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Solids and liquids

Teacher's Resources Interactive PDF

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Press on Teacher's Resources title above to go straight to Contents.
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You will also find yellow arrows throughout that allow you to:

- go back to previous page
- go forward to next page
- go back to contents

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Curriculum Visions

A CVP Teacher's Resources
Interactive PDF

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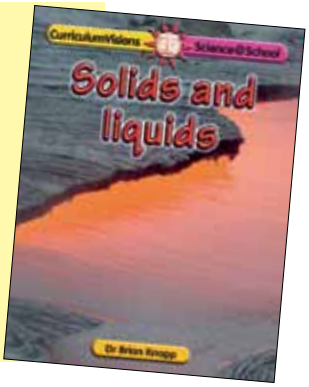
Contents

Section 1: Resources

Welcome to the Teacher's Resources for *Solids and liquids*. The resources we provide are in a number of media:

1 The Solids and liquids pupil book is the full-colour paperback book that introduces the two states of matter – solid and liquid – in simple, easy-to-follow units which make it accessible to a very wide range of abilities.



3 You can buy various Science @School sets, for example Year 3 set, KS2 class book set, KS2 TG set or the complete Book Box set.

2 Our Learning Centre at

www.curriculumvisions.com

has almost everything you need to teach your primary curriculum in one convenient Virtual Learning Environment.

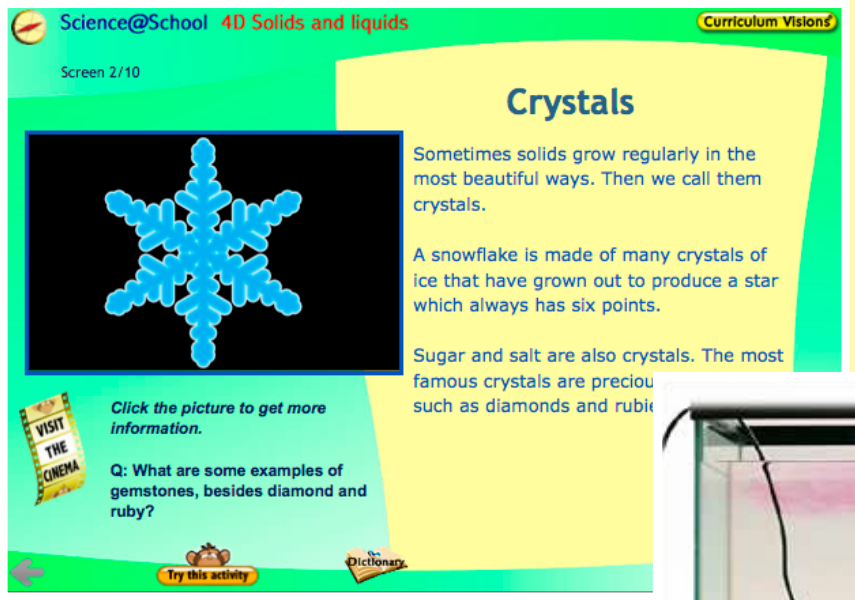
You can use support videos, e-books, picture and video galleries, plus additional Creative Topic books, graphic books called Storyboards, and workbooks. Together they cover all major curriculum areas.

All topics are easily accessible, and there is a built-in context search across all media.

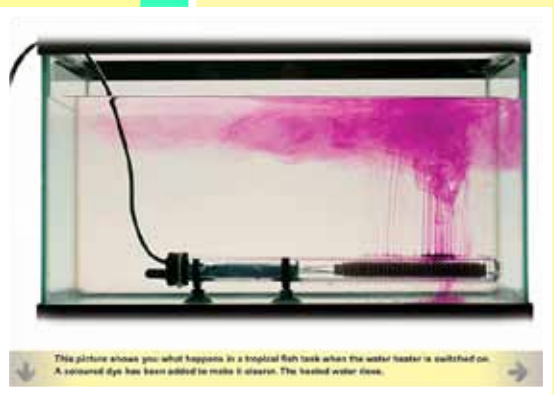
You can also use our printed student books online as part of your subscription to the Learning Centre. There page-turning versions of every printed Curriculum Visions book for use on your whiteboard.

▼ The Solids and liquids home screen

▲ 'Classroom cinema' video



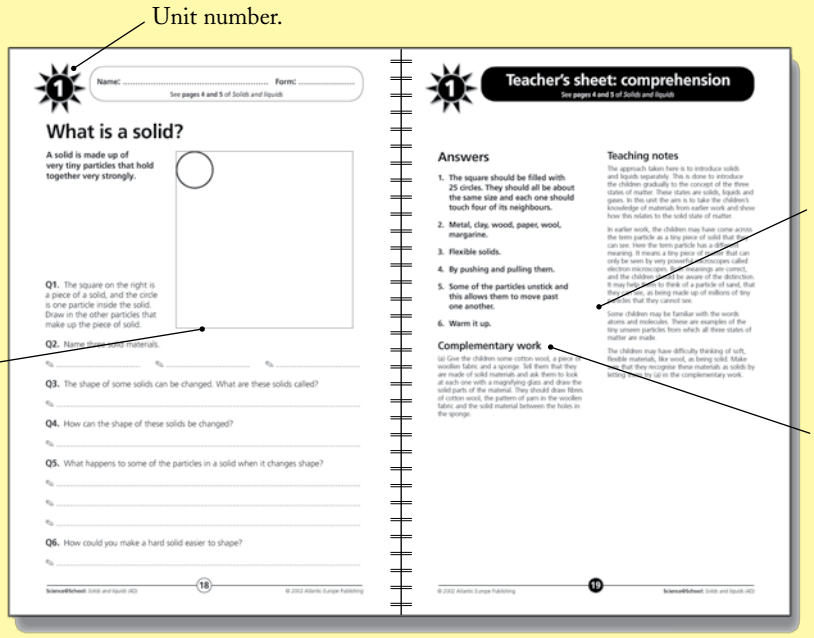
▲ Web site page



▶ Web site caption

▼ ***Each unit has one comprehension worksheet and one activity worksheet, each with a teacher's sheet.***

▶ ***The photocopiable comprehension worksheet and supporting teacher's sheet.***

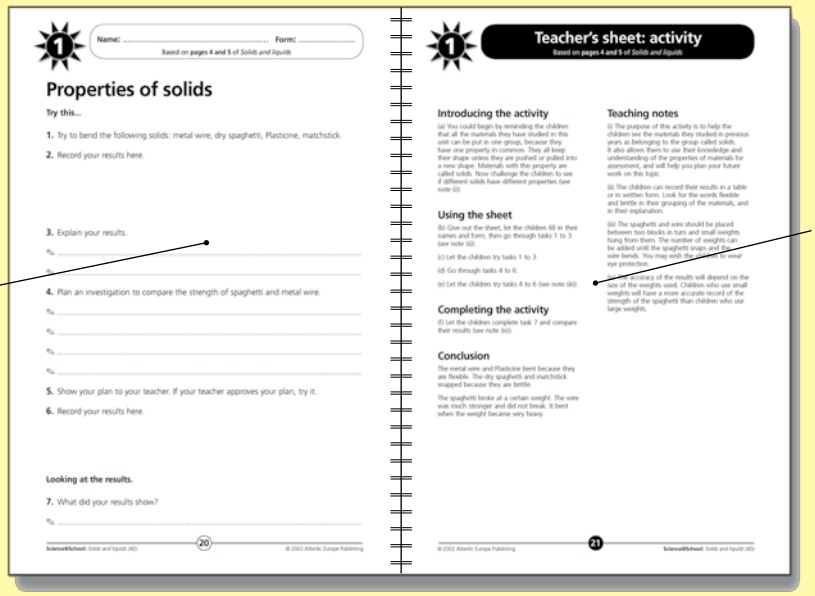


Left hand page is to photocopy and hand out to pupils.

Right hand page is the teacher's sheet and provides answers, suggestions for complementary work and teaching notes.

Resources needed to support the complementary work are shown in List 2 on page 15 of this Teacher's Guide.

▶ ***The photocopiable activity worksheet and supporting teacher's sheet.***



Left hand page is to photocopy and hand out to pupils. For some activities, pupils will also require additional sheets of paper.

