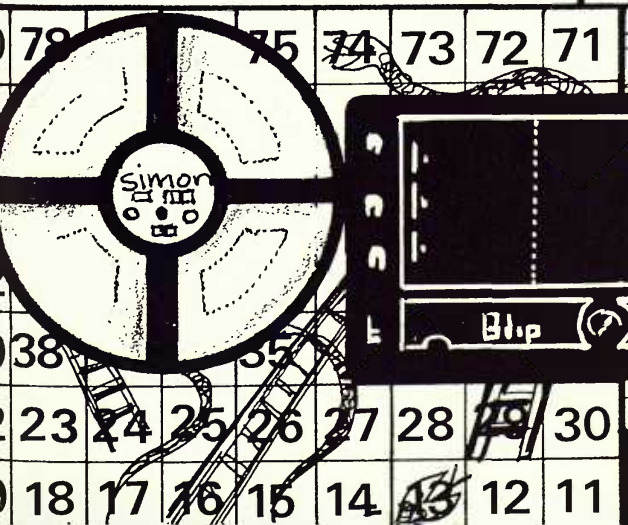
- Backgammon
- Nine Man's Morris
- Go
- Mancala
- Halma.

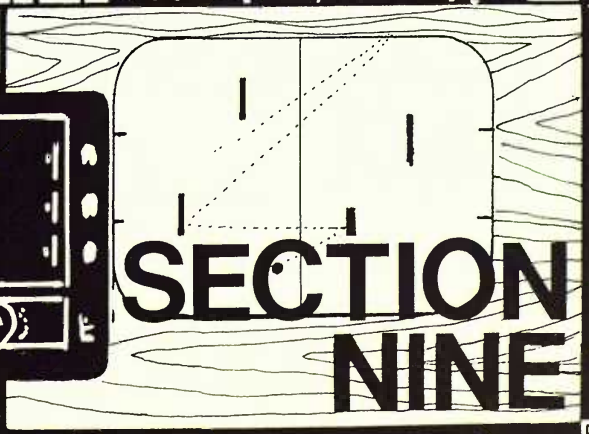
Find out about these games.

Sort your list into different sets and sub-sets.
Here are some suggestions:

- board games
- card games
- dice games
- word games
- games of position
- race games
- games of skill
- games of luck
- games of both luck and skill
- games for two players only.

