

SMALL SCIENCE

A series in
primary science

TextBook
Class 4

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Based on the theme 'Watch, listen, do and think!', the cover depicts a young girl,
Mini, watching the full moon rise over a rice field.

The neologisms 'TextBook' and 'WorkBook' are indicative of the
innovative and distinct approach of *Small Science*.

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GENERAL PREFACE

The Homi Bhabha Centre for Science Education (HBCSE) has been active in research and field work since 1974. Interdisciplinary scholarship at the Centre has been developed around a doctoral program in Science Education. As one outcome of this research and development, about ten years ago, textbooks, workbooks and teacher's books in primary science were brought out by HBCSE.

The books received warm and appreciative response from all quarters - teachers, students, parents, professionals and also Government agencies. At the time of first publication some of the ideas in these books appeared radical and unconventional. Today these ideas have become part of the discourse of education in our country. We are therefore very happy that the Oxford University Press has taken on itself the job of publishing and distributing these books on a much wider scale.

The National Curriculum Framework 2005 has prepared five guiding principles for curriculum development: connecting knowledge to life outside the school; ensuring that learning shifts away from rote methods; enriching the curriculum so that it goes beyond textbooks; making examinations more flexible and integrating them with classroom life; and nurturing an overriding identity informed by caring concerns within the democratic polity of the country. Often however there remains a gap between the generally agreed objectives of the curriculum and their actual translation into textbooks and teaching practices.

The books brought out by HBCSE reflect an attempt to close this gap as much as possible. It is for the users of these books to decide if this attempt has been successful.

Arvind Kumar

PREFACE TO SMALL SCIENCE CLASS 4

The Small Science books have emerged out of a process of research, field-work and classroom trials. Their activity-based approach is based on the idea that first-hand concrete experiences at an early age gradually strengthen the child's capacity to construct abstract formulations. Curriculum units are therefore developed around simple, cognitively and contextually appropriate, activities and exercises which help children explore and understand the world around them.

Small Science discourages memorisation of text, focusing instead on acquisition of tools of learning: namely, observation, design drawing and construction, along with basic scholastic skills of speaking, reading, writing and calculating.

The books interweave a story about two curious children, Mini and Apu, who learn many things by observing, doing, inquiring and reflecting on their experiences. Questions stimulate students to observe and think beyond the book, while stories and poems enliven their reading. The WorkBook lays out a format for recording results of the activities and exercises. The same format enables continuous assessment of the student's work.

The Teacher's Book provides conceptual guidance and practical hints. Much effort has gone into providing the teacher with background information relevant to the Indian socio-cultural, geographical and natural-historical context. Results of classroom trials too are conveyed through first-person accounts in the Teacher's Book.

These books are supplemented by a Teacher's Book in Environmental Studies for Classes 1 and 2 which is available from the Homi Bhabha Centre for Science Education (HBCSE), Tata Institute of Fundamental Research, Mumbai.

Do write and tell us if you liked the books; and please send us your ideas for improving them.

Jayashree Ramadas

Teacher support: smallscisupport@hbcse.tifr.res.in

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I would like to thank:

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The principals, staff and students of the Children's Aid Society, Nutan Vidya Mandir and the Atomic Energy Central Schools, Mumbai, and Vivek High School, Chandigarh, who enthusiastically participated in the trials

Karen Haydock who did the design and illustrations, contributed many good ideas and gave interesting feedback from the classroom

Children of Village Titaram, Kaithal Dist., Haryana, the Atomic Energy Central Schools, Mumbai, and Vivek High School, Chandigarh, who contributed some wonderful pictures

Members of HBCSE who clarified my doubts: Anand Ghaisas, Ashwini Kanhere, R. S. Korgaonkar, Rekha Vartak, Sandhya Thulasidas, Savita Ladage, V. G. Gambhir and V. N. Purohit; and those who also gave valuable suggestions on the draft versions: Bakhtavar Mahajan, Chitra Natarajan, G. Nagarjuna, Jyotsna Vijapurkar, K. Subramaniam, Poornima Burte and Sugra Chunawala

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The School of Mathematics, TIFR, who allowed use of their computer facilities

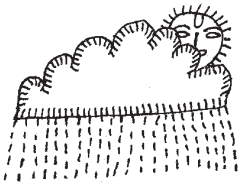
My daughter Rohini, son Harishchandra and many good friends, who were so supportive during some difficult times.