Right hand page is the teacher's sheet and provides a detailed activity plan, conclusion and teaching notes. *Resources needed to support the activity worksheet are shown in List 3 on page 15 of this Teacher's Guide.*

Matching the curriculum

This book covers the solids and liquids component of the curriculum in a way that is highly relevant to work in the lower junior classes at primary school. It extends earlier work on the properties of materials, and prepares the children for further work on materials science in the upper junior school. It provides fascinating information on the structure of crystals, and how solids behave when they are in the form of grains or powders. The stickiness of a liquid is related to the way it flows and allows objects to sink in it.

Mixtures of solids and liquids are thoroughly examined, as is the process of dissolving. Sieving and filtering are also introduced.

While covering the subject matter of the curriculum, *Solids and liquids* also facilitates the development of investigative skills, both in the pupil's book and the *Teacher's Guide*.

The pack is fundamentally built around the idea that solids and liquids are formed from tiny particles, and it is the way these particles are arranged that give solids and liquids their special properties.

Section 2: The pupil book explained unit by unit

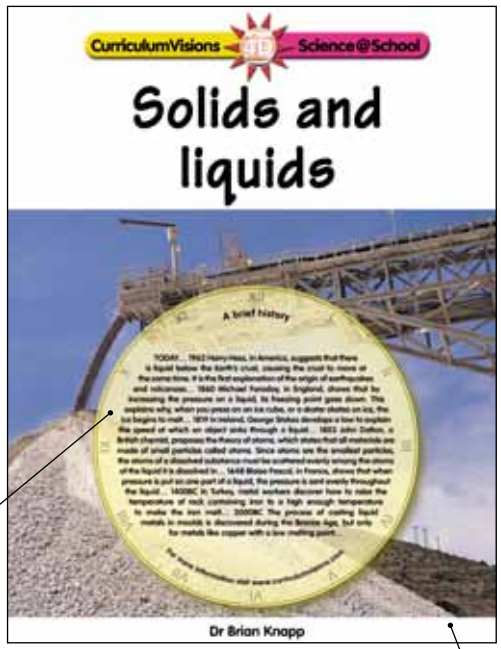
Although the pupil book – *Solids and liquids* – is clear and simple, a great deal of care and thought has been given to the structure and the content of each double page spread or unit. The worksheets and activities in this *Teacher's Guide* also link directly to the pages in *Solids and liquids*.

It is possible to use *Solids and liquids,* and the worksheets and activities, without reading this section, but we would strongly recommend that you take a short time to familiarise yourself with the construction of the pupil book.

The units are arranged in sequence, to help you with your lesson planning. In this section, a brief description of the content of each unit is given, together with hints on how to start or support it. List 1 (Starting a unit with a demonstration) on page 15 sets out the resources that you could use to do the demonstrations where suggested. The activity associated with each unit is also briefly described to help you see how the unit and activity work together.

Title page

The book begins on the title page (page 1). Here you will find information about science and technology in the form of a clock. You may want to use this to set the scene for the study of the book's contents. You may choose to focus on an event which ties in with your work in history, before moving onto the rest of the book. Alternatively, you may wish to skip over this page and return to it later. It is not a core part of the book, but helps the children see how the work they are doing now fits in with the work of scientists and engineers in the past. It may also be used to stimulate more able pupils to research the people and events that are described here.



A time clock giving additional historical information about the topic.

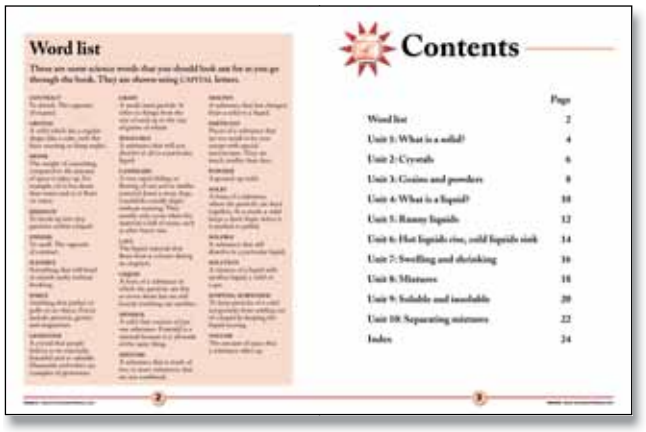
The picture shows crushed copper ore being stockpiled by a conveyor. The fist-sized material falls onto the pile and comes to a constant angle of rest.

Word list and contents

The core content of the book begins with a word list on page 2. This is a glossary, brought to the front for the pupils' attention. Pupils could be encouraged to look at the list and see how many of the words they already recognise.

One of the important things about science is the precision with which words are used. However, many scientific words are also common words, often used in a slightly different way from how they would be used in science. The word list presents the opportunity for pupils to consider the words they already know, and the meanings they are familiar with.

When your teaching unit has been completed, you may want to invite pupils to revisit this list and see if their understanding of the words has been enhanced or changed in any way. A visual dictionary is also given on the CD.



The entire contents are shown on page 3. It shows that the book is organised into double page spreads. Each double page spread covers one unit.

The units

Heading and introduction

Each unit has a heading, below which is an introductory sentence that sets the scene and draws out the most important theme of the unit.

Body

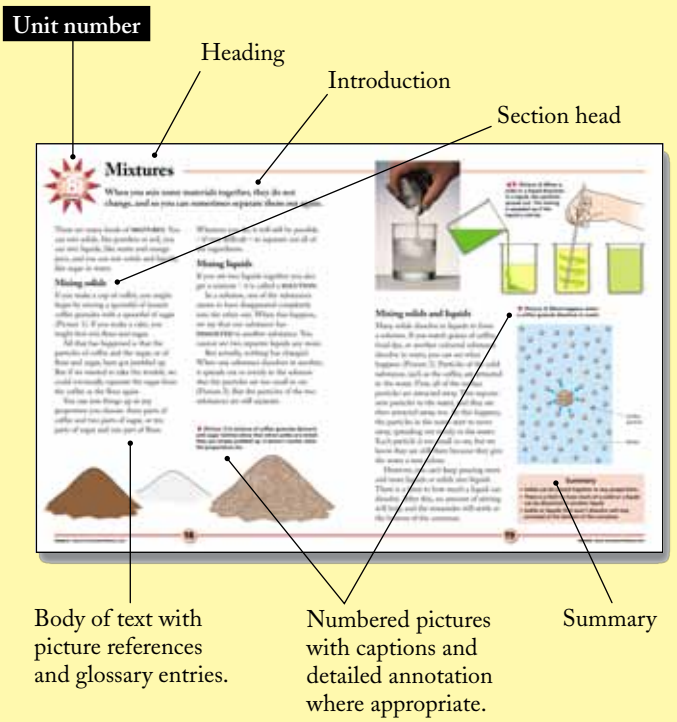
The main text of the page then follows in a straightforward, easy-to-follow, double column format.

Words highlighted in bold capitals in the pupil book are defined in the word list on page 2. A visual dictionary is also given on the CD.

The glossary words are highlighted on the first page on which they occur. They may be highlighted again on subsequent pages if they are regarded as particularly important to that unit.

Summary

Each unit concludes with a summary, highlighting and reinforcing the main teaching objectives of the unit.

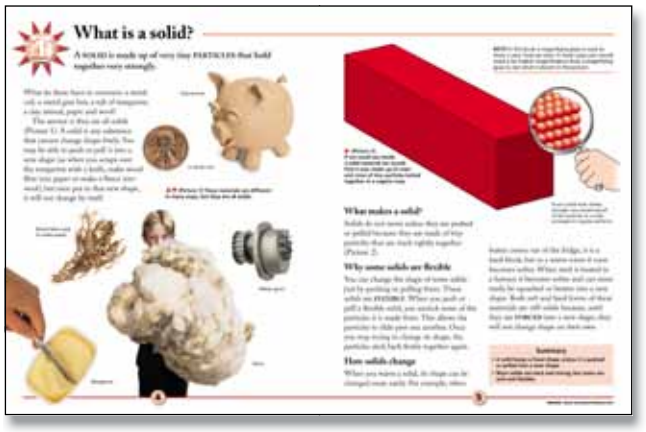


1 What is a solid?

You may wish to introduce this unit by asking the children to name ten solids around them. The answers may feature the names of materials, and the names of objects. If a chair is mentioned, someone may point out that it has hollow metal legs. This can lead into a discussion about what the term solid means. It can also help to link the children's knowledge of materials to the concept of the three states of matter: solids, liquids and gases.

