WATER

A Teacher's Book
for
Year 6

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Contents

Introduction

This book has been written for teachers of Year 6 to use as a guide during science lessons. Its purpose is to help children to develop a basic scientific understanding of water through a number of practical activities using simple, everyday materials.

After a description of each activity, in which all the children should take part, a few questions are given. These are intended to help the children to draw conclusions about what they have just done. They are usually asked to record what has happened, usually by drawing, and to give an explanation for it. After the questions there are suggestions as to the kind of answers children of this age may be expected to produce.

At this stage of their development, children learn best from practical experimentation and observation, and should not be expected to learn scientific facts without understanding them. The teacher's role in this process is to enable the children to come to that understanding by helping them to carry out the activities and by discussing with them what they see happening.

Chapter 1

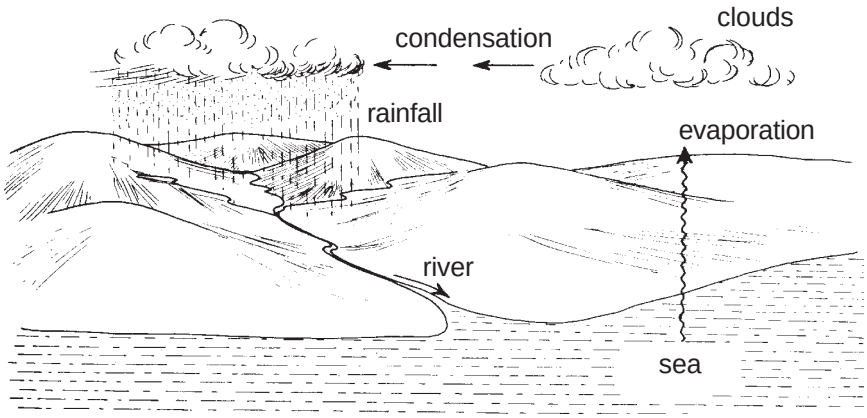
What is Water?

Water is everywhere. Water can be a **liquid**, a **solid** or a **gas**. When water is a solid, we call it **ice**. When water is a gas, we call it **water vapour**.

What colour is water? If water is pure, then water vapour, liquid water and solid ice are all almost clear and transparent. If they are not, then they are impure and contain other materials.

Has water got a taste? Pure water is tasteless, but water containing other materials will have some taste.

The water cycle



Water goes round in a cycle and this is called the **water cycle**.

1. Evaporation – the sea water is heated by the sun and changes into water vapour.
2. The water vapour rises into the atmosphere and cools down.
3. Condensation – the water vapour cools and changes back into small droplets of water held together in the form of clouds.
4. The wind blows the clouds over the land.
5. The clouds rise high into the cold air in the sky and so it rains.
6. The rain falls onto the land and into the rivers and streams.
7. The rivers flow into the sea.

   The cycle starts again.

Materials carried in water

Minerals

As the rainwater and water from the rivers and streams flow over and through the rocks, tiny parts of the rocks are washed off and dissolved in the water. When things dissolve in water we are not able to see them. These dissolved materials are called minerals and are washed down to the sea.

Air

Air also dissolves in water. Fishes and other living things that live in water are able to take in air from the water.

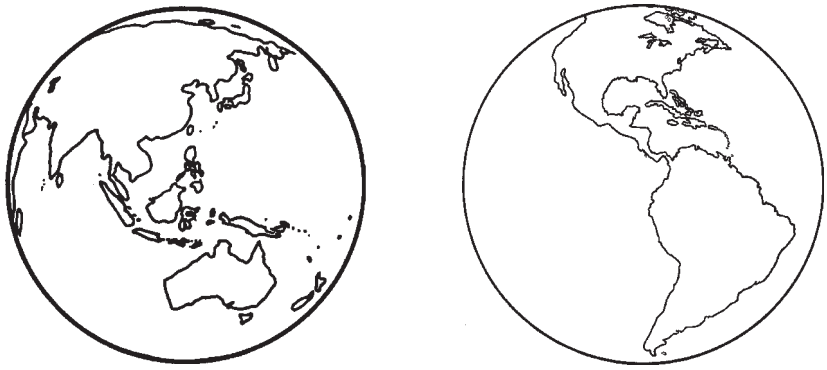
Other Particles

There are other materials in water which will not dissolve. These make the water cloudy and dark in colour.