Jayashree Ramadas

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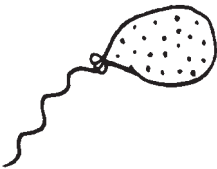


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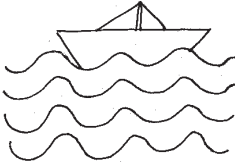


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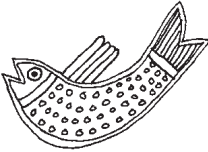


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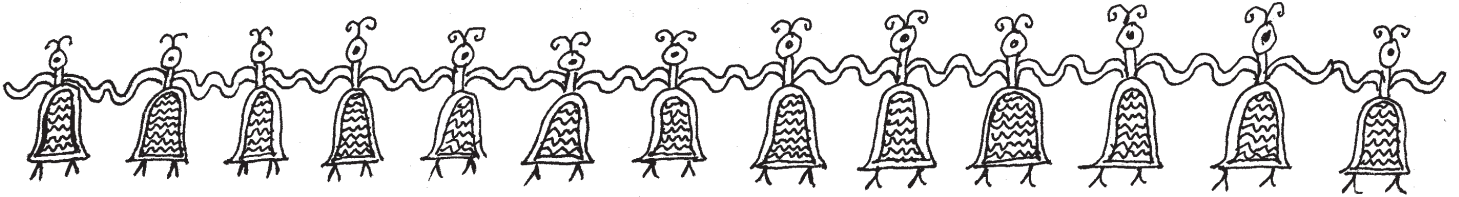
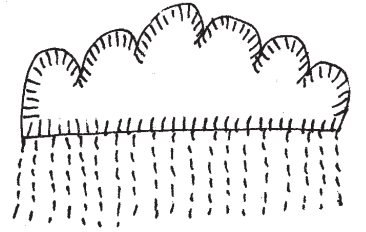
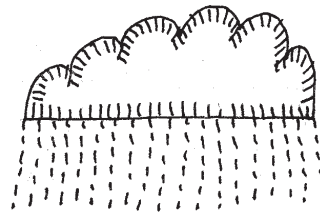
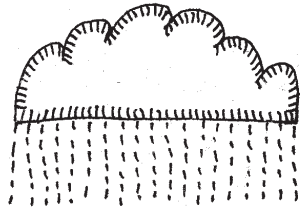
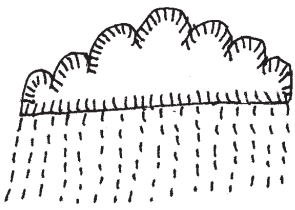
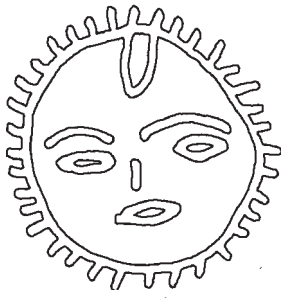


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UNIT 1

SKY AND WEATHER

Chapter 1

Sun, wind, clouds and rain

Chapter 2

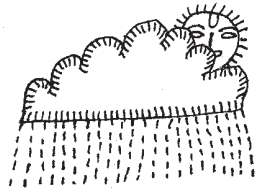
Day sky, night sky

*It's hot today! ... I'm wet with sweat! ...
Hoohoo it's cold!... Listen to the rain fall! ...
Whoosh comes the wind! ...*

*Do you notice the weather every day?
Does it change from morning to night,
and from day to day?
Can you guess what the weather will be like
in your vacations?
Or in the beginning of your next school year?*

*And the sky: so much happens there,
in the day and at night!
Clouds, sun, moon and stars come and go.
How will the sky look this afternoon?
When will the sun set?
What shape of moon will you see tonight?*

*The sky tells some wonderful stories.
Watch, listen, do and think, and you will find them out!*



CHAPTER 1 SUN, WIND, CLOUDS AND RAIN

The rains are coming!

It was a hot day in June. Mini and Apu were sitting in the shade eating cucumbers. “How dry and dusty everything looks!” said Mini.

“Yes,” replied Apu. “Did you see the pond? The water is all gone and the floor is cracked up with the heat.”



“Amma says that any day now, the monsoon winds will reach us. The winds will bring thick dark clouds. They will cover the sky, and then it will rain!”

“Ooh, that will be fun!” Apu replied, “We can get wet in the first rain. There might even be thunder and lightning ...”

*Heat all around
Even leaves have stopped speaking
Then: a storm wind blows!*

*The sky darkens, cools
Suddenly on a dry leaf
The raindrops patter*

Watching the weather

1. The weather

a. Look out of the window. Answer these four questions in your Workbook on page 3:

- (i) Is the sky cloudy or clear?
- (ii) Is the weather warm or cold?
- (iii) Is it windy or calm?
- (iv) Is it rainy or dry?

