BAL VAIGYANIK

class 6

an eklavya publication

I heard...

I forgot

I saw...

I remembered

I did...

I understand

BAL VAIGYANIK

Class 6

Dedication

To all those teachers and children whose participation in the Hoshangabad Science Teaching Programme during 30 years made this new revised edition possible

AN EKLAVYA PUBLICATION

BAL VAIGYANIK Class 6
Developed by Hoshangabad Science Teaching Programme

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Dear children,

This book is meant for doing, not for memorising. It has several interesting experiments. Perform them, observe, think and understand.

There is a lot to learn even outside the school. Go on field trips with your teacher and classmates to learn about crops, rivers, streams, insects, forest, rocks, soil, the sun, moon and stars. You can learn many things on your way to and from school and at home as well.

You will be performing experiments in groups of four. It is essential to do the experiments yourselves. It is not enough just to watch others performing them. To learn science well, you must perform all the experiments yourself during the course of the year.

Your school has a kit for performing the experiments. It is your collective responsibility to take care of this kit. After an experiment, clean the apparatus and put it away carefully and safely. Many of the items needed for doing experiments are available in your immediate surroundings. Collect these yourself whenever necessary.

Several questions have been included after each experiment and/or field trip. These questions are numbered and the number is written after the question. Note the question number in your exercise book when you write the answer. It is not enough to merely write 'Yes' or 'No' as your answer. Write the answers in such a way that you are able to remember which question each answer is related to even months after you have done the experiments. Your text book has the questions and your exercise book the answers. The two put together form the complete book. Therefore, preserve your exercise book till your Class 8 Board examination.

You will learn about new things in every chapter. After completing each chapter, carefully note all the new things you have learnt in your exercise book.

Repeated exercises are necessary to consolidate our understanding of any subject. All the chapters have questions for exercises at the end. You must attempt these questions. If you require more questions for exercises you can use the Question Bank. You can get more details about the Question Bank from your teacher.

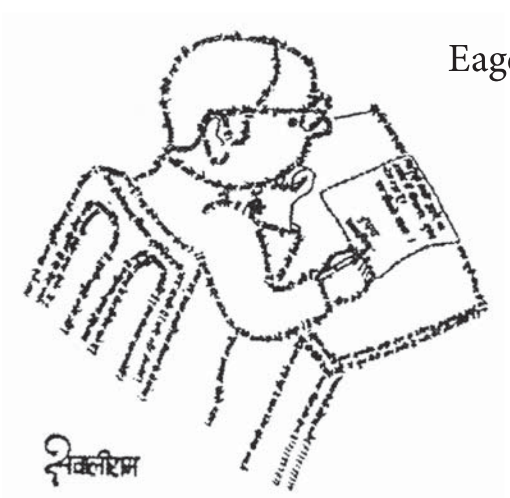
In addition to the chapters, your book has four pages containing interesting activities. You should do these activities on your own at home, or with your friends, during your leisure time. You must write to me about your experience with these activities.

Whenever a question arises in your mind, discuss it with your friends and ask your teacher about it. No question is worthless. Sometimes, you may not immediately find an answer to a question that may arise in your mind. Write down such questions in your exercise book. You may get the chance to ask someone else and get answers to your questions. If you wish, you could send these questions on a postcard to me.

How do you find this book? Do you enjoy learning science with it? Do you go on field trips? Are you able to perform all the experiments? Have you faced any problems? Write to me about all your experiences, and also send me questions to which you could not find answers. My address is:

SAWALIRAM

c/o Eklavya, Kothi Bazar
Hoshangabad - 461001

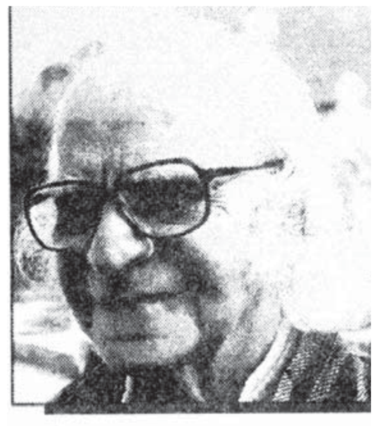


Eagerly awaiting your letters.

Yours,
Sawaliram

Picture of Sawaliram drawn by Umesh Chauhan, Assistant Teacher, Timarni

FOREWORD

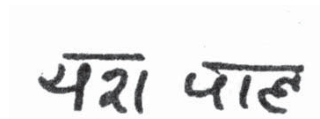


I am happy to say a few words about the revised edition of *Bal Vaigyanik*. The efforts made in last thirty years in the field of education by Eklavya and, before that, Kishore Bharati, are probably without parallel. What is so special about this work? Actually, several things. But first I would like to say that the attempt to link learning with life is rarely seen elsewhere. We generally assume that a good curriculum is one which is prepared by experts. And experts do not need to know about the environment in which a child begins to form her or his relationship with the world - what the child sees, understands, internalises and explores. And if the experts are from outside the country, all the better. It is assumed that if a good curriculum is packed well in a strong box and placed anywhere, knowledge will sprout and spread. But this just does not happen.

It is possible that some teachers, a few officials of the Education Department and some parents may suffer from the misconception that *Bal Vaigyanik* is science of a somewhat lower standard, because many chapters seem to be related to rural life. This is not true. The environment, flowers, plants and food items are found in life anywhere. What people generally fail to understand is that the elements of science are present in these things as well. This is why science education is often reduced to superficiality. When we live without understanding what is familiar to us, we slowly forget the very habit of understanding itself. If the habit of understanding and the method of understanding do not evolve together, then the science we learn remains barren. This disease afflicts not just school education today, but also our higher education as well. That affliction, too, needs to be eradicated.

Bal Vaigyanik is a profound effort. Yet it needs to go even further. Only when such thinking spreads to high schools, colleges and universities can we produce scientists of high calibre. Only then can we infuse new life into the nation. Any delay will ensure that education remains an exercise in preparing for subservience.

I congratulate the Education Department of Madhya Pradesh for having taken this vital step jointly with Eklavya. However, I would like to add a word of caution here. Do not take *Bal Vaigyanik* as the truth and ideal for all times. Teachers, too, must not think that they now have a new kind of *Gita* in their hands. This book needs to be used with freedom, not with reverence. If you feel something needs to be changed, change it. In fact, every child should have a unique curriculum which changes with her or his changing world. This may appear extremely difficult in the prevailing system. Nevertheless, let us take a step forward. It will be a joyful experience.



(PROFESSOR YASH PAL)

Professor Yash Pal is an eminent space scientist, active in popularising science. He was Chairperson of the committee constituted by the Government of India to recommend measures to reduce the load of the school bag. He has been associated with many organisations and institutions : as Scientist at the Tata Institute of Fundamental Research, Mumbai; Director of the Space Application Programme of the Indian Space Research Organisation; Chairperson of the University Grants Commission; and Chairperson of the Indian Science Congress.

A WORD FROM US. . .

You have, in your hands, the first book (Class 6) of the revised *Bal Vaigyanik* series. As with earlier editions, in this edition, too, major contributions have been made by school teachers and resource teachers of the programme. The feedback of their experiences with children in the classroom has formed the basis of the changes in this edition.

The resource group, too, has played an important role in this task. The Science Education Group of Delhi University had a major hand in conceptualising and preparing this edition of *Bal Vaigyanik*. Scientists and educationists from Delhi University, Indian Institute of Technology Mumbai, Tata Istitute of Fundamental Research Mumbai, National Institute of Immunology Delhi, Holkar Science College Indore, other colleges and institutions of Madhya Pradesh, all participated in the revision process, along with teachers and Eklavya personnel. They worked together to reinforce the content, conceptualise and design new experiments, and revise old ones wherever necessary.

Thus, the *Bal Vaigyanik* books are a well organised amalgam of a deep understanding of science and concrete experiences with children. *Bal Vaigyanik* attempts to facilitate learning of even the most difficult concepts of science through experiments and discussions in a simple and interesting manner.

We believe that learning science should be a fascinating experience and should excite the curiosity of the learner. If by its manner of teaching, science is boring and difficult, children will run away from the subject even more. Once the curiosity of children is excited, they can be motivated to happily learn the most difficult topics on their own initiative. Their pace of learning also becomes faster.

There is often a misconception that since *Bal Vagyanik* appears simple, it is science of a lower standard. This misconception needs to be removed. The topics covered in *Bal Vaigyanik* are the same as in other textbooks. Measurement, classification, and other topics in biology, physics and chemistry are all covered. Topics are given names different from those in conventional textbooks because they are often treated differently and also to raise the curiosity of children.

Hoshangbad Science is only a different approach to teaching and learning science; it is not a different type of science. Everyone accepts that science is not a subject to be memorised from textbooks. It is important that children understand scientific principles in depth. And the best way to understand scientific principles is by performing experiments and making observations. So if you want to teach the principles of magnetism, do not make children memorise definitions about magnetism. Place a couple of magnets, iron filings, some pins, a compass, thread and a few other things in their hands - you will find that within an hour or so they will discover many principles about magnets. Not just that, they will also start asking a host of questions - just like any scientist would.

Bal Vaigyanik does not generally contain answers to questions. This fact worries many parents and teachers. However, if you read the book carefully, you will find that questions are formulated on the basis of classroom experiences of children and are structured in such a manner that, with a little prodding, children are able to answer them and start thinking. To make children learn to think for themselves is the main objective of education today. If we ask and answer all the questions ourselves, how can children get the opportunity to think and understand?

However, one factor has been kept in mind while preparing *Bal Vaigyanik*. Questions which children might not be able to answer, or are unlikely to have information about, have been explained in a simple manner with illustrations.

In the present revision process two other aspects have also been kept in mind. The first is that we have included a number of new exercises to provide children the opportunity to practice and strengthen their understanding. For parents and teachers who want their children to do even more exercises, we have published a separate question bank, which is easily available.

Mahendra Baudh
Minister
School Education

Residence: 8, Civil Lines
Telephone R : 536033
0 : 552171
Fax : 536055
No.3439/Minister/Sha.Shi.//2000
Bhopal, dated 04/8/2000

MESSAGE

It gives me immense pleasure to learn that the MP TextBook Corporation is publishing the new revised edition of Class 6 *Bal Vaigyanik*, prepared as part of the Hoshangabad Science Teaching Programme.

The main objective of science should be to provide an innovative forum within the framework of accepted educational principles so that children are motivated to learn scientific theories by doing, observing and understanding, rather than through memorisation. Science should be taught in a manner which enhances curiosity, logical thinking, observation and experimental skills and the analytical ability of students.

The eminent scientist, Professor Yash Pal, had made valuable recommendations for decreasing the load of the school bag. I am happy that the MP Government has implemented these recommendations in an attempt to reduce the burden of the school bag, so that today's children can develop into scientists of the highest calibre who will make the nation and state proud.

Hearty congratulations to the Eklavya family for its innovative initiative.

(Mahendra Baudh)

The second aspect is that we have included a number of interesting narratives about science. The expectation is that children will read these narratives, understand them, think about them and, hopefully, be inspired by them.

We have also experimented with new ideas in terms of layout and illustrations in this edition of *Bal Vaigyanik*. Such experimentation was made possible through the involvement of members of the faculty of the National Institute of Design, Ahmedabad. We are eager to know about your reactions to these changes. Please let us know what you think.

The Hoshangabad Science Teaching Programme was an innovative experiment undertaken by the School Education Department of the Government of Madhya Pradesh and the State Council of Educational Research and Training (SCERT). A unique feature of this programme had been the involvement and contribution of non-goverment organisations like Kishore Bharati and Friends Rural Centre earlier, and Eklavya afterwards. We hope we can help in attempts to improve science education at the school level not just in Madhya Pradesh, but in Rajasthan, Gujarat and other states as well.

This revised edition of *Bal Vaigyanik* is but a step in its continuing improvement and progress. The road ahead is long. Therefore, you should continue to send us your valuable opinions, criticisms, and suggestions. We look forward to hearing from you.

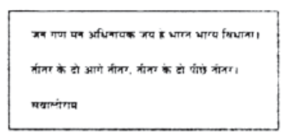
With best wishes

Hoshangabad Science Group, Eklavya

CONTENTS

FUN-N-GAMES 1

Look at the pictures below. Are you able to clearly see what is shown and read what is written?



Take a hand lens (magnifying glass) from the kit. Look at the pictures through it. Move the lens up and down until the images are clear and in focus.

What can you see when you look through the lens? Can you spot any mistakes in the drawings?

What's written in the box?

Let's now look at some tiny things with the lens. First catch an insect (an ant, mosquito, louse, fly or whatever). Examine it carefully through your lens.

Can you discover any new parts of the insect on looking through the lens? Draw a picture of whatever you see. Examine a few more insects with the lens and draw their pictures also.

Now take a piece of cotton thread. Draw a picture of it. Then examine it through the lens.

Draw another picture of what you see now.

In the same way, you can use the lens to examine different things like the torn edge of a piece of paper, cotton, grass or a slice of some vegetable.

A PUZZLE (SPOT THE DIFFERENCE)

These two pictures look alike, but they aren't. Examine them closely with the help of the lens.

Can you spot the differences between the two pictures?

MAKE YOUR OWN LENS

So far you have been using a hand lens to see small things. We can also use an old fused bulb to view small things more clearly. Let us see how this can be done.

Find an old transparent electric light bulb that is fused. Place it on the floor and remove the black part (*chapadi*) at the bottom by gently knocking it off with a stone. Be careful not to break the bulb. You could place the bulb on a piece of cloth or an exercise book to cushion it so that it does not break.

You will see a glass tube on which wires are fixed. Insert a long iron nail or wooden stick to break this tube.

Shake the bulb so that the broken pieces of glass and wire fall on a piece of paper. Carefully throw these broken pieces of glass and wire in a dustbin.

You now have a hollow glass bulb with a metal cap. Fill the bulb one third full of water. Your bulb lens is ready.

Use it to look at the writing in your book.

Do the letters look bigger?

Now use your bulb lens to take another look at the pictures at the beginning of this chapter.

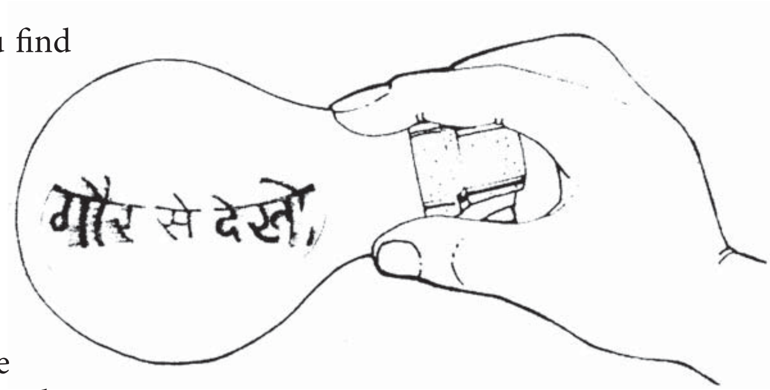
What can you see now?

Carefully examine the cycle drawn in the picture (Page 1) with both the hand lens and the bulb lens.

In comparison to the hand lens, does the picture seen through the bulb lens appear bigger or smaller?

Look at other tiny things with your bulb lens - a grain of sugar or salt, different kinds of seeds, etc.

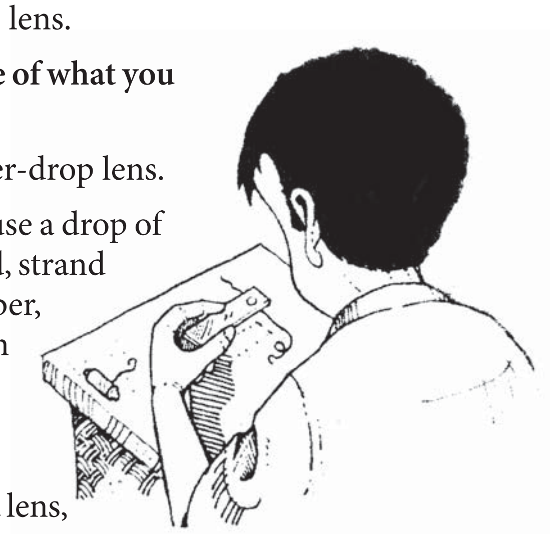
Draw pictures of whatever you find interesting among these.



A WATER-DROP LENS

Take a glass slide or a piece of glass with smooth edges. Clean it thoroughly and look at a piece of cotton thread through it. Now put a drop of water on the glass. To do this, take a matchstick, dip it in water and gently let one drop drip onto the glass. The drop shouldn't spread. If it does, then rub the slide a few times on your hair to spread the oil from your hair over the glass. Put another water drop on it. Then take another look at the piece of cotton thread through your water-drop lens.

Does the thread appear thicker? Draw a picture of what you see.



Look at a strand of your hair through your water-drop lens.

Now clean the glass slide and, instead of water, use a drop of oil or glycerine to make a lens. Look at the thread, strand of hair, etc, through these lenses also. Remember, you may have to move the slide up or down in order to see the object clearly.

THE MICROSCOPE

Whenever you wish to see anything clearly with a lens, you have to move the lens either closer or further away from the object. To make this task of adjustment easier, the lens is fitted into an instrument. Such an instrument is called a microscope.

A MATCHBOX MICROSCOPE

We will now make a microscope using a matchbox. We'll use a drop of water or oil for our lens and the matchbox as the body. Collect the following materials to make the microscope:

an empty matchbox (made of cardboard)

a pin	white paper
a one-sided blade	a stick of incense (agarbatti)
two rubber bands	glue

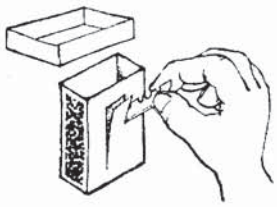


Figure 1

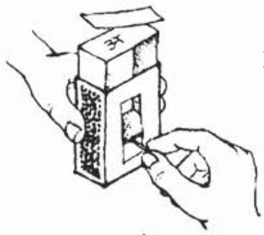


Figure 2

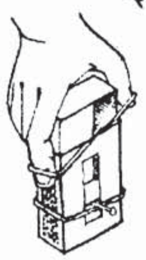


Figure 3

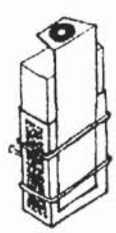


Figure 4

Use the blade to cut a window in the top of the outer casing of the matchbox (Figure 1). Take the inner tray of the matchbox and paste a strip of white paper on the surface marked 'A'. Slide the inner part of the tray into the casing. Stick a pin through the casing window into the lower wall of the tray (Figure 2).

On the last two pages of this book you will find a strip of stiff paper which you can use for making your microscope. Cut it out. At one end of this strip is a black circle with a white dot in the middle. Burn out this white dot with a lighted agarbatti so that you now have a small round hole. Fold this flap along the dotted line XY at a right angle.

Fix this strip to the back of the outer casing of the matchbox with the help of the two rubber bands (Figure 3). Apply a little oil on the black circle. Then dip your finger in water and gently tap a drop of water into the hole in the centre to make the lens. Your microscope is now ready (Figure 4).

Place whatever you want to see with the microscope on the white surface of the matchbox tray. Look at it through your water-drop lens. Adjust the distance between the lens and the object by moving the inner tray up or down, using the pin as a handle, to get the clearest view.

The matchbox microscope will give the clearest picture if you use it outside in bright sunshine.

THE MICROSCOPE IN YOUR KIT

Ask your teacher to let you look at the microscope in your kit (Figure 5). Ask your teacher to separate its parts and show you these parts. The separate parts of the microscope are shown in Figure 6.

The lens of this microscope is a glass bead. The picture shows where to fit the lens into the microscope.

This glass bead is the life of your microscope. Take good care of it.

Clean it and put it back into the microscope and then cover it with the lens cap.

HOW TO USE YOUR MICROSCOPE

Place the object you want to examine on a glass slide. Fix the slide under the two clips. Ensure that the object lies directly below the lens.

Close one eye and look into the lens with the other. Turn the knob of the microscope to adjust the distance between the lens and the object, until you see the object clearly.

Turn the mirror attached to the microscope towards a light source and then rotate it till you see the object more clearly.

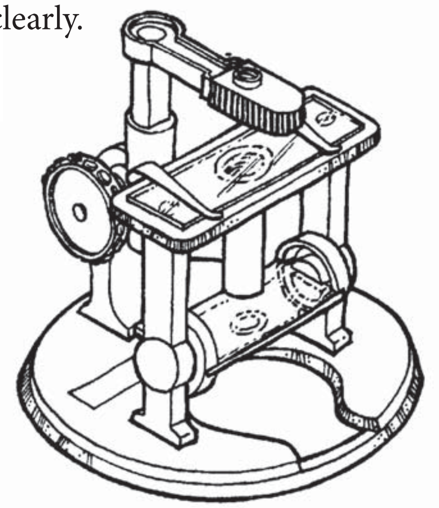


Figure 5

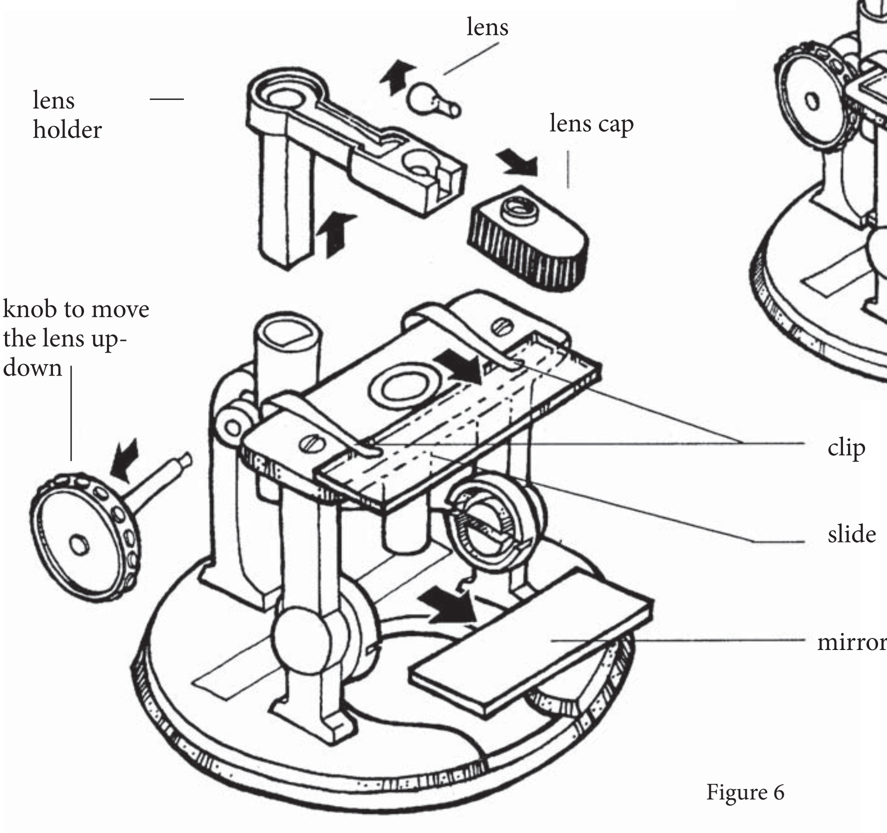


Figure 6

You will have to take turns practising how to use the microscope in order to learn to use it correctly.

Your microscope is a very delicate instrument. Use it carefully.

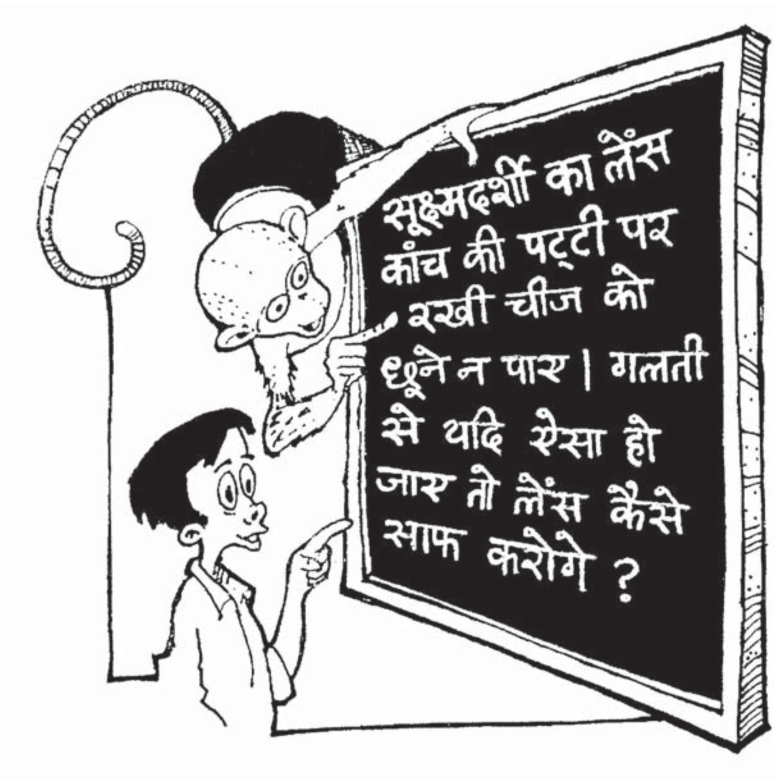
Use your microscope to look at a strand of your hair, tiny insects, the petal of a flower, grains of sugar, an ant, etc.

How thick does your hair appear?

What do the legs of a small insect or an ant look like?

The lens should not touch the object on the slide. If it does touch the object by mistake, how will you clean the lens?

What does the shape of a grain of sugar appear like through the microscope?



Can you see any new features in the flower petals?

Under this microscope, an object appears 50 times larger than its actual size.

CONDUCT AN INVESTIGATION

Get some water from a pond or a puddle. Put a drop of this water on a glass slide and examine it through the microscope.

What do you see in this drop of water?

SOMETHING ELSE TO THINK ABOUT

You might think by now that lenses always make things look bigger. This isn't true. You can also use the hand lens in your kit to make things look smaller and upside down.

In order to do this you will have to look at things that are far away. Keep the lens about two feet from your eye and look at distant things through it. To make these things look clearer you may have to move the lens back and forth.

NEW WORDS

hand lens	lens	microscope
instrument	slide	kit

The method of making the matchbox microscope (page 4) was developed by Shri Jagdish Chandra Srivastav, a teacher in Shasakiya Middle School No. 1, Sanwer, Indore District.

SORTING THINGS INTO GROUPS 2

You see and use many different things every day. You are usually able to identify these things without any difficulty because they are different from each other.

Examine the two things you have been given.

Do you see any differences between them? Note down these differences. (1)

Do they also have some similarities? If so, note these down as well. (2)

We will now repeat this exercise with some other objects.

MAKING GROUPS

Take the following objects from your science kit:

test tube, test tube stand, beaker, ball, cork, plastic cube, overflow vessel, marble, hand lens, glass tube, glass slide, measuring cylinder.

Do you know what these objects are? If you don't, ask your teacher to identify them.

Make sure you know what each object is.

Copy this table in your exercise book and fill the names of the objects you have in the third column. (3)

TABLE 1

No.	Name of the Group	Objects in the Group
1.	Glass things	
2.	Wooden things	
3.	Plastic things	
4.	Transparent things	
5.	Round things	
6.	Things that float in water	

Among the objects

given to you, is there anything that you haven't put into any group? If so, check carefully to see if you can put it into some group.

Now you have several groups of objects. There is at least one similarity between all the objects in each group. For example, in the first group everything is made of glass.

Thus, we see that we can put things into a group on the basis of a similarity. All the things in one group share that similar characteristic. We call this similarity the common characteristic of the group.

Now sort the objects into more groups on the basis of other similarities.

Write down the groups you make in Table 2. (4)

TABLE 2

No.	Similarity or Common Characteristic	Objects that fit in the Group
1.		
2.		
3.		
...		
...		

Think of at least one new item to add to each of these groups.

Discuss each name you have thought of with your class and decide if it has been added correctly. If it is correct, add the name to your list. (5)

Some characteristics (properties) are given below. Make groups based on these characteristics. Each group should have at least 10 members.

(a) animals with tails

(b) edible items

(c) things made of iron

(d) fruits

(e) things used in the kitchen. (6)

Answer the following questions about the groups you have made, giving reasons.

Can frogs be included in group (a)? (7)

Can a mango be included in group (b)? (8)

Which group would a frying pan be a member of? (9)

Would a hammer be a member of group (e)? (10)

Can a mango be included in group (d) also? (11)

Make a list of things that are made of iron and are also used in the kitchen and can, therefore, be included in both these groups. (12)

THINK IT OVER

Does an item that belongs to two groups have,

- the characteristics of neither of the two groups,

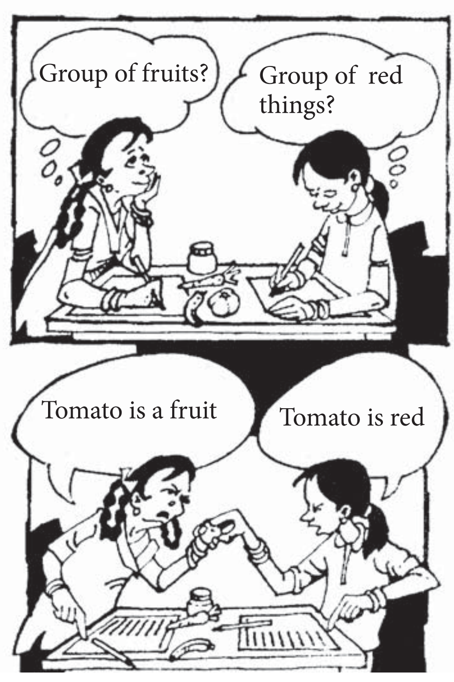
- the characteristics of both the groups,

- the characteristics of only one of the two groups? (13)

ONE THING, TWO GROUPS

Making a group does not mean that we actually have to pick up a thing and place it in the group. Making a group means that we write the common characteristic of the group and list in it the names of things that have that characteristic.

The actual things can stay wherever they are. If there is something that has the characteristics of two groups, we can write its name in both groups. If something has the characteristics of three groups, it will be in all three groups.



Sarla made a group of red things. Rashida made a group of fruits. They had an argument over a tomato. “It should be in my group,” said Sarla. “No. It should be in my group!” countered Rashida.

Could both of them be correct? Give reasons for your answer. (14)

ONE THING MANY GROUPS

A tomato has many characteristics. Of all the groups listed below, which ones does a tomato fit into?

(a) A group of round things

(b) A group of sweet things

(c) A group of coloured things

(d) A group of sour things

(e) A group of juicy things. (15)

TWO PROBLEMS

Dayalal noticed that kerosene floats on the surface of water. His friend Ramesh said, "Wood and cork also float on water."