Chapter 2

How Much Water Is There?

Most of the world is covered by water. About 70% of the surface of the world is covered by oceans and seas. The water in the oceans and seas is salty because of the minerals and salts washed down to the sea by the rain, rivers and streams.



There is also a lot of water on the land. There is water in ponds, lakes, streams and rivers, and in the soil. This water comes from the rain and is not salty. There is a lot of water in our bodies. 70% of our body is made up of water. There is also a lot of water in all the other animals and plants. Without water everything would die.

Studying a river or stream

(You can only carry out this activity if there is a river or stream close by.)

Materials

A one metre stick, an empty matchbox, a watch or timer, a plastic bottle, a sheet of clean white paper

Organisation

Work in groups and make two visits to the river.

Method

Brief the students beforehand on safety and what they are supposed to do. Take them out to a nearby river. Each group should pick a good spot, about 3 metres in length, along the river, where they can carry out these activities.

First Visit

A. How quickly does the river flow?

1. Where the river flows fastest, mark out 2 points one metre apart.
2. Drop the empty matchbox at the point where the river flows from. Start timing at the same time as you drop the matchbox.
3. Stop timing when the matchbox reaches the next mark.
4. Repeat steps 1 to 3 but this time do it where the river flows slowest. Then work out the mean or average speed.

B. How wide and deep is the river/stream flowing?

1. Using the one metre stick, find out how wide the river is where it is fastest. Record your answer in metres (m) or centimetres (cm). Repeat the measuring process where it is slowest.
2. Using the one metre stick again, find out how deep the river is by picking a spot at the centre of the river and measuring the depth. Record your answer in metres or centimetres. Repeat this for a spot at the side of the river.
3. Work out the means for both the width and the depth of the river.

(*Note:* As answers are based on a particular river or stream, and not all rivers and streams are the same, there are no set answers to most of the questions that follow.)

Q1. Does the river flow at the same speed everywhere in the area you have picked to study?
Q2. Does it flow fastest where it is shallow or deep?
Q3. Does it flow fastest where it is narrow or wide?

Second Visit

Questions

Q1. Draw the area of the river which the whole class is studying (not to scale). In your drawing, show the direction in which the river is flowing, and where it goes straight and where it bends. Label the river bank.
Q2. In which direction is the river flowing, upwards or downwards?

(*Expected answer:* Rivers always flow from a higher place to a lower place, so they flow downwards.)

Q3. Is the river flowing in a straight line or in a bending pattern?
Q4. What does the river do to the land it is flowing through?

(*Expected answer:* It washes away the soil from the land where it is flowing fast and deposits the soil where it slows down towards the river mouth. However, during heavy rains when the river floods, the deposited soil is washed on into the sea.)

Q5. What can you see floating in the river?
Q6. Can you see any living things in the river? What are they? Make up two lists, one of animals and one of plants.
Q7. What colour is the water? Can you see your reflection in the water?
Q8. Would you say this river water is pure enough to drink? Does it smell?
*Q9. What does the word **pure** mean to you? What is the opposite of pure?*

(*Expected answer:* **Pure** means that no solid materials are dissolved or floating in the water. The opposite of pure is **impure**, for example, sea water is impure, or river water is impure.)

Q10. Is there a village near the river? If yes, how do the villagers use the river?
Q11. Has this river washed away trees, rocks, sand, roads and houses before? If so, when did this happen? Why did it happen?

Collect some river water in the bottle to take back to the classroom. Then do the following activities.