When you answer these questions, you describe the weather for today. Was yesterday's weather similar or different?

b. Complete this story. Wherever you find a ... Δ ... add descriptions related to the weather. You might describe the colours in the sky, the shape of the clouds, whether and how the clouds were moving, the heat, cold and the effects of the weather on plants, animals and other things.

It was a beautiful Sunday morning ... Δ ... Mini and Apu went outside. They saw ... Δ ... They decided to fly a kite ... Δ ... Suddenly ... Δ ... (What happened next?)

After telling the story, write a title for it on page 3 in your Workbook.

2. Weather calendar

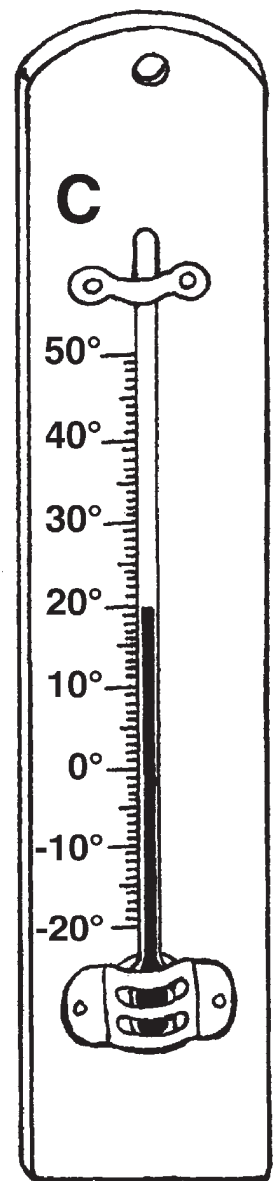
a. A design of a calendar is given on pages 3-7 in your Workbook. Fill in the year and the month. Write the dates in the boxes.

b. Observe the weather every day and fill it in the calendar. At the top of the date box note any other important happenings of that day.

3. Warm or cold

a. A thermometer measures temperature. It tells you how hot or cold something is. Find a thermometer that can measure the temperature of air around you. Does the temperature change through the day?

We measure length in metres, weight in kilograms and time in seconds. How do we measure temperature?



a thermometer

Apu measured the temperature at different times of the day. This is what he found. Colour the thermometers on page 9 in your WorkBook to show these temperatures in degrees Celsius ($^{\circ}\text{C}$).

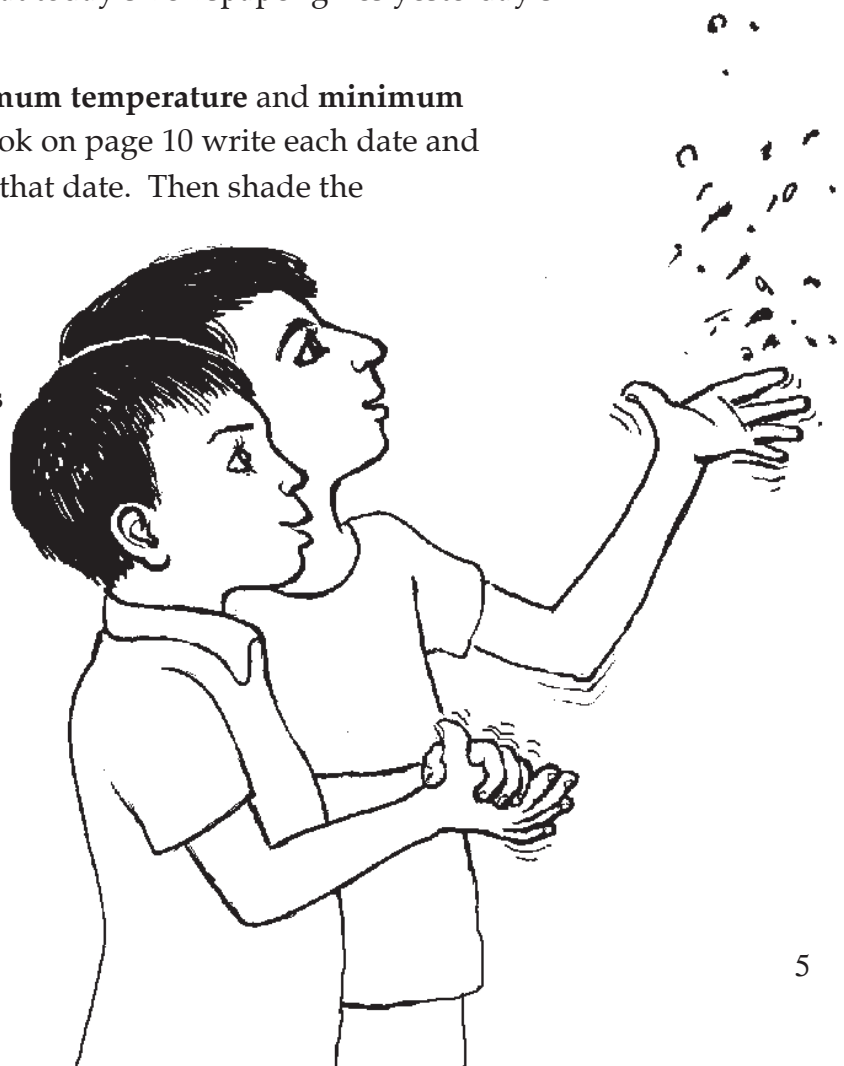
<u>Time</u>	<u>Temperature ($^{\circ}\text{C}$)</u>
6:00 am	8 $^{\circ}$
9:00 am	12 $^{\circ}$
12:00 pm	20 $^{\circ}$
3:00 pm	24 $^{\circ}$
6:00 pm	21 $^{\circ}$
9:00 pm	18 $^{\circ}$
12:00 am	15 $^{\circ}$
3:00 am	11 $^{\circ}$