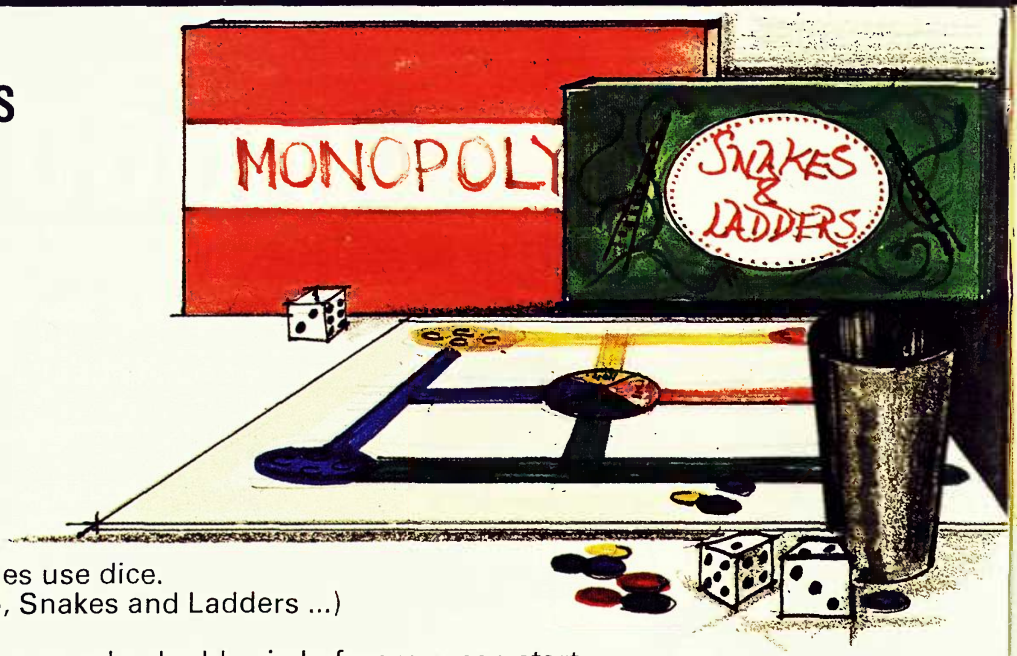






SECTION NINE

DICE GAMES



Many board games use dice.
(Monopoly, Ludo, Snakes and Ladders ...)

In some games you need a double six before you can start.
Have you tried and tried to get a double six while the others are racing on?

What are the chances of throwing a double six?

Here is a chart that shows the possible scores when throwing two dice.

	2	3	4	5	6	7
	3	4	5	6	7	8
	4	5	6	7	8	9
	5	6	7	8	9	10
	6	7	8	9	10	11
	7	8	9	10	11	12

1 How many ways can you score five?
2 How many ways can you score ten?
3 Which score is the most common?
4 What is the total number of ways of scoring?

The chance of something happening is said like this:
one in two – one in six – one in a hundred.
This means that for two (or six or one hundred) happenings one thing is likely to turn up.

1 If a coin is tossed, what is the chance of it falling 'heads'?

2 If one die is thrown, what is the chance of scoring three?

3 What is the chance of cutting the queen of spades in a pack of cards?

4 What is the chance of cutting an ace?

1 one in two
2 one in six
3 one in fifty-two
4 four in fifty-two
(= one in thirteen)

DICE GAMES

Toss a coin.
It lands heads.
If you toss again will it be tails?

Toss a coin a lot of times.
Is it more sensible to think that about half will be heads?

Throw a die six times. Will you score a one, a two, a three, a four, a five and a six?

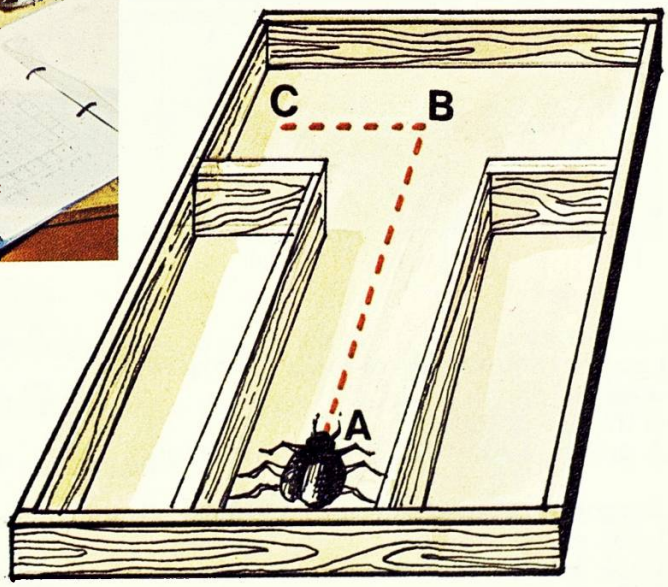
Throw two dice lots of times.
Add the two scores together each time.
Is it now more sensible to think there will be more sevens than double ones and double sixes?

Throw two dice lots of times.
(Perhaps friends can help.)

Compare your results with the chart opposite.

We must think about **chance** when working in a scientific way.
We must ask ourselves:
- is the result of the experiment the truth?
- is it just a chance happening?

Here is an example.



A beetle is put at A.

It walks to B.

It turns left to C.

Result – the beetle turned left. (True).