"So I can put kerosene in the same group as wood and cork," observed Dayalal.

On the basis of which property did Dayalal put these three things together? (16)

"But kerosene is not solid like wood and cork. So you cannot put all three into the same group," objected Ramesh.

What do you think about his argument? (17)

Some groups are given below. What is the common characteristic of each group?

(a) cycle, tonga, train, bus, motorcycle, truck

(b) pigeon, parrot, myna, butterfly, housefly, mosquito

(c) kurta, trousers, shirt, dhoti, vest

(d) milk, egg, honey, wool, leather. (18)

COMMON CHARACTERISTIC

Some groups are given below. In each group, there is one thing that doesn't fit in with the other three things. Which are the three similar things in each group and what is their common characteristic?

(a) cow, dog, tiger, buffalo

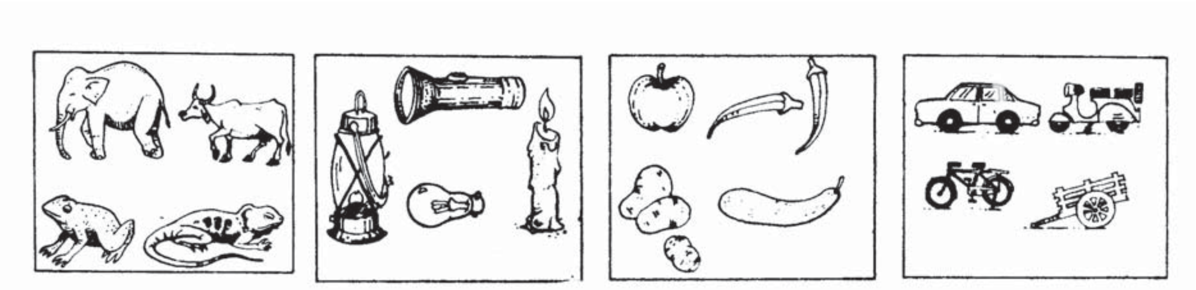
(b) bus, motorcycle, cycle, bullock cart

(c) hen, lizard, pigeon, crow

(d) brother, sister, maternal aunt (mausi), paternal aunt

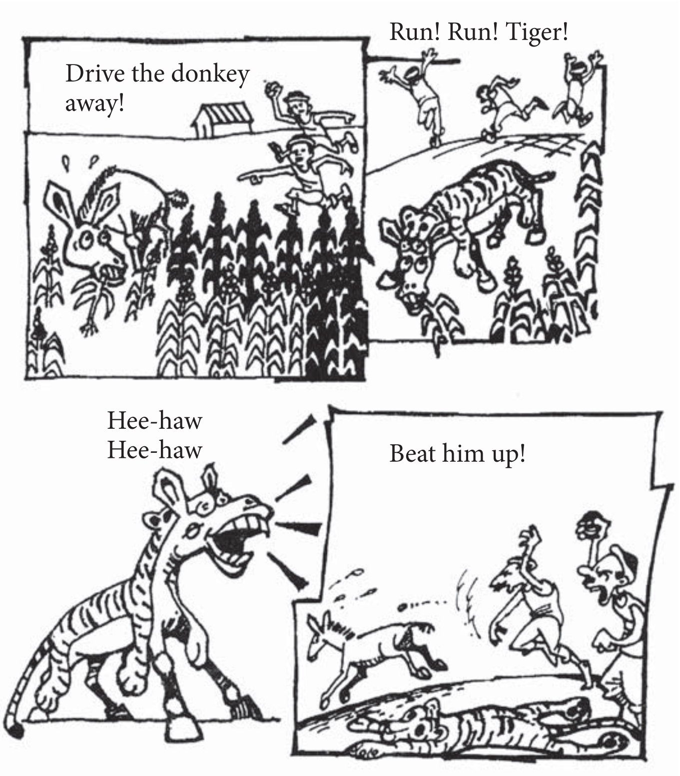
(e) lemon, papaya, tamarind (imli), amchoor

(f) paper, pencil, pen, chalk. (19)



In each of the pictures given above there are four things. Three in each picture have a common characteristic while one does not.

You have to identify the three things that are similar and the one that is different. You also have to say what is the similarity in the three things in each case. (20)



A DONKEY WEARING A TIGER'S SKIN

This donkey found a good way to be considered in the same group as tigers. But the poor thing got caught right away! What do you think was the characteristic that gave it away?

IMAGINE THIS MARKET

Have you ever been to the market? If you have, you must have noticed that different shops sell different things. One might sell foodgrain while another sells only stationery items.

Make a list of the different shops in your market and the kinds of things you get in each of them. (21)

Now imagine a market in which the shops are not like the ones you normally see.

Instead, one shop sells only white things, another only black things, a third only green things, a fourth only things made of iron, and so on.

The table below contains a list of such shops and some examples of the things they sell. Add more items to the list. (22)

TABLE 3

No.	Type of shop	Items sold
1.	White things	Chalk, cotton,
2.	Black things	Black ink, kajal
3.	Green things	
4.	Things made of iron	
5.	Wooden things	
6.	Transparent things	
7.	Liquids	

What problems would you face in such a market? Write your answer in the form of a short story about a visit to this market. (23)

In which shop would you get the following items: milk, cloth, ink, sugar, tomatoes? (24)

NEW WORDS

group	characteristic	property	member
table	list	similarity	object

GETTING TO KNOW LEAVES 3

We see greenery all around us. What gives us this greenery? It is the trees and plants which make the world so green. And the greenery comes from their leaves.

Many of these trees and plants are familiar to us and we can easily recognise them. But if they have no leaves it becomes a little more difficult. That's because the leaves of each tree or plant have some specific characteristics.

But is there something common between the leaves of different trees and plants? Let us learn something more about leaves. For this, we will go on a field trip.

A field trip means going out of the classroom and observing things and studying them. We will go on field trips several

times to study insects, animals, plants and trees, stones, rocks, soil, etc.

Today’s field trip is to study the leaves of trees and plants.

PREPARATION FOR A FIELD TRIP

Go on the field trip in groups of four along with your teacher. But before the field trip, each group should collect the following things:

(a) Blade, exercise book, pencil.

(b) A leaf chart to recognise the arrangement of leaves. You will find this chart in your kit copy.

Carefully observe the trees and plants you see. If there is a field or a garden nearby, go there too. Be careful that you do not harm or damage any plant or tree or standing crops.

THE ARRANGEMENT OF LEAVES

During the field trip, also observe the arrangement of leaves. You will find leaves on the stem or branches. We shall try and see whether the leaves in each plant are arranged in a specific way or whether they grow without any order or pattern.

Leaves can be found arranged on the branch in three ways.

In some plants they grow singly. That is, only one leaf grows from one point on the branch. Such a leaf is called a single leaf.

In some plants, the leaves are arranged in pairs. This arrangement is called a pair arrangement.

In some plants, the leaves grow in bunches from a point. This is called a whorled arrangement of leaves.

These arrangements are shown in the pictures in Table 1. The same table is given in the kit copy. This is the chart which you are supposed to take along with you on the field trip. Now look for at least five plants with each leaf arrangement and write their names in the table.

Paste the completed table in your exercise book. (1)

In plants with single leaves, observe carefully how the single leaf emerges. Do all these leaves grow on one side of the branch or on different sides? In case you find a plant in which the leaves grow only on one side of the branch, show this plant to the whole class.

TABLE 1

Leaf arrangement	Name of plants
	
	
	

COLLECT LEAVES

In order to get to know leaves more closely you will have to bring some leaves back to school. Each group should collect leaves of different types to bring back to school. Do not pluck more than one or two leaves from any plant. Keep the leaves in a wet handkerchief or napkin as soon as you pluck them. Or else, place the leaf flat on a magazine or newspaper and press it with your hands. By doing so the shape of the leaf is maintained.

Pluck the leaf with its stalk.

Write the name of the plant whose leaf you pluck. Also, record the leaf arrangement. It is possible that you may not know the name of some plant. You could ask a friend or someone else the name and write it down. If no one knows the name of a plant, then make up a new name or give the leaf a number.

Pluck the leaves of thorny plants by cutting them carefully with a blade.

We will do the rest of our study in school.

ON REACHING SCHOOL

Arrange the leaves you have collected in front of your group. We shall now study them. To study them means to consider their properties one by one.

Copy Table 2 in your exercise book. Observe the leaves carefully and look for the properties given in the table.

If a leaf has a particular property, write its name in the table in front of the matching property.

TABLE 2

No.	Property	Examples of leaves
1.	With a petiole or stalk.	
2.	Without a petiole or stalk.	
3.	With serrated edges.	
4.	With a pointed tip or leaf apex.	

All the possible properties of leaves are not given in the table. You may find many more properties. For example, you may find a triangular leaf or one with a tip or apex which is divided in two.

In order to understand the properties of leaves, try and observe them in different ways. Observe the surface, tip or apex and colour. Try and identify more and more properties in each leaf. Enter all such properties in your table and note down the names of all the leaves that have that property. If another group in your class has a leaf with a new property, then observe that leaf and note its name in your exercise book.

Some properties can also be shown in drawings. As an example, pictures of leaves with serrated edges and leaves with pointed tips or apices have been given here.

Try and draw any two properties you have chosen. (3)

ONE MORE PROPERTY OF LEAVES

We have seen many properties of leaves. Let us study another property of leaves. You will observe veins on the surface of the leaf. In case you find a leaf with no veins show it to the whole class.

In order to see the veins clearly, hold the leaf against the light.

Look at the spread of the veins in different leaves.

Can you see any differences between them? (4)

Venation is the term used to describe the pattern made by the veins.

In Picture 1, you can see a thick vein in the centre of the leaf. This is called the mid rib. On both sides of the main vein, you can see a web of veins. This kind of venation is called reticulate. Such a leaf is called a________________ leaf.

In Pictures 2 and 3, all the veins run parallel to each other. This kind of venation is called parallel or striped venation.

TABLE 3

Arrangement of veins (Venation)	Names of leaves
Meshlike Reticulate Venation	
Striped Parallel Venation	

Now, from the leaves you have collected, sort out the reticulate and striped leaves and write their names in Table 3. Copy this table in your exercise book. (5)

You are now well acquainted with different kinds of leaves. To find out how well you have understood leaves, we shall now play a game.

HIDE AND SEEK WITH LEAVES

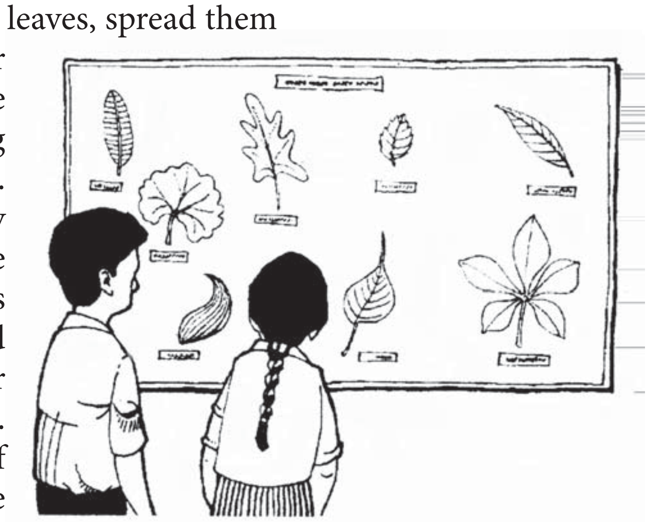
In this game, you have to recognise leaves by touching or smelling them. The game will be played between two groups. Before starting the game, both groups should see all the leaves. After this, all the children of one group are blindfolded. The other group gives them a leaf which they can feel with their hand and smell. They have to guess the name of the leaf.

When one group has finished identifying all the leaves given to it, the other group should be blindfolded and asked to recognise the leaves.

One should select the leaves for this game carefully. The leaves selected should be such that they can be identified by smell or by feeling them. If you choose leaves that are not very different from one another, then the other group will not be able to identify them. In that case, the game would not be any fun.

MAKE A LEAF EXHIBITION

When you have completed studying the leaves, spread them out between sheets of newspapers or magazines and press them. Write the name of each leaf on a tag and tie this tag on the stalk. Write the name in pencil. If the name is written in ink, it may spread due to the moisture and become unreadable. Now place the newspapers or magazines in which you have spread the leaves in a pile one on top of the other and put a heavy weight on top of the pile. But before placing this heavy object, if possible place a flat wooden board on the



pile. This way, the pressure would be evenly applied all over. Take out the leaves every two or three days and put them in fresh newspapers. Keep changing the newspapers till the leaves are completely dry.

PUTTING UP THE EXHIBITION

Prepare an exhibition of the dried leaves. For this, take a piece of cardboard. Either paste or stitch the leaves with thread to the cardboard. Write the name below each leaf. To make the exhibition more attractive, place the leaves in groups. On the left margin of the cardboard write the names of the groups. Paste leaves belonging to that group in front of the group name.

DO AT HOME: MAKE PICTURES WITH LEAVES

By arranging leaves, you can make beautiful pictures. A famous artist of Madhya Pradesh, Shri Vishnu Chinchalkar (Guruji), made many beautiful and interesting pictures using leaves, flowers, etc. According to him, art is present in everything around us.

LEAF FROM WHICH A NEW PLANT CAN GROW

You have already seen that leaves have many different properties. Now read about a leaf which has some unusual properties. After reading the passage, try and think whether there are other leaves, too, which are unusual or special in some way.

Ajuba, Patharchatta, Khatumaa (*Bryophyllum*) are names of one such plant. You may have seen this plant. The leaves of this plant are fleshy and their edges have notches. The interesting thing is that if these leaves touch the soil, new plants grow from the notches of the leaf. Often, small plants grow on the notches of the leaf in normal situations.

There are many such extraordinary leaves. If you search for them you will definitely find several.

But oh! we forgot one thing. There are so many leaves on a plant or a tree. What do they do after all? All leaves have veins, what do these veins do? You will look for answers to these questions in your next class.

QUESTIONS FOR REVISION

1. Take two leaves from two different families. Find five properties that are common to both. Look for five properties in which the two leaves differ.
2. In the diagram shown below you are given the shapes of some leaves. Draw these in your exercise book and, for each shape, write the names of three plants with leaves of a similar shape.

3. The names of some leaves are given below. You may have seen most of them. If you have not noticed earlier look at them carefully now and say whether they have reticulate venation or parallel venation or are they mesh-like or are they striped?

   Spinach, Coriander, Grass, Fenugreek, Radish, Mint, Mango, Pipal, Tulsi, Cabbage, Sugarcane

4. We give below a list of properties. Find one example of a leaf for each of these properties and write the name of the plant or tree to which each belongs.

Leaves with a smooth surface

Hairy leaves

Leaves with wavy edges

Thorny leaves

Leaves with special smell

Spotted leaves

Fleshy leaves

DO LEAVES SLEEP ?

Have you noticed that the leaves of some plants fold after sunset? That is, the leaves facing each other come together. If you haven't noticed this till now, try and find at least five plants in which the leaves fold. When . leaves fold in this way, it appears as if they have gone to sleep.

NEW WORDS

field trip	exhibition	species
single leaf	leaf pair	leaf whorl
midrib	venation	reticulate venation
succulent	parallel venation	

PLAYING WITH SHADOWS

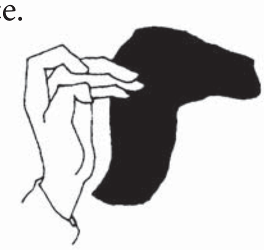
You might have observed your shadow when you are out in the sun. It always imitates you, doesn't it? It goes wherever you go. It appears to be doing whatever you do.

So why don't we do some tricks with the shadows of our hands? Not only will you find this activity enjoyable, you can also entertain your friends.

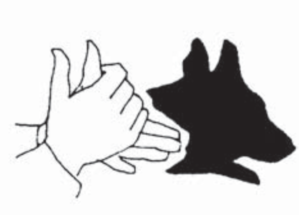
In this game you have to create different kinds of shadows with your hands on a flat surface. You can create the shapes of various animals by holding up your hands in particular positions. To make it more interesting, you can also produce the sounds of these animals as you make their shape.

But remember that the shadow will appear clearer and look better if it falls on a white wall or a curtain. Also, this shadow play can be more fun if performed in a dark room with light from a candle, an earthen lamp or a table lamp.

The pictures here show the positions of hands and the shape of the shadows they produce. Position your hands as shown in the pictures and create these shapes. See if your friends can identify the animals from the shapes you make.



Try to make some shapes other than those shown here.



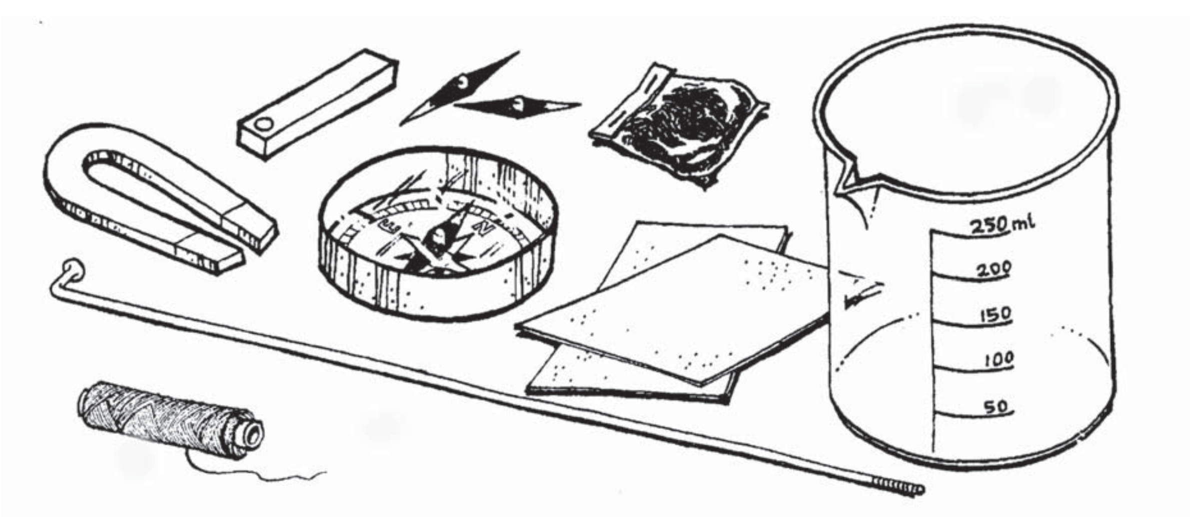
MAGNETS 4

Isn't it fun to play with a magnet? It has the power to attract things, pulling them towards itself. In some parts of the world you can find a special kind of stone that has such magnetic properties. From very early times, people had noticed the magnetic properties of this stone.

In this chapter, we will do some experiments with magnets and try to understand their properties. We shall try to understand how a magnet shows us directions and also actually make a magnet ourselves.

There are many ways in which we use magnets. Many instruments and equipment we use depend on magnets, for example, electric motors, fans, television, loudspeakers, telephones and radios.

What is so special about a magnet? Let us do some experiments to find out. Many scientists have done similar experiments.



Scientists usually keep a record of their observations in their notebooks. These records (of whatever they observed) are kept in the form of text as well as diagrams,

You should also keep a record of the experiments you do in your exercise book.

Before starting our experiments with magnets, let us read an interesting folk tale about the discovery of magnets.

STORY OF MAGNETS

Around 2,500 years ago, there lived an old shepherd named Magnus. He used to take his goats and sheep to the hills for grazing.

He always carried a wooden stick which had an iron cap on its lower end. One day, while his goats were grazing, Magnus idly dipped his stick into a spring of water and poked at the pebbles and stones at the bottom with it.

Suddenly he felt something pulling his stick. When he took it out of water, he saw a stone stuck to the iron cap.

The stone which Magnus pulled out is called lodestone. It is a naturally occuring form of iron which has magnetic properties.

ATTRACTION WITH MAGNETS

EXPERIMENT 1

Let us find out what kind of things are attracted by a magnet,

Collect various things made of glass, rubber, leather, iron, copper, plastic, aluminium, etc. Bring the magnet near each object, one by one, and see which of these are attracted by it.

Copy Table 1 in your exercise book and record your observations in it. (1)

The things that are attracted to magnets are called magnetic while the things that are not attracted are called non-magnetic.

TABLE 1

Things showing attraction to magnets	Things not showing attraction to magnets

TWO POLES OF A MAGNET

EXPERIMENT 2

Did you observe which part of the magnet things are attracted to most? Does every part of the magnet attract magnetic objects equally?

Do the following experiment to find the answer to this question.

Place some iron filings on a paper. Place a bar magnet horizontally in the filings and turn it over a few times.

Now lift the magnet.

What do you see? Make a drawing of what you see in your exercise book. (2)

Which part of the magnet has more iron filings sticking to it? (3)

Which part of the magnet has almost no filings sticking to it? (4)

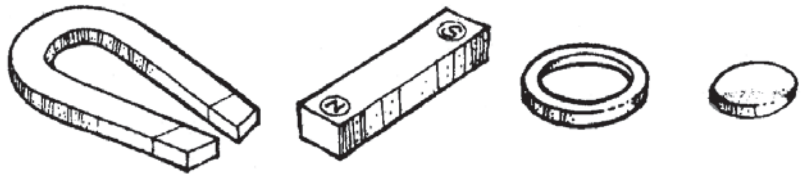
The parts of the magnet that attract the largest amount of iron filings are called its poles.

Repeat the experiment with a horseshoe magnet.

Can you recognise the poles of the horseshoe magnet?

Draw diagrams of a bar magnet and a horseshoe magnet in your exercise book and indicate the position of their poles by shading with your pencil. (5)

If you have a disc, ring or any other type of magnet at home, find the position of its poles by this experiment.



In experiments with magnets you will need to use iron filings again and again.

If you don't have iron filings, you can collect small pieces of iron and they will serve the purpose as well. You can do this by placing a magnet in a pile of sand and turning it around in the sand. The small pieces of iron present in the sand will stick to the magnet.

If you cannot find sand you can look for iron pieces in clayey soil as well.

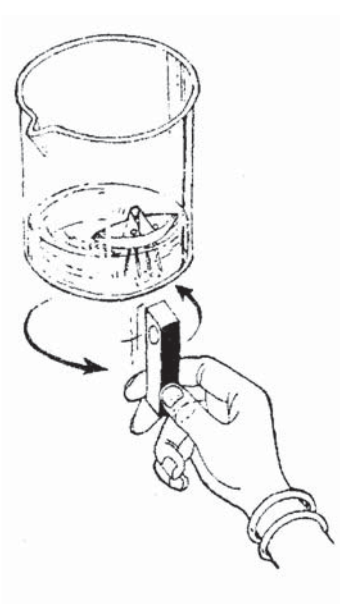
THROUGH WHICH OBJECTS DOES THE MAGNETIC EFFECT WORK?

EXPERIMENT 3

You saw that a magnet attracts several things. What would happen if you place something in between a magnet and an object and do not bring the magnet directly near the object? Would the object still feel the effect of the magnet?

Try this experiment with your exercise book first. Take your exercise book from your schoolbag and spread some iron filings or a few pins on its upper surface. Now hold the magnet under the lower surface of your exercise book.

Did the magnet attract the iron filings through the exercise book placed in between? (6)



MAGNETIC BOAT RACE

EXPERIMENT 4

Fill some water in the beaker provided in the kit. Make a small paper boat and insert a few pins in it. Insert the pins from the top of the boat so that they project out from the bottom. Place the boat in the water in the beaker and try to make it move forward by touching the magnet to the sides or the bottom of the beaker.

Does the magnet attract the pins through water? (7)

Describe this experiment in your own words. (8)

We have already discovered many properties of magnets. In the beginning of the chapter you had read that we can use magnets to find directions. How can a magnet tell us the direction? Let us find out.

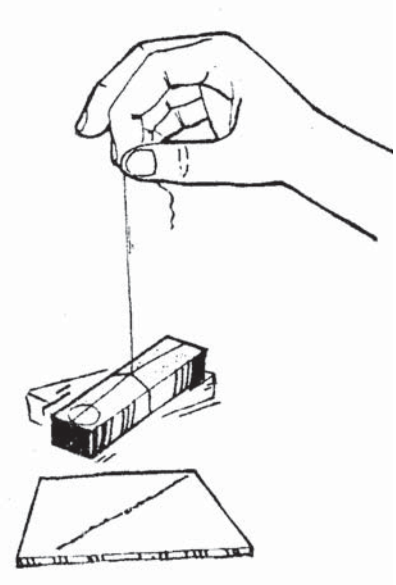
FINDING DIRECTIONS WITH A MAGNET

EXPERIMENT 5

Stick a pin upside down in a cardboard sheet, with its sharp end pointing upwards. Take a magnetic needle from the kit. You have seen bar magnets and horseshoe magnets. A magnetic needle is also a kind of magnet.

Make a mark with a piece of chalk on one end of the magnetic needle and balance it on the top of the pin.

Turn the needle gently and wait for it to stop spinning.



In which direction does the marked end of the needle stop? Does this end stop in the same direction every time the needle is rotated? (9)

Draw a line on a sheet of cardboard or the table along the direction in which the needle stops (ie, a line parallel to the needle). Remove the magnetic needle from the pin and keep it aside.

Now, tie a piece of thread to the centre of a bar magnet and suspend it over the line you have drawn. See in which direction the magnet stops. Turn the magnet gently and let it come to a stop again.

In which direction did the magnet stop this time? (10)

Do the bar magnet and the magnetic needle stop in the same direction? (11)

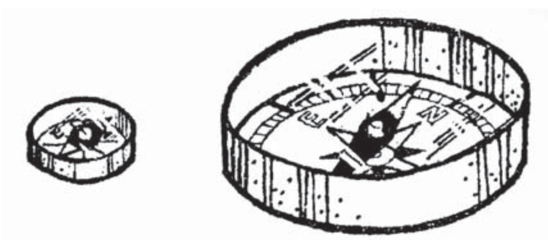
This is roughly the north-south direction. The end of the magnet that points to the north is called the North Pole. The end that points to the south is called the South Pole. On every magnet there is a sign to indicate which is the North or South Pole. What marking has been used on your magnet to indicate the poles? Has the magnetic needle also been marked to indicate its poles?

This property of magnets has been used for centuries to find directions. Around 800 years ago, the Chinese discovered that a suspended lodestone stops in a north-south direction.

The navigators of that country used to keep a piece of lodestone suspended in their boats and during a storm or mist, they used the lodestone to locate directions.

MAGNETIC COMPASS

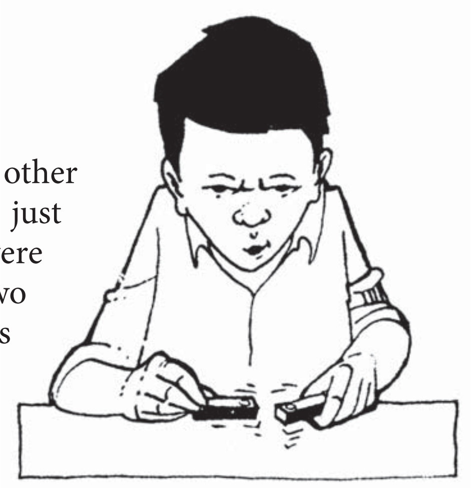
A compass is an instrument which is used to find directions. It is mostly used in ships and airplanes. As a rule, mountaineers also carry a compass with them so that they do not lose their way in unknown places.



The compass has a magnetic needle that can rotate easily. The marked end of the needle is the North Pole of the magnet.

If you have taken part in scout camps you must have learnt how to use a compass.

SOMETIMES REPULSION, SOMETIMES ATTRACTION



EXPERIMENT 6

Deenu once tried to bring two magnets close to each other in a particular way. But it seemed that the magnets just did not want to face each other and when they were brought closer they turned their faces away. Take two bar magnets and find out if the same thing happens with you as well.

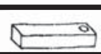
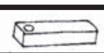
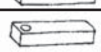
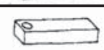
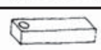
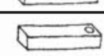
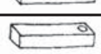
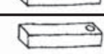
There are many ways of bringing two magnets close to each other. Table 2 indicates some of these ways. Copy this table in your exercise book.

Take two bar magnets and hold one in each hand. Bring them near each other in the different ways shown in the table. Note down in the table whatever you feel - attraction or repulsion.

When the North Poles of two magnets face each other, we say that like poles are facing each other. When the North Pole of one magnet faces the South Pole of the other, we say that unlike poles are facing each other.

Is there always attraction between two magnets? (12)
Do two magnets sometimes push each other away as well? In other words, is there repulsion between them, too? (13)

TABLE 2

Bar magnet in the left hand	Bar magnet in the right hand	Attraction or repulsion
		
		
		
		

FILL IN THE BLANKS

There is attraction between magnets when their ________ poles face each other. (14)

There is repulsion between magnets when their ________ poles face each other. (15)

Have you ever seen a magnet repel a piece of iron? Magnets always attract iron objects. This blow hot - blow cold relationship of attraction and repulsion exists only between two magnets.

A PUZZLE

Which of the following would be attracted to both poles of a magnet:

the North Pole of another magnet

the South Pole of another magnet

a piece of iron

a spoon made of stainless steel. (16)

MAKE YOUR OWN MAGNET

EXPERIMENT 7

If you have a piece of iron which is not a magnet, you can turn it into a magnet through a simple technique.

Take the cycle spoke in the kit. Put it on a table or on the floor. Hold it to the table by pressing its bent end with your thumb, as shown in Figure 1. Place the North Pole of a magnet near the bent end. Drag the magnet along the surface of the spoke from the bent end to the other end. Now lift the magnet and place it again on the bent end and drag it to the other end. Repeat this about 10-20 times.

Figure 1

Now, take the spoke near some iron filings to check if it attracts them. If it has no effect at all on the iron filings, you will have to repeat the process and try once more to magnetise the spoke.

If the magnetic needle in your kit has stopped working because of disuse then you should have no problem in magnetising it again now.

ANOTHER WAY TO MAKE A MAGNET

EXPERIMENT 8

Take two bar magnets. Place the North Pole of one and the South Pole of the other together at the centre of a spoke.

Now, drag these magnets along the surface of the spoke in opposite directions. (Rub the magnets on the spoke as shown in Figure 2)

Repeat this process several times until the spoke becomes a magnet. Sprinkle iron filings near the spoke you have rubbed to find out whether it has become a magnet and locate its poles.