b. Find out the temperature for one week from the radio or TV weather report or a newspaper. Remember that today's newspaper gives yesterday's temperature.

Find out the meaning of **maximum temperature** and **minimum temperature**. In your WorkBook on page 10 write each date and the maximum temperature on that date. Then shade the temperatures in the graph.

4. Which way the wind blows

a. Crush a dry leaf and throw up the pieces. See if the wind blows them to one side. Can you tell which way the wind is blowing?



b. Make a wind vane to tell which way the wind is blowing.

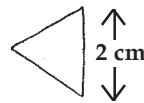
You will need:

- a twig with a soft centre **or** a pencil with an eraser at one end
- a drinking straw
- a pin
- a piece of card paper

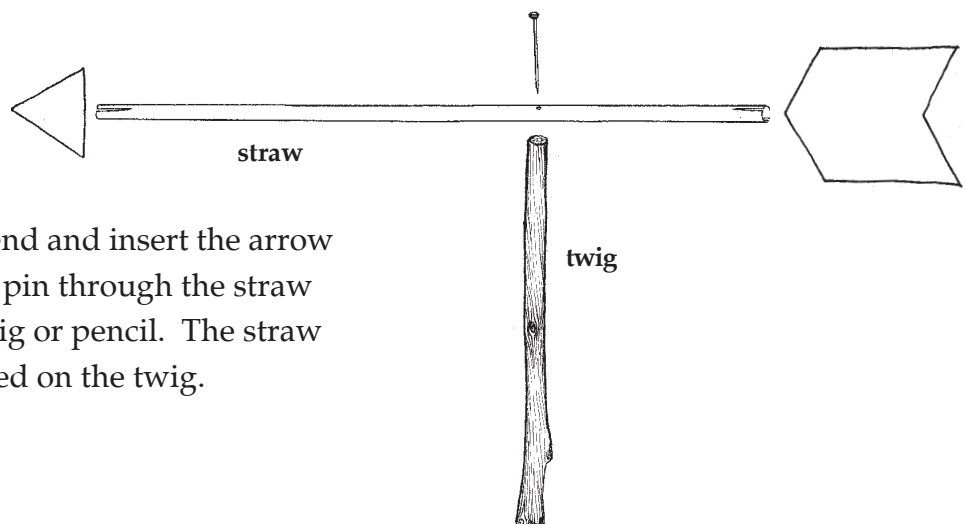
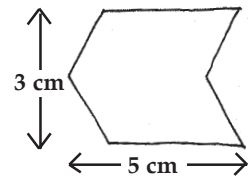
Cut these arrow shapes from the card paper.

Notice that the tail of the arrow is longer and wider than the head.

head of arrow

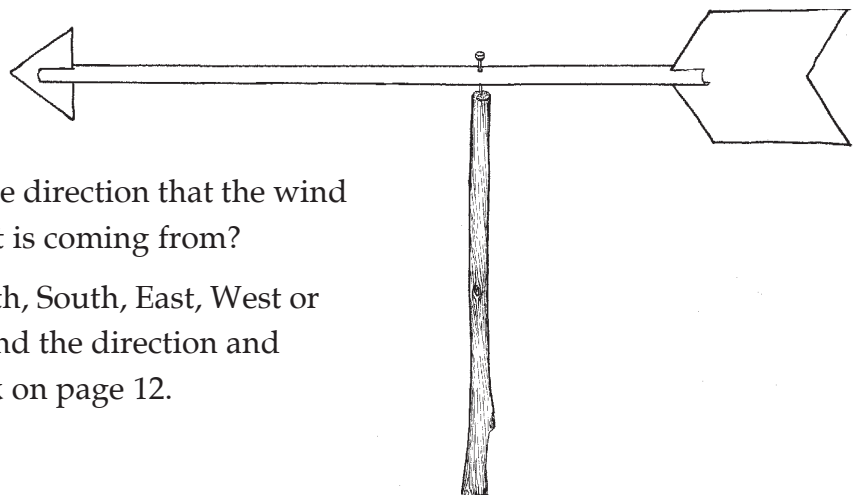


tail of arrow



Slit the straw at each end and insert the arrow shapes in it. Push the pin through the straw into one end of the twig or pencil. The straw should remain balanced on the twig.