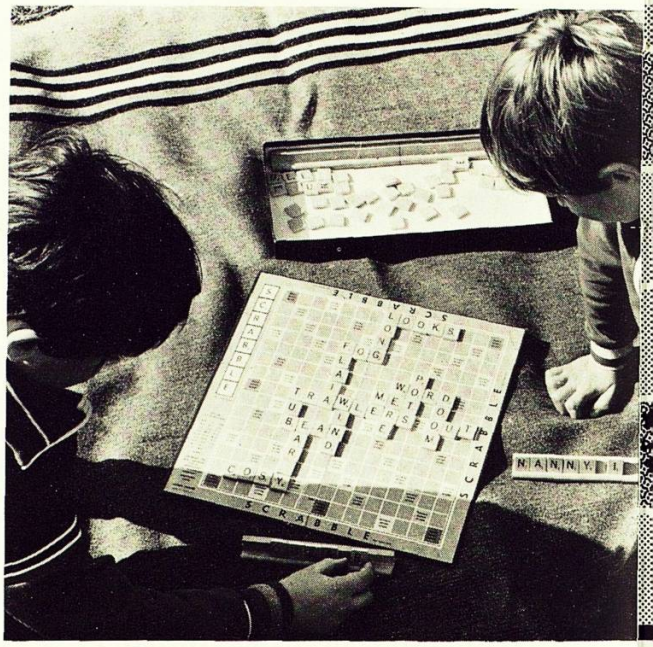
From this experiment can you say:
'Beetles always turn left'?

As with all experiments you need to repeat it many times before you could be sure it was not just – **chance.**

WORD GAMES

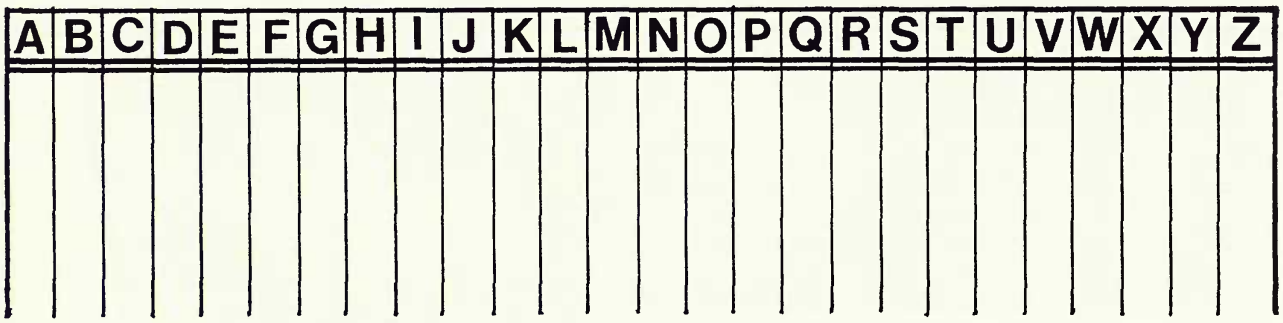
Lexicon, Kan-U-Go and Scrabble are word-making games.

Scrabble uses one hundred letter tiles.
There are more of some letters than others.
The number of each is as follows.



A – 9	B – 2	C – 2	D – 4
E – 12	F – 2	G – 3	H – 2
I – 9	J – 1	K – 1	L – 4
M – 2	N – 6	O – 8	P – 2
Q – 1	R – 6	S – 4	T – 6
U – 4	V – 2	W – 2	X – 1
Y – 2	Z – 1		