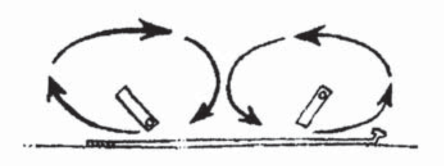
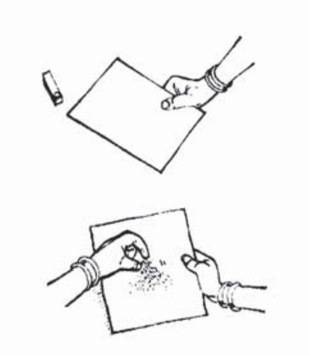


Figure 2

MAGNETIC PATTERNS

EXPERIMENT 9

A magnet can create patterns. Let us see how. Place a bar magnet on the floor and put a sheet of cardboard over it. Sprinkle some fine iron filings on the cardboard around the spot where the magnet is. Now tap the board gently with your fingers.



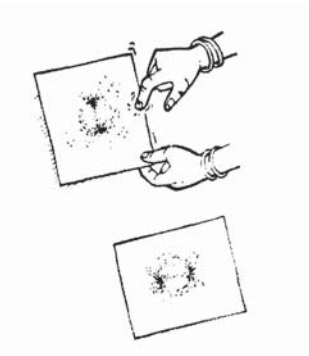
What happens? Do the iron filings occupy a particular shape? (17)

When the *toli* of Kamal, Seema, Gopal and Chandra tried this experiment, they found that the iron filings spread as shown in the figure.

Do you see a similar pattern of iron filings in your experiment too?

Make a drawing of what you see. (18)

Let us have some more fun with magnets. Remove the cardboard sheet from on top of the magnet. Then once again spread the iron filings on the cardboard sheet. Now divide the class into two groups. One group should move a little distance away. Children from the other group should then place the magnet under the cardboard sheet in any position they like. When on tapping the cardboard sheet the iron filings take on a fixed new pattern, the other group should be called to look at the patterns. By looking at the pattern the second group must guess how the magnet is placed under the cardboard sheet and where its poles are.



Magnets are important because of the properties we have learnt about above. You must have seen stickers made with a magnet which people attach to steel cupboards or refrigerators.

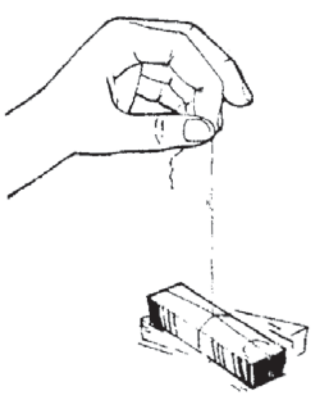
Shopkeepers selling steel utensils usually keep a magnet. Since stainless steel does not show any attraction to a magnet, they use the magnet to show that the utensil is made of stainless steel.

Later you will learn of another method to make magnets by using an electric current. You will also learn how to make an electric motor.

Make a list of properties of magnets that you learnt in this chapter. (19)

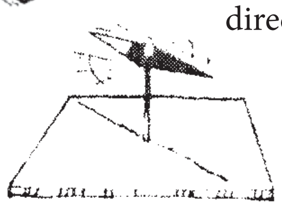
QUESTIONS FOR REVISION

1. How can the position of the poles of a magnet be found?
2. Put a tick mark against the sentences which are correct :
   a. Magnetic objects are attracted more to the middle of a magnet.
   b. Magnetic objects are attracted more to the two ends of a magnet.
   c. Magnetic objects are attracted to all places of a magnetic equally.
3. How can a magnetic needle be used to find the east direction? Answer in your own words.
4. Gopal saw an interesting magic trick at a fair. There were three statues, one each of Rama, Sita and Ravana. When Ravana's statue was brought near Sita, she would turn away. However, when Rama's statue was brought near her, she would turn towards it. Explain what could be the science behind this magic.
5. A magnet is suspended with a thread. A magnetic needle is kept close by. How can you identify the North and South Poles on the needle.

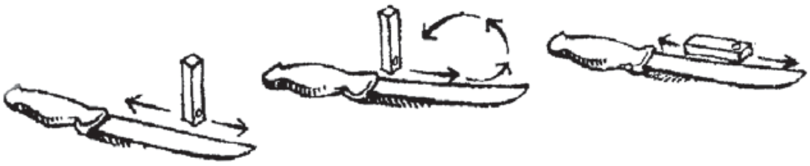


6. FILL IN THE BLANKS:

If we have a magnet, we can use it to find directions because if we suspend it, one end will always point in the______ direction while the other end will point in the______ direction. With this information we can also find east and west because if we stand facing north, our right hand will point to the________ and our left hand will indicate the__________.



7. Kala wants to magnetise a knife. How should she rub it with a magnet? Identify the correct method from among the following pictures:



8. A few iron-filing patterns are given below. Identify the patterns that could have been made by a magnet and indicate how and where the magnet is placed.

9. You are given two bars which look exactly alike. One of them is a magnet. Without using anything else, how would you find out which is the magnet?

NEW WORDS

magnetic	non-magnetic	compass
poles	attraction	repulsion

GAMES WITH AN ABACUS 5

Let us begin with Ghanshyam's story.

This is a very old story. A story so old that it is about a time when people did not know how to count. A man lived on the banks of the Narmada river. We don't know his name but let us call him Ghanshyam. Ghanshyam possessed a few cows. Every night he drove his cows into a cave so that they would be safe from wild animals. He would let them out to graze in the morning and herd them back to the cave when he returned every evening. But Ghanshyam was always worried. He was never sure whether all his cows had returned or not since he didn't know how to count. So he kept thinking about how to keep track of his cows. One day Ghanshyam did find a way. In the morning when the cows were ready to leave for the forest he stood at the entrance of the cave with his fists closed and his hands stretched out in front. As the cows went out of the cave one by one, he opened one finger of his right fist for each cow. When all fingers of the right hand had been opened he started opening the fingers of his left hand. When all the cows had gone the position of the fingers on his two hands were as shown in Figure 1.

Figure 1

How many cows did Ghanshyam have at that time? (1)

In the evening when the cows returned, he again stood at the entrance of the cave with his fists closed and opened one finger for each cow entering the cave. When all the cows had entered the cave, only the thumb of his left hand remained closed. So he knew that all his cows had returned.

This went on for many months but then a new problem arose. The number of cows in his herd increased. Ghanshyam discovered that even after opening the fingers of both hands there were still some cows remaining to be counted.

What could he do now?

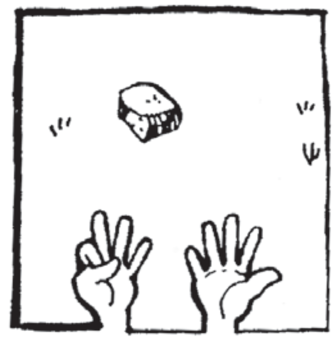
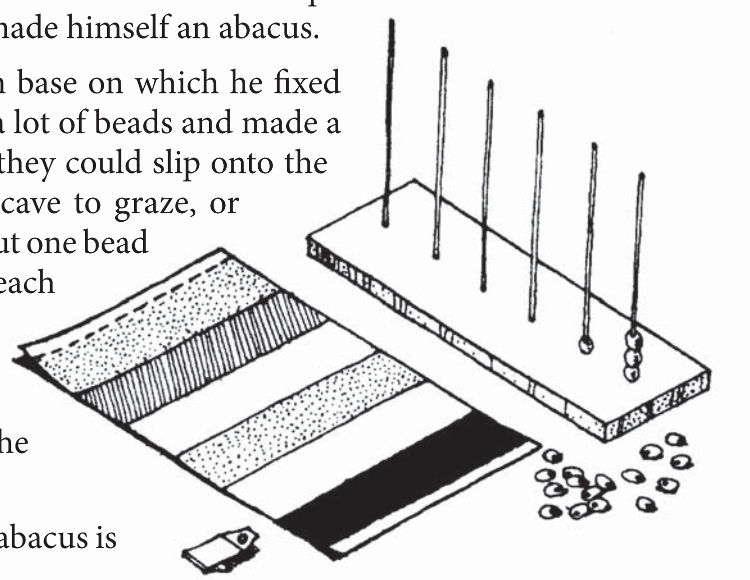


Figure 2

Ghanshyam was a clever person. He found an answer to this new problem too. When all the fingers of his hands were opened he picked up a pebble, kept it to one side and then closed both his fists again. As the cows went out he again opened his fingers one by one for every cow that passed, just as he had done earlier. When all the cows had left, Ghanshyam found he had one pebble and the position of his fingers was as shown in Figure 2.

How many cows did Ghanshyam have now? (2)

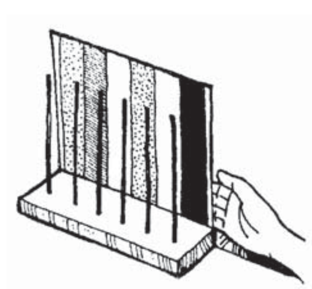
The number of cows Ghanshyam had kept increasing. He used his pebble technique to count them and check whether all his cows had returned. In a few years Ghanshyam had so many cows that he had to keep a lot of pebbles with him. To escape this laborious and tedious task he made himself an abacus.



Ghanshyam's abacus had a wooden base on which he fixed many thin rods. He then collected a lot of beads and made a hole through each one of them so they could slip onto the rods. Whenever his cows left the cave to graze, or returned in the evening, he would put one bead on the rod at the extreme right for each cow. When no more beads could be put on that rod, he would remove all the beads from the rod and, in their place, put a single bead onto the rod next to it.

Look at the abacus in your kit. This abacus is like the one Ghanshyam made.

Let us do some experiments with the abacus. First of all, cut out the abacus strip from your kit copy and fix it on your abacus.



EXERCISE 1

With the help of the beads, show how you would count the first nine cows on the abacus.

How will you show the tenth cow on the abacus? (3)

Show a count of 11; 14; 17 and 19 cows on your abacus. (4)

EXERCISE 2

Display the following number of cows on your abacus: 21; 29; 50; 87 and 99. (5)

How would you show the 100th cow? (6)

How would you show 1,000 on the abacus? (7)

How would you display 10,000 on the abacus? (8)

Show the following numbers on your abacus: 7; 56; 115; 827; 589; 9,901. (9)

Is there some relationship between the numbers as they are written and the number of beads on different rods in the abacus? (10)

What is the largest number that can be shown on your abacus? (11)

What would you have to do to show 10,00,000 on this abacus? (12)

PLACE VALUE

EXERCISE 3

Remove all the beads. Take one bead and place it on the rod at the extreme right. What number does the abacus show now? (13)

The place value of the bead in this case is one.

Remove this bead and place it on the adjacent rod, that is, the second rod from the right. Now what is the number shown on the abacus? (14)

How many times the previous number is this number? (15)

The place value of the bead here is ten.

Remove the bead and place it on the third rod from the right. What is the number shown now? (16)

How many times the previous number is this number? (17)

What is the place value of the bead in this position? (18) Whenever you shift the bead to the next rod to the left, how many times the previous number is the new number? (19)

Show 382 on the abacus and say what the place value of 3 is. (20)

Show 3,082 on your abacus and say what the place value of 3 is. (21)

Show 5,82,755 on your abacus. What are the place values of 5 in this number? (22)

Multiply the following numbers on your abacus and write the answers in your exercise book:

2 x 10

4 x 100

70 x 1,000 (23)

Multiply the following numbers on your abacus and show your results to your teacher:

11 x 10

21 x 100

325 x 10

EXERCISE 4

Remove all the beads from the abacus. Take a bead and place it on the rod at the extreme left and read the number.

What is the place value of the bead in this position? (24)

Now remove the bead and place it on the rod next to it to the right. Read the number again. What part of the previous number is this number? (25)

What is the place value of the bead in this position? (26) Remove the bead and shift it one more place towards the right. What part of the previous number is this new number? (27)

Each time you shift the bead one place to the right, what fraction of the previous number is the new number? (28) Divide the following numbers on your abacus and write your answers in your exercise book:

7,800 ÷ 100

530 ÷ 10

400 ÷ 100 (29)

Repeat Exercise 3 and 4 with two beads. That is, put two beads on a rod and then shift both beads to the left or right each time. Repeat this exercise with 5 and 8 beads.

DECIMAL NUMBERS ON THE ABACUS

EXERCISE 5

Show the following numbers on your abacus:

a)	One lakh	1,00,000
b)	One-tenth of this	10,000
c)	One-tenth of this	1,000
d)	One-tenth of this	100
e)	One-tenth of this	10
f)	One-tenth of this	1

If you now have to show one-tenth of one, what would you have to do? (30)

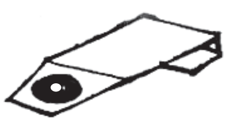


Figure 3

Cut out the decimal strip from your kit copy. Fold it and fix it to the abacus in such a way that the decimal point lies between the first and second rods from the right (Figure 3).

Remove all the beads from the abacus. Now take a bead and place it on the rod to the extreme right. In this position the bead depicts one-tenth of one. The place value of this bead is 0.1. That is, this bead displays 0.1 in this position.

How would you now show 0.2; 0.6; 0.7 and 0.9 on your abacus? (31)

If you add another one-tenth (ie, 0.1) to the last number, how would you show it on the abacus? (How did you depict 10 after 9 in Exercise 1?) (32)

EXERCISE 6

Display the following numbers on your abacus: 0.5; 0.9; 1.3; 8.9; 15.7 and 109.6. (33)

Your teacher will now show you some numbers on the abacus. Write down these numbers in your exercise book. (34)

What would you do if you have to depict one-tenth of 0.1, that is one-hundredth of one? (How did you depict one-tenth of one?) (35)

Shift the decimal point to between the second and third rods from the right.

Show the following numbers on your abacus: 0.01; 0.03; 0.05; 0.09.

If another one-hundredth is now added, how would you show it? (36)

How would you show one-thousandth of one, that is one-tenth of 0.01? (37)

Your teacher will give you many decimal numbers. Show these decimal numbers on the abacus. (S)he will also show you many numbers on the abacus.

Write down these numbers and draw the respective pictures of the abacus in your exercise book. (38)

EXERCISE 7

Shift the decimal point to lie between the third and fourth rods from the right. Remove all the beads from the abacus. Now put a bead on the rod to the extreme left.

What number is this? (39)

Now remove the bead and place it on the next rod to the right. Write down this number. What part of the previous number is it? (40)

Repeat this process by shifting the bead one place to the right each time.

What part of the number is obtained each time when the bead is moved one place to the right? (41)

Does the same thing happen, in the same manner, even when the bead crosses to the right of the decimal point? (42)

Now let us do a few exercises with decimals:

a) Multiply the following numbers on your abacus and write the answers in your exercise book: 0.01 x 10; 0.18 x100; 0.56 x 1,000. (43)

b) Show the one-hundredth part of 315, the one-tenth part of 0.1 and the one-thousandth part of 0.01 on your abacus. (44)

NEW WORDS

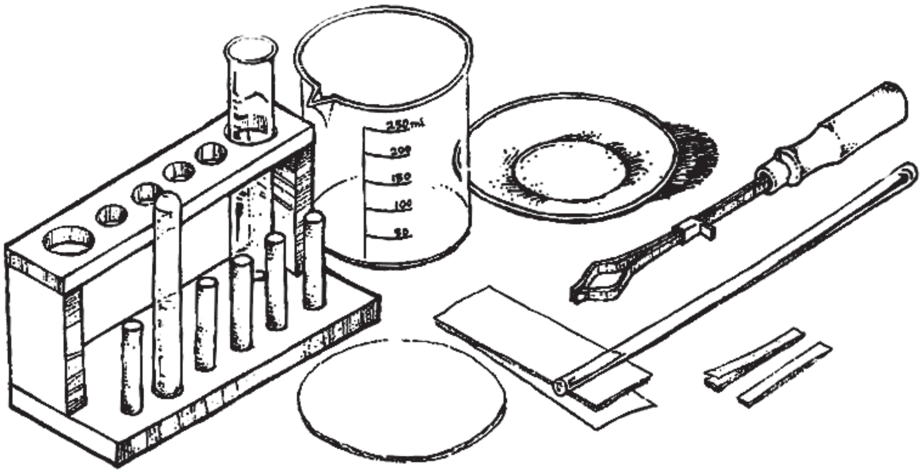
abacus place value

IDENTIFICATION OF ACIDS AND BASES 6

One day, while eating, some vegetable curry fell on Ramesh's white shirt. It left a big yellow stain. So Ramesh decided to clean the stain with soap. To his surprise, he saw the stain turning red when he rubbed soap on it. "Why did this happen?" he asked his mother. She told him that the turmeric in the vegetable, which caused the yellow stain, had turned red on applying soap. Ramesh wondered whether turmeric would change colour with other substances as well. He decided to investigate.

He collected turmeric and several other substances for testing. The names of these substances are given in Table 1. Ramesh made a solution of turmeric in water, dipped a strip of paper in it and dried the paper in the sun. He then cut the paper into strips. He used these strips of turmeric-coated paper to test the substances one by one.

Using a glass tube, Ramesh put a drop of the first substance listed in the table on a bit of turmeric paper. He then washed



the glass tube with water and repeated the process with every substance in his list, using a fresh strip of turmeric paper each time.

TURMERIC CHANGES COLOUR

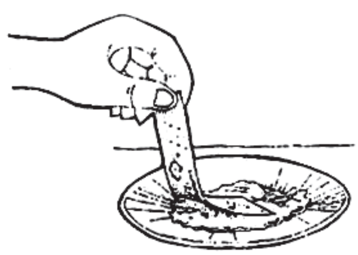
EXPERIMENT 1

Do you want to perform this interesting experiment of changing colours? You will need to bring some turmeric and the other substances listed in Table - 1 from your home. You will also have to learn to make solutions from your teacher.

Prepare the strips of turmeric paper which you will use for testing.

PREPARING TURMERIC PAPER

Take a teaspoon of well ground turmeric powder and add some water to it so as to make a thick paste-like solution. Rub this paste on the filter paper and dry the paper.



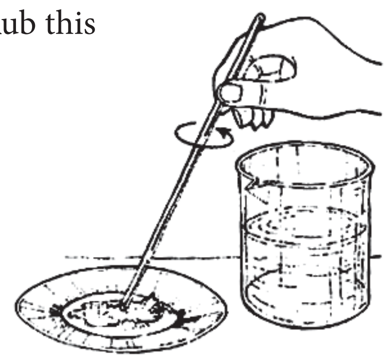


TABLE 1

No.	Substance	Did turmeric change colour?
1	Solution of baking soda	
2.	Lemon juice	
3.	Slaked lime	
4.	Sugar solution	
5.	Tamarind juice	
6.	Lemon pickle	
7.	Solution of washing soda	
8.	Salt solution	
9.	Milk	
10.	...	
11.	...	

Cut the filter paper into strips about 1 cm wide and 3 cm long. Your turmeric paper is ready.

Test all the substances one by one and note whether they change colour or not. Fill in these details in Table 1. (1)

If you wish, you could test other substances as well and find out whether they change the colour of the turmeric paper.

Ramesh wondered whether there were other things besides turmeric which changed colour like chameleons in the presence of various substances.

You will be surprised to know that, indeed, there are many such things which change colour in this manner. Let us repeat this experiment with a few such things.

CHANGE THE COLOUR OF FLOWERS

EXPERIMENT 2

We will perform the experiment with the substances listed in Table 1. Instead of turmeric, we will add flowers of various colours to these substances and see whether these flowers change colour.

Collect some colourful flowers such as China Rose (*gudhal*), Ipomea (*besharam*), Bougainvillea (preferably red-coloured), etc, from your home or on your way to school.

Pluck the petals of one of the flowers. Rub them on a filter paper so that the filter paper absorbs their colour. To colour the filter paper fully, you will need the petals of at least three to four flowers. Now cut this coloured filter paper into strips, like you did earlier with the turmeric paper. Test these strips of flower-coloured filter paper with the substances you have.

Record your observations in Table 2. (2)

TABLE 2

No.	Substance	Effect on China Rose paper	Effect on Ipomea paper
1.	Solution of baking soda		
2.	Lemon juice		
3	Slaked lime		
4.	Sugar solution		
5.	Tamarind juice		
6.	Lemon pickle		
7.	Solution of washing soda		
8.	Salt solution		
9.	Milk		
10.	...		

Do all the substances change the colour of the China Rose paper? List those substances which changed the colour of this paper. (3)

List the substances which changed the colour of Ipomea paper. (4)

Which substances change the colour of Bougainvillea paper? (5)

You can do this experiment with other flowers too, and also conduct the test with other substances.

Ramesh did this experiment with a large number of flowers and became completely absorbed in this magic of changing colours. But a thought struck him. Was it possible to restore the original colour of the turmeric paper or the flowers, after they had changed colour?

Can you suggest a method by which the original colour of turmeric can be restored? (6)

LITMUS

Litmus is a special type of paper. There are two types of litmus paper - red and blue.

We will first test all the substances in Table 1 with blue litmus paper and then with red litmus paper.

Before starting the tests, copy Table 3 in your exercise book. Enter your observations in this table.

TESTING WITH BLUE LITMUS

EXPERIMENT 3

Take a small piece of blue litmus paper in your hand and put a drop of the substance to be tested on it.

Note what effect this substance has on the colour of the litmus paper. Test the other substances one by one in the same Way.

Don't forget that you have to wash the glass tube you use for putting drops of the substance on the litmus paper before testing each new substance.

Record your observations in Table 3. (7)

TESTING WITH RED LITMUS

EXPERIMENT 4

Repeat what you did in Experiment 3 with red litmus paper.

Test all the substances one by one.

Record your observations in Table 3. (8)

TABLE 3

No.	Substance	Test with blue litmus		Test with red litmus	
		Turned red	Remained blue	Turned blue	Remained red
1.	Solution of baking soda				
2.	Lemon juice				
3.	Slaked lime				
4.	Sugar solution				
5.	Tamarind juice				
6.	Lemon pickle				
7.	Solution of washing soda				
8.	Salt solution				
9.	Milk				
10.	...				
11.	...				

You can now divide these substances into three groups.

Substances which turn blue litmus red are said to be acidic.

Substances which turn red litmus blue are said to be basic.

Some substances do not affect either blue or red litmus paper. That means, when they are tested, the blue litmus paper remains blue and the red litmus remains red. These substances are called neutral.

On the basis of your observations recorded in Table 3, make groups of acidic, basic and neutral substances and record these in your exercise book. (9)

On the basis of these groupings and with the help of your observations recorded in Table 1, answer the following questions.

What is the effect of basic substances on turmeric paper? (10)

What is the effect of acidic substances on turmeric paper? (11)

What is the effect of neutral substances on turmeric paper? (12)

The turmeric stain turned red when it was washed with soap. On the basis of this observation, which group would you place the soap solution in? (13)

INDICATORS — SUBSTANCES WHICH CHANGE COLOUR

In the above experiment, you used litmus paper to find out which substances are acidic and which are basic. This means that litmus tells us what is acidic and what is basic. Substances which provide such an indication are called indicators. Besides litmus, there are many other indicators which show one colour with acidic substances and another with basic substances.

Can flowers and turmeric paper also be called indicators? (14)

Indicators have another property. They can change their colour repeatedly. For example, blue litmus turns red with acid and this red litmus can again be turned blue on contact with a base. If you wish, you can test this.

Can you say what should be done to restore the original colour of turmeric paper once it has changed to red? (15)

There are many other indicators which are used to identify acids and bases. You will come across another such indicator in your higher classes.

QUESTIONS FOR REVISION

I. On the basis of Table 3, can we say that all sour things are acidic in nature?

   Test the following sour substances and verify your answer:

   Curd, buttermilk, unripe mango, tomato.

2. It is not known whether a certain substance is acidic, basic or neutral. When 2-3 drops of this substance were put on red litmus paper, there was no change. On observing this, Ajay said the substance is certainly neutral. But Rehana said, perhaps, it is acidic. How can we find out whether the substance is acidic or neutral?

3. You are given three solutions. One is acidic, another basic and the third neutral. You are also given blue litmus paper. Can you use it to identify which solution is which? Explain how you arrived at your answer.

4. A particular solution does not affect yellow turmeric paper. On the basis of this, which of the following statements is correct:

   a. The solution is acidic.

   b. The solution is basic.

   c. The solution is not basic.

   d. The solution is neutral.

   Can you guess what effect this solution will have on red litmus paper?

NEW WORDS

indicator	acidic	basic
neutral	litmus	

OUR FOOD 7

We eat at least two or three times a day.

What would happen if we did not eat at all?

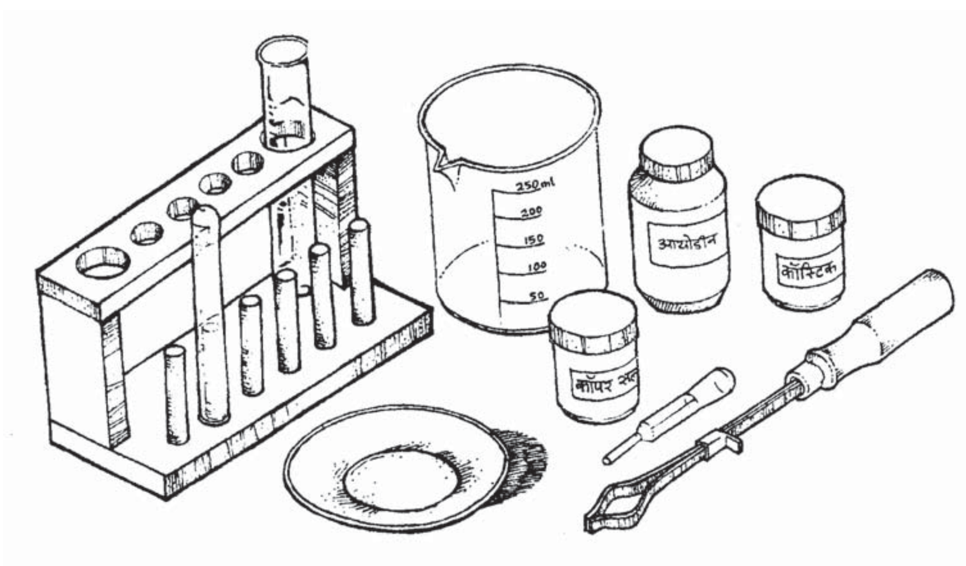
Have you ever been on a fast? If you have, describe how it feels if you have had nothing to eat for a whole day. (1)

Imagine how you would feel if you had to starve for many days. (2)

If a person does not get proper food (s)he loses weight, does not have the energy to work and is also likely to fall ill.

We eat an unbelievable variety of foods. Some people eat chappatis made of wheat flour with dal (lentils), others prefer rice. Some eat meat and fish, while others prefer vegetables. Some people drink milk everyday, while others like to eat lots of fruit.

What does our food consist of?



Whatever we eat, food basically contains three main substances called nutrients. These are fat, protein and starch. In addition, our bodies require water, salt, vitamins and sugar.

It is comparatively easy to find out whether something contains fat, protein or starch and we will now learn how to test different foodstuff for these substances.

It is not possible, at this stage, to test for minerals, vitamins and sugar, but these substances, too, are essential for our bodies.

Copy Table 1 in your exercise book and record your observations in it. (3)

TEST FOR FAT

EXPERIMENT 1

Take a small quantity of the substance to be tested and rub it lightly on a piece of paper. Let the paper dry for a while. If it becomes smooth, oily and translucent, it means the substance contains fat.

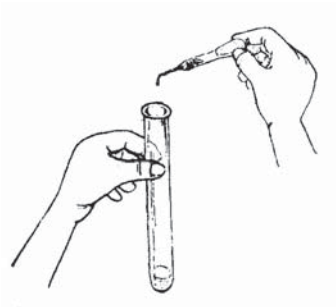
Kerosene, diesel and wax also make paper translucent, but they are not food materials. They do not contain fat.

TEST FOR PROTEIN

EXPERIMENT 2

If the substance to be tested is a liquid, put 10 drops of it in a clean test tube. If the substance is solid, grind a small quantity, put it in the test tube, add 10 drops of water to it and shake well.

Now add two drops of 2% solution of blue vitriol (copper sulphate) and 10 drops of 10% solution of caustic soda to the



test tube. Shake well. If the solution turns violet, the sample contains protein.

TEST FOR STARCH

EXPERIMENT 3

Add 2-3 drops of dilute iodine solution to the substance to be tested. If it turns dark blue or black, the substance contains starch.

If iodine solution is not available in your school, you could get

TABLE 1

No.	Substance	Fat Present or absent	Protein Present or absent	Starch Present or absent
1.	Boiled rice			
2.	Water in which rice has been boiled			
3.	Uncooked rice/*kutki*			
4.	Wheat			
5.	Wheat flour			
6.	Slice of potato			
7.	Peanuts			
8.	Whole *tuar* dal			
9.	Broken *tuar* dal			
10.	Ghee			
11.	Milk			
12.	A slice of any vegetable (lady's finger, pumpkin)			
13.	A slice of any fruit (banana)			

tincture iodine from a hospital. Doctors apply tincture iodine to disinfect wounds.

Put 10 drops of tincture iodine in a clean test tube. Fill half the test tube with water. Your dilute iodine solution is ready. It should be light yellow in colour.

Now test different foodstuff for the presence of fat, protein and starch.

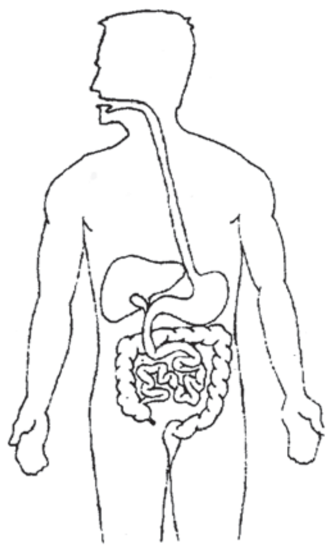
If a substance contains fat, protein or starch, write 'Yes' in your table in the appropriate column; if does not, write 'No'. (4)

Were fat, protein and starch present in all the foodstuff you tested? (5)

Would it be correct to say that a foodstuff may contain more than one nutrient? (6)

Is there any difference in the reactions of iodine with whole wheat and wheat flour? If yes, what are these differences? (7)

DIGESTION OF FOOD



Most nutrients in food cannot be directly assimilated by the body. It is necessary to first then into substances which can. This process is called digestion.

Digestion takes place in the internal organs of the body. Ask your teacher to point out the organ responsible for digestion in the body of the dissected rat.

You cannot actually see food being digested by these organs. However, you can observe the digestion of starch which begins in our mouth when we chew food.

TRY THIS AND THINK ABOUT IT

Slowly chew some beaten rice *poha* ar a piece of roti.

Does the taste change after a while? If yes. what is the new taste like? What could be the reason behind this change in taste?

You can perform an interesting experiment to find out.