The unit begins by presenting a range of materials which are classified as solids. It mentions wool and wood fibres (for making paper), which are less familiar examples of solids, but serve to broaden the children's view of solid materials. The text moves on to explain that solids are made from particles which are held together tightly. This concept is developed by discussing how the particles move in a flexible solid.

The unit ends by considering the effect of heat on the hardness of a solid. You may like to extend the work by allowing the children to compare butter that has been kept in the fridge with butter that has been kept in a warm room.



In the complementary work, the children investigate the structure of sponge, wool and cotton wool. In the practical activity, the children compare how solids bend, and design a fair test to investigate strength.

2 Crystals

Crystals are fascinating structures, so begin by showing the children a geological specimen which features a group of large crystals. Remind the children that solids are made from very tiny particles. Tell the children they are going to see how the way the particles stick together help to make a crystal shape. Give each group of children 16 pea-sized balls of Plasticine and tell the children to arrange four of them in a square. The children should push the Plasticine balls together so that they stick to each other. Make three more squares like the first, then carefully place one square of Plasticine balls on another until you have built up four layers and made a cube.

The unit begins by considering how a snowflake is made up from ice crystals, then moves on to describe sea salt crystals. The way crystals form from molten rock is described, and striking pictures of sulphur crystals and pyrite show that many substances have a crystalline form.

In the complementary work, the children compare the hardness of minerals and use secondary sources to find out about gemstones. In the practical activity, the children study crystals of sea salt and sugar. They also can grow their own crystals very quickly by painting a solution of Epsom salts on glass and letting it dry.

Grains and powders

You could begin by saying that you are going to time your introduction with a timing device which has been used for thousands of years. Produce a sand timer and let the grains begin to fall. Take two pieces of sandstone and rub them together. As you do this, remind the children that solids have a fixed shape, that all matter is made from very tiny particles, and that rocks are made from minerals, which form crystals. Show the children the sand grains you have produced, and say that they are tiny solid particles that we can see. Let the children see how long you have taken for your introduction (you may have had to turn the sand timer a few times if it is a small one), then start the unit.

The unit begins by comparing grains and powders, then moves on to describe how falling particles, such as the sand in a sand timer, form a cone. There is also a section on how water affects grains and powders. A little water gives the particles strength, but if too much water is added, all strength is lost. The unit ends by considering the effect

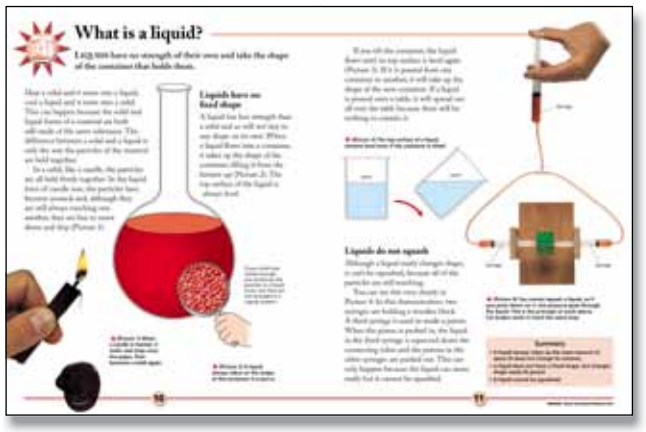
of water on soils and the disastrous consequences of landslides.

In the complementary work, the children are encouraged to build their own timing device using grains. This activity could be used as a technology exercise. The practical activity directs the children to compare grains and powders, and the effect of water on them. In this activity, they discover the unusual properties of wet cornflour.

What is a liquid?

You may like to introduce this unit by showing the children two balloons. One is filled with ice and the other is filled with water. Tell the children that the balloons are filled with the same substance and ask them why the substances appear different. Look for an answer which states that the substance is in liquid form in one balloon and in solid form in the other. Ask the children what the substance might be. If they suggest water, ask the children how they might prove this without looking in the balloon, then hold up a thermometer. The children should suggest taking the temperature of the two balloons. Tell the children that the balloons will be left in the classroom while they continue with their work, and ask them to predict what might happen.

The unit begins by establishing the link between the solid and liquid form of a substance through melting and freezing. The change of a solid into a liquid is also described in terms of how the arrangement of particles of matter change. The strength of a liquid is compared with a solid and used to explain how a liquid takes up the shape of



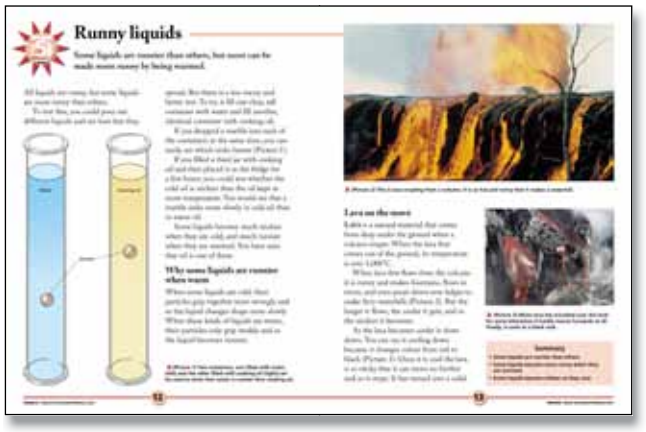
any container into which it is poured. The unit closes by showing how liquids cannot be squashed, and how this property can be used in hydraulics.

In the complementary work, the children are asked to find out about water clocks and devise and test a water clock. In the practical activity, the children investigate how volume does not change when a liquid is poured into containers with different shapes.

5 Runny liquids

In the previous unit, the focus was on how the liquid state is different from the solid state. This unit builds on the concept of the liquid state by comparing one property of different liquids. Introduce the unit by showing the children a range of different liquids such as cooking oil, shampoo, washing-up liquid and syrup. Ask the children how the liquids differ, and look for answers describing their colour, smell, transparency or cloudiness. You could pour each liquid from its container so the children can see how they flow.

The unit begins by stating that liquids differ in their runniness, and this affects how quickly they spread if they are poured out onto a surface. A less messy experiment is described and illustrated, in which liquids are compared by letting objects sink in them. The text then moves on to describe how the temperature of a liquid affects its runniness. In the last section, the action of lava is described and illustrated by striking photographs of a lava waterfall and lava cooling to black rock.



In the complementary work, the children are challenged to find out the names of volcanoes which are active today. The practical activity allows the children to compare the runniness of different liquids with the speed at which objects sink in them.

6 Hot liquids rise, cold liquids sink

You may like to introduce this unit by setting up a lava lamp and letting the children watch the oil warm, expand and rise, and then cool, contract and sink. Ask the children to explain what they see happening. You may tell the children that a lava lamp is a rather spectacular example of the rising and sinking of liquids, but liquids rise and fall whenever they change temperature. You may wish to give an example of the movement of water when boiling vegetables.

The unit takes the concept of the flow of water a stage further, and considers what happens when water changes temperature. The circulation of water in a tank is clearly shown by the movement of a dye rising above the heater. The sinking of water from an ice cube is also shown by the use of a dye. The technological implications of the movement of hot water is explored in the design of the immersion heater tank for the home.

The complementary work extends the study of the immersion heater tank into a research project

on the cold water systems and hot water systems in a home. In the practical activity, the children investigate the movement of cold and warm water by studying the effect of plunging a small jar of warm water into cold water, and by studying how water sinks under ice cubes.

7 Swelling and shrinking

This unit makes a further comparison between solids and liquids. It compares how they expand when heated and contract when cooled. Most materials behave in this way. A familiar example of expanding and contracting occurs in the liquid in a thermometer. The children may have used a thermometer in weather studies earlier in their school life, and you could remind them of it now. The reason they could tell the temperature was because of the way the liquid swelled or shrank inside the thermometer.