Classroom activity A

Materials

A kettle or other container of water, fire to heat the kettle, a cool object such as a bottle, a piece of paper.

Organisation

Class experiment.

Method

1. Pour the water onto the paper and then allow it to dry. What to you see? Is the paper clean or dirty? Is the water pure? If not, what can be done to the water to make it pure?

2. To make water pure, boil it in a kettle or other container. Then place a cool object such as a water bottle above the steam and collect the water droplets in a clean container. Then follow the steps in Method 1 to see if the water is pure.

Classroom activity B

Provide each group with a large sheet of drawing paper.

Each group of students makes larger, better and clearer drawings about the river and what they saw in it. These should be displayed and if possible prizes should be awarded for the three best posters.

Chapter 3

Finding out more about Water

How can we show that there are three forms of water?

If you or someone close by has a refrigerator, arrange to get some ice blocks prepared ready for the lesson.

Materials
A kettle, a fire, some water, a glass bottle filled with cold water with lid on, an empty drinking glass, some ice blocks.

Organisation
Class experiment.

Method

1. If you have some ice blocks with you, let the children observe them before they melt. Allow them to feel the ice. Then put some water in the drinking glass and place an ice block in the water.

Q1. What does the ice block feel like?
Q2. What happens to the ice block when it is placed in water?

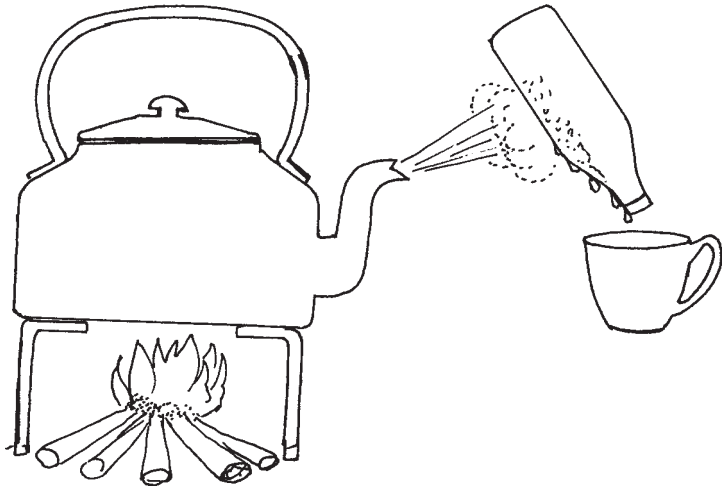
(*Expected answers:* The ice feels cold. It floats on top of the water.)

2. Make a fire or light a stove and place the kettle of water on the fire. Observe what happens when the water boils.

Q3. What do you see coming out of the kettle spout?

(*Expected answer:* Steam)

3. Hold the bottle of cold water above the steam. Make sure the steam does not go on your hand. Tilt the bottle so that whatever forms on the outside of the bottle can drip into the drinking glass. Someone else should hold the glass to collect whatever drips down.



Q4. What do you see forming on the outside of the bottle of cold water?

(*Expected answer:* Water droplets)

Q5. Use the words listed below to fill in the blanks to complete the following sentences.

vapour*, *water*, *cools*, *cold*, *ice*, *heated*, *condenses*, *freezes*, *boils*, *steam

When water is very _____, it _____ and turns to _____. When water is _____, it _____ and turns to _____ or _____. When vapour _____, it _____ and turns back to _____.

(*Answers in the order in which they occur:* cold, freezes, ice, heated, boils, steam, vapour, cools, condenses, water)

New words: **vapour**, **evaporates**, **condenses**, **freezes**

Making clean water from dirty water

Have some sea water and muddy water ready before the class starts.

Materials
Some sea water, some muddy water, 2 kettles, a fire, 2 bottles of cold water with lids on, 2 empty drinking glasses.

Organisation
2 groups.