FIRST STEP IN DIGESTION

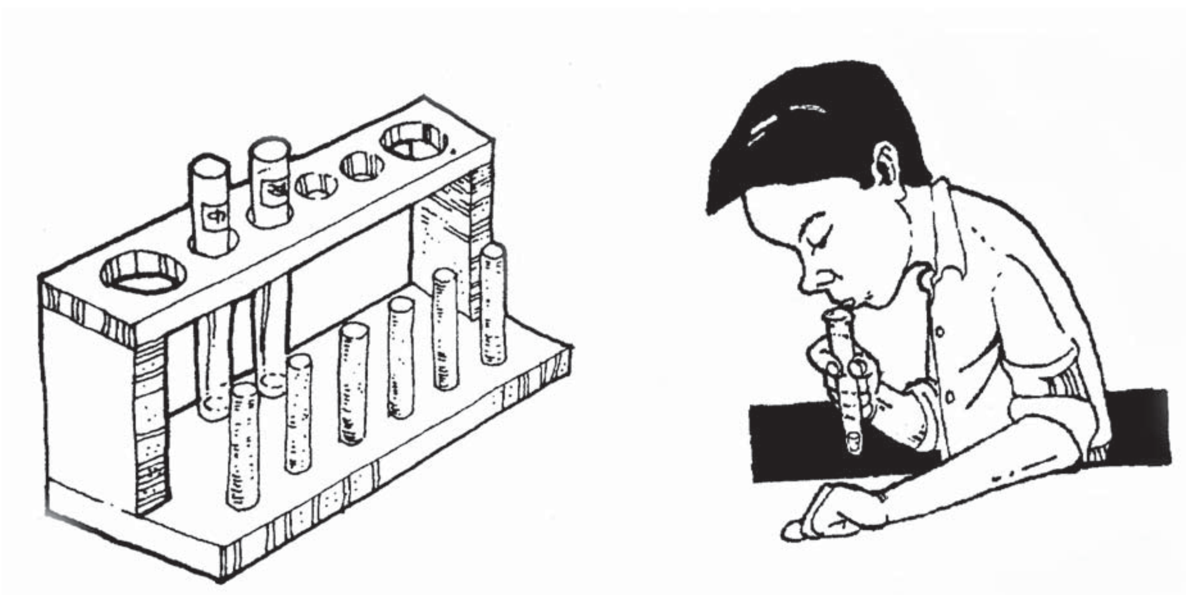
EXPERIMENT 4

Take a beaker and fill it one fourth with water. Put a half tablespoon of wheat flour in the beaker and shake well. Pour 10-12 drops of this solution into a test tube.

Add two drops of iodine solution to the test tube and see if the contents turn blue or black. Paste paper labels on two clean test tubes and mark them 'A' and 'B'.

Pour 25 drops of the wheat flour solution from the beaker into each of the test tubes.

Bring test tube 'A' near your mouth. as shown in Figure 2, and spit into it. The quantity of saliva should be roughly equal to the quantity of solution in the test tube. Shake the test tube well after adding saliva.



Do not add saliva to test tube 'B'.

Let both test tubes stand for half an hour. Then add two drops of iodine solution to each of them.

Copy Table 2 in your exercise book and record your observations in it. (8)

Describe the effect of saliva on starch. (9)

The action of saliva on starch is the first step in digestion.

Why are we advised to chew our food well? (10)

TABLE 2

Test tube	Saliva added or not	Whether blue/ black colour obtained	Starch present/absent
A.			
B.			

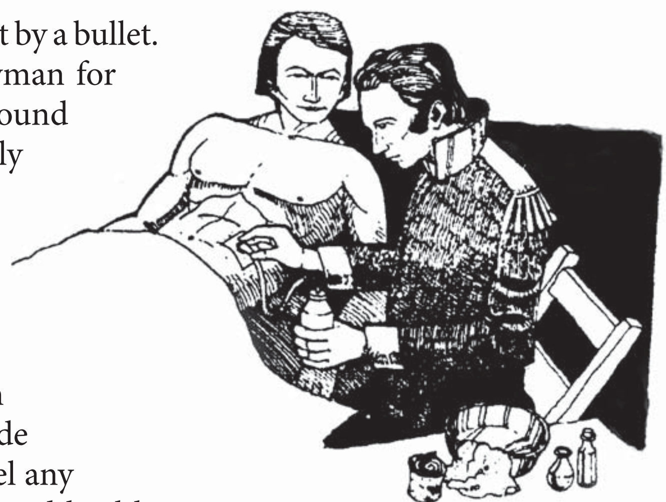
Food chewed in the mouth reaches the stomach through a tube which passes through the chest. The stomach is in turn connected to a long tube called the intestine. Fat, protein and the starch remaining after the action of saliva in the mouth are digested in the stomach and intestines.

Where are the stomach and intestines situated in the body? What do they look like? Locate them in the body of the dissected rat. You can ask your teacher to help you.

The process of eating and digestion is called nutrition.

A STOMACH WITH A WINDOW

Till about 150 years ago, scientists did not know what happened to food after it reached the stomach. They did not know about the process of digestion. They had no way of looking into the stomach to see what happens there. Then a strange incident occurred.



In 1822, a soldier named Martin was hit by a bullet. He was taken to a doctor called Bowman for treatment. The doctor dressed the wound for a year and a half while it gradually healed. But something strange had taken place. Although the wound had healed, the hole in the stomach remained open. It was covered by a flap of skin which could be lifted. If a tube was inserted into the stomach through this hole, the food present inside could be taken out. Martin did not feel any pain when this was done and was fit and healthy otherwise.

Dr Bowman decided to use Martin's unusual stomach to study the mystery of digestion. For nine long years he carried out different experiments in this stomach with a window and gathered a host of new information.

Dr Bowman first took out some digestive juice from the stomach, poured it in a small bottle and put some food in it. He noticed that the digestive juice dissolved the food within a few hours. Thus, he came to know that digestion is not a magical process. It is the juices in the stomach that actually help digest food.

Dr Bowman came to the conclusion that a chemical reaction takes place between the digestive juices and the food in the stomach. He had duplicated this reaction outside the stomach in the bottle.

NUTRITION: QUANTITY AND QUALITY OF FOOD

It is commonly believed that if a person eats a full meal regularly, (s)he will get proper nutrition. But this is not correct. For example, eating a lot of just one type of food does not provide all the nutrients that the human body requires for remaining healthy. It is essential to eat a variety of foods.

A meal should consist of different types of food. Only if such meals are eaten regularly does one get proper nourishment. A diet containing all the nutrients is called a balanced diet. If a person does not get adequate food, or if her/his diet does not contain all the nutrients, (s)he becomes weak. When the body does not get adequate nutrition, it is said to be suffering from malnutrition.

Children are more prone to malnutrition than adults. Figure 3 shows a child suffering from rickets. Children who do not get adequate nutrition suffer from this disease.

Figure 3: Child suffering from rickets

Light brown hair, face like that of an old man, always hungry, distended stomach, underweight and skinny, very little flesh on bones.

Figure 4: Child suffering from protein deficiency

Swollen face, swollen limbs, discoloured skin and hair, upper arms thin (circumference less than 13 cm)

Sometimes a child gets enough to eat, but the food does not contain enough protein. Figure 4 shows a child suffering from protein deficiency.

Have you ever seen a child suffering from rickets or protein deficiency? If yes, then find out what and how much food this child eats in a day. (11)

Why does this child not get enough food? Discuss in the class. (12)

A weak person is prone to illness. A person who falls ill tends to become even weaker. Malnourished children fall ill frequently. They tend to become even more malnourished as a result of the illness. Thus, they are trapped in a vicious circle of illness and malnutrition. In order to help such children, it is necessary to ensure that they get a balanced diet and enough food to eat.

A child suffering from malnutrition does not require expensive medicines and tonics. The only remedy for malnutrition is an adequate and balanced diet. Such a diet is certainly not as expensive as medicines and tonics.

If lentils (dal), rice, roti, green vegetables and a bit of jaggery are eaten regularly and in enough quantity, they will provide all the nourishment the body requires. In addition, if we eat beans, tomato, carrot, guava, cucumber, lemon, ripe papaya, *amla*, etc, our body will also get all the essential vitamins and minerals it needs.

The following recipe, if eaten regularly, will cure a child of malnutrition.

Mix groundnut, wheat and gram in equal quantities and grind into flour. Lightly roast this flour in a little oil and add jaggery to it.

Whenever possible, this should be given to the child even after (s)he is cured.

QUESTIONS FOR REVISION

1. On the basis of the information you have filled in Table 1, find out which of the following sentences are right or wrong:
   a. Eating only rice is enough to fulfil the nutritional requirements of the body.
   b. If a person eats only ghee (clarified butter), there is no need to eat anything else.
   c. A balanced diet consists of a variety of foods.
2. Why should we chew our food properly during meals?

3. In Experiment 4, you added saliva to test tube ‘A’ but not to test tube ‘B’. Can you suggest why the flour solution was also added to test tube ‘B’? Write the answer in your own words after discussing it with your teacher and classmates.

NEW WORDS

nutrition	energy	fat	protein
starch	minerals	vitamin	digestion
malnutrition	rickets	balanced diet	nutrient
stomach	chemical	reactions	digestive juices

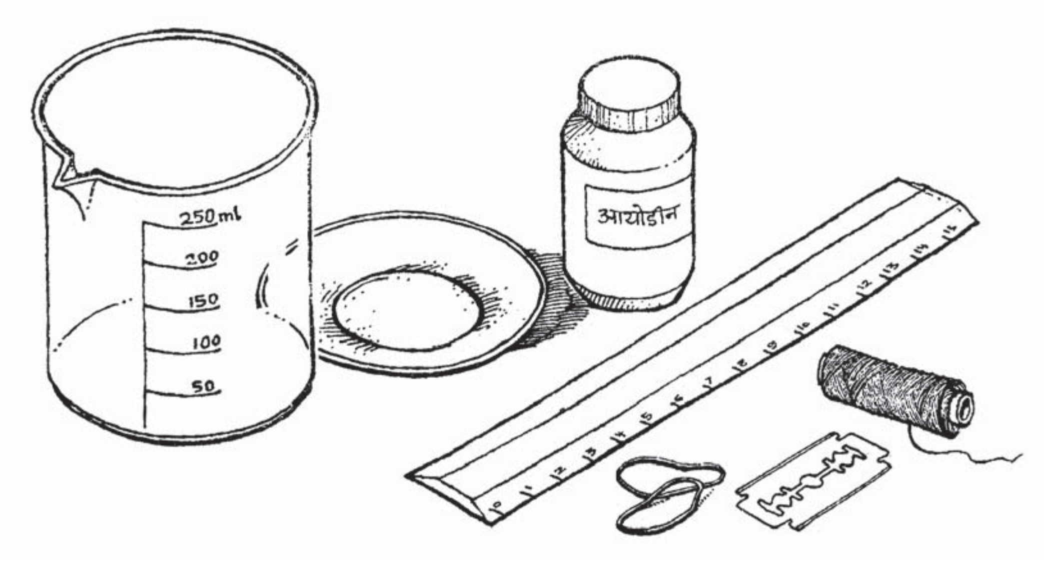
SEEDS AND THEIR GERMINATION 8

We use a variety of seeds every day. Have you noticed how many types of seeds are used in your food?

Make a list of seeds that you are familiar with. The list must contain the names of at least 25 seeds, for example, peanut, aniseed, cuminseed, etc. (1)

Have you ever thought about the importance of seeds, apart from their use in our food? Just think what good does the seed do for the plant.

Farmers sow seeds to raise various crops such as wheat, maize, gram, etc. A complete plant develops from a single seed. Does this mean that a tiny plant is hidden inside the seed? Have you ever seen this tiny plant inside the seed? Let us study seeds by examining them from the outside as well as inside.



INVESTIGATING A SEED

We will look for three things in a seed.

(a) First of all, we will hunt for that part of the seed which develops into a plant.

(b) In the initial stage of development of the plant, neither the roots nor the leaves are developed fully. Where does this seedling-like plant get its food from? Is there some provision for food in the seed itself? If there is, then where is this food stored?

(c) A seed gives rise to a new plant. Thus a plant's lineage is continued by the seed. Is there an arrangement for protecting such an important property?

SOAKING THE SEEDS

We will need to make some preparations before trying to find answers to these questions. First of all we need to soak the seeds. Seeds swell upon soaking and it becomes easier to open them and study them from inside. Soak some maize and bean seeds one or two days before the experiment.

BEAN SEED FROM OUTSIDE

Take a soaked bean seed and, first of all, observe it from outside. Use a hand lens, if necessary.

Make a drawing of this seed. (2)

Indicate in your drawing the spot at which this seed may have been attached to its pod. (3)

Every seed has a hole or a crevice through which the germinating plant emerges.

Look for this hole or crevice in the bean seed and indicate its position in the drawing. (4)

BEAN SEED FROM INSIDE

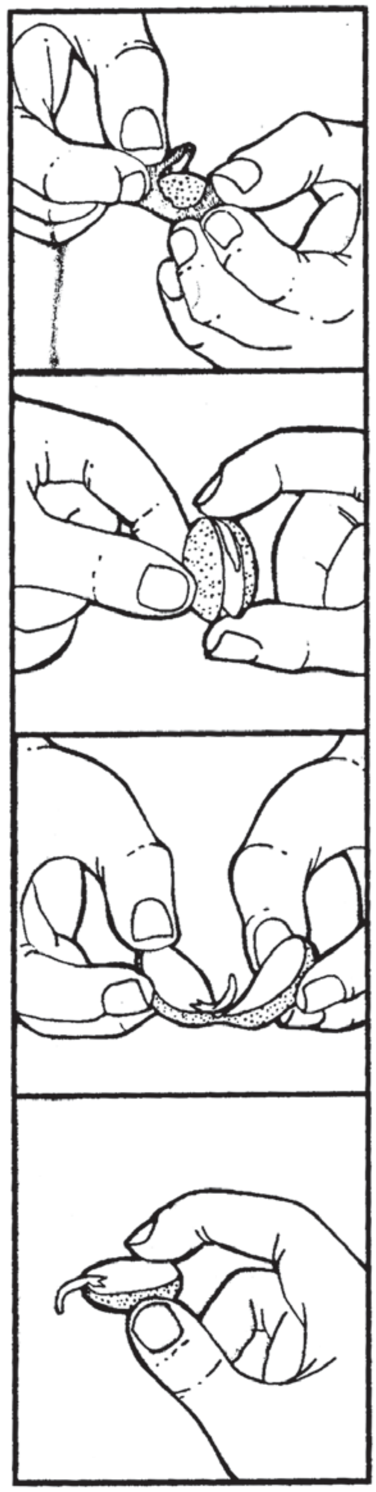
EXPERIMENT 1

Open a bean seed following the method shown in the pictures and study its inner structure:

Remove the outer covering of the seed. This is called the seed coat. Is this seed coat made up of a single layer, or is there a thinner layer inside a thick layer? What purpose does the seed coat serve for the seed?

Make a drawing of the seed after removing the seed coat. (5)

Hold the seed from which you have removed the coat and press it gently with your fingers. How many parts does the seed divide into? A bean seed is made up of two fleshy and almost identical looking halves. These two halves are the cotyledons of the seed.



Separate the cotyledons from each other and observe them with a hand lens. Do you see a special structure attached to one of the cotyledons? This is the axis.

Observe the axis and the cotyledons with a hand lens and make a drawing of them. (6)

Cotyledons are always attached to the axis. One end of the axis is leaf-like and the other end is pointed. Identify these two ends in the picture. Can you guess which end of the axis will become the root and which will develop into the shoot? The end of the axis which becomes the root is called the radicle and the other end, which gives rise to stem, leaves, etc, is called the plumule.

Label the radicle and plumule in your drawing of the seed. (7)

The axis and the cotyledons are together called the embryo.

QUEST FOR FOOD

From where does the embryo get its food in the initial stage? We had talked about the food we eat in the chapter titled 'Our Food'. We eat a variety of seeds like maize, wheat, rice, pulses, etc. The food that we get from these seeds is actually meant for the embryo. This means that the embryo's food is present in the form of starch, fat and protein.

A table is given below.

Copy this table in your exercise book and complete it on the basis of the information from the chapter titled 'Our Food'. (8)

You had tested a bean seed for the presence of starch, fat and protein in that chapter.

In what form is the food for the axis of the seed present in the bean seed? (9)

TABLE 1

No.	Name of the seed	Starch Yes/No	Protein Yes/No	Fat Yes/No
1.	Bean			
2.	Maize			
3.				
4.				
5.				

We had earlier studied a seed which had two cotyledons. Such seeds are called dicot seeds.

Give five other examples of dicot seeds. (10)

There are also some seeds which have only one cotyledon. Let us investigate an example of one such monocot seed.

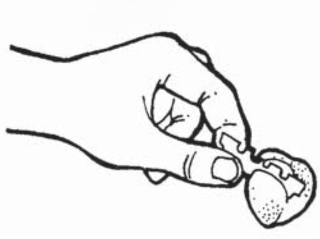
MAIZE SEED

Take a soaked maize seed.

Make a drawing of this seed, indicating its yellow and white portion. (11)

Indicate in your drawing the spot at which the seed could have been attached to the cob. (12)

The yellow portion of the seed is the endosperm, and the white portion is the embryo. Have you noticed that when you eat roasted corn, many a times a tiny white thing separates out from the gram. This tiny white thing is the embryo of the maize. This part contains both the axis and the cotyledon. The maize seed has only one cotyledon. Therefore, it is called a monocot seed.



It is difficult to see the cotyledon and the axis separately in the maize seed.

SECTION OF A MAIZE SEED

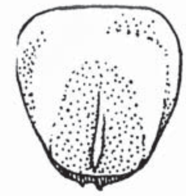
EXPERIMENT 2

Cut a soaked maize seed into two halves as shown in the picture.

Observe the cut portion with a hand lens and make a drawing of it. (13)

On the basis of Table 1, say in which form food is stored inside a maize seed? (14)

We have seen in the two seeds we examined, the tiny plant or the axis which develops into an entire plant. The seed also contains food for this axis. Even small seeds like mustard contain the axis and its food supply.

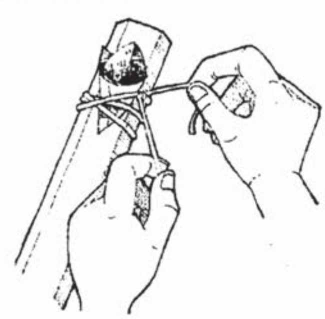


However, inspite of all these provisions, why is it that the seeds stored in homes or godowns do not germinate? What does a seed need to germinate? Let us try and understand this. Seeds stored in the home or in godowns get plenty of air. But if these seeds are sowed in the field, would the farmer leave his field dry? Of course not; she will irrigate the fields after sowing. This means that seeds cannot germinate without water.

But would seeds germinate if they get only water? You might have heard that if it continues to rain heavily after sowing, the seeds rot instead of germinating. It is obvious that the seeds get plenty of water. Then what else is lacking?

Have you eaten germinated lentils (for example, *moong*)? What needs to be done to germinate the *moong* seeds? If we drown them in a vessel full of water will they germinate?

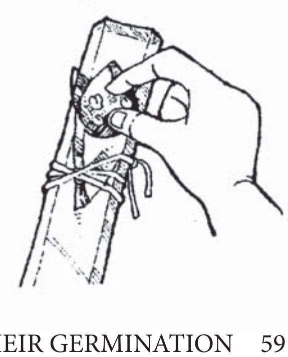
Let us try to understand this by performing an experiment:



WHEN DO SEEDS GERMINATE

EXPERIMENT 3

Take at least 9 bean, cow pea (*chawla*), gram or maize seeds. Make three small paper cones (like the ones peanut sellers make). Tie these cones to a plastic scale with a thread. One cone should be tied at the centre of the scale while the other two cones should be at the two ends. Put two-three seeds of one type in each cone. Now place the scale in a beaker in the manner shown in the picture on page 60. Fill the beaker with water to the extent that the seeds in the middle cone are half immersed.



PRECAUTIONS

1. The cones should be made of paper that does not disintegrate

in water. Also, ensure that no hole remains in the bottom of the cones, otherwise the seeds may drop out through these holes.

2. If a scale is not available, then a strip of any other material can be used, provided water does not rise on it. Otherwise, water would reach the seeds in the top cone too.

Observe the seeds every day and if the water level goes down, pour enough water to again half immerse the seeds in the middle cone.

Continue this experiment for three-four days and answer the following questions:

Do the seeds in the lowest cone get air? (15)

Do the seeds in the top cone get water? (16)

Which seeds get both air and water? (17)

In which cone do the seeds germinate? (18)

What is required for germination? Write your answer in your own words. (19)

Why is it necessary to first soak moong seeds in water and then keep them wrapped in a wet cloth so that they can germinate? (20)

SEED GERMINATION AND SEED COAT

For a seed to germinate, it is essential that it should be free from any disease or infestation and should be mature.

For example, a maize seed taken from an unripe cob, if sown, will not germinate.

Germination of seeds is a very interesting phenomenon. Just imagine! A new plant begins to develop as soon as a seed germinates. The seeds must have some means of protecting themselves. This protection is provided by the seed coat.

Seeds lie around in the open. They would dessicate or break into two pieces if they had no seed coat. Many a times seeds are eaten by animals. Yet they pass undamaged through the guts of the animal because of the seed coat. You would be surprised to learn that even the seeds of soft and succulent fruits, such as melons and tomatoes, are so hard that we cannot digest them. Tomato seeds pass through our guts undamaged. The same is true of melon seeds. Of course, it is a different matter if we remove the seed coat before eating them.

The seed coat protects the seed in many ways. It does not permit the seed to germinate until conditions are favourable. If the seed germinates at a time when conditions are not favourable, the plant will die.

There are many plants whose seeds do not germinate for months or years, even if they get air and water. Their seed coat is so hard that it does not soften after light rain. Only after very heavy rain does the seed coat soften and then water enters the seed and germination begins. The coriander seed is an example of such seeds.

You must have heard about the teak (*sagon*) tree. Seeds of this tree lie on the ground for many years. The seed coat softens slightly during each rainy season, and the embryo emerges only when the seed coat has softened sufficiently. If we want the seed to germinate earlier, it has to be soaked in acid for some time. Acid softens the seed coat.

Before sowing, cotton seeds are embeded and pressed in cow dung for a few days in order to soften their seed coats.

There are many seeds which do not germinate till they are eaten by birds and then excreted. Some examples of such seeds are pipal, banyan. The seed coats of these seeds soften inside the guts of birds.

In this context, there is a well known story about the relationship between a tree and a bird. A certain type of tree used to grow in Mauritius. Its seeds would not germinate unless a bird called the dodo ate and excreted them. Human beings used to hunt the dodo to such an extent that they soon became extinct. Not a single dodo was left on the island. After this, the seeds of this tree also stopped germinating. Fortunately, scientists have now found a method of germinating these seeds artificially.

There is another aspect about germination that needs to be noted. Cotyledons of some seeds emerge above the ground during germination. However, there are many seeds whose cotyledons remain underground. Can you make a list of seeds whose cotyledons emerge above the ground during germination? You might have noticed that imli (tamarind) seeds germinate in this way.

Find out more examples of this type of seed and write their names. (21)

QUESTIONS FOR REVISION

1. Soak some seeds like mustard, black mustard, peanut, gram and pea for a day. Following the method you learned in this chapter, remove their seed coats and draw pictures of their embryos (cotyledons and axis). You may need a hand lens for this.
2. Do all seeds look alike? Are they similar in colour, shape, texture, etc? Doesn't seem that way, does it! So, group these seeds in different ways according to characteristics like round seeds, long seeds, seeds of different colours, smooth seeds, fragrant seeds, etc. You can also do this exercise at home.
3. Sheela soaked gram seeds to germinate them but forgot to remove them from the water. The gram seeds lay there for many days. They did not germinate and began to rot. Explain why this happened.
4. In the chapter we saw that a new plant develops from a seed. However, there are plants which grow without seeds. For example, banana. Enumerate more examples of this kind.

NEW WORDS

cotyledons	axis	radicle	plumule
embryo	endosperm	seed coat	

DISPERSAL OF SEEDS 9

In the experiment on germination of seeds you observed that a complete plant develops from a single seed. You must have also eaten many fruits like *ber*, mango, tamarind, guava and custard apple and seen their seeds as well.

Does every fruit have only a single seed? (1)

A tamarind tree bears thousands of fruits. Each of these has more than one seed. Similarly, a neem tree bears thousands of fruits.

If all the seeds of a tree fall around it and germinate, will each new plant get sufficient air, water, sunlight and soil? (2)

Will all the plants survive? (3)

To ensure that the maximum number of seeds of a plant are able to germinate and grow into new plants it is important that the seeds are spread out over a large area. However, since most plants remain fixed at one place, there must be some arrangement for dispersing their fruits and seeds far and wide.

In this chapter we shall see how this dispersal of fruits and seeds takes place. We will also observe how the shape, structure and nature of fruits and seeds contribute to this process.

FRUITS THAT BURST TO DISPERSE SEEDS

Have you ever seen a soyabean crop? When the soyabean pods ripen and dry, they burst. This produces a crackling sound and the seeds are dispersed all around.

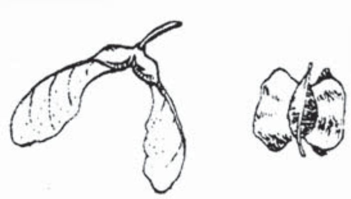
Do you know other plants whose fruits also burst open to disperse their seeds? Write the names of at least five such plants. (4)

Balsam (*gultevdi*) is a plant which bears red, pink or white flowers. When the fruits of this plant ripen, they burst open at the slightest touch and the seeds are strewn all around. Sometimes the seeds are thrown as far as two metres away.

Another plant of this kind is the squirting cucumber. It must have got its name because when its fruit becomes ripe, it sprays its seeds in a fountain, just like a *pichkari*. The seeds are thus scattered over a considerable distance.

SEEDS THAT FLY WITH THE WIND

Not all fruits burst open in this manner. Seeds are dispersed in other ways too. For example, some seeds are very light. They are carried by the wind over great distances. You must have often seen such seeds floating in the air. In addition to being very light, these seeds have certain structures such as wings, hair, etc, that help them to float in the air.



Make a list of such seeds.(5)

SEEDS THAT FLOAT IN WATER

Seeds of some plants such as the coconut travel from one place to another by floating on water. But it is not just the seed but the whole fruit of the coconut that floats on water. The seed inside germinates when the fruit reaches solid ground. This is the reason why coconut trees generally grow near water.

SEEDS RIDING ON ANIMALS

Have you observed fruits or seeds stuck to the hair on the bodies of animals? If you have, then list the names of these seeds. (6)

What is the special feature in the structure of such fruits and seeds that enables them to stick to the hair of animals? (7)

These seeds travel with the animal, going wherever it goes. When they finally fall off, they germinate on the ground. This is one way in which animals help in the dispersal of seeds.

DISPERSAL BY BIRDS AND ANIMALS

Some seeds are sticky. When birds eat the fruit, these seeds stick to their beaks. When the birds clean their beaks at some other place, these seeds take root there. Seeds like *gondi* (losoda), *bandha* (Loranthus, mistletoe), etc, are dispersed in this manner.

There are many fruits that birds and animals are very fond of. They eat these fruits along with the seeds. The fruits, of course, get digested in their stomachs, but the seeds, because of their hard cover, don't. They come out with the droppings. These seeds take root wherever the droppings fall. In this way birds and animals carry seeds to distant places. Their droppings also provide excellent manure for the seeds when they germinate.

Can you think of how plants like pipal, banyan, etc, grow on the walls of buildings, forts and wells? (8)

DISPERSAL BY PEOPLE

People have contributed significantly to the dispersal of plants by carrying seeds from one place to another. They have spread seeds intentionally. Sometimes they have taken seeds of plants noted for their beauty or fragrance or medicinal value from one place to another. Seeds of some plants are transported over large distances because they are used for food. For example, when European traders came to India, they brought along seeds of vegetables grown in their countries and planted them here. Cauliflower and peas are examples of such vegetables. Similarly, Portuguese traders brought with them seeds of many South American plants like tomato, potato, tobacco, custard apple, guava, etc.

We often transport seeds from once place to another unknowingly. For example, seeds of *gajar ghas* (Parthenium) came to India with the wheat imported from America.

Not only do people help in dispersing seeds, they also try to stop many seeds from dispersing. For example, if seeds of crops like wheat, jowar, paddy, bajra or soyabean were to disperse on their own, there would be no point in planting such crops. After all it is only for their seeds that we plant crops. If the seeds get dispersed far and wide, what would remain for us?

We can, therefore, say that people have contributed significantly both to the dispersal of seeds as well as to restricting their dispersal.

Now complete the table given below. (9)

Method of dispersal	Name of the fruit or seed
By bursting	
By wind	
By water	
By animals	
By birds	
By people	

You have learned about various methods of dispersal of seeds. You also know the names of seeds that disperse in these different ways. Collect five different seeds which are dispersed by each of these methods. Note their names and draw their pictures in your exercise book. Please note that it may take you some time to collect these seeds.

Explain in your own words the importance of dispersal of seeds in nature. (10)

LIGHT BULBS AND ELECTRICAL CIRCUITS 10

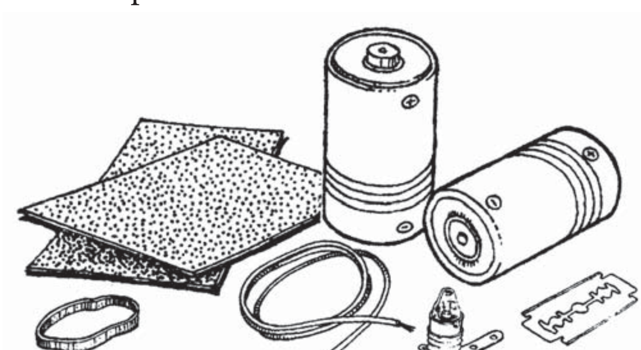
Sabiha's father was upset. He kept banging his torch on the ground, muttering to himself, "Arre, Chhuttan just put in new batteries today and this stupid torch still doesn't work."

Sabiha took the torch from her father, sat in a corner and examined it. The questions kept racing through her mind. "Perhaps, the bulb is fused," she thought as she began unscrewing the top. "Ooph, who screwed this on so tight? Hah, it's open at last. Let me check if the bulb is fused. It seems to be alright from the outside. Can there be anything wrong with the batteries? But they are new. Oh, what's this? One of the batteries has been put in the wrong way. This must be Chhuttan's doing."

Sabiha put the battery in the correct way, switched on the torch. It lit up. She gave the lit torch to her father. He was very pleased and patted her back in appreciation.