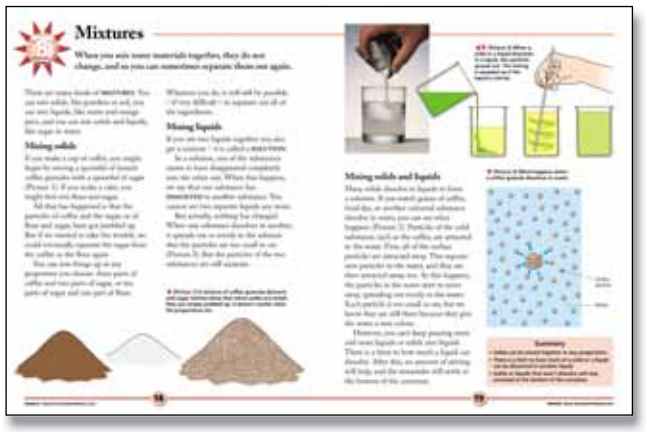
The unit begins by explaining how a thermometer works, then shows how a bottle of water can be used as a simple thermometer. A blacksmith making wheels is used to show how solids behave when heated and cooled. You may like to use this example as part of a history project. The unit moves on to compare how liquids and solids expand and contract, and also compares how two different metals expand at different rates.

In the complementary work, the children use secondary sources to find out about how expansion and contraction affect the way large metal bridges are constructed. In the practical activity, the children investigate the expansion of water and compare it with the expansion of an air-filled balloon, which provides a surprising end to the study of the unit.

8 Mixtures

You may like to introduce this unit by making some muesli. Do not tell the children what you are making but add two ingredients and then a third and so on. At some stage in your mixing you could ask the children what they think you are making but do not answer until you have finished. Ask the children about other mixtures they have seen or made. The answers may include cake mixtures, or even mixing mud with water.

The unit begins by giving examples of different kinds of mixtures, then considers each kind in more detail. In mixtures of solids, the children learn how the proportions of solids are worked out using, for example, three parts of one solid to two parts of another. Mixing of liquids follows logically from the mixing of solids, and the term solution is introduced. In the next section, mixing solids and liquids, the term dissolving is introduced and the mechanism of dissolving is described and illustrated. This unit is important in preparing the children for the next two units in the pupil's book.

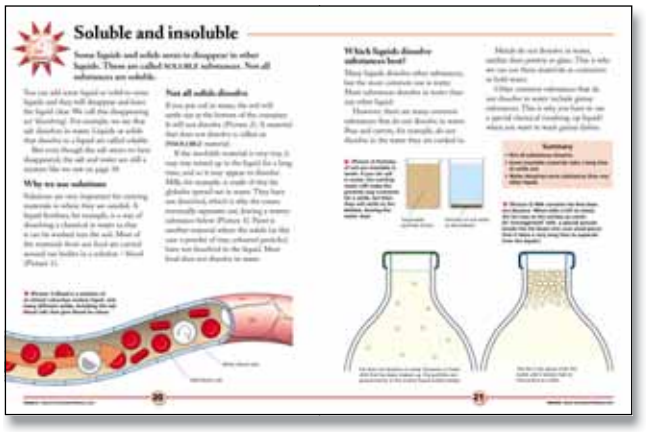


In the complementary work, the children can find out about the ingredients in different kinds of bread and cakes, and look at recipes from around the world. In the practical activity, the children compare how sugar and salt dissolve and make suggestions to improve the experimental design.

9 Soluble and insoluble

You may like to begin by giving the children a mixture of sand and salt. Do not tell them what it is. Ask the children to write down what they think the mixture is and what they think will happen when water is added to it. The children then put their answers away and stir up the mixture with water. When the children have finished, ask them to compare their answers with what happened, and ask them if the test helped to identify the mixture.

The unit begins by explaining that the salt disappears in a process called dissolving. The text moves on to give examples of useful solutions, including blood, and introduces sand and fat as examples of materials which are insoluble in water. Paint is introduced as a useful material which contains insoluble coloured solids. Water is established as the best 'dissolver', but a range of materials, including glass and pottery, do not dissolve in it and are used to contain watery solutions.



In the complementary work, it is suggested that the children use secondary sources to find out about how paint is made. They could also find out about how paint was made by early people as part of a history project. In the practical activity, the children conduct a survey of materials to discover which ones are soluble and which are insoluble in water.

10 Separating mixtures

Show the children a bucket of sand in which you have hidden some marbles or other brightly coloured objects of a similar size. Tell the children that there are some objects which are precious to you hidden in the sand. Ask the children to think of a quick, clean way to separate the sand from the objects. Look for sieving as an answer, then produce a sieve and second bucket to collect the sand. Ask some children to perform the task and collect your precious objects.

Turn to the unit and go through the first section. It deals with separating stones, sand and clay, and the need for different sieves, with large holes and with small holes, to separate different sizes of particles. In the following section, the filter is introduced as a finer kind of sieve, which is specially designed to separate an insoluble solid from water containing a dissolved solid. Tea bags, a tea strainer and a coffee filter are illustrated as examples of filters in action.

In the complementary work, the children can find out how different kinds of flour are made. The practical activity provides an opportunity to sieve a small range of substances and make predictions and observations.

Index

There is an index on page 24.

Section 3: Using the pupil book and photocopiable worksheets

Introduction

There is a wealth of material to support the topic of solids and liquids in the pupil book and in the *Teacher's Guide*. On this and the following three pages, suggestions are made on how to use the worksheets and their associated teacher's sheets on pages 18 to 57, and how to integrate them for lesson planning. On the page opposite you will find the resource lists for introductory demonstrations, the complementary work and the activity worksheets. The learning objectives are shown on pages 16 and 17.

Starting a unit

Each unit in the pupil book forms the basis for a lesson. You may like to start by reading it with the class, or begin with a demonstration (see pages 7 to 13 and List 1 on page 15). Always begin the unit by reading the introductory sentences in bold type. This helps focus the class on the content of the unit and to prepare them for the work.

The first part of the main text introduces the content, which is then developed in the headed sections. The illustrations are closely keyed to the main text, and the captions of the illustrations develop the main text content (*see* 'The units' at the bottom of page 8).

With less skilled readers, you may prefer to keep to the main text and discuss the illustrations when they are mentioned. With more skilled readers, you may want to let them read the captions for themselves. Each unit ends with a summary. The children can use this for revision work. They can also use it to test their understanding by trying to explain the points made in the summary.

You can find the learning objectives for each unit on pages 16 and 17 of this *Teacher's Guide*.

The style and content of the unit also make it suitable for use in literacy work, where the needs of both English and science are met. You may wish to use the unit as a topic study in literacy work, or you may want to perform an activity in science time and follow it up with a study of the unit during literacy work.

Using the comprehension worksheets

Each unit in the pupil book has one photocopiable comprehension worksheet in this *Teacher's Guide* to provide a test. The learning objectives on page 16 are for these comprehension worksheets and relate directly to the knowledge and understanding component of the science curriculum.

The comprehension worksheets begin with simple questions and have harder questions towards the end.

The worksheets may be used singly, after each unit has been studied, or they may be used along with other worksheets to extend the study.

The teacher's sheet, which is opposite the comprehension worksheet, shows the answers and background information to the unit. This teacher's sheet also carries a section on work complementary to the study topic. This work may feature research using other sources. It may also have value in literacy work.

Using the activity worksheets

The activities are designed to develop skills in scientific enquiry. The learning objectives for practical skills associated with each unit are given on page 17. The activities may be small experiments, may focus on data handling or comprise a whole investigation.

Each activity section is a double page spread in this *Teacher's Guide*. On the left hand page is a photocopiable activity worksheet to help the children in practical work, or it may contain data for the children to use or interpret. The page opposite the worksheet is a teacher's sheet providing a step-by-step activity plan to help you organise your work. Each plan has a set of notes which provide hints on teaching or on the use of resources. The activity plan ends with a conclusion, which you may like to read first, to help you focus on the activity in your lesson planning.