This is your **wind vane**. Take it outdoors and hold it in the breeze.



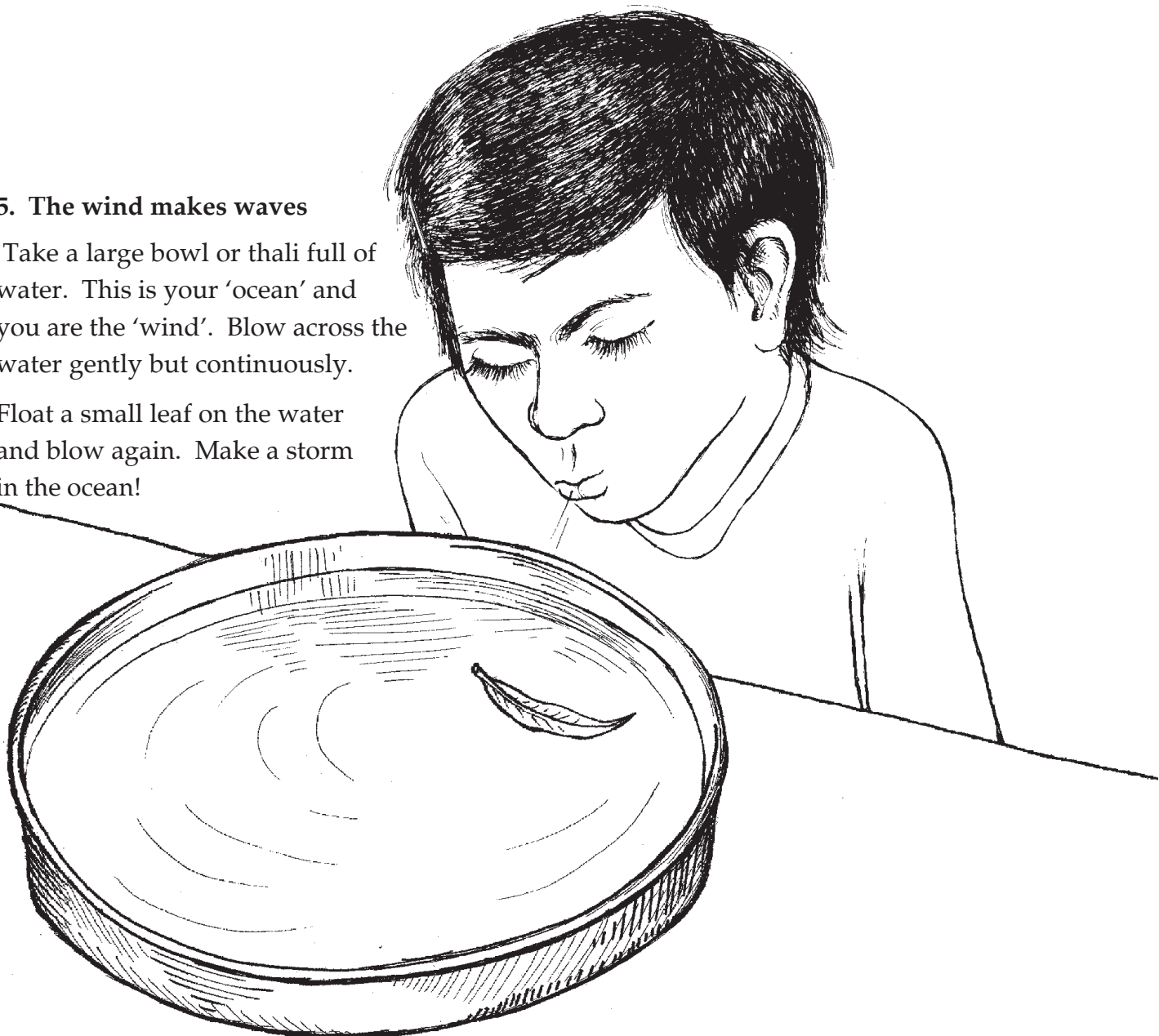
Is the arrow pointing in the direction that the wind is going, or the direction it is coming from?