Can you also repair a torch? Do you know the correct way of placing the batteries in a torch?

You will learn this and other such things in this chapter. You will also learn answers to questions like: What is a switch? Which materials can electricity flow through? Which materials do not allow electricity to flow? You will find the answers by performing some experiments that you may find interesting. You will do more experiments with electricity in the higher classes as well.



WARNING

These experiments should only be performed with batteries used in a torch or radio. Do not, under any circumstance, make the mistake of performing these experiments with the electricity supply in your home, farm or school. Playing with the household electric supply can be extremely dangerous!

CONNECTING THE BULB TO THE BATTERY

EXPERIMENT 1

Take a battery, a torch bulb, a bulb holder, short lengths of electric wire and a rubber band cut from the inner tube of a bicycle. Do you know how to connect these together in a circuit so that the bulb will light? Let us do this, proceeding carefully, step by step.

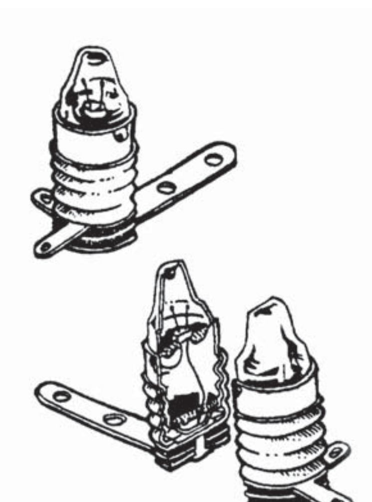


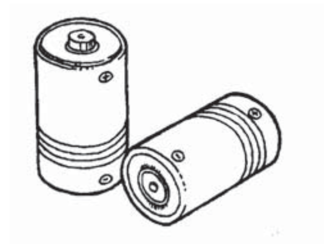
Figure 1

1. Clean the wire: Electric wires are often covered with plastic. First, remove about two centimetres of the plastic covering from both ends of the wire. Ensure that the naked wire is clean. If the ends are not clean, sandpaper them, or rub them on a stone or any other rough surface till they start to shine.

2. Check the bulb and bulb holder: There is a small coil or filament of very thin wire inside the bulb. Use a magnifying lens to examine it. If the coil is broken, the bulb is fused and will not light. We will need to replace such a bulb. A torch bulb is quite small but the bulbs we use in our homes are much bigger. It is much easier to see the filament in them.

Now examine the knob of metal at the base of the bulb. One end of the filament is connected to this knob and the other end is connected to the threaded metallic part of the bulb. This is why the knob and the threaded metal are called the two terminals of the bulb. Look at Figure 1 and try to understand the construction of a light bulb.

When the bulb is screwed tightly into the bulb holder, its threaded part fits into the threaded outer part of the holder and its knob touches the base of the holder. Two metal strips project out of the bulb holder. One strip is connected to its base and the other to its thread. Can you identify these strips in Figure 1? These strips are called the terminals of the bulb holder. If the terminals of your holder are rusted, clean them with sandpaper. Then connect electric wires firmly to each terminal.



3. Identify the terminals of the battery: The battery also has two terminals. Look carefully at the small knob at the top of the battery. Is there a sign near this knob? This is the positive terminal of the battery and is indicated by a (+) sign. The flat bottom end of the battery is the negative terminal and is indicated by a (-) sign.

Protect your battery: Never connect the two terminals of a battery directly to each other with a wire. If you do so, the battery will get discharged (lose all its power) within a few minutes.

4. A simple battery holder: How will you connect wires to the battery? There is a simple way of doing this. Take an old inner tube of a bicycle and cut it into narrow bands. Each band should be wide enough to cover the knob of the battery. This is your cell (battery) holder.

Check that you have made all your preparations correctly before proceeding further.

5. Your bulb will now light up: The two wires connected to the bulb holder should now be connected to the battery - one to its knob and the other to its flat bottom surface. Do this by carefully slipping the ends of the wires under the rubber band. Your bulb should light up. If it doesn't, clean the ends of the wires once again and make sure they are inserted properly under the rubber band. If the bulb doesn't light up even after this, consult your teacher.

6. How will you switch off the bulb? If you do not want to waste your battery what should you do? Just remove one of the wires connected to the battery from under the rubber band.

If you reverse the connections to the battery, what will happen? Try it and see. (1)

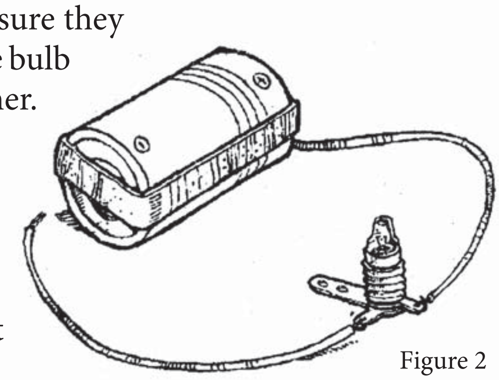


Figure 2

EXERCISE: YOU SUCCEEDED IN LIGHTING YOUR BULB.

Let us find out if you really know how this should be done. Mannu, Golu, Meena, Chhuttan and Gudiya connected their bulbs to batteries in different ways which are shown in Figure 3.

Which of these bulbs will light up and which won't? (2)

Now make these connections yourself and check whether you answers are correct or not. (3)

ELECTRICAL CIRCUIT

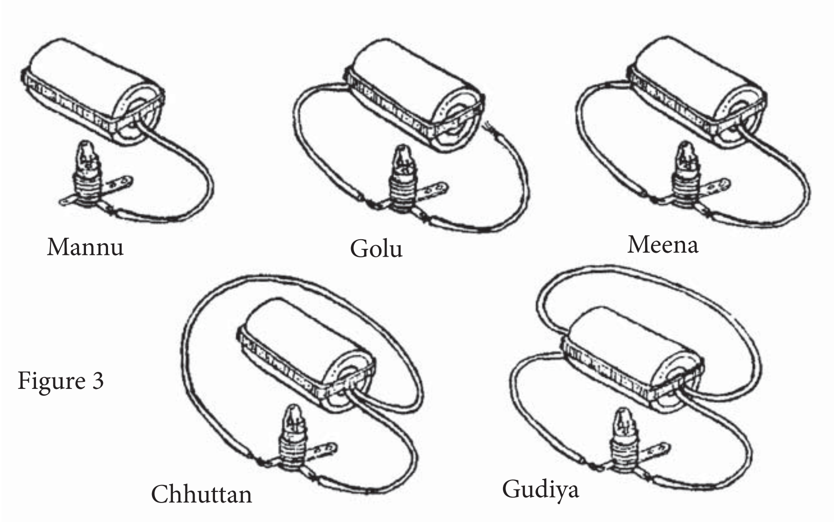
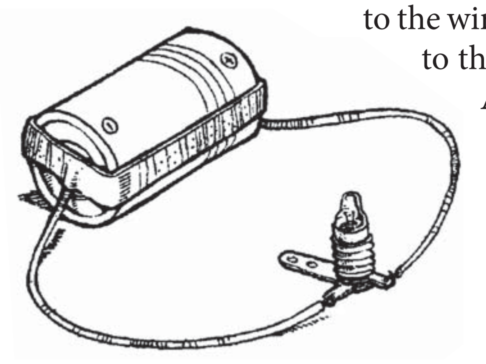


Figure 3



If a bulb lights up, this is an indication that electricity is flowing through it. But how does the electricity reach the bulb? It reaches the bulb through the wire. From the battery to the wire, from the wire to the bulb and from the bulb again to the battery through the other wire - a complete path. A complete path is necessary if electricity is to flow. The bulb, the wires and the battery make up what is called a circuit. You made a circuit to light your bulb. When electricity flows through a circuit, it is said to be a complete circuit. When electricity does not flow through a circuit, it is called an incomplete or broken circuit. For example, when you disconnected one wire from your circuit (Figure 2), it became incomplete.

Which circuits shown in Figure 3 are incomplete? (4)

How can we find out whether or not a circuit is complete? (5)

GOOD AND BAD CONDUCTORS

EXPERIMENT 2

You switched off your bulb at the end of Experiment 1 by disconnecting one wire from the battery. There were two wires in the circuit then. Now connect a third wire as shown in Figure 4.

Is this circuit complete or incomplete? (6)

Will the bulb light up if the two open ends of wires are connected? Try it yourself and find out. (7)

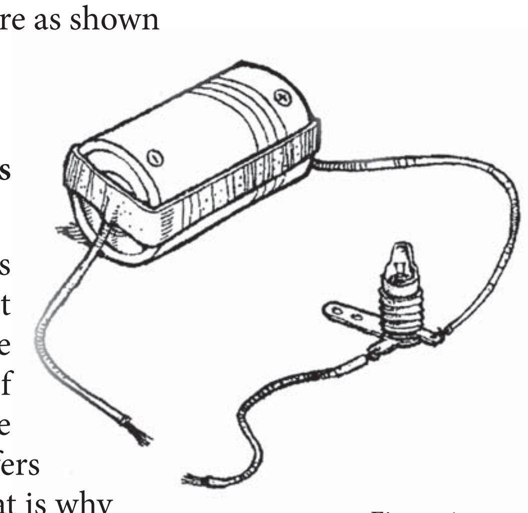


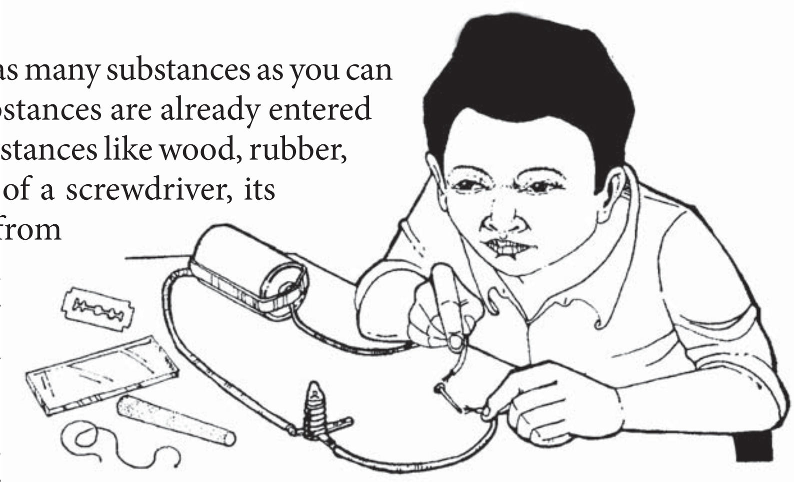
Figure 4

To begin with, we will keep the ends of the wires open as shown in Figure 4. We will then connect the open ends to different materials and observe when the bulb lights up and when it does not. If the bulb lights up, the material connected to the wires is a good conductor. A good conductor offers very little resistance to the flow of electricity. That is why the bulb lights up. However, there are some materials which when placed in the circuit stop the bulb from lighting up. These materials are called bad conductors or poor conductors. These bad/poor conductors resist the flow of electricity so much that the bulb cannot light up.

Let us now identify good and bad conductors.

Start with an iron nail. Place the nail between the open ends of the wires in such a manner that it touches both wires. Observe whether the bulb lights up or not. Copy Table 1 in your exercise book and note your observations in it. Show whether the nail is a good or bad conductor by placing a tick mark (√) in the appropriate column.

Repeat this experiment with as many substances as you can find. The names of some substances are already entered in the table. Collect more substances like wood, rubber, copper wire, plastic, the tip of a screwdriver, its handle, black shellac (lac) from an electric bulb, aluminium foil, the divider from your compass box, a bit of lead from a pencil, etc.



You checked whether an iron nail is a good conductor

or not. Now try the same experiment with other iron objects like a pin, wire, blade, etc.

Do you get the same result? (8) Now think back and explain why it was necessary to remove the plastic covering from the ends of the wire before making a circuit. (9)

TABLE 1

No.	Object	Good conductor	Bad conductor
1.	Iron nail		
2.	Chalk		
3.	Fifty paise coin		
4.	Cotton thread/Cloth		
5.	Paper		
6.	Silver earring		
7.	Glass slide		
8.	....		
9.	....		

Is the black lac found in a bulb a good or a bad conductor? Why is it used in the bulb? (10)

In your table, look at substances made of metal, like iron, brass, aluminium, etc.

Can you draw any conclusions about metals on the basis of your observations? (11)

During Experiment 1 Sunita's group could not get their bulb to light. Sunita sought help from Soni who was sitting nearby. Soni took one look at Sunita's bulb holder and said, "Look at the amount of rust on the terminals of your bulb holder. Clean them with sand paper." Sunita did so and again connected the battery to the bulb holder. The bulb immediately lit up.

Explain in your own words why the bulb did not light when the terminals had rust on them. (12)

AIR: A GOOD OR BAD CONDUCTOR?

You tested glass, rubber, iron, etc, to see whether they are good conductors or not. If you are now asked if air is a good conductor or a bad conductor what would you say? Would you just scratch your head wondering how to answer that question? Remember, you have already done several experiments with air.

Earlier you made a circuit like the one shown in Figure 4, in which the ends of the wire were not connected to each other.

Did the bulb in such a circuit light up? Is there nothing

between the open ends of the wire in this circuit? Not even air? Think carefully before answering. (13)

Would you call air a good or a bad conductor of electricity? (14)

Think how fortunate it is for us that air is a bad conductor. Imagine what would happen if air was not a bad conductor. List some possible dangers. (15)

THE CIRCUIT IN A TORCH

You read the story of Sabiha and Chhuttan at the beginning of this chapter. Sabiha examined the torch and found that Chhuttan had put one battery in the wrong way. How should two batteries be placed in the torch? How is the circuit from the batteries to the bulb completed in a torch? Let us try to understand this.

TORCH BATTERIES

The two batteries in a torch are placed such that the positive terminal or knob of one battery touches the flat negative terminal of the second battery (Figure 5) either directly or though another metal object.

What mistake do you think Chhuttan made?

Yes, he had not connected the batteries correctly. Since he had put one battery in the wrong way, its negative terminal was in contact with the negative terminal of the other battery (figure 6). That is why the torch did not light up.

Figure 5

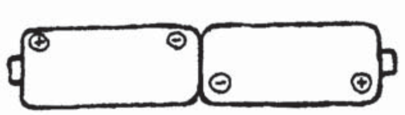


Figure 6

TORCH BUTTON OR SWITCH?

Now look carefully at the torch circuit that Sabiha made. Get hold of a torch and try to trace its internal circuit.

Remember, you had disconnected one wire to switch off the bulb in your circuit. But is there any arrangement within a torch to switch the bulb on and off? Let us try to understand this with the help of Figure 7.

As shown in these diagrams, there is a button or switch placed on the outer surface of the torch. When this switch is pressed and pushed forward the bulb lights up (Figure 7 a). The bulb is turned off when the switch is moved backwards (figure 7B). This means that it is the switch that completes or breaks the circuit.

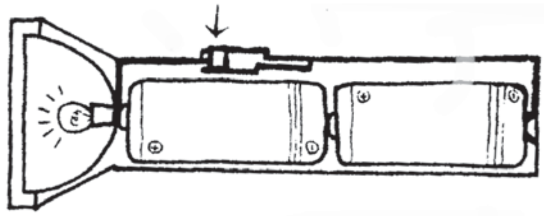


Figure - 7A

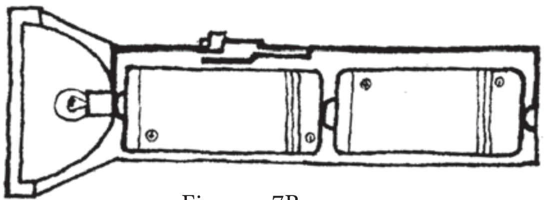


Figure - 7B

Let us now open the torch and examine it. The switch is made of plastic on the outside, but inside it is attached to an iron strip. Moving the switch forward and backward causes this strip to move forward and backward as well. When the strip moves forward it touches one terminal of the bulb. Can you identify, with the help of Figures 7 and 8, which terminal of the bulb the strip touches? The threaded portion or the knob?

Observe how the circuit is completed between the batteries and the bulb. When we screw the cap holding the bulb on to the body of the torch, the knob of the bulb directly touches the knob of the battery. This end of the bulb and the two batteries should press tightly against one another. To make this possible there is a thick spring in the lower cap of the torch. This spring keeps the batteries pressed against each other and the knob of the bulb. You should also notice that the wire connected to the spring goes along the side of the torch and is connected to the metal strip of the switch.

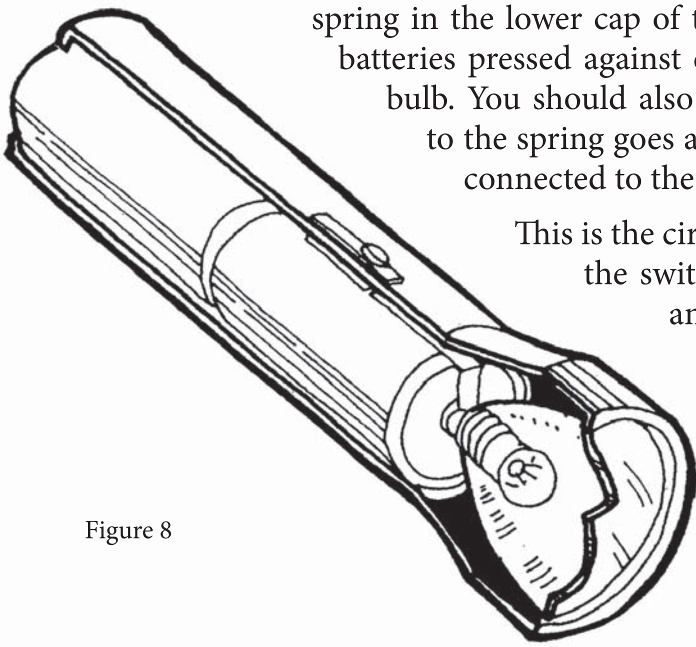


Figure 8

This is the circuit of the torch. When we push the switch upwards the strip moves up and touches one terminal of the bulb. When this happens the circuit is completed and the bulb lights up.

POINTS TO PONDER

You studied the circuit in Sabiha's torch whose body is made of plastic. But the body of Meena's torch is made of metal. There is no connecting wire from the lower cap.

How is the circuit from the bottom of the battery to the switch completed in a torch with a metal body? (16)

If you have a plastic torch, you should check to see that its construction is like Sabiha's torch. If it is not, try and find out how the circuit is completed in your torch.

WHAT MAKES THE BULB LIGHT UP?

Have you ever thought about how a bulb gives out light? The petromax or kerosene lamp gives light because of the fire burning inside them. But what happens in the coil of the bulb to cause it to glow? There is no fire there.

Lightly touch a lighted bulb. Does it feel warm?

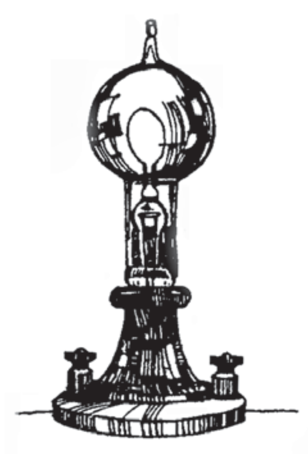
You must have seen that a bulb which is lit for long becomes quite hot. We can barely touch its glass cover. If the glass cover itself gets so hot, imagine how hot the bulb's filament, through which electricity is flowing, must be. Have you seen a blacksmith heating iron in his furnace? The iron becomes so hot that it gives out a reddish glow. Something similar happens in a lighted bulb. When electricity flows through the filament, the filament becomes so hot that it starts glowing and gives off light. The bulb shines brightly.

You can find out how the first bulb in the world was made from the following story.

INVENTION OF THE BULB: THE STORY OF EDISON

The story of the invention of the bulb is very interesting. We may think that a bulb is a very simple gadget. Just press a switch and it lights up. But do you know that many scientists worked hard for many years before the first succesful bulb was made? The first attempts were made about 150 years ago. By then scientists had found out that if electricity flows through a wire, the wire gets hot. Some wires become so hot that they begin to glow and give out light. But the problem was that they burnt out very quickly. It was not possible to make a bulb until this problem was solved.

This challenge was taken up by many leading scientists of the world. One of them was Thomas Edison who ultimately succeeded in making the first bulb.



Edison's life story is very interesting. He is considered one of the leading scientists and inventors of all times, but in his entire life he attended school only for three months.

From his childhood he was of an inquisitive nature and he learned science by performing experiments himself. He had an extraordinary genius for understanding a technical problem and finding a solution to it. You will be amazed to know that in his lifetime he made more than 1,000 inventions.

Even a talented scientist like Edison had to work hard for many years before he could make a bulb that worked. First of all, he passed electricity through a thin, thread-like platinum wire. He noticed that the wire did give out light after being heated, but it burned out after only a few seconds. Edison then thought that if the air surrounding the wire coil was removed then, perhaps, the wire would not burn out so quickly.

He made a glass casing and fitted a filament of platinum wire in it. He then removed all the air from within the glass casing. He passed an electric current through the wire and, to his delight, the bulb lit up and did not burn out for eight long minutes.

Edison knew he was on the right track. He began experimenting with different materials in search of a filament that would give out light for a long time and also be inexpensive.

He tried cotton thread coated with soot. This filament burned continuously for 45 hours. The result was encouraging but he felt a longer lasting filament was needed.

He tried different kinds of thread. One summer day he saw a man fanning himself with a bamboo fan and the idea came to his curious mind, "Well, why not try bamboo fibre for a filament?" He did and, amazingly, the bamboo filament burned continuously for a number of days. Finally, he succeeded in making a cotton filament that was even better than the bamboo one.

News of Edison's invention was first published in a newspaper in the United States of America in December, 1879. It caused a sensation across the whole world. Many people were not ready to believe that such a bulb could be made. But everyone was convinced after Edison demonstrated his invention in front of about 3,000 people.

Today we use the same kind of bulbs as were first made by Edison. The only difference is that our bulbs have a filament made of a metal called tungsten.

QUESTIONS FOR REVISION

1. Rahul purchased a new battery. It had a plastic seal covering its knob. Rahul placed the battery in his torch without removing the seal. Explain why Rahul's torch did not light.
2. We say a bulb is 'fused' when its filament is broken. Why does a fused bulb not light?
3. Kishan had a piece of wire. He connected one end of it to the metallic thread of a bulb and pressed the other end against the bottom of a battery. Then he pressed the bulb against the battery and the bulb lit up. Draw a picture of the arrangement in your exercise book and explain how he could complete the circuit with only one wire.
4. Explain in your own words why a bulb gives out light.

NEW WORDS

bulb holder	circuit	conductor	filament
platinum	switch	terminal	tungsten

BITE SUGAR (MISRI) AND PRODUCE A FLASH

Man has invented many ways of producing light. Lighting a fire to produce light is the oldest method. How many other methods of producing light can you think of? You may consult your friends if you like.

Are there more ways to produce light than those you have thought of? Yes, indeed! There are many more.

Let us produce light by a sweet method. Sweet method? Aren't you a little curious and surprised? To produce light by this method we need a few lumps of sugar (*misri*), a mirror and pitch darkness. We need darkness because very feeble light is produced and it can be seen only for a moment. So, even if there is faint illumination in the room, you will not be able to see the light you produce and the whole point of the experiment will be lost.

What you have to do is this. Take a few large lumps of *misri* and the mirror and enter a dark room. Since there should be complete darkness for the experiment to be successful you can only do the experiment at night.

Stand in front of the mirror, open your mouth and crush the lump of sugar with your teeth. Be careful not to wet the lump with your saliva. What did you see? Did you see a faint flash of light reflected in the mirror when the sugar lump was crushed?

Isn't this extraordinary? If you don't have a sweet tooth and do not like to eat lumps of sugar, you can use a pair of kitchen tongs or pliers to crush the lump of *misri*.

Field Trip

ROOTS, LEAVES AND SEEDS

11

In this chapter we will first study the two main types of roots. We will then try to find the relationship that exists between the type of root, the venation of the leaf and the number of cotyledons in the seed of the plant. On this basis we will then classify plants into two groups.

In order to carry out this study, we will need to bring small plants with their roots and leaves intact to the classroom. We will go out on a field trip to collect these plants. We will need the following things for the field trip:

1. Old newspapers or magazines or any other type of waste paper.
2. Exercise book and pencil.
3. A cloth bag and a wet cloth (towel or napkin).
4. A small spade or any other tool for digging and a knife.

During this field trip, if you find that a plant is too big to collect intact with its roots and leaves and bring back to school, look for smaller plants of the same variety. You may find these growing nearby. Try to collect as many different types of plants as possible. Try to collect plants you can find easily or those for which you know the number of cotyledons in their seeds. Dig around the plants carefully and uproot them gently so that the roots are not damaged. Try to find out the names of all the plants you collect.

Write these names on slips of paper and tie the name tags to the respective plants. Wrap the plants in the wet cloth.

AFTER RETURNING TO SCHOOL

Take the plants out of your bag and arrange them on a flat surface.

Figure 1 (A)

Figure 1 (B)

ROOT

Carefully observe the roots of all the plants. Do all the roots appear similar?

In Figure 1 you are shown two types of roots.

The root shown in Figure 1 (a) has one main root, with many smaller roots emerging from it. This type of root is called a tap root.

In Figure 1 (b) there is no main root. All the roots are similar and seem to originate from the same point on the plant. This type of root is called a fibrous root.

Now divide the plants into two groups on the basis of the type of roots they have - tap root or fibrous root.

Select one plant from each group and draw its diagram. (1)

Make a list of plants in each group. (2)

LEAF

You already know that leaves have two types of venation and you also know how to identify them. Both types of venation are shown in the adjoining figure.

Divide the plants you have collected into two groups on the basis of the venation of their leaves - reticulate or parallel.

Make a list of plants in both the groups. (3)

SEED

In the chapter on 'Seeds and their Germination' you had studied the number of cotyledons present in different seeds.

Using this as a basis, make a list of dicot and monocot plants. (4)

If you have collected any new plant during the field trip, find out the number of cotyledons in its seed and add its name in the appropriate place in these two groups. (5)

COMBINED TABLE

Look at the table given below. You have to fill in the number of cotyledons, type of root and type of venation against each plant. Two examples have been filled in.

You had, earlier in this chapter, grouped plants on the basis of the types of roots, types of venation and number of cotyledons.

Complete the table on the basis of this information. (6)

No.	Name of plant	Number of cotyledons	Type of root (Tap or fibrous)	Venation (Reticulate or parallel)
1.	Mango	2	Tap	Reticulate
2.	Wheat	1	Fibrous	Parallel
3.				
4.				

Now answer the following questions on the basis of the information available in the table:

What type of venation is found in the leaves of plants with fibrous roots? (7)

What type of venation is found in plants which have a tap root? (8)

What can you say about the roots of a plant whose leaves have reticulate venation? (9)

If the leaves of a plant have parallel venation, what would be the type of its root? (10)

Complete the following sentences and write them in your exercise book:

(a) Monocot plants usually have__________________roots

and leaves with_____________venation.

(b) Dicot plants usually have________________ roots and

leaves with___________venation. (11)

QUESTIONS FOR REVISION

On the basis of what you have learnt about roots and leaves, describe the relationship between the type of root and the venation in the form of a rule.

Complete the following table:

No.	Name of plant	Number of cotyledons	Type of root	Venation
1.	*Chiku* (Sapota)	2		
2.	Bamboo		Fibrous	
3.	Gulmohar			Reticulate
4.	Mustard (*Rai*)			

NEW WORDS

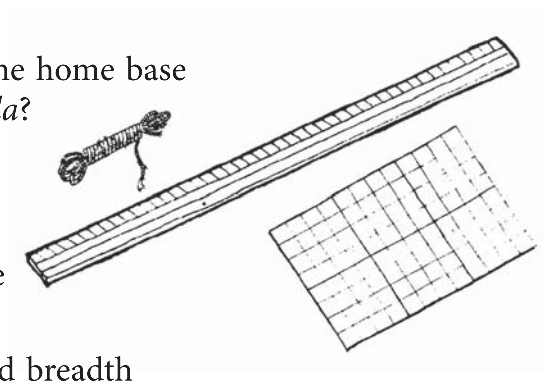
fibrous tap roots

MEASURING DISTANCES

12

You must have measured distances many times while playing, or seen others doing so. On the basis of your experiences or observations discuss the following in class.

How do you measure the distance from one end of a kabaddi field to the other?



How do you measure the distance between the home base (*guchchak*) and the *gilli* while playing *gilli danda*?

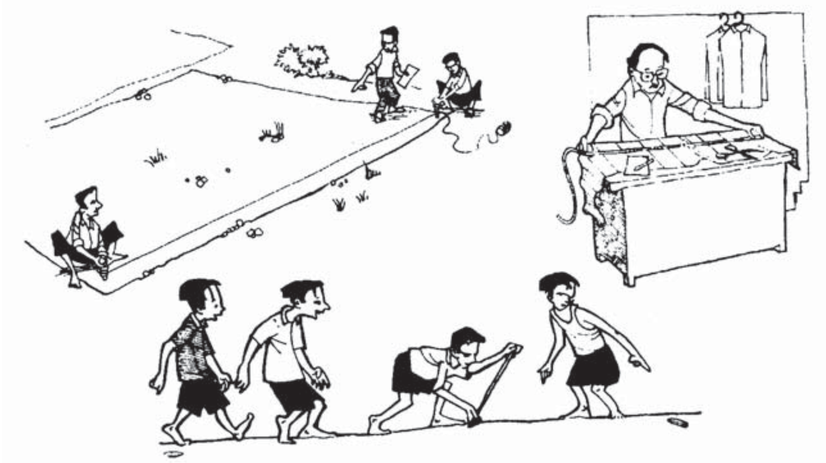
How is the depth of a well measured?

How do you measure your height?

How does the shopkeeper measure the cloth he sells?

How does the *patwari* measure the length and breadth of a field?

How would you measure the distance from your village or town to the next village or town?



WHO IS THE TALLEST?

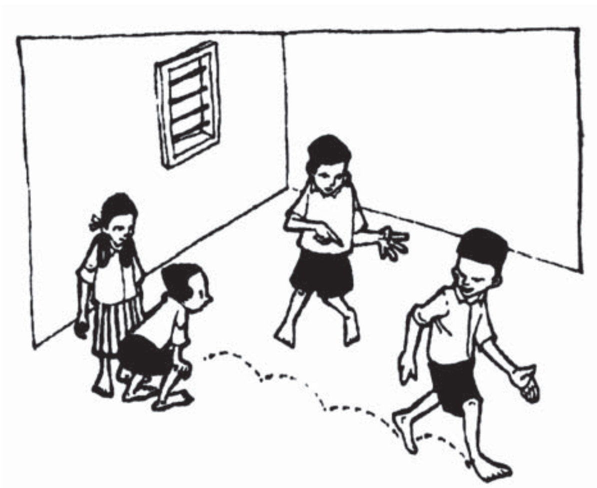
EXPERIMENT 1

You can compare the height of two students by making them stand side by side.