Planning to use a unit

The materials in this pack are very flexible and can be used in a variety of ways. First, look at the unit and activity objectives on pages 16 and 17. Next, read the unit in the pupil book, and the associated worksheet and activity units in this *Teacher's Guide*. Finally, plan how you will integrate the material to make one or more lessons. You may wish to add more objectives, or replace some of the activity objectives with some of your own.

Safety

The practical activities feature equipment made from everyday materials or available from educational suppliers. However, make sure you carry out a risk assessment, following the guidelines of your employer, before you do any of the practical activities in either the pupil's book or the *Teacher's Guide*.

Resources

The three lists below show the resources needed to support the photocopiable worksheets.

- List 1 shows resources for demonstrations suggested for starting a unit.
- List 2 gives resources needed for the complementary work featured on the teacher's sheet associated with each comprehension worksheet.
- List 3 details those resources needed for the 10 activity worksheets.

List 1 (Starting a unit with a demonstration)

▼ UNIT

1. Cold butter, warm butter, plastic knife.
2. A geological specimen that features large crystals. Sixteen pea-sized Plasticine balls for each group.
3. A sand timer, two pieces of sandstone, paper to collect the sand grains.
4. A balloon half-filled with water and then frozen, a balloon half-filled with water.
5. A selection of liquids such as cooking oil, syrup, shampoo, washing-up liquid, beakers in which to pour them.
6. A lava lamp, (check school policies in the use of domestic electrical appliances in school). The lamp will need switching on at least half an hour before the lesson in order to allow the oil to warm up.
7. A selection of grains and dried fruits from a health food shop for preparing your own muesli.
8. –
9. A bucket of sand containing marbles or other similar-sized colourful objects, a sieve, a second bucket to collect the sieved sand.
10. Thermometer used to record temperature in weather studies (optional).

List 2 (Complementary work)

Each group will need the following items:

▼ UNIT

1. Cotton wool, woollen fabric, sponge.
2. A minerals hardness test set (available from educational suppliers). Secondary sources about diamonds, emeralds, sapphires, rubies and opals.
3. Materials for making a sand timer. These could include plastic funnels, paper cones, container to collect the sand. Clock.
4. Secondary sources about water clocks. Materials for making a water clock such as plastic containers with a small hole in the bottom and Plasticine for modifying the size of the hole. Clock.
5. Secondary sources about volcanoes which are active now, secondary sources about large volcanic eruptions in the past.
6. Secondary sources about the hot and cold water systems in a home.
7. Secondary sources about the recipes for bread and cakes, and for recipes from around the world.
8. Secondary sources about how paints are made.
9. Secondary sources about how wholemeal, brown and plain flour are made.
10. Secondary sources about how bridges are prevented from buckling in hot weather.

List 3 (Activity worksheets)

Each group will need the following items:

▼ UNIT

1. A piece of dry spaghetti, a piece of wire, Plasticine, spent match, eye protection, gap between two tables, weights such as coins, or 10g slotted masses from an educational supplier.
2. Sugar, sea salt, magnifying glass, Epsom salts, small beaker, teaspoon, measuring cylinder, glass or jar, paint brush, black paper or cloth.
3. Rice, sand, flour, cornflour, bowl, magnifying glass, access to water.
4. A range of transparent containers (minimum volume 50cm^3) such as ketchup bottles or shampoo bottles, one container which should be a shallow dish or tray, measuring cylinder.
5. Ramp made from a tray or plank and wooden blocks, stop clock, water, syrup, shampoo, cooking oil, measuring cylinder, beaker, tall jar, Plasticine for making objects, paper towels, ruler (optional).
6. Small jar (such as small food colour jar), string, clear plastic jar, food colouring, ice cubes, ice cubes stained with food colouring, talcum powder, spoon (the end of the spoon handle can be used as a measure for the small amount of talcum powder that is needed).
7. A glass bottle such as a drinks bottle (not less than half the size of a milk bottle), Plasticine, bowl, balloon, hot water (adult supervision).
8. Measuring cylinder, jar, spoon, sugar, salt.
9. A collection of soluble substances such as bath salts, bicarbonate of soda, Epsom salts and coffee grains; and a collection of insoluble substances such as sand, chalk, aluminium foil, marble chip, metal paper clip, plastic paper clip. Measuring cylinder, spoon, clock, beaker, stirrer.
10. Sieve, magnifying glass, bowl, samples of granulated sugar (make sure it has some lumps in it made by crystals sticking together), icing sugar, plain flour, wholemeal flour.

Learning objectives

Comprehension worksheets

The table below shows the learning objectives for knowledge and understanding associated with each unit in the pupil book, using the comprehension worksheets in this *Teacher's Guide*:

Unit 1

- Solids maintain their shape unless acted on by a force.
- The shape of some solids may be changed by applying forces to them.

Unit 2

- There is a range of crystal forms.
- Crystal forms are produced because the particles inside them pack together in a regular way.

Unit 3

- Grains and powders have properties which differ from solids and liquids.
- Adding water to grains and powders alters their properties.

Unit 4

- Liquids are produced when solids melt.
- Liquids do not have a fixed shape and cannot be squashed.

Unit 5

- Liquids differ in their runniness.
- The temperature of a liquid affects its runniness.

Unit 6

- Warm water rises up through cold water.
- Cold water sinks through warm water.

Unit 7

- Solids and liquids expand when they are heated.
- Solids and liquids contract when they are cooled.

Unit 8

- When some materials are mixed together they do not stick together or combine.
- A mixture can be made from different solids, different liquids or solids and liquids.
- Solids that will not dissolve in a liquid collect at the bottom of the liquid's container.

Unit 9

- Materials can be divided into those that are soluble in water and those that are insoluble.
- Some insoluble substances take a long time to settle out.

Unit 10

- A sieve can be used to separate solids of different sizes.
- A filter can be used to separate an undissolved solid from a liquid.

Learning objectives

Activity worksheets

The table below shows the learning objectives for practical skills associated with each unit in the pupil book, using the activity worksheets in this *Teacher's Guide*:

Unit 1

- Record results in a table or in written form.
- Plan and carry out a fair test.
- Use simple materials and equipment safely.

Unit 2

- Make observations using a magnifying glass.
- Record observations in written form.
- Measure out a volume of water.

Unit 3

- Make observations using a magnifying glass.
- Make comparisons.
- Record observations in written form.

Unit 4

- Use simple equipment to make measurements.
- Use measurements to draw a conclusion.

Unit 5

- Plan a fair test.
- Carry out a fair test.
- Make measurements.
- Compare data from different experiments.

Unit 6

- Follow instructions.
- Use simple materials and equipment safely.
- Record observations in written form.
- Use the observations from one investigation to explain the observations in another investigation.
- Explain observations using scientific knowledge and understanding.

Unit 7

- Follow instructions and perform an investigation safely.
- Make careful observations.
- Record observations in written form.
- Use scientific knowledge and understanding to explain observations.

Unit 8

- Use simple materials and equipment safely.
- Make measurements and observations.
- Evaluate the investigation and suggest improvements.

Unit 9

- Make predictions and test them.
- Plan a fair test.
- Compare conclusions with predictions.

Unit 10

- Make close observations.
- Record observations in written form.
- Make predictions and test them.
- Compare predictions with conclusions.

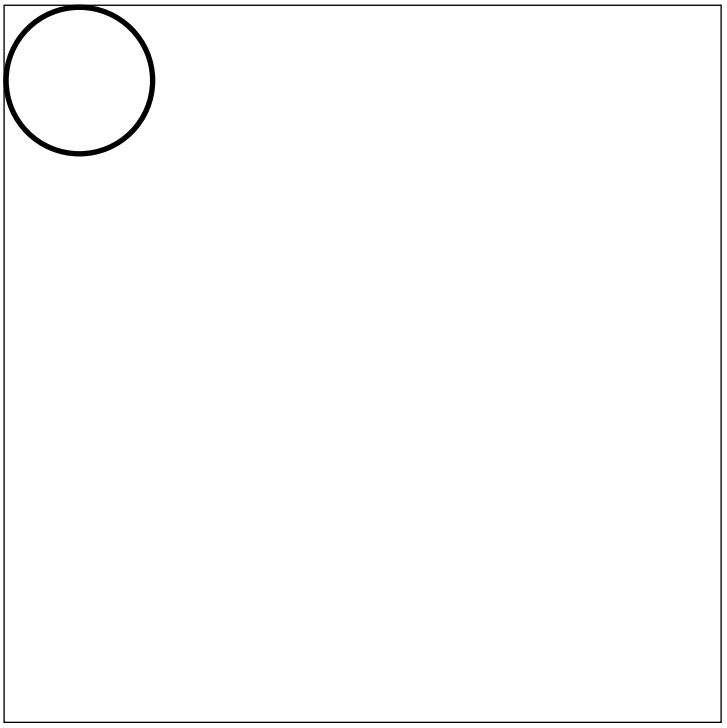
C 1

Name: ..... Form: .....