Method

1. Make a fire. One group heats the sea water and the other heats the muddy water.
2. When the water in the kettles start boiling, hold the bottles of cold water above the steam, making sure your hands do not come in contact with the steam.
3. One student holds the bottle in a tilted position so that the water droplets forming on the bottle drip into the glass. Another student holds the glass to collect the water droplets.
4. Taste what you have collected in the drinking glasses.

Q1. What does the water collected from sea water taste like?
Q2. Would you say that the water in both glasses is pure enough to drink?

(*Expected answers:* The water is tasteless, it does not taste of salt. Yes, it is pure enough to drink.)

Dissolving materials in water

Materials

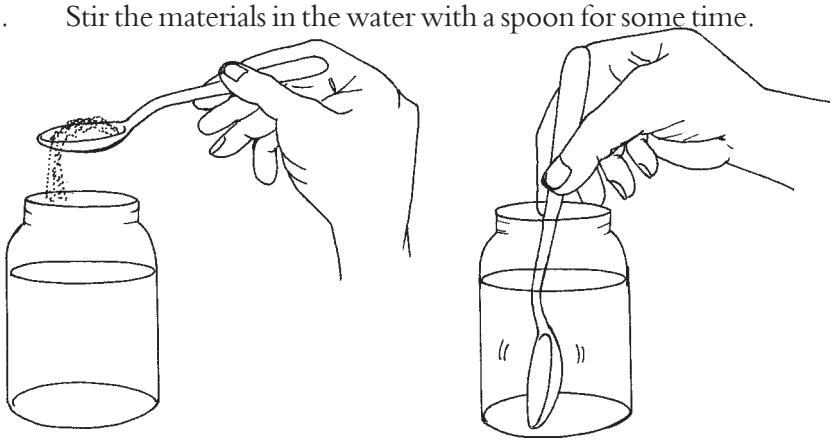
4 drinking glasses or glass jars, a teaspoon, some sugar, some salt, some sand, some sawdust, some water.

Organisation

Class experiment.

Method

1. Put water in the glasses so that they are three-quarters full.
2. Into each glass, place one teaspoon of one of the different materials, that is, sugar in glass 1, sand in glass 2, salt in glass 3, sawdust in glass 4.
3. Stir the materials in the water with a spoon for some time.



Q1. Which of the four materials dissolve in water?

Q2. What is the meaning of dissolve?

(*Expected answers:* Sugar and salt dissolve. When a material dissolves, it disappears completely in the water.)

Q3. Copy this information:

When a material dissolves in water we say that a ***solution*** *is formed.*

Q4. Pour some sugar solution and salt solution on a saucer and leave it out in the sun for a few days. What happens? What do you see?

(*Expected answer:* There is sugar and salt left on the saucers as the water evaporates.)

New words: **dissolve**, **solution**

Floating and Sinking

Materials
A dish or bucket of water, a nail, a pencil, a pen-top, a dry leaf, chalk, some coconut husk, a rubber, a ruler, some coral, a bottle-top, seeds, fruit, a ball of plasticine, some polystyrene (foam)

Organisation
Class experiment

Method
1. Draw up your table as shown below.

Name of object	Will it float or sink? (Guess)	Does it float or sink? (Findings)

2. Look at the objects and put down your guesses on the table. Each student should be left to put down their own guesses.
3. Place the objects in the dish or bucket of water and write down your findings in the third column of the table.
4. See if you can make the plasticine float.

Q1. *How did you make the plasticine float?*
Q2. *Why does it float?*

(*Expected answers*: The plasticine floats when it is made into a boat shape. This is because it now has a greater surface area and becomes lighter for its size.)

Wet and Dry

Water makes things wet. Some materials absorb water easily and will get very wet. Some materials are not easy to wet right through. Some materials do not let water pass through them at all. These materials are said to be **waterproof**.

Some birds and animals have waterproof coverings. Ducks have waterproof feathers, seals and otters have waterproof fur.

Try washing your hands in cold water without soap. What did you find out? Did the water form large drops which ran off your skin? Why did this happen? After the water drops ran off your skin, did your hands feel wet or dry?