Who is the tallest student in your class? (1)

WHOSE ROOM IS LONGER?

Salim and Ramesh are students in different classes of the same school. They once got into an argument about whose classroom is longer.



Can Ramesh and Salim compare the lengths of their two classrooms by putting them side by side, as you did when comparing the heights of students in your class? (2)

To settle their argument the two boys decided to let Ramesh first walk across his classroom in his natural stride and then walk across Salim's classroom in the same manner. The lengths of the two rooms could then be compared to find out which is longer.

Ramesh strode across both classrooms and got the following measurements:

	Salim's classroom	Ramesh's classroom
Length of the room (in Ramesh's strides)	23	20

Whose classroom is longer? How did the friends compare the lengths of the two classrooms? (3)

When two objects cannot be brought together, we use a third object to compare their lengths. What we judge is how long or short these two objects are in comparison to the third object.

In this experiment, we used Ramesh's stride to compare the two objects. Salim and Ramesh could have used many other things in place of Ramesh's stride, such as their hand span, arm length, length of a rope, wooden stick, scale, etc.

HOW TALL IS LAMBU?

Sushma is the tallest girl in her class. She always boasts that she is 10 hand spans tall. One day the other girls in the class decided to check whether her claim was correct.

They made Sushma stand against a wall. Then Madhuri put a mark on the wall just above Sushma's head. The girls then measured the distance of this mark from the ground, using their hand spans and finger widths (complete hand spans and the remainder in finger widths).

Their measurements are given in Table 1.

Table 1

No.	Name of the students	Hand spans	Finger width
1.	Sushma	9	0
2.	Suresh	9	2
3.	Madhuri	10	0
4.	Suhail	9	4
5.	Madhav	9	8

Are all the measurements alike? (4)

Why are all the measurements not the same? (5)

Is Sushma actually 10 hand spans tall? (6)

Is your hand span equal to your friend's hand span? (7)

If everyone were to use their hand spans and finger widths to measure lengths what problems would it create? (8)

The hand & spans, foot sizes and strides of different people are not the same. They vary from person to person. Hence, we can use them only to estimate distances, not to measure distances accurately.

For correct measurements we need a scale. What is a scale and how did people begin using scales for measurement? Let us try and imagine what might have happened in the past.

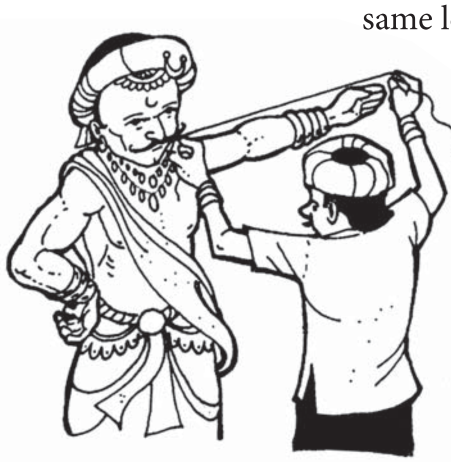
THE STORY OF THE SCALE

Many hundred years ago, people measured distances with their hand spans, strides or foot spans. One day a very tall man went to a shop to buy some cloth for a shirt. He asked for three-and-a-half arms length of cloth in exchange for two *paseri* of wheat. The shopkeeper measured out three arms length of cloth and then added approximately another half-arm length.

The tall man felt the shopkeeper had cheated him. So he measured the cloth with his arms and found there was not even three arms length. The two got into a heated argument in the busy marketplace. Whose arm should be used as the measure? How should one measure a half or a quarter arm length?

This must have been a familiar scene in those days - people getting into arguments over measuring the length of fields, or a rope or a hundred other things.

Finally, some sensible people got together and decided to have a scale of a fixed length to measure various things. They marked this scale with several smaller but equal divisions. They then decided that everyone would measure lengths with this scale. They used wood and metal to make scales of the same length.



Why did they make their scales with wood and metal? Why didn't they use cloth or rubber? Discuss among yourselves and answer. (9)

In one particular country, people decided to use the distance between the nose and the tip of the middle finger of their king as a measure. They called this distance one yard. This yard was divided into three equal parts and each part was called a foot. They then divided each foot into twelve equal parts called inches. They even further divided each inch into smaller segments.

For longer distances, they decided that 220 yards would make a furlong and eight furlongs would make a mile.

Other countries in the world also made their own scales. These made measurements simpler. But because each country had its own scale, which was different from that of other countries, this led to a lot of problems in trade and commerce. There was always a chance of quarrels breaking out.

Finally, in France it was decided that a certain rod of a special metal kept in a museum would be called a metre. The metre was divided into 100 equal parts and these parts were called centimetres. Each centimetre was further divided into 10 equal parts called millimetres.

While there are still different scales and units used to measure length in different places, the metre is now accepted as the standard international unit of measurement of length.

SCALE IN YOUR KIT

Carefully examine the scale in your kit. It has markings on it to measure distances.

The numbers on this scale denote centimetres (cm). Each centimetre has ten equal divisions. Each such division is a millimetre (mm).

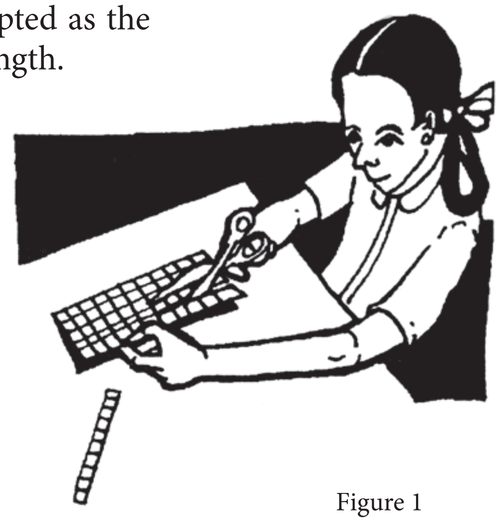


Figure 1

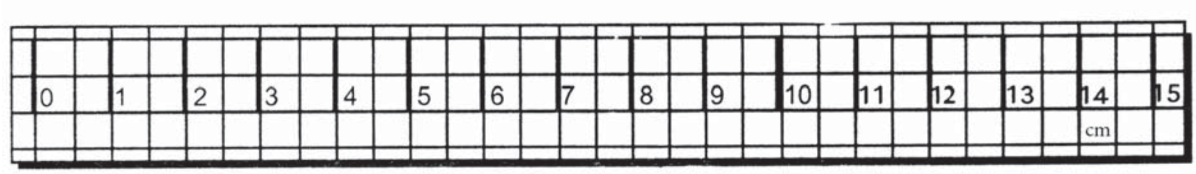
MAKE YOUR OWN SCALE

EXPERIMENT 2

Cut out a long strip of graph paper along the thick lines from your kit copy. (Figure 1)

What is the length of the side of each large square in this strip? (10)

Count 15 such squares and mark them from 0 to 15. Your scale is ready. You can paste it along the top edge of your exercise book and use it.



How many small divisions do each of the big squares have? (11)

Can you use this scale to measure wavy, zig-zag or curved lines? (12)

EXERCISE YOUR BRAIN

Look carefully at the 15cm long scale shown in Figure 2.

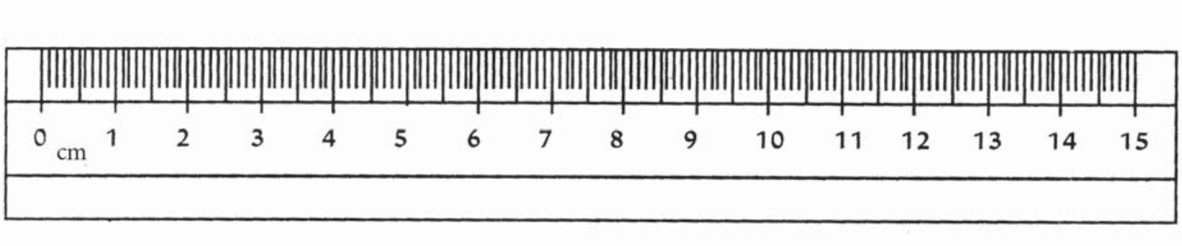


Figure 2

How many divisions does each centimetre on this scale have? (13)

What is each such small division called? (14)

In the scale you made, how many millimetres does each small division equal? (15)

What is the smallest distance you can measure with this scale? (16)

The smallest distance that can be measured by a scale is called its least count. You should always check the least count of a scale before using it.

HOW LONG IS A METRE?

Carefully examine the metre scale in your kit.

How many centimetres (cm) does one metre (m) contain?

(17)

How many millimetres (mm) does one metre (m) contain?

(18)

Are you more than one metre tall? (19)

HOW LONG IS A KILOMETRE?

A ‘kilo’ means one thousand. So a kilogram is 1,000 grams.

In the same way, a kilometre (km) is 1,000 metres.

THINK AND ANSWER

Fill in the blanks. (20)

1 cm	**=**	**......mm**	**1 mm**	**=**	**......cm**
1m	**=**	**......cm**	**1 cm**	**=**	**......m**
1 m	**=**	**......mm**	**1 mm**	**=**	**.....m**
1 km	**=**	**......m**	**1m**	**=**	**......km**

THE CORRECT WAY TO USE A SCALE

To measure the length of a straight object, place the scale parallel to the object. Then count on the scale the number of mm between the two ends of the object.

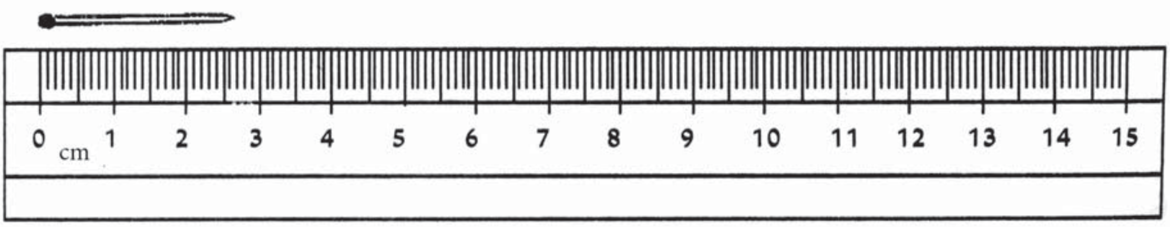


Figure 3

Count the number of mm in Figure 3 and find the length of the pin in mm. (21)

In the same way, we can count the number of cm and mm between the two ends of the object.

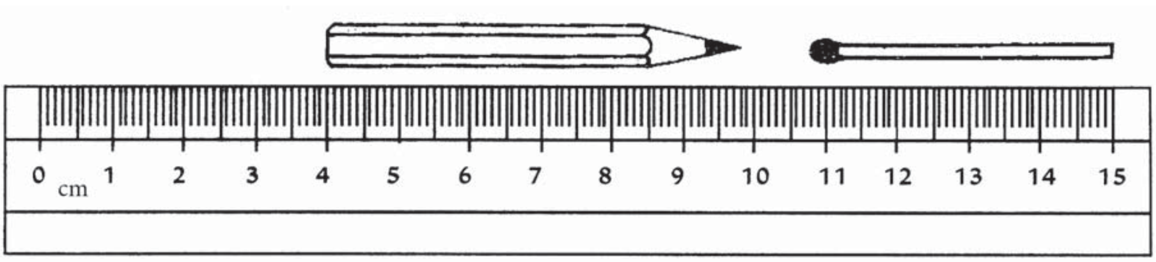
The length of the pin in Figure 3 is ....cm ....mm. (22)

Write down the length of the pin in cm. (23)

Don't forget to specify the units you use when writing down a measurement. If you do not write down the unit, your measurement will be considered incorrect. If you do not specify the unit, how would one know whether a distance is in cm, mm or metres?

You don't have to count the small divisions every time you measure a length. There is a simpler way.

Figure 4



In Figure 4, one end of the pencil is at the 4.0 cm mark, while its other end, the tip, is at the 9.8 cm mark. So the length of the pencil is (9.8 - 4.0) cm = 5.8 cm. You could check this answer by counting the small divisions on the scale from one end of the pencil to the other.

The markings on a scale begin a little away from one end and finish a little before the other end. So when you measure any distance, do so only from the '0' mark on the scale, not from its end.

You can use your scale even if it is broken or if its '0' mark is missing. The way to do so is to use it like you did earlier when measuring the pencil.

AN EXERCISE

What is the length of the matchstick in Figure 4? (24)

Note the length of the refill in Figure 5 and write it in your exercise book. (25)

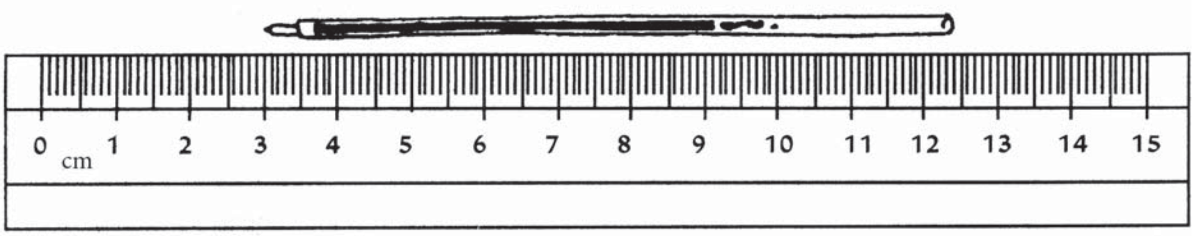


Figure 5

SPOT THE MISTAKES

Shyam and Shafique measured the length of the leaf shown in Figure 6.

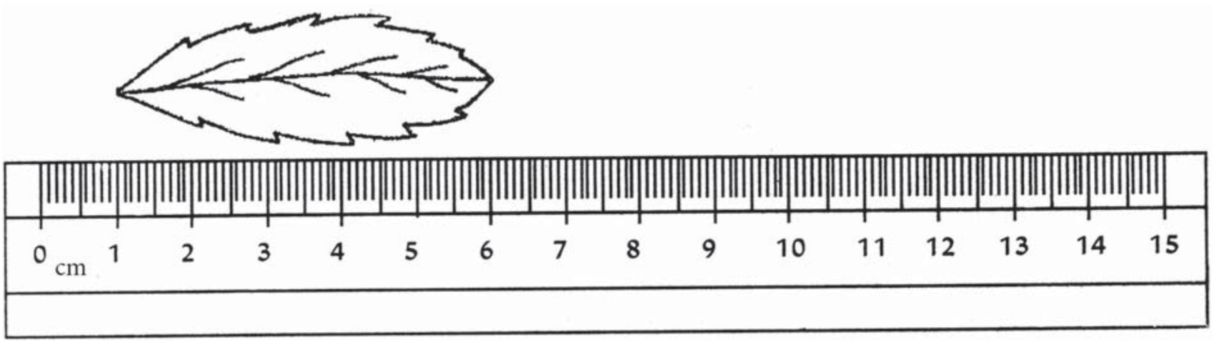


Figure 6

Shyam wrote its length as 6 cm.

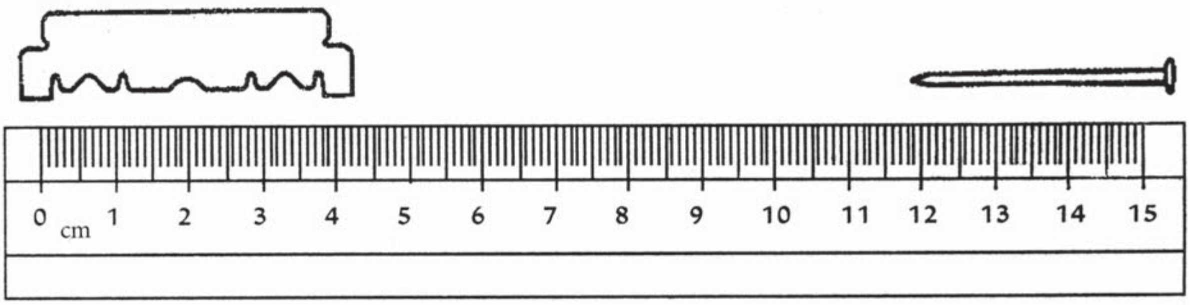
Shafique wrote its length as 5 cm.

What mistake did Shyam make in measuring the leaf? (26)

What mistake did Shafique make in measuring the leaf? (27)

What is the correct length of the leaf? (28)

Kallu measured the length of the blade as 4.2 cm and the nail as 3.2 cm. (Figure 7)



What mistake did he make in his measurements? (29)

Figure 7

Figure 8 shows a pencil being measured with two scales A and B.

What is the length of the pencil on scale A? (30)

What is the length of the pencil on scale B? (31)

Figure 8

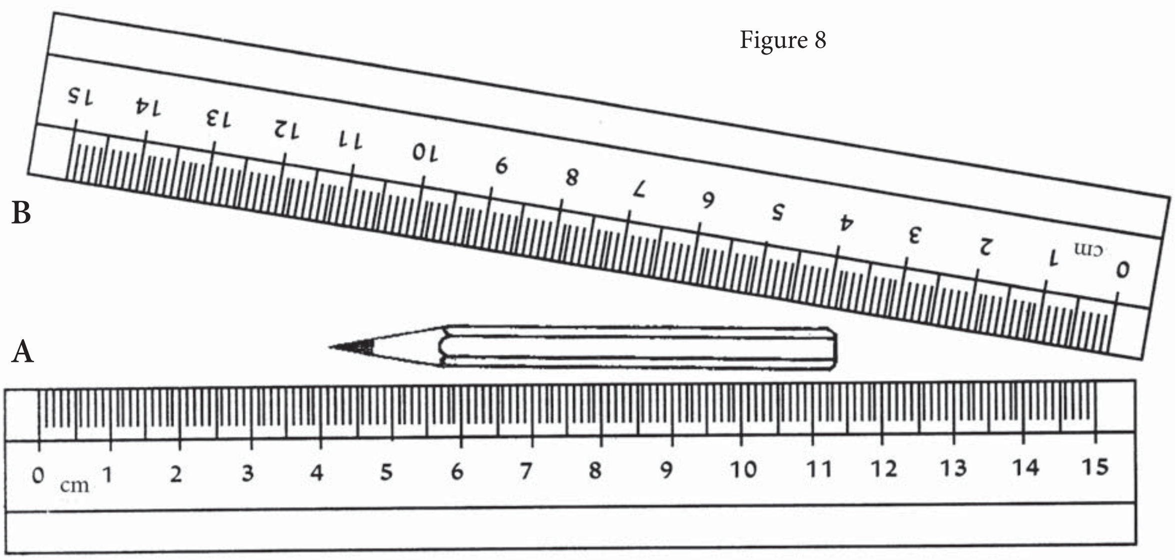


Figure 8 shows that if you wish to measure a length correctly, the scale should be kept parallel to the object being measured. If you keep the scale at an angle, as with scale B, you will get a wrong measurement.

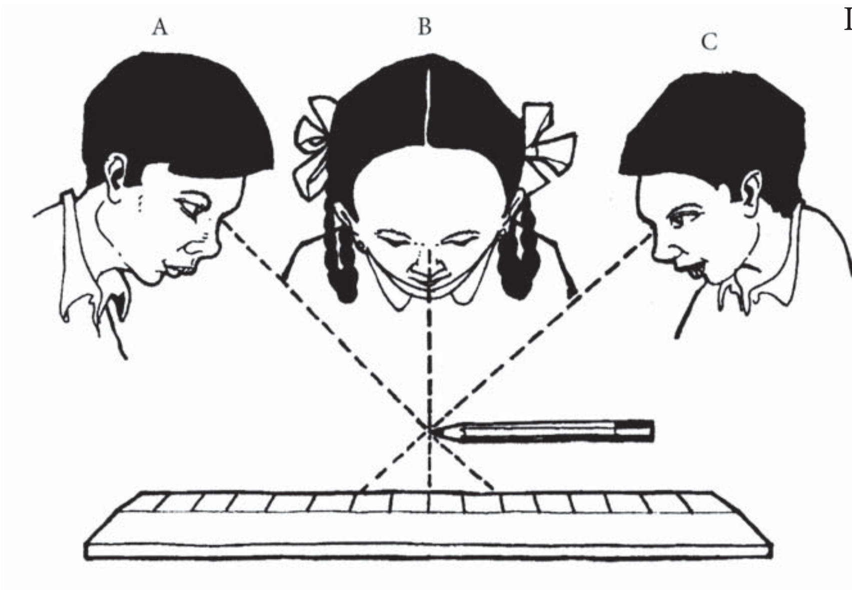


Figure 9

In Figure 9, the pencil placed next to the scale is being viewed from three different positions.

Which is the correct position - A, B or C? (32)

You can now understand the importance of the position of the scale, the object and the eye in measuring correctly.

Let us now practise measuring distances.

EXPERIMENT 3

Guess the length of your exercise book. Copy the table given below in your exercise book and write down your estimate. (33)

TABLE 2

No.	Name of the object	Estimated	Measured
1.	Length of exercise book	.......cm	.......cm
2.	Breadth of exercise book	.......cm	.......cm
3.	Thickness of exercise book	.......cm	.......cm

Now measure the length of the book with a scale. How good was your estimate?

If you try this exercise again, then perhaps your estimate will be closer to the actual measurement.

Now estimate the breadth of your exercise book. (34)

Measure the breadth with a scale.

Was your estimate closer to the actual measurement this time? (35)

Let us make another attempt at correct estimation.

This time estimate the thickness of your exercise book.

Now measure the thickness with a scale.

Does your estimate improve as you repeat the exercise several times? (36)

HOME ASSIGNMENT

We often have to make estimates of the length and breadth of objects because we do not always have a scale to measure. So it is necessary to improve our ability to estimate correctly. To practise, choose any ten objects. First estimate their length, breadth, height, distance, etc, and then measure these with a scale.

Do not forget to enter both your estimates and the actual measurements in Table 2.

EXPERIMENT 4

Measure the distance you cover in ten strides with a scale and then calculate the distance covered in one stride.

What distance do you cover in one stride when walking naturally? (37)

While returning home, count the number of strides you take while going from your school to your home and then estimate this distance in metres.

THINK AND ESTIMATE

Name a few things which you use in your daily life which are approximately

a) one metre long

b) one centimetre long

c) one millimetre long (38)

NEW WORDS

scale	least count	unit

LIGHT A CANDLE

You may have lit a candle with a matchstick many times, holding the burning matchstick to the wick of the candle until the wick catches fire.

But can you light the candle without touching the burning matchstick to the wick?

Do you think this is impossible? Let us see how it can be done.

Place a candle in a safe place and light it. No, No! The first time around, the candle cannot be lit without touching the wick with the burning matchstick. So do just that the first time. Let the candle burn for some time.

After about two minutes, hold a burning matchstick in one hand and blow the candle out. What did you notice? Did you see a column of white smoke rising from the wick as soon as you extinguished the flame?

Now quickly bring the burning matchstick close to this smoke, but do not touch the wick with it.

What happens?

Did the candle not catch fire from a distance?

If you wish, you can make a game of this. See which student in your class can light the candle from the farthest distance.

Discuss with your friends how and why the candle got lit from a distance.

VARIATION AND APPROXIMATION 13

VARIATION IN MEASUREMENTS

Bhola and Karim were playing *gilli danda*. Bhola hit the *gilli* and claimed a distance of 100 *dandas*. Karim, however, measured the distance from the *guchchak* to the *gilli* and said it was only 98 *dandas*. The two got into an argument. So they decided to measure the distance together. On doing so, they got a distance of 101 *dandas*. Karim felt this just could not be possible. "Let us check once more," he said. This time they measured the distance as 100 *dandas*. They were both confused. What was happening? Even after taking so much care they kept ending up with a different number of *dandas.* Would such differences occur every time they carried out a measurement? How can we find out what the distance actually is? Would such variations occur even if we use a scale to measure the distance?

Let us measure and find out for ourselves.

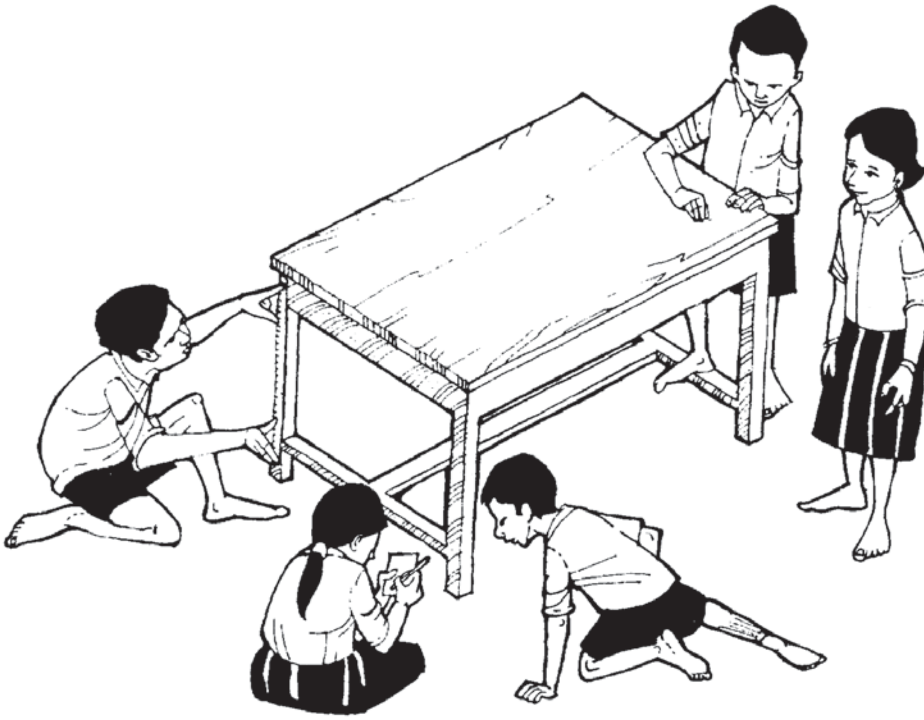
PRECAUTIONS WHILE MEASURING

We had discussed some points in the chapter on measuring distances which, if not kept in mind, could lead to errors in measurement. Do you remember those precautions? For example, you must first note down the least count of the scale, then you must place the scale straight and read the measurement from the correct point.

EXPERIMENT 1

You have to measure the length of a table. Take a half metre scale.

What is the least count of the scale? (1)



Measure the length of the table carefully and note your measurement on a piece of paper. Do not show what you have written to anyone else, otherwise they might copy your measurement. When we know what someone else has measured, we often tend to feel that our measurement should also be the same. Then we are not really able to measure independently.

After everyone has finished measuring, record all the measurements in your exercise book.

Are all the measurements the same? (2)

Even after everyone taking care there are still variations in the measurements.

Can you suggest any reason for such variation? (3)

Do you think all the measurements should have been the same?

Part of the variation could be because each person used his or her own scale. But even when a single person repeats a measurement several times with the same scale such variations can occur. Some differences can always creep in while placing or reading the scale for each measurement. If you like, you could try measuring the length of a table five times.

IDENTIFYING WRONG MEASUREMENTS

Do some of the measurements you have noted seem to be obviously wrong?

If a measurement is very different from the rest of the measurements, it can be assumed to be wrong. Let us try to understand this with the help of an example.

14 children measured the height of a window with a half-metre scale. Their measurements were as follows:

1)	91.2 cm	8)	93 cm 5 mm
2)	93 cm 8 mm	9)	80.3 cm
3)	92 cm 5 mm	10)	91 cm 8 mm
4)	90.7 cm	11)	90.9 cm
5)	1.42 ft	12)	91.4 cm
6)	923	13)	92 cm 4 mm
7)	92.6 cm	14)	93.6

Two of these measurements appear to be correct but their units have not been mentioned.

Identify these measurements. Also write their units. (4)

Two measurements in the list are completely wrong. Identify them. (5)

Some mistake must have been made while taking these two measurements. So they can be safely removed. That leaves 12 measurements.

If we write all these measurements in centimetres our list will be as follows:

91.2 cm	93.5 cm
93.8 cm	91.8 cm
92.5 cm	90.9 cm
90.7 cm	91.4 cm
92.3 cm	92.4 cm
92.6 cm	93.6 cm

On the basis of these measurements can you say what is the height of the window? What do you suggest should be done?

All these measurements are not equal but they are close to each other. There is a small variation among these measurements.

What is the smallest measurement? (6)

What is the largest measurement? (7)

We can now make a good estimate of the height of the window. We can say that the height of the window lies somewhere between the smallest and the largest measurement. The average of all these readings is used as a measure of the length in such situations.

How does one obtain the average?

FINDING THE AVERAGE

Add the 12 measurements:

91.2 cm

93.8 cm

92.5 cm

90.7 cm

92.3 cm

92.6 cm

93.5 cm

91.8 cm

90.9 cm

91.4 cm

92.4 cm

93.6 cm

Total : 1,106.7 cm

Since there are 12 measurements, we divide the total by 12. On doing so we get:

Average of measurement = 1106.7/12 = 92.225 cm

Look carefully at the average value. If we were to say that the average height of the window is 92.225 cm, it would create a lot of confusion. The first place after the decimal point denotes one-tenth of a centimetre. The height of the window was only measured up to the first decimal place. Now look at your scale. The second and third place after the decimal point denote one-hundredth and one-thousandth of a centimetre respectively. These cannot be measured with this scale. Therefore, it would be appropriate to write the average value up to the first decimal place only.

If we need to write 92.225 cm up to the first decimal place what should we do?

When we round off or approximate 92.225 cm to the first decimal place we get 92.2 cm. You will learn about how approximation is done at the end of this chapter. Therefore, we can state on the basis of these measurements that the average height of the window is 92.2 cm.

Now look at the list again. It does not contain a single reading of 92.2 cm. Yet we accept this figure as the average height of the window. That means we cannot say that any of the 12 measurements is either correct or incorrect. We can, however, say that some of these measurements are closer to the average height than the others.

FOOD FOR THOUGHT

If we took 20 measurements instead of 12, could the average height of the window change?

Whenever we take a measurement, there is scope for some variation. Therefore each time the average of measurements could also be different.

Yet, the window is the same. It does not expand or contract. It is only that we cannot tell what its actual height is. All we can say is that on the basis of these measurements, the average height of the window is so much. Of course, the more accurately we measure, the more accurate would be the average height we obtain.