See **pages 4 and 5** of *Solids and liquids*

What is a solid?

A solid is made up of very tiny particles that hold together very strongly.



Q1. The square on the right is a piece of a solid, and the circle is one particle inside the solid. Draw in the other particles that make up the piece of solid.

Q2. Name three solid materials.

✎..... ✎..... ✎.....

Q3. The shape of some solids can be changed. What are these solids called?

✎.....

Q4. How can the shape of these solids be changed?

✎.....

Q5. What happens to some of the particles in a solid when it changes shape?

✎.....

✎.....

✎.....

Q6. How could you make a hard solid easier to shape?

✎.....

Teacher's sheet: comprehension

See **pages 4 and 5** of *Solids and liquids*

Answers

1. **The square should be filled with 25 circles. They should all be about the same size and each one should touch its neighbours.**
2. **Metal, clay, wood, paper, wool, margarine.**
3. **Flexible solids.**
4. **By pushing and pulling them.**
5. **Some of the particles unstick and this allows them to move past one another.**
6. **Warm it up.**

Complementary work

(a) Give the children some cotton wool, a piece of woollen fabric and a sponge. Tell them that they are made of solid materials and ask them to look at each one with a magnifying glass and draw the solid parts of the material. They should draw fibres of cotton wool, the pattern of yarn in the woollen fabric and the solid material between the holes in the sponge.

Teaching notes

The approach taken here is to introduce solids and liquids separately. This is done to introduce the children gradually to the concept of the three states of matter. These states are solids, liquids and gases. In this unit the aim is to take the children's knowledge of materials from earlier work and show how this relates to the solid state of matter.

In earlier work, the children may have come across the term particle as a tiny piece of solid that they can see. Here the term particle has a different meaning. It means a tiny piece of matter that can only be seen by very powerful microscopes called electron microscopes. Both meanings are correct, and the children should be aware of the distinction. It may help them to think of a particle of sand, that they can see, as being made up of millions of tiny particles that they cannot see.

Some children may be familiar with the words atoms and molecules. These are examples of the tiny unseen particles from which all three states of matter are made.

The children may have difficulty thinking of soft, flexible materials, like wool, as being solid. Make sure that they recognise these materials as solids by letting them try (a) in the complementary work.

C 1

Name: ..... **Form:** .....

Based on **pages 4 and 5** of *Solids and liquids*

Properties of solids

Try this...

1. Try to bend the following solids: metal wire, dry spaghetti, Plasticine, matchstick.

2. Record your results here.

3. Explain your results.

✎.....

✎.....

4. Plan an investigation to compare the strength of spaghetti and metal wire.

✎.....

✎.....

✎.....

✎.....

5. Show your plan to your teacher. If your teacher approves your plan, try it.

6. Record your results here.

Looking at the results.

7. What did your results show?

✎.....

Teacher's sheet: activity

Based on **pages 4 and 5** of *Solids and liquids*

Introducing the activity

(a) You could begin by reminding the children that all the materials they have studied in this unit can be put in one group, because they have one property in common. They all keep their shape unless they are pushed or pulled into a new shape. Materials with this property are called solids. Now challenge the children to see if different solids have different properties (see note (i)).

Using the sheet

(b) Give out the sheet, let the children fill in their names and form, then go through tasks 1 to 3 (see note (ii)).

(c) Let the children try tasks 1 to 3.

(d) Go through tasks 4 to 6.

(e) Let the children try tasks 4 to 6 (see note (iii)).

Completing the activity

(f) Let the children complete task 7 and compare their results (see note (iv)).

Conclusion

The metal wire and Plasticine bent because they are flexible. The dry spaghetti and matchstick snapped because they are brittle.

The spaghetti broke at a certain weight. The wire was much stronger and did not break. It bent when the weight became very heavy.

Teaching notes

(i) The purpose of this activity is to help the children see the materials they studied in previous years as belonging to the group called solids. It also allows them to use their knowledge and understanding of the properties of materials for assessment, and will help you plan your future work on this topic.

(ii) The children can record their results in a table or in written form. Look for the words flexible and brittle in their grouping of the materials, and in their explanation.

(iii) The spaghetti and wire should be placed between two blocks in turn and small weights hung from them. The number of weights can be added until the spaghetti snaps and the wire bends. You may wish the children to wear eye protection.

(iv) The accuracy of the results will depend on the size of the weights used. Children who use small weights will have a more accurate record of the strength of the spaghetti than children who use large weights.

C

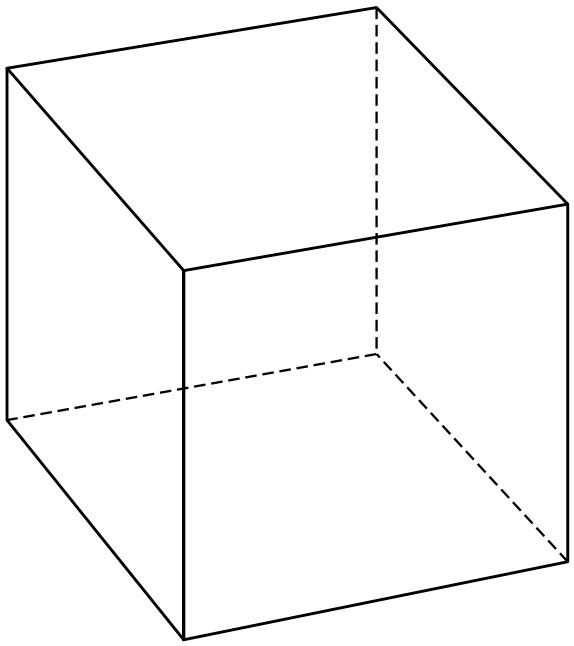
2

Name: ..... Form: .....

See **pages 6 and 7** of *Solids and liquids*

Crystals

Crystals show us how solids are made of particles packed in a regular way.



Q1. The diagram shows a crystal shape.

(a) What is the name of the shape?

✎.....

(b) Name a substance that has this crystal shape.

✎.....

Q2. What are snowflakes made from?

✎.....

Q3. What does a crystal need to grow?

✎.....

Q4. What do the crystals called gemstones form from?

✎.....

Q5. Name two gemstones.

✎..... ✎.....

Q6. What makes crystals form their special shapes?

✎.....

✎.....

Teacher's sheet: comprehension

See **pages 6 and 7** of *Solids and liquids*

Answers

1. **(a) A cube; (b) salt, sugar.**
2. **Ice crystals.**
3. **Room. A liquid which is turning into a solid very, very slowly.**
4. **Molten rock.**
5. **Diamond, emerald, ruby.**
6. **The way the particles inside the crystal are locked together in regular ways.**

Complementary work

(a) Let the children examine a mineral's hardness test set (available from educational suppliers). They can compare the hardness of the minerals and revise the previous year's work on hardness in *3C Properties of materials*.

(b) Let the children use secondary sources to find out about diamonds, emeralds, rubies and sapphires. If they study opal, they will find that it does not have a crystal form.

Teaching notes

Many solids have a crystalline structure. There are seven basic forms of crystal. The cube is one form. The rhombus and hexagon are two other forms. Rocks are made of different crystals which have grown into each other. This often results in the crystal shapes being impossible to see. Sometimes, as in granite, pink crystals of feldspar and black crystals of mica can be seen in a white mass of quartz crystal. If a crystal is broken, it breaks in a special way that is related to its form. Mica, for example, is a thin, flat crystal which splits to form more thin, flat crystals if it is broken.