Is the arrow pointing North, South, East, West or in any other direction? Find the direction and write it in your WorkBook on page 12.

5. The wind makes waves

Take a large bowl or thali full of water. This is your 'ocean' and you are the 'wind'. Blow across the water gently but continuously.

Float a small leaf on the water and blow again. Make a storm in the ocean!



6. Sky and clouds

Do these activities on four different days (see Workbook page 13):

a. Watch the sky for clouds. Write down some words to describe the clouds. You can describe: the colour of the clouds, how big they look, their shapes and how much of the sky they cover. Draw the shapes of the clouds as you are looking at them. Do the shapes change?

b. Watch the colour of the sky. Is it always blue? Is the entire sky of one single colour? Does the colour of the sky change from day to day? Describe how the colour changes through the day - in the morning, afternoon, evening and night.

Think! Think!

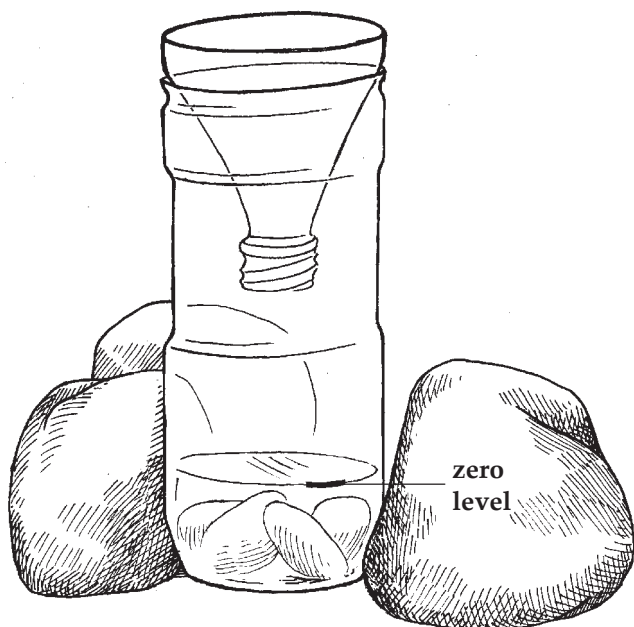
What do you think clouds are made of?

What makes clouds move in the sky?

7. Measure the rain

a. Find a large plastic bottle. Cut off the top and invert it into the lower part. This is your **rain gauge**.

If you cannot find a bottle, use any tins or jars with upright sides. Put some stones in these containers. Add enough water to cover the stones. Mark the 'zero' level of water.



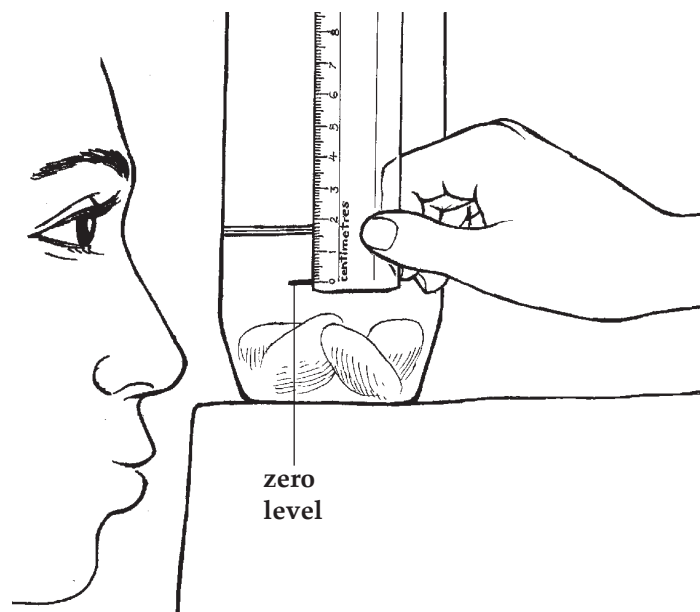
Keep the containers in different places out in the rain - for example, on a terrace, or in an open ground. Support the containers with stones or bricks. Make sure that rain can fall into them freely. Note the date and time on page 14 in your Workbook.

Each day, measure how much the water level has risen in your container. Note this measurement in the Table and Graph in your Workbook on pages 14-15. Empty the container back to the zero level.

Did the water level remain unchanged on any day?

Did the water level decrease on any day? Guess why.

Was the change in water level about the same in every group's container?



8. Humid or dry?

On some days you perspire a lot. Your wet clothes stay wet for a long time. These are humid days.

On other days your skin feels very dry. Wet clothes dry soon. These are dry days.