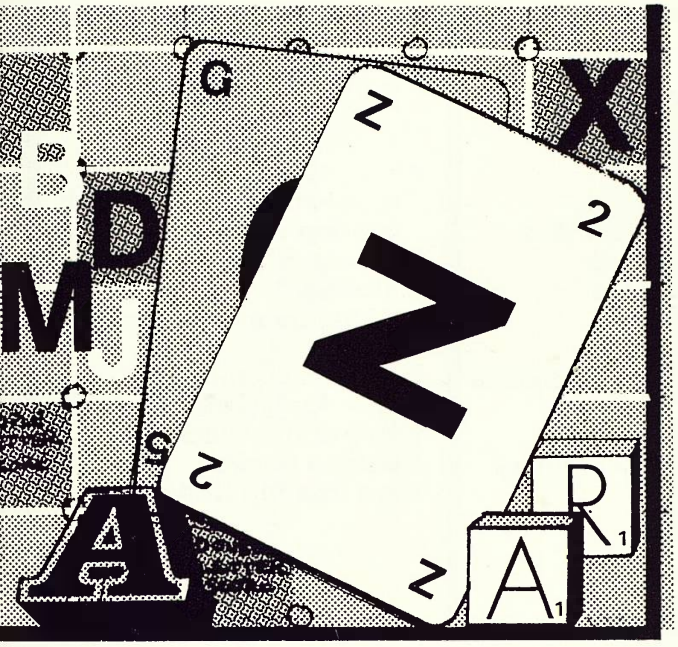
Why are the letters shared out like this?
Have the manufacturers been 'scientific'?
Research with letter counts.
Choose a page from a book.
Count how many times each letter is used.



Look at your count.
Look at the number of letter tiles Scrabble uses.
Is there a pattern?
A graph of each will help comparison.

Scrabble also gives scores for each letter.
Look at the scores.
Look at your letter count.
Is there a pattern here?

A – 1	B – 3	C – 3	D – 2
E – 1	F – 4	G – 2	H – 4
I – 1	J – 8	K – 5	L – 1
M – 3	N – 1	O – 1	P – 3
Q – 10	R – 1	S – 1	T – 1
U – 1	V – 4	W – 4	X – 8
Y – 4	Z – 10		



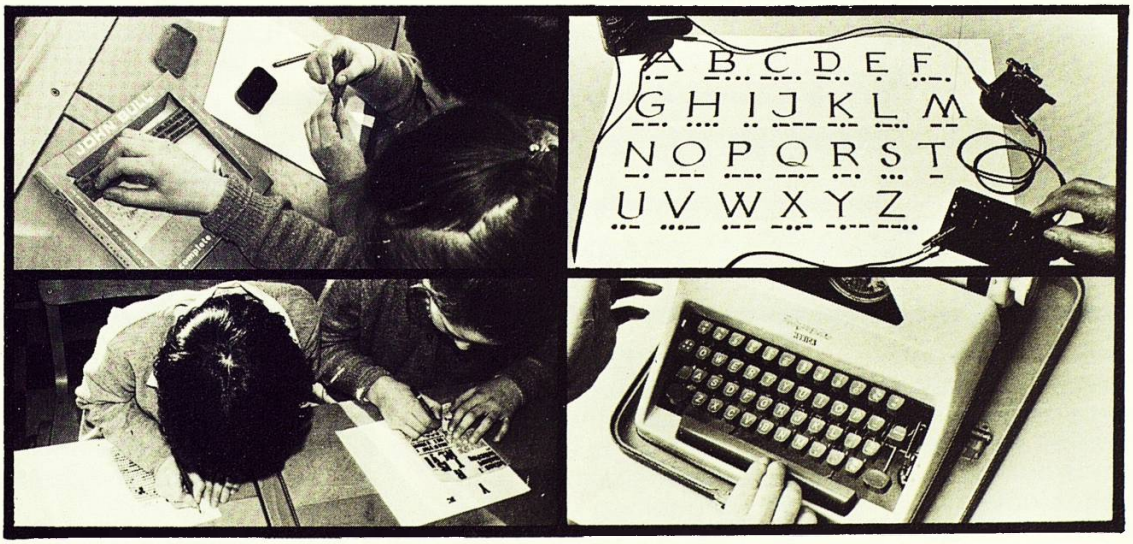
WORD GAMES

These games are played all over the world.
Will the number of letters have to be altered for sale in France?
Get a copy of something printed in another language. Look at more than one language.
Check these for letter counts.
Compare again with your Scrabble numbers.

Do the other word games have a pattern that matches your letter count?