The crystals seen in geological specimens or in gemstones have their special shapes because there was space for the crystals to form properly.

Metals also have a crystalline form, but often this cannot be seen. 'Fool's gold' is the mineral chalcopyrite. It contains copper, iron and sulphur. The crystal structure of zinc can be seen in its ore, and in the pure metal. Zinc ore is a mineral called sphalerite. It contains zinc and sulphur, and has a cubic form. You can see the boundaries between crystals of zinc on galvanised steel such as farm gates and buckets.

C 2

Name: ..... **Form:** .....

Based on **pages 6 and 7** of *Solids and liquids*

Looking at crystals

Try this...

1. Look at some sea salt and sugar crystals with a magnifying glass.

2. Describe how the crystals are (a) similar, (b) different.

(a) ✎.....

✎.....

(b) ✎.....

✎.....

3. Look at some Epsom salts with a magnifying glass.

4. How are the crystals different from sea salt and sugar crystals?

✎.....

✎.....

✎.....

5. Measure out 10cm^3 of water and put it in a small beaker.

6. Add one teaspoon of Epsom salts to the water in the beaker and stir well.

7. Dip a paint brush into the water in the beaker, then paint the water on part of the outside of a glass. Leave the water to dry for a few minutes.

8. Look at the side of the glass with a magnifying glass and describe what you see.

✎.....

✎.....

✎.....

9. What do you think has made the features you can see on the side of the glass?

✎.....

Teacher's sheet: activity

Based on **pages 6 and 7** of *Solids and liquids*

Introducing the activity

(a) Begin by telling the children that they are going to compare sea salt and sugar with Epsom salts. You can also tell them that they will have a chance to try and grow crystals in a few minutes (see note (i)).

Using the sheet

(b) Give out the sheet, let the children fill in their names and form, then go through tasks 1 to 4.

(c) Let the children work through tasks 1 to 4 (see note (ii)).

(d) Go through tasks 5 to 9, then let the children work through them (see note (iii)).

Completing the activity

(e) Let the children compare their descriptions.

Conclusion

Sugar and sea salt have a cubic crystal structure. Sugar crystals are larger than sea salt crystals.

Epsom salt crystals vary much more greatly in size. Some fragments are as small as sea salt crystals, others are larger than sugar crystals. They do not have a cube shape (see note (iv)).

When the water containing Epsom salts dries on the glass a white substance is formed which has lines in it. Some of the lines may form a structure like a fan.

The appearance of the substance on the side of the glass is due to the formation of crystals.

Teaching notes

(i) Epsom salts are made from a mineral called epsomite. This mineral rarely forms crystals naturally, but forms a crust on the walls of caves and mine workings. When Epsom salts are dissolved in water they make crystals readily when the water evaporates.

(ii) Make sure that granulated sugar is used.

(iii) A very small beaker or other container can be used. The brush needs to be painted across the side of a glass about six times. Drops of water can be allowed to flow down the glass. Just half the side of a glass tumbler can be used, or one side of a flat-sided jar (the crystals do not form well on a plastic surface). It may take half an hour for the crystals to form. They are best viewed by holding the jar above a black cloth and using a magnifying glass.

(iv) The crystals have a rhomboid form.

C

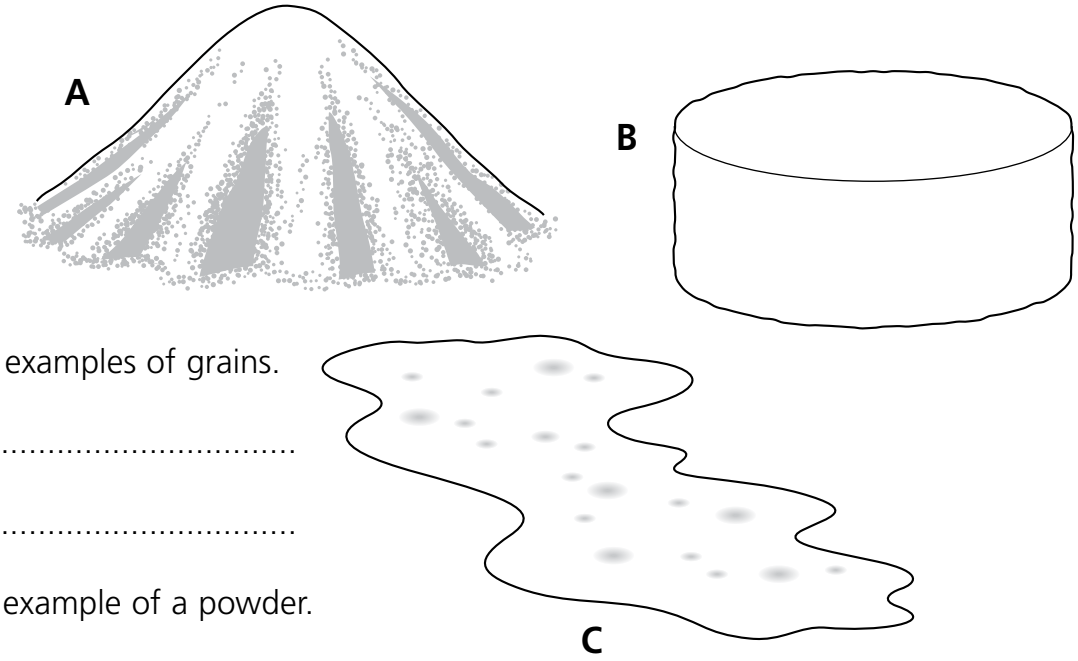
3

Name: ..... Form: .....

See **pages 8 and 9** of *Solids and liquids*

Grains and powders

Grains and powders are small pieces of solid. Because they are small, both grains and powders can move more easily.



Q1. Give two examples of grains.

✎.....

✎.....

Q2. Give one example of a powder.

✎.....

Q3. In the diagram above, A and B are two mixtures of flour and sugar. B has one more ingredient than A and this makes it hold together. What is this extra ingredient?

✎.....

Q4. Mixture C has the same ingredients as mixture B, but the proportion of one ingredient has been increased. What is it?

✎.....

Q5. How is a landslide caused?

✎.....

✎.....

✎.....

✎.....

✎.....

Teacher's sheet: comprehension

See **pages 8 and 9** of *Solids and liquids*

Answers

1. **Sand, rice, wheat.**
2. **Flour.**
3. **Water.**
4. **It has too much water. (The extra water has made the mixture lose its strength.)**
5. **A landslide forms on a hillside when the soil gets very wet. The very wet soil loses its strength and flows like a liquid down the side of the hill.**

Complementary work

(a) If you have used a sand timer in your introduction, you could challenge the children to make one. They could first draw out their design and discuss it with you. If the materials needed are within the resources of the school, and the children are able to handle the materials safely, you may let them make their timers and assess how accurate they are.

Teaching notes

In this unit the children can use the word particle to mean tiny pieces of solid that they can see. This can be used freely as there is no mention of the tiny particles from which all matter is made.

The children may think that a group of particles behaves exactly like a liquid. It does behave like a liquid in that the particles can flow and take up the shape of the container they are put in. However, when grains or powders are poured into a container, they do not form a level surface, but a cone. If the container is gently shaken the cone will be destroyed and the surface will become level. When the container is tipped, the particles will move, but their surface may not form a horizontal surface, as when liquid is tipped in a container. (You may like to leave this property until the next unit, where the tipping of water in a container is featured.) A further difference between groups of solid particles and liquids is that the groups of solid particles do not form drops when they are poured.

3

Name: ..... Form: .....

Based on **pages 8 and 9** of *Solids and liquids*

Looking at grains and powders

Try this...

1. Pour some rice into a bowl. Look at how it settles in the bowl.

2. Add a little water to the rice and stir it in. Pick up some of the rice and push it together.

3. Add much more water and stir it in. Put your hand into the mixture and take it out again.

4. Write down your observations about rice.

✎.....

✎.....

5. Repeat steps 1 to 3 with sand, then write your observations about sand here.

✎.....