THE LENGTH OF YOUR TABLE

Let us now return to the length of the table. Look at the measurements written in your exercise book once again. You had measured the length of the table. Which of these measurements are completely wrong? Identify and mark them. What kind of mistakes might have been committed while taking these measurements?

Leaving out the wrong measurements, make a list of all the measurements in centimetres. (8)

Calculate the average of these measurements. (9)

Write the average length of the table in centimetres up to the first decimal place. (10)

To do this you will again have to round off or approximate the average value.

RULE FOR APPROXIMATION

Suppose we have to round off 27.73 to the first decimal place.

Look at the digit in the second decimal place. If that digit is less than 5, we ignore it and write the remaining number as it is, up to the first decimal place. If, however, the digit is 5 or greater than 5, then we increase the digit in the first decimal place by 1.

The digit in the second decimal place in 27.73 is 3, which is less than 5. So we ignore it and write the number as 27.7 rounded to the first decimal place.

If the number, however, were 54.86, the digit in the second decimal place would have been 6, which is more than 5. So we add 1 to the 8 in the first decimal place to get 9. Therefore, 54.86 rounded off to the first decimal place would be 54.9.

The rule therefore is that if we have to round off to any digit, we should look at the digit immediately to the right. There may be more digits to the right of that point but there is no need to look at these remaining digits.

For example, if 7.847356 is to be rounded off to the second decimal place, we need only look at the digit in the third decimal place. The digit in the third place in this case is 7, which is greater than 5. So we add 1 to the digit in the second place which is 4. The rounded number would thus be 7.85.

Here are some more examples of rounding off to the second decimal place:

0.282 will become 0.28

8.1072 will become 8.11

66.06498 will become 66.06

2.0049 will become 2.00

If we round off to the first decimal place then:

57.87 becomes 57.9

0.052 becomes 0.1

3.4531 becomes 3.5

6.036 becomes 6.0

If we round off to the units place then:

8.8 becomes 9

99.64 becomes 100

0.5 becomes 1

6.2 becomes 6

SOME EXERCISES FOR REVISION

a) Round off the numbers below to the tens place:

878
10909
3635 **(11)**

b) Round off the numbers below to the units place:

9.9
503.28
0.6 **(12)**

c) Round off the numbers below to the first decimal place:

1.25
88.325
110.826 **(13)**

d) Round off the numbers below to the second decimal place:

0.995
77.3224
3.259 **(14)**

NEW WORDS

approximation average rounding off variation

VISUAL DECEPTION

The ability to estimate the length and breadth of an object is extremely valuable. With practice we can make fairly good estimates. However, we can be misled sometimes.

Look carefully at the lines a and b, in Figure 1.

Which of these, in your estimation, is longer?

Figure - 1A

Figure - 1B

Measure their lengths using a scale.

Was your estimate correct?

Repeat this experiment with the lines of Figure 2.

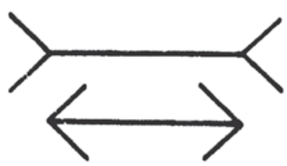


Figure - 2A

Figure - 2B

WHICH IS LONGER?

Look carefully at the two bamboos in Figure 3.

Which of these is longer in your estimate, the vertical one or the horizontal one?

Now measure their lengths

Was your estimate correct?

What have you seen?

Can you always rely on your estimates?

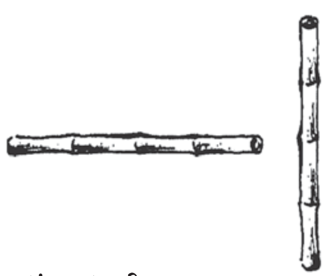


Figure 3

SEPARATION 14

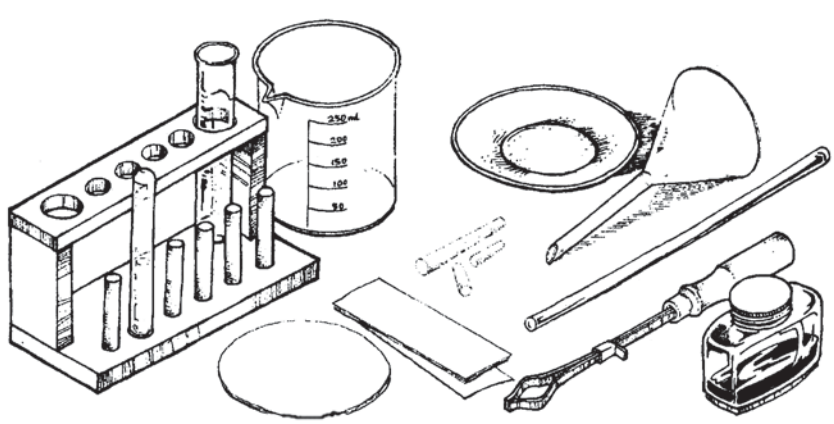
We mix rice, dal (pulse), salt, chilli powder and other ingredients to make khichri. That means khichri is a mixture of various things. We use many such mixtures every day. A cup of tea, cooked vegetables, mud bricks and mortar are all mixtures.

Sometimes we need to separate some things from a mixture. For example, we have to pick out and separate small stones from rice, wheat or pulses that we buy from the market. How do we identify a stone from a grain of food?

If the stones are visibly very different from the grain, they can be easily picked and separated. Sometimes there are stones mixed with rice that are shaped like rice and have the same colour as rice. In such cases it is more difficult to separate them from rice.

We separate many things from various mixtures every day. What are the different methods we use to separate things?

Each group (*toli*) must suggest at least one method for separating mixtures and also explain the basis used for separating things. For example, to separate stones from wheat



grain, we used differences in the shape, size and appearance between the two.

Copy the following table in your exercise book. When each *toli* suggests a method, the whole class should discuss and analyse the method to see if it is feasible.

If everyone agrees that the method will work, note it in your table. (1)

TABLE 1

No.	Method of separation	Example	Basis of separation
1.	Hand picking	Removing stones from wheat grain	Difference in shape, size and colour
2.			
3.			
4.			
5.			

In the table above list all the methods that were agreed upon in the classroom. Choose one of these methods and actually put it into practice.

SEPARATING SALT FROM SAND

If sand and salt are mixed with each other, can you separate them?

For this we will have to use the difference between the two substances with respect to a particular property. Let us try to understand this property.

If we put sand and salt into water, would both these substances dissolve? Which would dissolve in water and which would not dissolve? (2)

Those substances which dissolve in water are called soluble and those substances which do not are called insoluble. For example, salt is soluble and sand is insoluble in water.

Find out which of the following substances are soluble and which are insoluble in water:

Sugar, chalk, salt, soil, clay, turmeric powder.

Before you start sorting these substances, please note that a substance can be called soluble only if it forms a transparent solution on being dissolved in water. That is, we should be able to see through the solution. If the solution is not transparent and if the particles of the substance can be seen floating in the water then the substance cannot be considered soluble.

Can we separate salt and sand using the property of solubility? If yes, describe how it can be done. (3)

EXPERIMENT 1

You will require two test tubes, a test tube stand, a funnel, a glass rod, filter paper and water for this experiment.

Pour the mixture of salt and sand into a test tube. For this experiment. half a spoon of this mixture would be the proper quantity to take. Fill the test tube up to one-third with water. Shake the test tube vigorously and keep it on the test tube stand. Learn the correct way of shaking the test tube from your teacher.

Let the test tube stand for some time, observe it and then try to explain where the salt is and where the sand is.

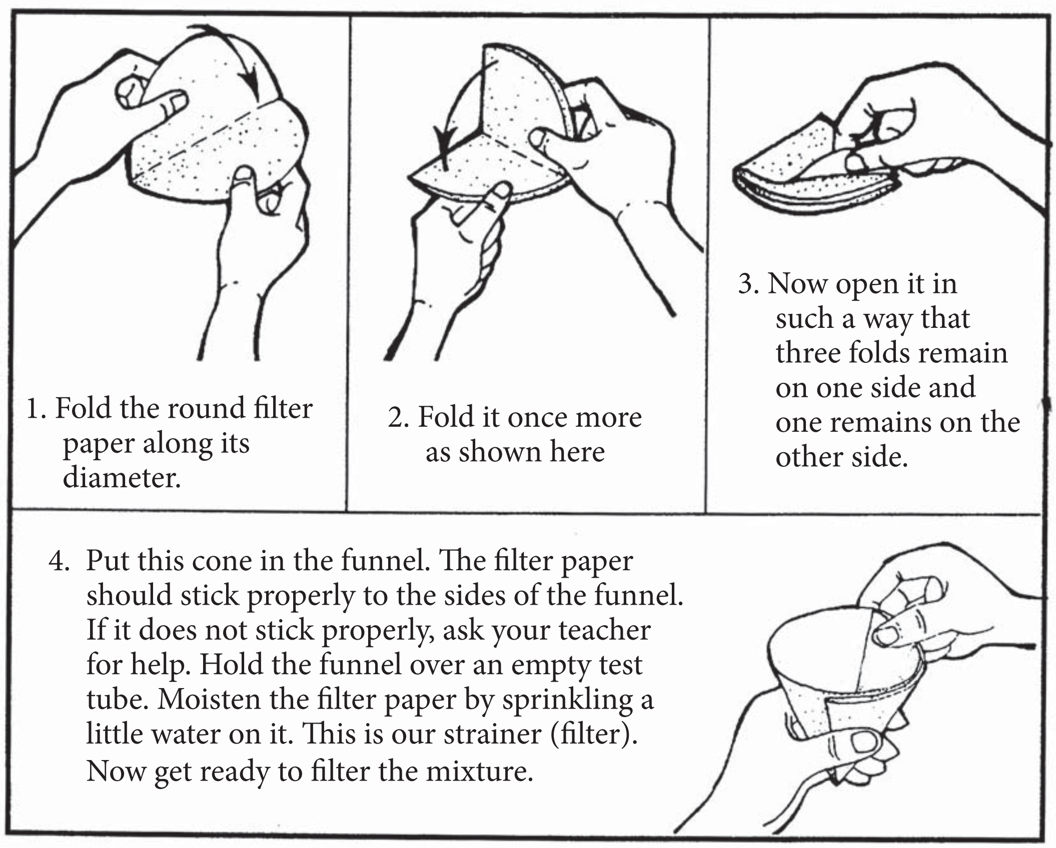
One method of separating the salt solution from the sand is decantation. Gently pour out the salt solution and the sand will be left at the bottom of the test tube.

Filtration, however, is better than decantation for separating such a mixture.

At home we use a strainer or a piece of cloth to filter substances. Here we will use filter paper to make a strainer. The method of making a strainer from filter paper is shown in the figure below.

Pour the mixture of salt and water and sand through the filter paper. Do not pour the mixture from a height because there is a chance that the filter paper may tear and the mixture would not be properly filtered. Therefore, pour the mixture gently onto the filter paper along the glass rod as shown in the figure below.

FILTER PAPER



Do not pour the entire solution at one go or the cone may overflow. There should be a little space left at the top of the filter paper. Now wait till the water seeps through the filter paper. When the entire mixture has been filtered see if there is any sand left in the first test tube. If there is some sand, wash the test tube with some water and pour this water also into the filter paper.

What do you see in the test tube below the filter paper after filtration?

Where is the sand left behind?

How would you recover the salt from the salt and water solution? Suggest a method. (4)

UNDERSTANDING SOLUBILITY A LITTLE BETTER

If we understand the property of solubility a little better, we can use the above method more effectively. For example, in the following experiment, we will try to observe the effect of heat on solubility.

EXPERIMENT 2

You will require a boiling tube, a test tube holder, a test tube stand and a candle for this experiment. Keep a plastic spoon with you as well.

Your teacher will give you the following four substances:

Common salt

Benzoic acid

Ammonium chloride

Calcium carbonate

Copy Table 2 in your exercise book .

Try this experiment in turn with each substance and record your observations in the table. (5)

TABLE 2

No.	Substance	Dissolves in cold water?	Dissolves in hot water?	What happens when hot water is cooled?
1.	Common salt			
2.	Benzoic acid			
3.	Ammonium chloride			
4.	Calcium carbonate			

Put about a quarter of a spoon of the first substance in the boiling tube and fill it one-third with water. Shake it well.

How will you take out these substances from the bottles in which they are stored? You could do so by using a piece of paper, but a better way is to use the spoon in the kit. Be sure to clean and dry the spoon every time before using it.

If the substance dissolves in cold water, write 'Yes' in the first blank column of the table and if it does not dissolve, write 'No'.

If the substance does not dissolve in cold water then heat the boiling tube over a candle or a spirit lamp. Use your test tube holder to hold the boiling tube over the flame but remember to keep it slightly tilted with its mouth pointing away from you. Shake the boiling tube gently as you heat it.

Does the substance dissolve in hot water? If it dissolves, write 'Yes' in the appropriate column of the table. If it does not, write 'No'.

If the substance dissolves in hot water, place the boiling tube on the test tube stand until it cools. Observe the solution in the boiling tube after it has cooled.

Can some substance be seen in the boiling tube after it has cooled?

Write down your observations in the table.

After these tests are completed with one substance, wash the boiling tube properly before repeating the tests with the next substance. Repeat the tests with all four substances one by one.

Don't forget to write down your observations in the table.

Suggest how we can separate the following three substances from a mixture on the basis of solubility in hot and cold water:

Salt, benzoic acid and sodium carbonate. (6)

If you are given a mixture of salt, ammonium chloride and calcium carbonate, can you separate these substances from the mixture? (7)

AN IMPORTANT RULE

Don't taste any of the materials you use in the experiment. Some of them might harm you.

We have observed in the above experiments that different substances have different solubility in water. We have also studied the effect of heat on solubility.

These properties of substances are not only used by scientists for various purposes but also by us in our daily lives. For example, if there is some impurity in water we filter it through a piece of cloth.

Give at least two more examples of the use of filtration from your daily life. (8)

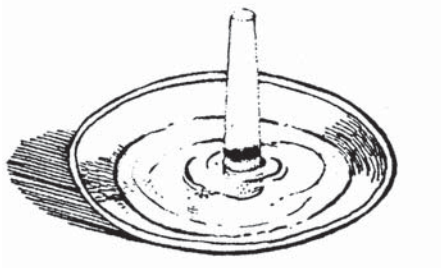
CHROMATOGRAPHY: A NOVEL METHOD OF SEPARATION

You may not have heard of this method of separating things. But chromatography is very interesting. However, instead of reading about it, why don't you just see it for yourself by doing it. You will enjoy the experiment.

CHROMATOGRAPHY WITH CHALK

EXPERIMENT 3

Take a whole stick of white chalk and make a ring of black ink about 1 cm from its broad end. To do this you could dip a matchstick or the tip of a ballpoint pen refill into ink and touch it to the chalk as shown in the picture. You should complete the ring slowly and carefully, touching the ink-wetted matchstick in a circle along the curved surface of the chalk.



Now pour some water in a plate or the lid of a tin and stand the chalk in the water. Ensure that the water in the plate is not more than 0.5 cm deep. The ink on the chalk should not be immersed in the water. Now watch and see the patterns that form on the piece of chalk.

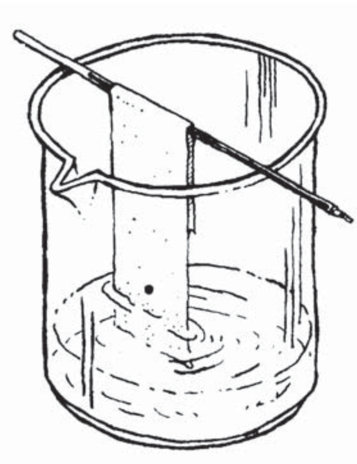
Does the water rise in the chalk?

Can you see anything else happening?

Remove the chalk before the water reaches its top.

Which colours do you see on the chalk from the bottom to the top? Draw a picture of the chalk in your exercise book and show the colours you see in it. (9)

From where did these colours appear? (10)



CHROMATOGRAPHY WITH FILTER PAPER

EXPERIMENT 4

We use filter paper for filtration. The same filter paper can also be used for chromatography. Let us see how.

Take a beaker and a refill of a ballpoint pen. Fill water up to a height of 1cm in the beaker. Cut a strip of filter paper about 12 cm long and 4 cm wide. Dip the head of a pin in black ink and put a small drop from it on the strip of filter paper roughly 2 cm from one end of the strip.

Now fold the other end of the filter paper strip, hook it over the refill and hang it in the beaker as shown in the figure alongside. The end of the strip that has the ink mark should dip into the water. Ensure, however, that the ink drop itself is above the level of the water. The filter paper strip should not touch the sides of the beaker either.

Wait for a little while. You will observe the water climbing up the filter paper strip. When the wetness nears the refill, remove the filter paper strip and dry it. How many colours do you see on the strip? Name these colours. What is their order from bottom to top?

Draw a picture of the filter paper in your exercise book and show the colours in the same order. (11)

ANOTHER INTERESTING EXPERIMENT

Wasn't this experiment interesting? The ink appears to be made of a single colour but it actually has many colours hidden in it. Now that you know the truth about black ink, would you not like to see the colours hidden in other coloured inks? Why wait? Just go ahead and try chromatography with different inks and find out which colours they contain.

If you want to separate these colours from each other, then break the different coloured portions of the chalk you used for chromatography. Grind each piece separately and put each coloured powder into a different test tube. Pour some water into each test tube and shake the test tube well. The different colours will appear in the different test tubes.

Do the black inks of different companies have the same colours or are they mixtures of different colours? Take black ink produced by different manufacturers and compare them with each other using chromatography.

Are the black inks of all makes made of the same colours? (12)

Chromatography is a very useful technique for separation. It is difficult to match this method for separating materials. In fact, it can be used even when the amount of mixture to be separated is very small. For example, you needed only a drop of ink for separating its colours.

SEPARATING MEDICINES FROM PLANTS

Chromatography can be used to separate medicinal chemicals from plant extracts. Many plants like tulsi, neem, *chiraita,* etc, have medicines in them. The plants are first boiled in water and filtered to obtain an extract. Then chromatography is used to separate the medicines from the extract.

There are many other uses for chromatography. For example, it can be used to detect contamination in different substances and to examine the colours of flowers.

Separation of substances is a very important scientific activity and is also important in our daily lives. You have learnt some methods of separating materials in this chapter. The properties of the substances in a mixture always suggest ways in which they can be separated.

QUESTIONS FOR REVISION

1. Can you separate the components of the following mixtures on the basis of their solubility:

   A. Milk and water

   B. Sugar and salt

   C. Sand and sugar

   D. Powdered chalk and sand

* Give the reason for your answers

2. Think, explain and do:

   Jetram observed that kerosene rises up the wick of a lantern. He also saw that oil rises up the wick of a lamp. He thought, 'Why not try chromatography with these two substances instead of water?' He took a fresh wick and put a spot of ink just above one of its ends. Then he dipped the wick into kerosene just as you had dipped the filter paper into water in your chromatography experiment.

   Do you think Jetram's experiment was successful? Try it and see for yourself.

3. Can you separate sawdust and sand using the difference in their solubility? If you cannot, then how would you separate them?

4. Pictures of some experiments being performed are given below. Spot the mistakes in them and write them down.

NEW WORDS

soluble insoluble solubility chromatography

GROUP WITHIN A GROUP - MAKING SUB-GROUPS 15

By now you must have practised making groups several times and gone on field trips as well.

Make a list of the chapters in this book. (I)

What would you call this group? (2)

From this list, write down the names of the chapters which involve going on field trips. (3)

Can these chapters form a separate group? (4)

In Class 8 you will study a chapter titled 'Protection of Crops'. You will have to go on a field trip while doing this chapter.

Can this chapter be a part of the group of Class 6 chapters with field trips? (5)

Bicycle, truck, bullock cart, bus, boat, airplane, car, cart, tempo, motorcycle and ship together form a group.

We can call this a group of modes of transport.

Divide this group into smaller groups on the basis of the following characteristics:

(a) **Two wheelers**

(b) **Three wheelers**

(c) **Four wheelers**

(d) **Having wooden wheels**

(e) **Having wheels with tyres**

(f) **Driven by fuel**

(g) **Driven by human or animal power (6)**

You have divided a group into smaller groups. These smaller groups within a group are called sub-groups.

A SUB-GROUP HAS TWO CHARACTERISTICS

It is necessary that the members of a sub-group should not only have the characteristics of that sub-group but also of the main group. For example, you made a sub-group called 'driven by human or animal power'. A plough, too, is driven by animal power.

Can the plough be included in this sub-group? Give reasons for your answer. (7)

Has anything been included in more than one sub-group? Make a list of such things. (8)

Write down the names of kharif crops. (9)

This is a group.

Now make three sub-groups from it. (10)

Sarla made sub-groups from the group of 'things made of plastic in the science kit'. One of the sub-groups was 'in which water can be filled'. In this sub-group she included beaker, plastic glass, measuring cylinder and boiling tube.

Kusum told Sarla, "You have made a mistake."

Sarla replied, "No, I have made correct groups."

Look at the four items in the kit and write down whether or not Sarla had made a mistake. Give reasons for your answer. (11)

DISCUSS AMONG YOURSELVES

When Prembai tried to make four equal sub-groups of students of Class 6 she found that the sub-group of students whose height was more than 4 ft 6 inches was one member short. She added the name of her sister to this sub-group to complete it. Her sister is 4 feet 8 inches tall and studies in Class 8.

Should we accept Prembai's sub-group as correct? Discuss this among yourselves and write the answer in your own words, giving reasons. (12)

EXERCISE YOUR MIND

Your class is a group. Think of a characteristic and make a sub-group of this group of which you would be the only member.

Write down the characteristics of this sub-group in your exercise book. (13)

MAKE CORRECT GROUPS AND WIN THE GAME

Here is an interesting game which you can play with your friends.

1. The game can be played between two teams or two persons.
2. Collect about 20-25 things and place them in the middle between the two teams.
3. One team should write down, on a piece of paper, the name of one of the articles placed in the centre. This name should be hidden from the other team.
4. The other team has to ask questions to find out the name written on the piece of paper. For this, they are only allowed to ask questions of the first team. The questions should be such that their answers can only be given as a 'Yes' or 'No'.

   For example: "What is the colour of the object?" is not a permitted question and should not be answered. "Is the thing black?" is a permitted question and can be answered 'Yes' or 'No'.

   Similarly, "How long is the object?" is not permitted. "Is the object more than 6 cm long?" would be all right.

   "Is the object long?" although permitted, is not a good question because the answer can be either 'Yes' or 'No', depending upon what the other team considers is long.
5. The team asking questions gets 1 point for each question asked.
6. After the second team guesses the name of the object, it will be their turn to write down a name and conceal it. The first team will now try to guess the name by asking questions and points will be added to their account for each question asked.
7. The game can be stopped after both teams have been given the chance to guess the same number of answers. The team which scores fewer points wins.
8. Decide among yourselves the penalty for a team that gives a false answer to an allowed question.
9. Choose a referee who will decide whether a question is permitted or not.

10. You can toss a coin to decide which team should get the first turn.

In this game the team which chooses the right characteristics to make correct groups and sub-groups has a better chance of winning because it will have to ask fewer questions.

NEW WORDS

sub-group

VARIATION IN THE LIVING WORLD 16

There is a saying in Hindi: "Boya ped babul ka to aam kahan se hoye" which means: "If you plant a babul tree, you cant expect to harvest mangoes." That's common sense. Mangoes don't grow on babul trees. Similarly, if you sow a grain of wheat, what you get is a wheat plant. Even from a distance, you can easily tell a pipal from a tamarind tree, and you would never mistake even the blackest cow for a buffalo. Or, no matter how fat an ant grows, it can never become an elephant. And if the elephant goes on a fast it can never become a mouse.

Every species of animal and plant has its own special characteristics. That means there are recognisable differences between different species of plants and animals. But suppose we compare two individuals of the same species. Will there be differences between them as well? That's what we shall try to find out in this chapter.

EVERY TREE IS SPECIAL

EXPERIMENT 1

Carefully observe two trees of the same species.

Are they similar? (1)

Do they have some differences as well? Make a list of these differences. (2)

Let us now observe some small plants. As an example let us take doob grass, or any other small plant that grows in large numbers. They all look alike, don't they? Let us try and find out if they are identical to each other. Select two plants from among those that look as like each other as possible.

Compare the two plants you have selected. Some points for comparison are listed in Table 1.

TABLE 1

No.	Characteristic	Plant 1	Plant 2
1.	Height		
2.	No of leaves		
3.	Length of top-most leaf		
4.	Length of lower-most leaf		
5.	Distance between 2nd and 3rd leaf from below		

Enter your observations in this table. (3)

Compare your findings with those of other groups in your class.

On the basis of your experiment and discussion with your friends, do you think it is possible to find two plants which do not have any differences among them? (4)

EACH LEAF A UNIQUE ONE

EXPERIMENT 2

A tree has hundreds of leaves. Is it possible to pluck two exactly similar leaves from among them? Let us try and find out.

Bring several similar looking leaves from any tree or bush. Try and find two leaves which are exactly similar.

Were you able to find two such leaves? If you did, show these leaves to everyone in the class. (5)

If you cannot find exactly similar leaves, then describe the differences you observed between them. (6)

VARIATION AMONG ANIMALS

Are such variations found only in plants and trees? Are such differences to be found among animals and insects as well?

Try and search for two puppies or calves that look exactly alike.

If you think you have found them, take another careful look at the pair and try and spot the differences between them.

List at least five differences you observe. (7)

Try to observe differences among birds like parrots, cocks, chickens or insects like cockroaches.

Do you think you would find differences if you examined two small insects like ants? Write down the reasons for your answer. (8)

We all have two ears, two eyes and a nose. We have hair on our heads and nails on our fingers.

Everyone breathes through the nose, sees with the help of the eyes and eats with his or her mouth. In spite of such similarities, can you find two individuals who are exactly alike?

TWIN BROTHERS, TWIN SISTERS

You may have seen or heard about twin brothers and sisters. Are there any such twins in your village or locality? Several films have been made about twins.

The plots of these films are based on the idea that it is impossible to distinguish between 'identical' twins. But is that really true?

Are there no differences between twin brothers or sisters?

If there are twins in your locality, find out how their parents tell them apart. If possible, meet the twins and find out for yourself whether there are any differences between them.

YOUR FINGERS ARE ALSO UNIQUE

EXPERIMENT 3

Compare your index finger with those of your friends. Compare their length, the thickness at the base and the length of the middle segment.

Each group should record the measurements of the index fingers of its members in Table 2. (9)

TABLE 2

No.	Name of student	Length of finger	Thickness of base	Length of middle segment
1.				
2.				
3.				
4.				

Compare these measurements with those of other groups.

Are the index fingers of any two students identical? (10)

In the chapter on measuring distances, each of you had measured the length of the same object with the span of your hand. The measurement of each student was different.

Can you now explain why measurements vary from person to person when the handspan is used as a measure? (11)

OUR UNIQUE THUMBS

EXPERIMENT 4

Many people cannot sign their names so they put their thumb impression on a document. Sometimes we are asked to put our thumb impression along with our signature. Do you know that the thumb impression of each person is different and unique? Let us find out the nature of the differences between thumb impressions of different persons.

Ask 10 of your friends to put their thumb impressions on a page in your exercise book. The impression should be clear and visible. You could use an ink pad, inkpot or pen to get the impressions.

Now study thew tomprestns with a magnifying glass.

Are any two thumb impressions identical?

Could you identify circular and shell-shaped patterns in the impressions?

Write down the differences you observed between any two thumb impressions. (12)

The impressions of the thumb and fingers of each person are unique. They differ so much from person to person that an individual can be identified solely on the basis of these impressions. Police use fingerprints to identify criminals. The police maintain records of the fingerprints of known criminals. If a person present at the site of a crime touches some object, that person's fingerprints are left on the object. Such impressions are compared with the fingerprints maintained in the police records. If they match, then the police can identify the person present at the scene of the crime.

It is an interesting fact that even the fingerprints of twin brothers and sisters are different.

VARIATIONS AND MORE VARIATIONS

We see so much variation around us. On the one hand, we see many different species of plants and animals. On the other, we also see many differences between two plants or animals of the same species. For example, no two human beings are alike in all respects.

But variation does not only mean that someone's finger is thicker or thinner than someone else's; or that one leaf of a plant is bigger or smaller than another. There are variations in many other properties as well. Take rice, for example. In our country there are around 20,000 to 25,000 varieties of rice. One may be a high-yielding variety while another may mature early. One may have a pleasant flavour, while another may be resistant to disease. Farmers select seeds according to the properties they require.

VARIATION SAVED MOSQUITOES

Mosquitoes are real pests. There are so many of them and they can be quite irritating. They keep buzzing around you, biting you and not letting you sleep in peace. But the story of these mosquitoes is quite interesting.

Before we begin our story you must know one other important fact about mosquitoes. Their bite can give you malaria. You are probably familiar with malaria. That is the disease in which you run a high temperature, feel cold and start shivering. The fever comes every alternate day. In many places malaria is called *ektara*.

Many people suffer from malaria. When a person contracts malaria (s)he has to take a medicine called quinine. If a patient is not treated in time, (s)he may even die. People thought that since malaria is transmitted by the bite of a mosquito, the disease could be wiped out if we killed all the mosquitoes.

So, around 40 years ago, sometime in the 1960s, a programme for eradicating mosquitoes was launched.

There are some chemicals that kill mosquitoes. DDT and BHC are examples of such chemicals. Have you heard these names before? DDT and BHC were dissolved in water and sprayed in all areas where mosquitoes were found.

The mosquitoes were killed in large numbers. Seeing this, some experts thought this was the perfect way to rid the world of mosquitoes.

So, more chemicals were sprayed and more mosquitoes were killed. But were all the mosquitoes in the world wiped out? No, they were not. It so happened that variations in the living world helped the mosquitoes.

You have seen in this chapter that no two living beings are exactly alike. Similarly, there are variations among mosquitoes as well. So, among the millions of mosquitoes, there were one or two that were not affected by these chemicals.

They did not die when the chemicals were sprayed. This characteristic which helped these mosquitoes resist the effect of chemicals was passed on to their offspring.

Slowly and steadily, the number of mosquitoes which could not be killed by DDT or BHC increased. So while earlier most mosquitoes died when DDT or BHC was sprayed, the situation today is quite different. Not many mosquitoes die when these chemicals are sprayed.

It is variations in the living world that saved the mosquitoes from becoming extinct. Otherwise we may have had a world free of mosquitoes today.