Try to guess which days are very humid and which days are very dry. See if your friends agree.

Clouds and rain

Clouds are made up of tiny drops of water. They move with the wind.

When clouds cool, the water drops in them come together to form bigger drops. These drops are very heavy, so they fall down. We call it rain.

Sometimes pieces of ice fall with the rain. This is called hail.

In very cold places in winter, white flakes of snow fall down instead of rain.

Weather is important for farming

To plant crops we need rain. Seeds need water to sprout. Crops need water to grow.

But if it rains at harvest time, crops can be damaged. Rain can damage grain and fruit. Groundnuts rot in wet ground. Cotton bolls get wet and dirty.

Know these words

weather	thunder	breeze	hail	flood
monsoon	lightning	gale	snow	drought
		storm	mist	
			fog	



EXERCISES

Name and draw

1. Rain
2. Colours of the rainbow

Interesting questions

Answer questions 1-4 after completing the chart on pages 18-19 of your Workbook.

1. In which months of the year do you have winter?
2. In which months of the year do you have summer?
3. In which months of the year do you have a rainy season?
4. In which months do you have school sports, outings or picnics? Why?
5. Name some fruits and vegetables that we get in winter and in summer.
6. On what kind of day (hot, cool, cold, wet, etc.) would you wear clothes made out of: cotton, nylon, wool or plastic?
7. Which of these things happen when the temperature is low?
 - Butter is soft
 - You feel cold
 - You sweat a lot
 - Coconut oil becomes solid
 - You wear thin clothes
8. Write down some things that happen on a very hot day.
9. Write down some things that happen on a rainy day.
10. Which of these things would you **not** do on a rainy day?
 - Swim in a river
 - Graze the cattle
 - Write a letter
 - Play outdoors
 - Do some cooking
 - Wash a lot of clothes



11. Which of these things happen best on a windy day?

Boats sail

Rivers flow to the sea

Windmills work

Clothes dry faster

Birds fly

12. Name some ways in which wind is useful to us.

13. Name some things that happen in a storm.

14. In what kind of weather is it dangerous for fishermen to go fishing in the sea?

Classroom discussion

1. Which time of the year do you think has the best weather? Why do you think so?
2. How do different animals behave on a very hot or a very cold day? Are they quiet or active? Do they look for shelter?
3. What is a flood? Have you or your parents seen a flood? Have you heard of floods in other places? When and where did these floods take place? What were the reasons for the floods? What happened then?
4. What is a drought? Have you or your parents experienced a drought? Have you heard of droughts in other places? When and where did these droughts take place? What were the reasons for the drought? What happened then?

What's the same? What's different?

1. A chart describing summer is given in your WorkBook on page 26. Complete it. Make a similar chart for winter.

Talk and write

1. Remember some poems or songs about any of the seasons. Make up some new ones of your own.
2. Describe a thunderstorm to your friend. Your friend will ask you some question about the thunderstorm. Answer these questions.

Play with words

1. Find different words which mean **wind**. Arrange the following words from **weak wind** to **strong wind**:

gale cyclone breeze storm

2. Find words for these:

Light, fine rainfall

Pieces of ice that fall with rain

Fluffy frozen water from the sky

The rainy season

The sound with lightning

3. Match each day with what happens on that day

Rainy day

No dark shadows

Hot day

You cannot see very far

Cloudy day

Clothes take long to dry

Foggy day

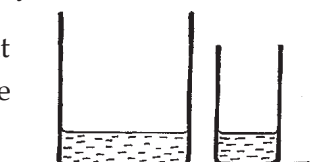
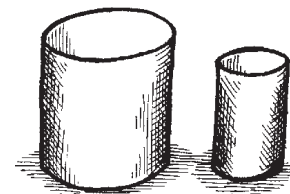
Ghee flows easily

Ask and find out

1. In which different months of the year do farmers sow seeds? Why?
2. Find out what the weather is usually like on any five festival days celebrated in your area.
3. Have you ever heard of **lou (लू)** and **aandhi (आंधी)**? What kinds of weather conditions are these? Do you have names in your own language for unusual weather conditions?

Figure it out

1. Suppose you have two containers, one wide and the other narrow. Both have upright sides. You keep them together out in the rain. Would the height of the water collected in both containers be the same, or different? Why?
2. Now suppose both containers have water up to a height of one centimetre. Would the **amount** of water in them be the same or different?
3. Suppose you keep two identical containers: one on the terrace and one in the open ground. Would they collect the same or different amounts of water?



(side view)

4. Mini and her friend Varsha put their rain gauge out on Aug 11. They measured the change in water level every day for ten days and recorded it in this graph.