Which type of cloth soaks up most water and which type dries the quickest?
(This activity requires a sunny day and needs to be done in the morning to allow enough time for students to time how long each piece of cloth takes to dry. All of the pieces of cloth should be of the same size.)

Materials
One piece each of cotton cloth, nylon cloth, terylene cloth, woollen cloth, and umbrella cloth, all the same size, a dish or bucket of water, a measuring jug, an empty bucket, pegs, a line on which to hang the pieces of cloth.

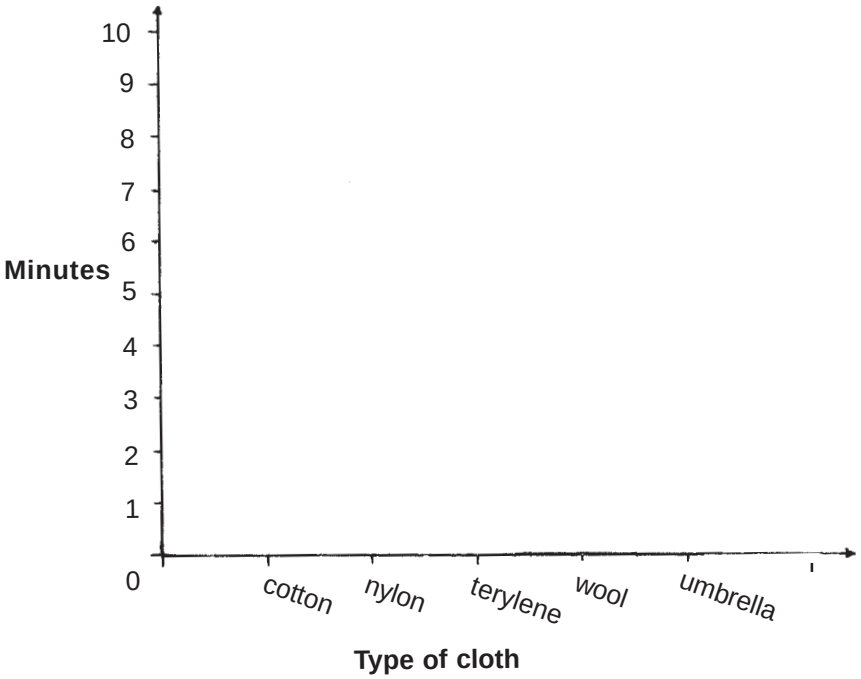
Organisation
Class experiment.

Method
1. Soak each piece of cloth one at a time and squeeze the water out into the bucket. Then pour it into the measuring jug to find out how much water was soaked up by the cloth.

Q1. *Which cloth type soaked up most of the water?*
Q2. *Which cloth type soaked up the least water?*

(*Expected answers:* The woollen cloth soaked up the most water. The umbrella cloth soaked up the least.)

Q3. *Complete the chart below to show your results.*



2. This time hang the pieces of cloth out and keep checking them every 20 minutes to find which one dries faster.

Q4. Which cloth type dried the fastest?
Q5. Which cloth type took the longest time to dry?

(*Expected answers:* The umbrella cloth dried the fastest. The woollen cloth took the longest time to dry.)

Q6. Complete this sentence by using the words in brackets.
The cloth type that soaked up most water took _____ to dry while the one that soaked up the least water took _____ to dry. (less time, more time).