A scientific letter count is used for these
- a printing set
- the Morse code
- rub-down letters
- a typewriter key board

How is the letter count used?



Here is a secret message.
You should be able to break the code.
Find the figure that occurs most often.
Your letter count will tell you which letter occurs most often.
Match them.
If you then have a three letter word ending in 'e' or starting with 'a' you should be able to guess what it will be.
Start putting these letters in place of the figures.

24.10.25.26.14, 24.22.9, 23.26, 23.13.10.6.26.9, 23.20, 6.9.10.18.4.9.2, 15.3.22.15, 14.10.8.26, 7.26.15.15.26.13.14, 22.13.26, 16.14.26.25, 8.10.13.26, 15.3.22.9, 10.15.3.26.13.14, 15.3.26, 7.26.15.15.26.13.14, 15.3.22.15, 22.13.26, 16.14.26.25, 22, 7.10.15, 24.22.9, 23.26, 11.16.15, 4.9.15.10, 11.7.22.24.26, 4.9, 15.3.26, 8.26.14.14.22.2.26, 22.9.25, 15.3.4.14, 24.22.9, 23.26, 15.3.26, 23.26.2.4.9.9.4.9.2, 10.1, 23.13.26.22.6.4.9.2, 15.3.26, 24.10.25.26.

SPORTS AND GAMES

MATHEMATICS

Speeds and Timing
Pitches and Tracks – Measuring and Marking
Scoring – Counting – Recording
Chance and Probability
Sampling
Co-ordinates
Length, Area and Volume
Maps, Plans, Scales
Paths of Movement
Averages
Costing – Clothes and Equipment
Statistics

GEOGRAPHY

Nations and National Sports
Mapwork – Land and Leisure
National Parks
Playgrounds and Plans
Teams and Places
Races and Routes
Orienteering
Mountain Sports
River, Sea and Lake Sports
Sports for Different Climates
Leisure – a New Industry

R.E. and MUSIC

Games and Contests in Early Religions
The Maya Ball-game
Fair Play
Codes of Honour in Sport
Cheating and Fouls
Hunting, Blood Sports and Bullfights
Spectators and Violence

Post Horn Gallop
Music for Olympic Games
Entry of the Gladiators
Blaydon Races
Eton Boating Song

ENGLISH

Vocabulary of Sport
Surveys – Questionnaires
Sport and Games in Stories and Poems
'Tom Brown's Schooldays'
'Reynard the Fox'
'England, their England'
'Three Jolly Farmers'
Word Games and Crosswords
Playground Rhymes and Games
Oral Work – Sports Commentaries
Creative Writing – Sports Reports
Reference Work – Great Sporting Events and Personalities

ART AND CRAFT

Action Paintings
Wire Sculptures
Co-operative Pictures – Sports Day
Making Games
Modelling
Technology – Devising Test Equipment
Design – Badges, Symbols, Tee Shirts

HISTORY

Marathon
The Early Olympics
Chariots and Gladiators
Hunting and Hawking
Tournaments and Jousts
Duelling
Bear-baiting and Cock-fighting
Road-racing and Coaching
Cricket and Prize-fighting
History of Present-day Sports
Mechanical Sports
Sportsmen of the Past
Record Holders

I do not know if you had realised. but each Science in aTopic Books - has a FAMOUS SCIENTIST of the Book.

eg.
- SHIPS - LORD KELVIN.
- HOUSES - MICHAEL FARADAY.
- CLOTHES - SIR WILLIAM PERKIN.
- COMMUNICATION - THOMAS EDISON.
- FOOD - LOUIS PASTEUR
- MOVING ON LAND - ISAAC NEWTON.
- ROADS BRIDGES AND TUNNELS - I.K. BRUNEL.
- -IN THE AIR - BEN FRANKLIN.

the GREAT SCIENTIST OF SPORTS AND GAMES ....

is featured on page 13.

Science in a Topic – SPORTS AND GAMES

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