QUESTIONS FOR REVISION

1. What differences would you expect to find between two similar looking grass plants if you were to observe them closely?
2. What would be the possible consequences if the thumb of each individual was not unique and a number of persons had identical thumb impressions?
3. Answer the following questions on the basis of the story related at the end of the chapter:
   - i. Which chemicals were used in the attempt to wipe out mosquitoes?
   - ii. Did all the mosquitoes die when these chemicals were sprayed?
   - iii. Why were all the mosquitoes not killed even after

spraying so much DDT and BHC? Was there anything wrong with the DDT and BHC which were used?

iv. If a new chemical is discovered which could kill all those mosquitoes that survived the spraying of DDT and BHC, can one be certain that all the mosquitoes in the world would be wiped out if we use this new chemical? Give reasons for your answer.

NEW WORDS

variations	expert

SENSITIVITY 17

BEING IN TOUCH WITH OUR SURROUNDINGS

There is so much that happens around us all the time. When you sit in class, your friends nearby keep shifting and moving. You, too, cannot keep still. The teacher may be explaining something but, at the same time, students talk among themselves and make a lot of noise. Your friend may tickle you from behind, or aim a paper rocket at you. Sometimes you feel thirsty and sometimes itchy. A fly may settle on your nose. Birds sing outside the classroom.

Are you aware of all that is happening around you? Obviously, you are. You listen to the teacher, you swat the fly. When tickled, you control your laughter. Or, sometimes, you just cannot stop yourself from laughing.

You respond in one way or another because you are aware of all that is happening around you. This quality of being aware of your surroundings and responding to them is known as sensitivity.

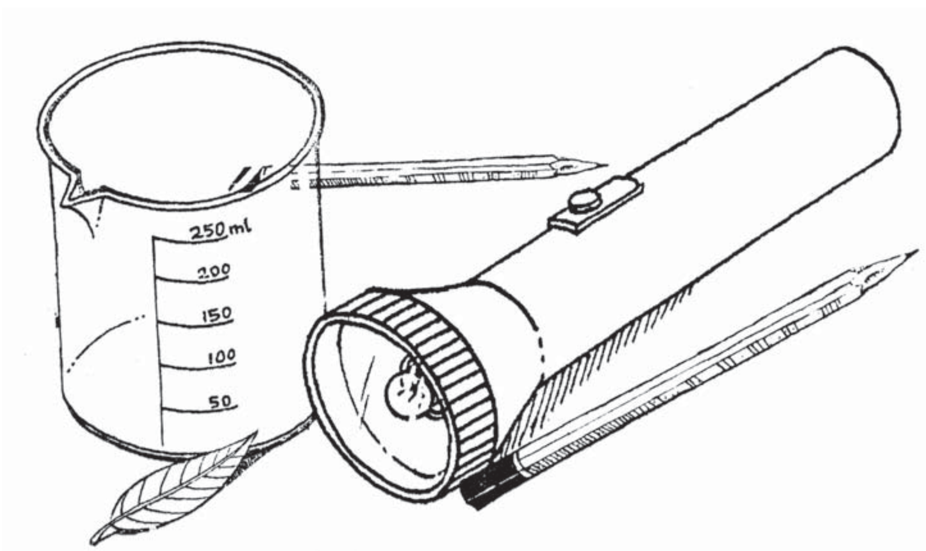


TABLE 1

No.	What is happening?	Are you aware of it?	Which organs inform you?
1.	A fly settles on your body		
2.	The wind is blowing		
3.	You are pricked by a thorn		
4.	Heat/cold		
5.	Dry/wet		
6.	Mosquito bite		
7.	Dark/light		
8.	How far is an object?		
9.	Colour		
10.	Friend's voice		
11.	Scent of flowers		
12.	Direction of sound		
13.	Round or cuboid object		
14.	Smooth/rough		
15.	Thirst		
16.	Hunger		
17.	Taste		
18.	Stepping on a pebble		
19.	Soft/hard		
20.			
21.			
22.			
23.			

When you step on a thorn you move your foot away immediately. Does a stone react in the same way? If a fly sits on a stone or a table, do they react in any way? Does a chair get tickled?

Does the stone, table or chair possess this quality called sensitivity?

In this chapter we will try to understand how we become aware of so many things around us. First of all, let us look at the kinds of things we become aware of and which organs help us to do so. Table 1 contains several examples of things that happen around us.

Copy the table in your exercise book and fill in the columns after discussing with your friends. (1)

If you are not sure about an entry, do not fill it in. If there is something not included in the table which you would like to add, please do so.

Look at Table 1 after you have completed it and make a list of the organs that keep you informed about your surroundings. (2)

We call these organs the sense organs. Let us study these sense organs in some detail.

Our skin tell us what is hot or cold.

What are the things we become aware of by touch? (3)

If hot water falls on our body, or if ice is placed on the palm of our hands, we are able to tell without looking whether the object is hot or cold.

When something is extremely hot, what happens to our body which doesn't happen when it is cold? (4)

Similarly, what happens to our body when the thing is very cold? (5)

In other words, our body is sensitive to heat and cold. Do animals also have this kind of sensitivity? Give some examples to support your answer.

We can tell the difference between hot and cold, but sometimes our senses can be deceived, too. For example, if we reach the shade of a tree after walking in the hot sun we feel cool. However, if we leave a cool room and shelter under the shade of the same tree we feel hot. Why is this so? After all, it is the same shade of the same tree.

CONFUSION BETWEEN HOT AND COLD

EXPERIMENT 1

Take three beakers or glasses. Fill one with hot water, one with lukewarm water and one with cold water. Dip a forefinger into the beaker with hot water and the other forefinger into the beaker with cold water.

After about half a minute, put both your forefingers in the beaker with lukewarm water.

Write down in your own words what you experience. (6)

Discuss in the class why this happens.

OUR SKIN AND THE SENSATION OF TOUCH

If an insect crawls on your back you at once know something is crawling on your back. In the same way, if something touches the sole of your foot, you move your foot away immediately. But is the skin on all parts of the body equally sensitive to touch? Do all parts of the palm of your hand or the soles of your feet feel the sense of touch equally? Let us perform an experiment to try and find out.

TOUCH

EXPERIMENT 2

One student in each *toli* should place her/his foot on a sheet of white paper. Another member of the *toli* should trace the outline of the foot with a pencil. Ensure that the pencil is always in contact with the foot while the outline is being drawn. The student whose foot has been outlined should now be blindfolded with a piece of cloth. S(he) should stretch her/ his leg so that the sole of the foot is clearly visible. Another member of the *toli* should take a leaf with a pointed tip and use it to touch different parts of the sole.

Touch each part of the foot and observe carefully. While performing the experiment. remember that equal pressure should be applied each time you touch the sole of the foot.

If the blindfolded student can feel the touch (s)he should indicate this by saying yes. The point where the pressure is felt should be ticked (√) on the drawing of the foot. If the student does not feel the pressure at a certain point, this point should be indicated on the drawing with a (x) mark.

After the experiment, look at the drawing of the sole of the foot in which the ticks and crosses have been marked and say whether pressure is felt equally every where on the sole? (7)

Where is pressure felt more acutely and where is pressure not felt at all? (8)

Can you explain why this is so? (9)

BLIND PEOPLE READ WITH THEIR FINGERS

Many of you may be aware that there are books printed for blind people. They do not read the books with their eyes but with their fingers. The letters (alphabets) in these books are made by using raised dots on the surface of the paper. Each letter is formed by a different pattern of raised dots. This form of writing is called Braille. The blind person moves her/his fingers across the paper and reads the book by recognising the letters formed by the raised pattern of dots. You may think it isn't easy to recognise letters quickly in this way, but you will be surprised by the speed with which blind persons identify letters and read such texts. The sensitivity of their fingers is greatly increased in the absence of vision.

What else do we learn by touching?

In the game *ankh-micholi* you had tried to identify leaves with your eyes closed. Do you remember the attributes of leaves that you were able to recognise by touch?

It is through touch that we are able to tell the difference between dry and wet, smooth and rough, soft and hard, etc.

Sometimes a person may lose sensitivity in a part of her/ his skin. This means (s)he is not able to feel heat, cold, touch, the prick of a thorn or anything else on that portion of skin. If this happens, a doctor should be consulted immediately. It is possible that (s)he may have contracted a serious disease.

TASTE

We have paid a lot of attention to the miracle of touch. However, touch is not everything. For example, even if we cover our body with sugar syrup, we cannot taste its sweetness. It is impossible to experience taste without the help of our tongue.

TASTE CAN DECEIVE

Can you be deceived by your sense of taste, too? Is it possible to tell what you are eating merely by tasting it with your tongue? If you close your nose while eating, by pinching your nostrils with your fingers, you will probably not be able to identify what you are eating. "What does taste have to do with the nose?" you may well ask.

Let us try and find the answer to that question through an experiment.

EAT WITH YOUR NOSE CLOSED

EXPERIMENT 3

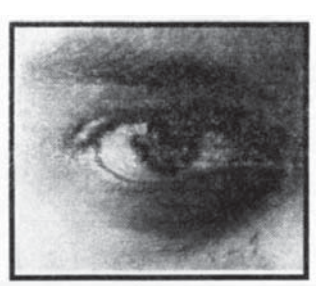
Blindfold yourself. Your teacher will now give you something to eat. You must close your nostrils tightly with your fingers before eating what is given to you. Keep your nose closed, and try to enjoy the taste of what you are eating.

Can you identify what you are eating? If yes, write down its name. (10)

Remove your fingers from your nose. Can you now say what you are eating? (11)

Could there be some relationship between taste and smell? (12)

When you have a cold and your nose is blocked, why does everything you eat seem to taste different? (13)



A LOOK AT OUR EYES

We see with our eyes, but have you ever examined your eyes carefully? Let us do some experiments with our eyes. These experiments will help us learn some new things about our eyes. First, look carefully at the eyes of all the children in your group.

Are you able to see the iris of your friends' eyes? (14)

We will now performs an experiment to find out the effect of light on the iris. We will need a torch for this.

LIGHT ON THE EYES

EXPERIMENT 4

Look at the irises of the eyes of one of the members of your *toli* and observe carefully how big they are. Now shine the torch on the iris of one eye.

Did the size of the iris change when light fell on it? If yes, what was the change? (15)

Is the iris sensitive to light? (16)

We know that we see with our eyes, but is there a difference between seeing with one eye and seeing with both eyes? In order to understand this difference, let us perform the following experiment.

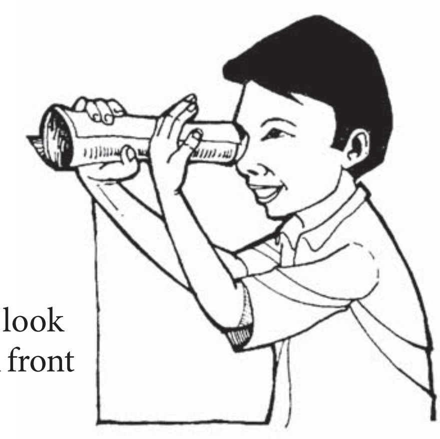
EXPERIMENT 5

Ask a friend to hold a pencil approximately 30-45 cm away from you. You should also hold another pencil close to your eyes. Now close one of your eyes and try to make the tip of the pencil in your hand come in contact with the tip of the pencil (s)he is holding in front of you.

Are you able to align the points of both pencils? (17)

Now repeat this experiment with both eyes open.

Is it easier to align the points now? (18)



A HOLE IN YOUR PALM

EXPERIMENT 6

Roll a paper into a tube. Keeping both your eyes open, look through this paper tube with one eye. Keep your palm in front of the other eye and rest it against the paper tube.

Do you see a hole in your palm? (19)

LISTEN! LISTEN!

You generally shut your ears with your hands if there is a lot of noise around you. But if there is a pleasant sound, your head turns in the direction of the sound. Similarly, the moment anyone calls out to you, you know where the sound came from. But is your estimate always correct? Let us do an interesting experiment to find out. The whole class should perform the experiment together. You can have a lot of fun, but the condition is that every one should keep absolutely quiet.

EXPERIMENT 7

Let a student sit blindfolded in the centre of the classroom. Let four students stand at a little distance around her/him on all four sides - one exactly behind, one exactly in front, one to the left and one to the right. Each of them should clap in turn. Then they should each clap again, but not in the same order, and the blindfolded student should indicate with her/his hand the direction from which (s)he thinks the sound came.

Let your teacher indicate which of the four students should clap.

After each of the four students has clapped three to four times, answer the following questions.

Did the blindfolded student indicate correctly the direction from which the sound came? (20)

If (s)he was not able to indicate correctly each time, which were the directions where (s)he made errors? (21)

In this chapter we did some experiments related to sensitivity of our body.

Think carefully and name the organs of the body that help us to receive information about our surroundings. What do you think could happen if you do not receive this information? (22)

We will see in another chapter whether the property of sensitivity is found only in human beings. We will perform some experiments to test the sensitivity of plants as well.

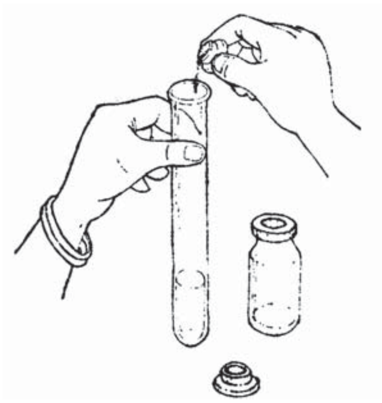
NEW WORDS

sensory organs braille

SOLUBILITY 18

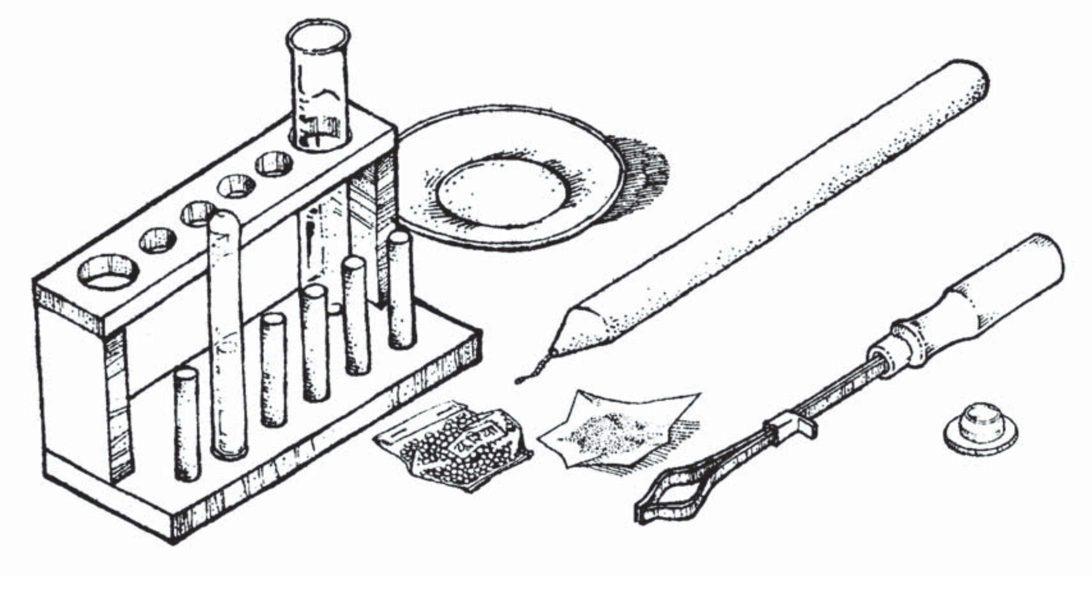
In the chapter on 'Separation' we had seen that some substances are soluble in water while others are insoluble. There are also some substances that are insoluble in cold water, but dissolve in hot water.

In this chapter we shall perform some more experiments on solubility.



For these experiments, we will require measured quantities of water as well as salt and urea.

You may have seen the rubber stopper of an injection bottle. If you place this stopper upside down you will notice that it has a pit. If this pit is filled with salt or urea and levelled with a finger, the quantity of the substance it contains is about half a gram. Measured twice in this manner, you will get 1 gm of salt or urea. In the following experiments, wherever you are



asked to take 1 gm of a substance, you should use this method for measuring the substance.

SOLUBILITY IN COLD WATER

EXPERIMENT 1

Fill a boiling tube one-fourth with water. Dissolve 1 gm of salt in it.

Did the salt dissolve? If yes, then add 1 more gram of salt to the boiling tube.

Did this dissolve too? Keep repeating this process till the salt stops dissolving.

Label this boiling tube as 'Salt solution' and keep it aside.

After adding how many grams did the salt stop dissolving in water? Write the quantity in Table 1. (1)

Take another boiling tube, fill it one-fourth with water and repeat the same experiment, now using urea.

After how many grams did the urea stop dissolving? Write the quantity in Table 1. (2)

Label this boiling tube as 'Urea solution' and keep it aside.

TABLE 1

Name of sustance	Maximum amount dissolved in cold water
Salt	
Urea	

Are the observations of any group different from the observations of your group? Discuss and share your observations with one another in the class.

Choose the right options and complete the following sentences:

In a specific amount of water the solubility of a substance is......

(a) specific

(b) not specific (3)

In equal amounts of water salt and urea dissolve.....

(a) equally

(b) unequally (4)

The solubility of different substances in water is.....

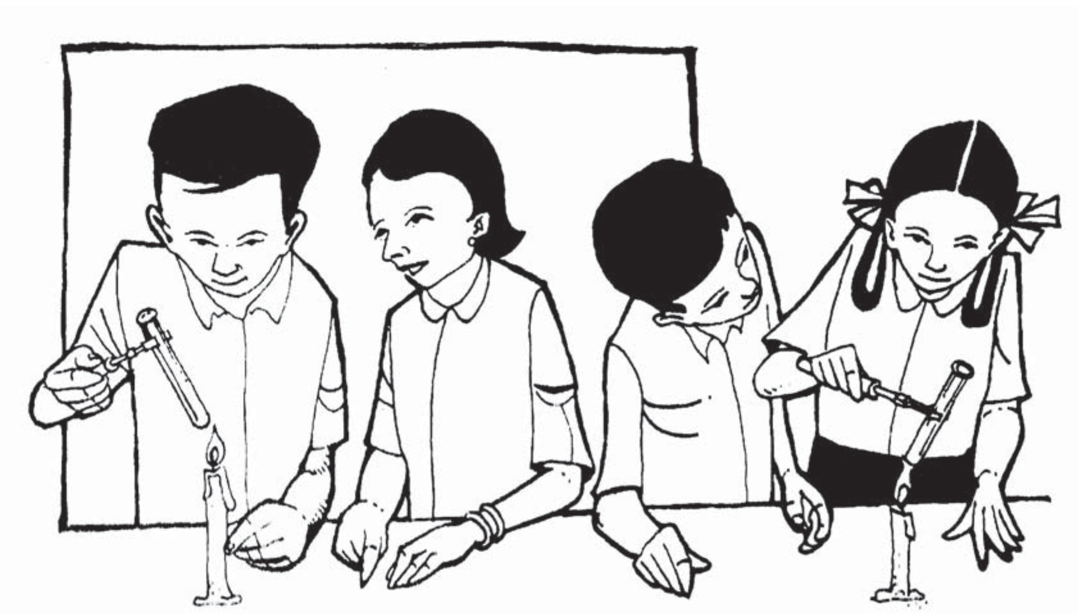
(a) the same

(b) different (5)

EFFECT OF HEAT ON SOLUBILITY

EXPERIMENT 2

In this experiment we will try to find out what effect heat has on the solubility of different substances. We will particularly



investigate whether the effect of heat on the solubility of salt and urea is the same or different.

In Experiment 1, you had kept aside a boiling tube labelled 'Salt solution'. Take this boiling tube and heat it until the solution in it starts boiling.

Did the undissolved salt present in the boiling tube dissolve upon heating?

If yes, add another 5 gm of salt and boil the solution again. Did this salt dissolve as well? If this 5 gm of salt dissolves, then add another 5 gm of salt to the solution and boil it again.

Did this salt dissolve? Write down your observations in Table 2. (6)

Keep the solution aside to cool.

TABLE 2

Effect of heating			
Substance	**Did the undissolved substance present in the cold solution dissolve**	**Did the first 5 gm dissolve?**	**Did the second 5 gm dissolve?**
Salt			
Urea			

Repeat the same experiment with urea.

Record your observations in Table 2. (7)

Keep this solution aside for cooling as well.

On the basis of your observations, state whether the solubility of both salt and urea increases upon heating. (8)

Is the effect of heat upon the solubility of salt and urea the same or different? (9)

If the effect is not the same, the solubility of which substance is affected more by heating? (10)

Can we conclude from this experiment that heat affects the solubility of different substances to different extents? (11)

Observe both the solutions after they have cooled.

Do you see any difference in the two solutions? Describe in your own words. (12)

Can you give any reason for this difference? (13)

You have seen that if more than a certain quantity of a substance is added to water, it remains undissolved. What will you do if you wish this remaining substance to dissolve?

Until now we have experimented with the solubility of various substance in water. There are substances which are insoluble in water but dissolve in some other liquid. For example, if cloth becomes stained with grease, we clean it with kerosene. This is possible because grease is soluble in kerosene.

LIQUID IN LIQUID

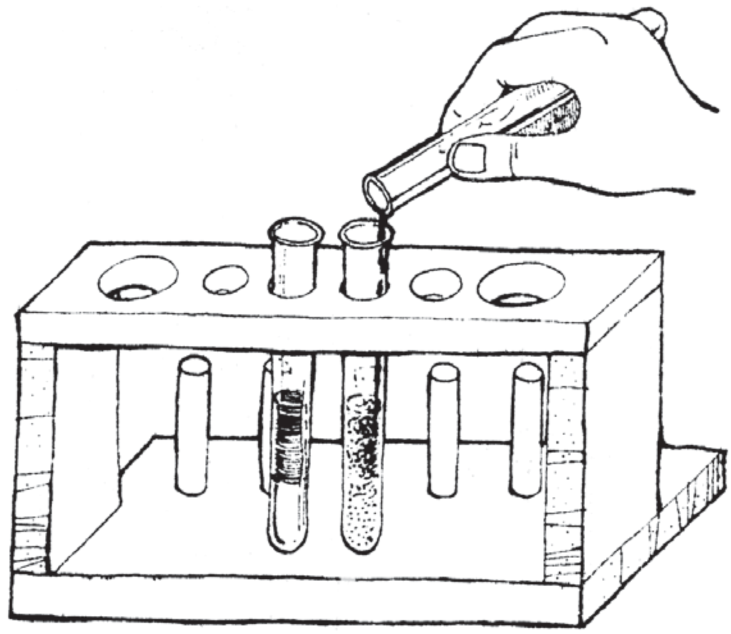
EXPERIMENT 3

Until now we have only talked about the solubility of solid substances like urea and salt. Two liquids, too, can be soluble in each other or they can be insoluble in each other.

Have you ever tried mixing kerosene and water?

Are water and kerosene soluble in each other? (14)

Let us do a simple experiment to find out.



Fill two test-tubes about one-third with kerosene. Pour about one-third test-tube of coconut oil into one of them. What happened?

Pour about one-third test-tube of water into the other test-tube. What happened?

What is the difference between the solubility of coconut oil and water in kerosene? (15)

NEW WORDS

soluble insoluble undissolved

KIT COPY

This kit copy contains :

Material	**Quantity**	**What will you do with it**	**Which chapter**
Microscope strip	1	To make a matchbox microscope	Fun-N-Games
Leaf Chart	1	To find out leaf arrangement	Getting to know leaves
Abacus strip	1	To make an abacus	Games with an abacus
Decimal strip	1	To put a decimal on abacus	Games with an abacus
Graph paper strip	1	To make your own scale	Measuring distances

* Whenever you need the above material just cut it out of the kit copy.

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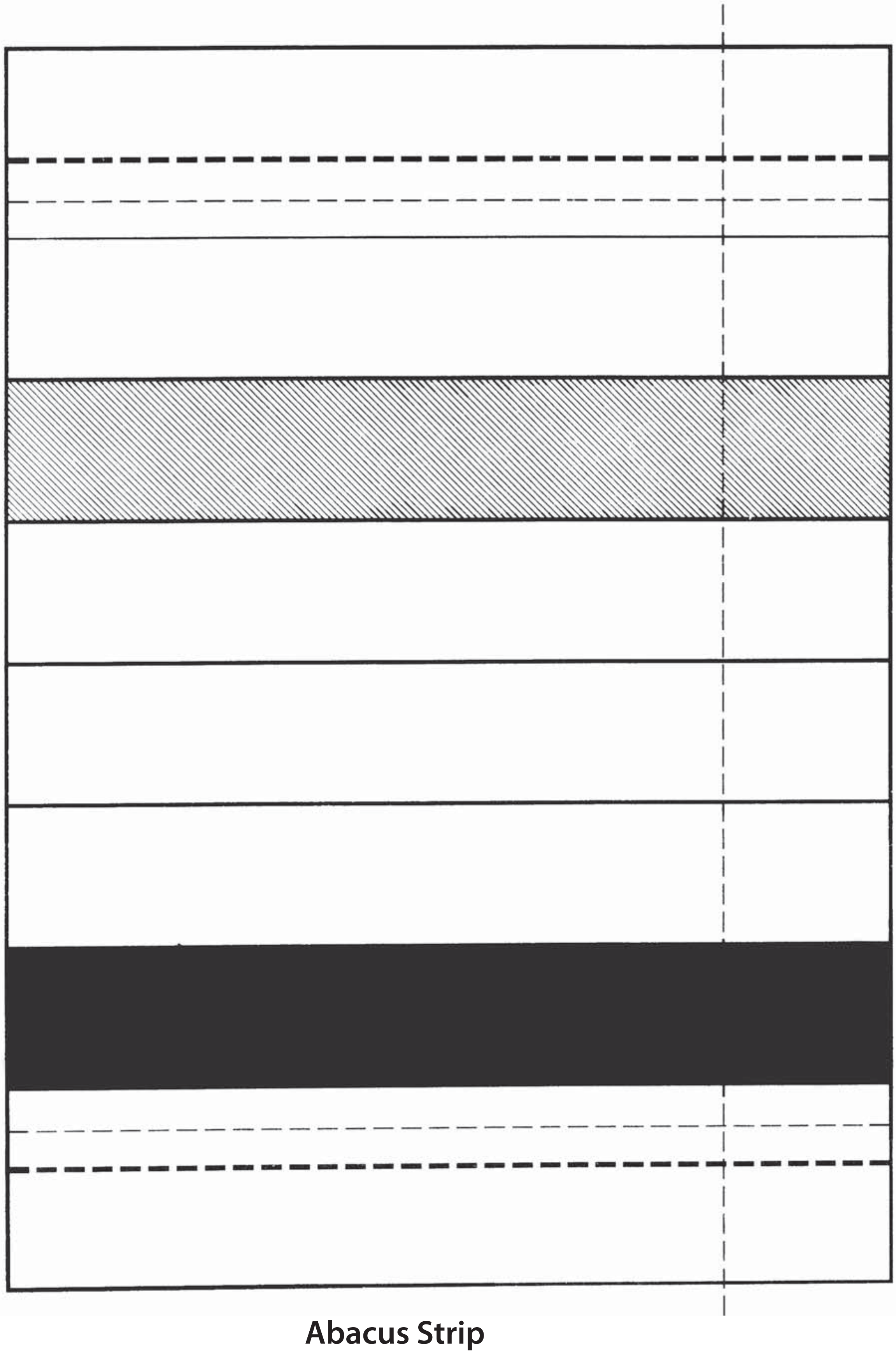
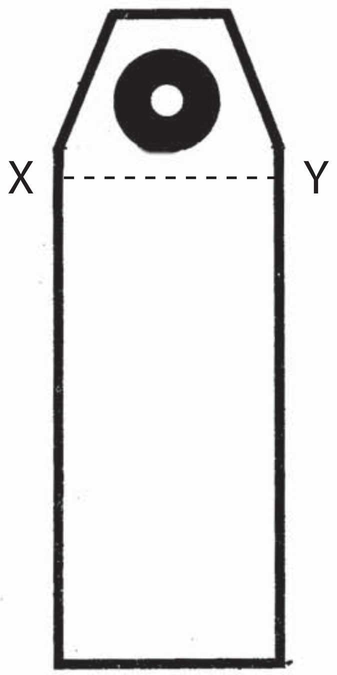
Leaf Chart

Leaf arrangement	Name of plants
	
	
	



Abacus Strip

Fill in different colours in every section of this strip



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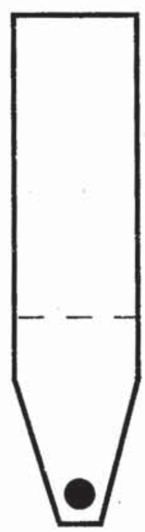
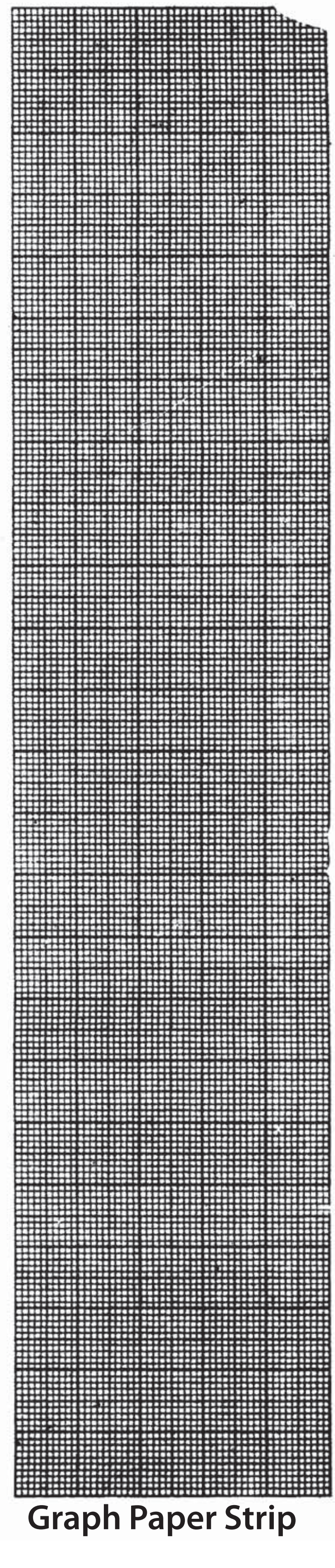


Decimal Strip



Graph Paper Strip

Eklavya is a non-governmental registered society working in the fields of education and peoples' science since its inception in 1982. Its main aim is to develop educational practices and materials that are related to a child's environment, and are based on play, activities and creative learning.

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This book is an insider's view of the well-known Hoshangabad Science teaching Programme (HSTP) which began in 1972 and continued for nearly three decades. This highly readable book tries to give a clear picture of the educational components of this unique and innovative programme, such as: the development of education materials and the way they were structured; teachers' participation and the methods used to orient them; and evaluation of what children had learned.

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