(*Expected answers*: more time, less time)

New word: **waterproof**

Water Pressure

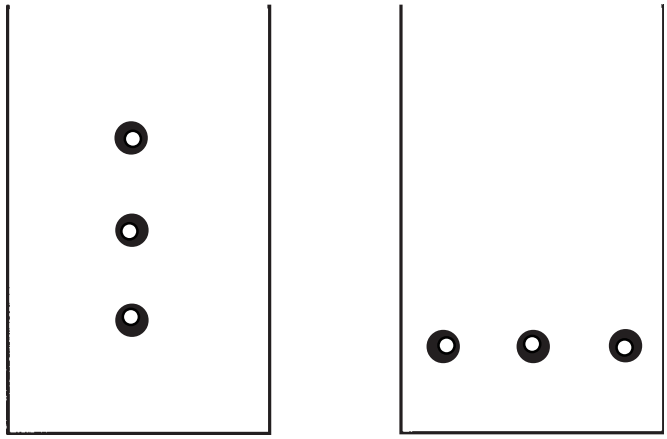
Water, like air, has its own force pressing downwards on objects. Have you tried diving deep down into the sea or fresh water before? Have you felt anything pushing against your ears?

Materials
2 empty tins of the same size (Milo or Sunshine milk), a hammer, a nail, some sticky tape.

Organisation
Group work.

Method

1. With the hammer and nail, make holes on the side of one tin and on the bottom of the other where marked.



2. Cover the holes up with a strip of sticky tape.

3. Take the tins outside and place them on a level surface.

4. Fill the tins up with water and quickly remove the sticky tape from the holes.

Q1. Complete these diagrams to show how water came out from the holes.
Q2. Is water pressure the same at different depths?
Q3. Is water pressure the same at the same depth?
Q4. Where is water pressure the greatest?

(*Expected answers*: The water pressure is the same at the same depth. It is different at different depths. Water pressure is greatest at the bottom of the tin. The deeper the water, the greater the pressure.)

New word: **water pressure**

Chapter 4

Water and Living Things

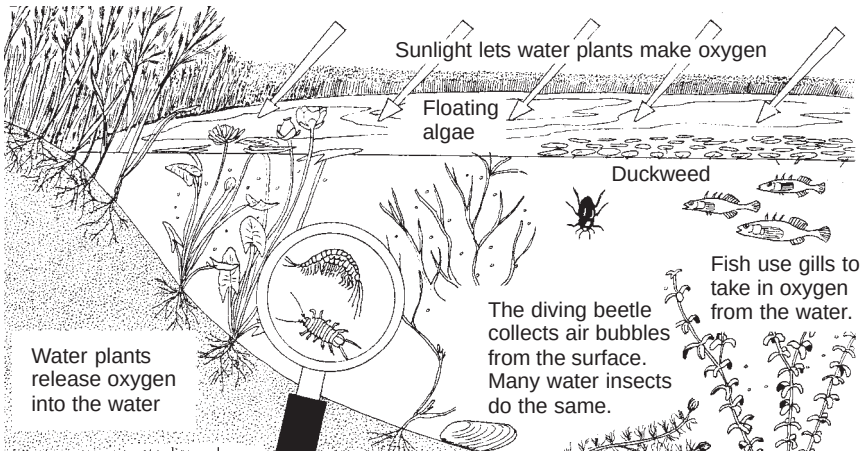
All living things need water to live. They do not only need water but they are actually partly or largely made of water; for example, a watermelon is 99% water, a tomato is 95%, a pineapple is 87%, a jellyfish is 99%, a chicken is 74%, a fish is 67%.

Very few plants and animals can live in the deserts of the world because there is so little water there. A camel can live in the desert. It can drink as much as 120 litres of water in 10 minutes and then go for about two weeks without water. A cactus is a typical desert plant with a swollen stem. It can live for a long time without water. When it rains, it takes up a lot of water with its very long roots, which spread out to collect water from a large area.

Many plants and animals live on the land where there is plenty of water available. The animals drink water from ponds, lakes, rivers and streams.

Plants and animals which live in fresh water or the sea have water all around them. Those animals that live in fresh water drink the water around them, those that live in the sea drink the salty water around them. Some plants which live in water grow along its edges. The roots of these plants help to keep the banks at the edge of the water firm. Some plants float on the water. Some seem to be floating, but have long stems reaching down to roots in the mud at the bottom of the water. Other plants grow under the water.

Plants are very important to life in the water. They make hiding places for many of the animals. They also make oxygen for the animals to use.