Rainfall

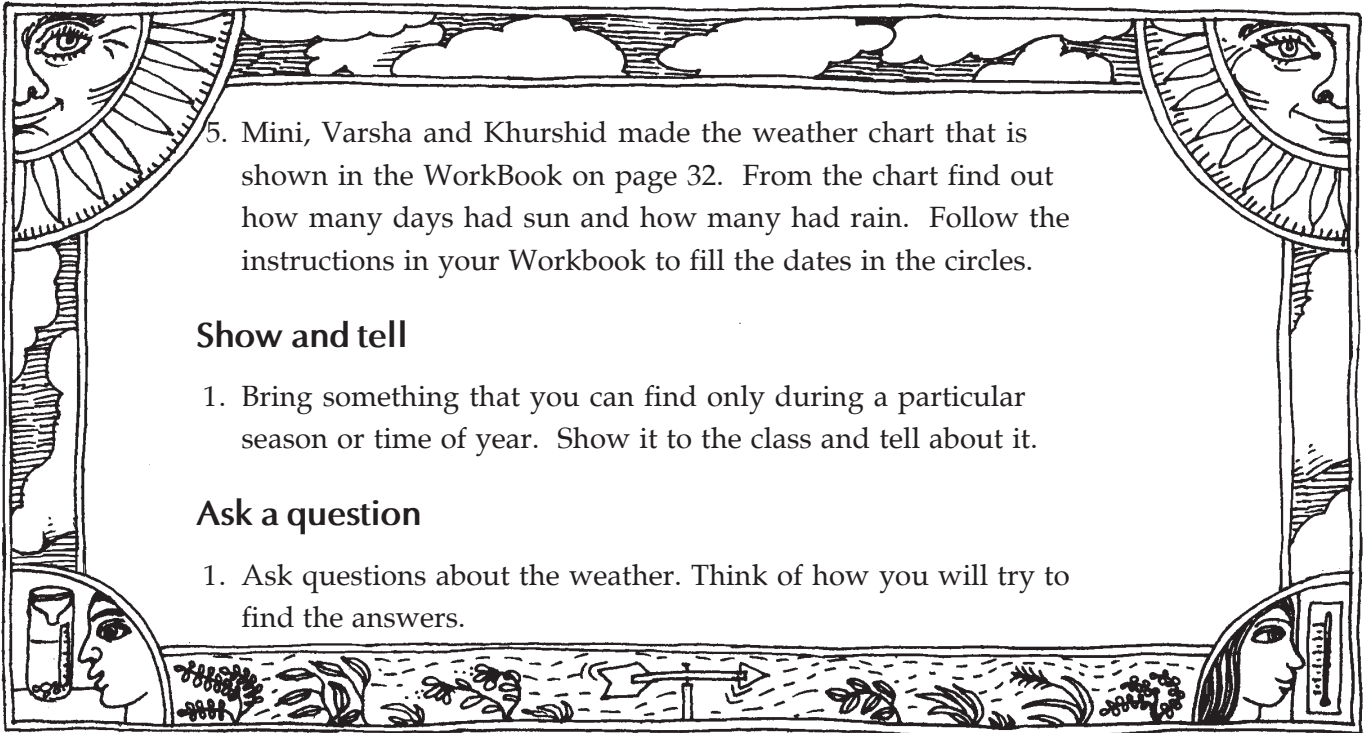
Change in water level (mm)

Aug 12
Aug 13
Aug 14
Aug 15
Aug 16
Aug 17
Aug 18
Aug 19
Aug 20
Aug 21

Date

Use the graph to answer these questions:

- How much change in water level did they find on Aug 12?
- How much rain did they record on Aug 13?
- How much rain did they record on Aug 14?
- On which days did they record 24 mm of rain?
- On which days did they record the most rain?
- On which days did they record the least rain, or none at all?
- What do you think happened on Aug 20?
- How much did it rain between Aug 11 and Aug 21?
- On which days did they record 6 mm of rain?



5. Mini, Varsha and Khurshid made the weather chart that is shown in the Workbook on page 32. From the chart find out how many days had sun and how many had rain. Follow the instructions in your Workbook to fill the dates in the circles.

Show and tell

1. Bring something that you can find only during a particular season or time of year. Show it to the class and tell about it.

Ask a question

1. Ask questions about the weather. Think of how you will try to find the answers.

DID YOU KNOW?

In October and November every year cyclones form over the Bay of Bengal. A cyclone is a huge rotating storm. It could be hundreds of kilometres wide. Cyclonic winds blow very fast - up to 300 kilometres per hour (three times as fast as an express train). They make huge waves and blow sea water far into the land, causing floods, uprooting trees, destroying houses and killing tens of thousands of people.