Q1. Name three plants and three animals that live in fresh water.

(*Possible answers:* Freshwater plants may include watercress, duckweed, water lily, water hyacinth. Freshwater animals may include snail, water flea, fish, water beetle, freshwater prawn.)

Q2. Name three plants and three animals that live in sea water.

(*Possible answers:* Sea plants may include seagrass, seaweed, mangroves, algae. Sea animals may include fish, crabs, shellfish, dolphins, turtles.)

(For both questions, the children should use their language name if they do not know the Bislama or English name).

Q3. Is it wise to cut down all the plants that grow along the edge of a river or around a pond? Explain your answer.

(*Expected answer:* No. The roots of these plants hold the soil so that it is not easily washed away.)

Q4. Why is oxygen important for the animals in the water?

(*Expected answer:* They use it to burn up their food in their bodies to get energy.)

Do plants need water?

(This activity should be started 3 weeks before the actual lesson by students working in group).

Materials

For each group: four empty 1 kg rice plastic bags, some soil, some bean seeds or peanuts, some water, a marker, one big spoon ordinary eating spoon).

Organisation
Group work

Setting up
(To be done 3 weeks before the lesson)

1. Fill your plastic bags up to ¾ full with some good soil. Plant your bean seeds. Label the bags A to D.
2. Water them everyday until they start growing.
3. Once they have grown into good healthy seedlings or plants water them each day as follows:
   A – 0 spoon of water (0 ml)
   B – 2 spoons of water (20 ml)
   C – 5 spoons of water (50 ml)
   D – 10 spoons of water (100 ml)

Record your results in a table, as drawn below, every second day for ten days. The children must look at and record leaf colour changes, leaf shape and size, stem colour and size and the overall growth.

	Amount of water each day	**after 2 days**	**after 4 days**	**after 6 days**	**after 8 days**	**after 10 days**
Plant A	0 spoon (0 ml)					
Plant B	2 spoons (20 ml)					
Plant C	5 spoons (50 ml)					
Plant D	10 spoons (100 ml)					

Method
On the day of the lesson, you should have your table of results completed, ready for answering the following questions:

Q1. Which of the four plants looked least healthy after 10 days?
Q2. Which of the four plants looked most healthy after 10 days?
Q3. What do the plants use the water for?
Q4. How do they take up water?

(*Expected answer:* The plants use water in photosynthesis to make their food. They take up water through the root hairs or roots.)

What happens to water in plants?

Materials
A plastic bag, a piece of string or rope. The work will be done using a branch still growing on a small tree.

Organisation
Work in groups.

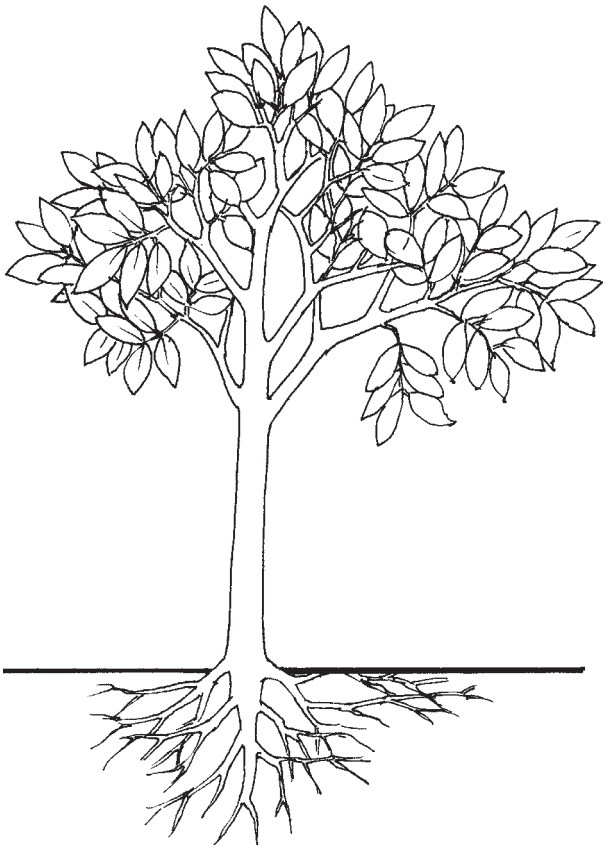
Method

1. Go outside and choose a small tree near the classroom.
2. Tie your plastic bag over a small branch of the tree with its leaves and leave it there for three days.
3. After three days, go and find out what has happened.

Q1. What can you see in the plastic bags?
Q2. What do you think has happened?

(*Expected answers:* You can see water droplets in the plastic bags. The water has come out of the plant's leaves.)

Q3. Draw how you set up the activity and show what happened.
Q4. Draw a whole plant showing its roots, stem, branches and leaves as shown below then, using arrows, show how water moves through a plant.



(The children should now understand that water comes into the plant through the roots and then travels up the stem to the branches and then to the leaves, where excess water leaves the plant. They should show this with their arrows.)

Chapter 5

Using Water and Keeping it Clean

Water is a very important natural resource. We tend to take many things for granted, and water is one of these many things.

If there was no more water left on this planet, would you be able to survive? You who live in the two towns, Port Vila and Luganville, if you woke up one morning to find that UNELCO had cut off the water in your area, would you be happy to go to school? I am sure your teachers would not want you, if there was no water there.

How useful is water?

Water is useful in many ways:

to maintain life
Life will not go on without water. As we saw in Chapter 4, all living things are made up of some amount of water. For example, humans are made of 70% water, chickens are made of 74%, watermelons of 99%. The water within a plant or animal is used mainly for the transportation of materials.

in industries
In industrialized countries, much more water is used in factories, mines, mills and power stations than in people's homes.

Water is used to cool hot objects, and to keep industrial buildings clean.

It is used in manufacturing processes. In cloth making, for example, it is used to prepare the materials. In paper making, it is used for preparing mixing the ingredients for a good quality paper.

in health
Water is very important for the good health of individuals and communities. We need plenty of clean water for drinking and cooking. In order to keep clean and healthy, we need water to wash ourselves, and to wash our clothes and dishes. We need water to wash away waste from modern toilets. We need water, too, for cleaning sores and in the treatment of other injuries, at home or at the clinic or hospital.

in leisure
Water has come to play a major role in leisure activities and sports. These include swimming, canoe racing, wind surfing, kayaking, yachting, fishing and diving. Many of these activities form an important part of what we in Vanuatu are able to offer to tourists.

in safety
Water is very important in putting out fires. It is also used for cooling down objects like car engines, in order to prevent overheating which may lead to the breakout of fire.

Activities
Q1. Make a list of the ways in which we use water inside and outside our homes.
Q2. Draw pictures showing the different ways in which we use water.
Q3. Can water be used to make electricity?
Q4. Where in Vanuatu is water used to make electricity?

(*Expected answers for Q3 and 4:* Yes, water can be used for making electricity. This process is called hydro-electricity. There are hydro-electricity projects taking place on Efate, Santo and North Malakula.)

Dirty water

Human activities have contributed much to making water systems dirty. Such activities include:

- building pit latrines near rivers or streams
- washing in rivers or streams
- throwing our rubbish into the sea or rivers
- cutting down trees along the rivers or near the rivers. This causes the soil to be washed into the rivers then out to the sea.
- allowing sewage from modern toilets to pass out into the sea
- adding chemicals and fertilisers to agriculture land. The chemicals and fertilisers will be washed down into the water if there is a water system nearby using water in industries which is later released back into rivers This water may be hot and kill off organisms in the water.

What can we do to stop water pollution?

If we say that we need water to live, then, we should again be very careful in our activities to make sure we have clean and pure water all the time! Discuss what we can do to make sure that we do not cause too much water pollution. (This topic is developed further in the HNA Health Books.)