✎.....

6. Repeat steps 1 to 3 with flour, then write your observations about flour here.

✎.....

✎.....

7. Repeat step 1 with cornflour.

8. Ask your teacher for a cornflour and water mixture and examine it.

9. Add more water to the mixture and examine it.

10. Write down your observations about cornflour.

✎.....

✎.....

Teacher's sheet: activity

Based on **pages 8 and 9** of *Solids and liquids*

Introducing the activity

(a) Introduce this activity to the children after they have studied the section on the effect of water on pages 8 and 9 of the pupil's book.

Using the sheet

(b) Give out the sheet and let the children fill in their name and form, then go through tasks 1 to 4 (see note (i)).

(c) Let the children perform tasks 1 to 4.

(d) Go through tasks 5 and 6 with the children, then let the children try them.

(e) Go through tasks 7 to 10 with the children, then let the children try them (see note (ii)).

Completing the activity

(f) Let the children compare their observations.

Conclusion

All the substances form a cone when they are poured.

Rice grains stick together with a little water, but separate almost completely when more water is added.

Sand grains stick together with a little water and can be made into a wider variety of shapes than rice. When more water is added, the sand grains may flow together at the bottom of the bowl.

When a little water is added to flour, it makes a sticky dough. When more water is added, the dough becomes slimy and breaks up.

When the cornflour is mixed with a little water, it forms a liquid, but if you press the mixture it turns into a solid. When more water is added, the cornflour forms a creamy liquid.

Teaching notes

(i) This activity is potentially messy, so it is important for all the children to perform all the tasks at the same time and to clear up between the examination of each substance. Depending on the ability and attitude of the children, you may like to pour out the grains, powders and water for them.

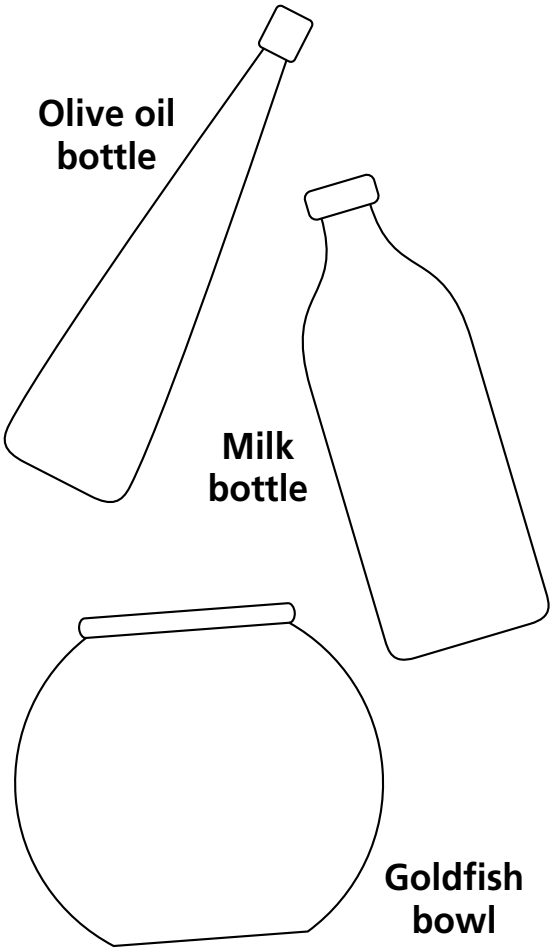
(ii) If you make a mixture of 20cm^3 of water and four teaspoons of cornflour, you should produce a substance which flows slowly in the bowl but turns into a solid when you put your fingers in it to pick it up. When you pick up a solid lump and hold it in your hand it will turn back to liquid and flows through your fingers. Squeezing and pulling will make the substance turn back to a solid. You may have to add a little more cornflour or water to your mixture to make it exhibit these unusual properties. You should practice making a successful mixture before you make a mixture in class.

Name: ..... Form: .....

See **pages 10 and 11** of *Solids and liquids*

What is a liquid?

Liquids have no strength of their own and take the shape of the container that holds them.



Q1. Each of these containers is half full of water. Draw a line in each one to show the water surface.

Q2. How can you turn a solid into a liquid?

✎.....

✎.....

Q3. How can you turn a liquid into a solid?

✎.....

✎.....

Q4. A liquid is poured into a cube-shaped container. What shape does the liquid become? ✎.....

Q5. The liquid is now poured from the cube-shaped container into a globe-shaped container. What happens to the liquid?

✎.....

✎.....

Q6. Two syringes are connected to each other by a plastic pipe. One syringe, and the pipe, are filled with water. The other syringe has its piston pushed in so it does not contain any water. When you push on the piston of the water-filled syringe, the piston of the other syringe moves out. Why does this happen?

✎.....

✎.....

✎.....

✎.....

Teacher's sheet: comprehension

See **pages 10 and 11** of *Solids and liquids*

Answers

1. **All the lines in the containers should be horizontal.**
2. **By heating it until it melts.**
3. **By cooling it until it freezes.**
4. **Cube-shaped.**
5. **It changes its shape and becomes globe-shaped.**
6. **The water moves from one syringe through the pipe to the other syringe. It does this because a liquid cannot be squashed.**

Complementary work

(a) Let the children use secondary sources to find out about water clocks.

(b) From their research on water clocks, let the children design a water clock. If the materials can be easily provided and the children have the ability, let them make their water clocks and test their accuracy. You could use this activity as part of a technology project or a history project.

Teaching notes

This unit forms the bridge between solids and liquids. You may like to revise the properties of solids at some point in your introduction, then move on to show how liquids are different.

The unit also gives you an opportunity to revise the children's ideas on heating and cooling from earlier in their school work. It will also prepare them for later studies on changes.

Here the main focus is on comparing the solid state and liquid state, so it is sufficient to keep your work to the study of wax and water. In the following unit you can introduce a range of liquids.

You may like to demonstrate the activity in Picture 1, or show the children a candle with wax running down its sides and ask them to explain why the wax has set again lower down the candle.

You may also like the children to tip a container carefully and see how the water surface always stays horizontal. You could compare tipping a container of sand to show how a group of solid particles move when they are tipped.

A weight may be placed on a wooden block, and on a balloon containing water, to show how both give support because they cannot be squashed.

When the study of the unit is almost over, show the children the two balloons you used in the introduction. They should find that they appear and feel the same because the balloon that was frozen has thawed out.

Name: ..... Form: .....

Based on **pages 10 and 11** of *Solids and liquids*

Investigating volume

Try this...

1. Collect four different containers and a measuring cylinder.

2. Label each container A to D.

3. Measure out a volume of water using the measuring cylinder.

4. Write down the volume here ✎.....

5. Pour the water into container A.

6. Mark the water level on the side of the container.

7. Pour the water from the container into the measuring cylinder.

8. Find the volume of the water in the measuring cylinder and write it down in the table.

Container	Volume of water in container (cm^3)
A	
B	
C	
D	

9. Repeat steps 5 to 8 with container B.

10. Repeat steps 5 to 8 with container C.

11. Repeat steps 5 to 8 with container D.

Looking at the results.

12. What did your results show?

✎.....

Teacher's sheet: activity

Based on **pages 10 and 11** of *Solids and liquids*

Introducing the activity

(a) Show the children a collection of containers. Pick up two containers (use two that are very different, such as a bottle and a tray) and mime pouring a liquid from one container to the other. Ask the children if they think the volume of the liquid could change when it moves from one container to another. Ask them how they could check.

Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through tasks 1 and 2 (see note (i)).

(c) Let the children perform tasks 1 and 2.

(d) Go through tasks 3 to 8 with the children.

(e) Let the children perform tasks 3 to 8.

(f) Check that the children have successfully completed tasks 3 to 8, then let them try tasks 9 to 11.

Completing the activity

(g) Let the children complete task 12 (see note (ii)).

(h) Let the children compare their results.

Conclusion

The volume of the water does not change when it is placed in containers with different shapes. The level of the water in the container changes from one container to the next. In a tall, thin container the water level is high. In a broad, shallow container the water level is low.

Teaching notes

(i) The children could stick labels on the containers or write on them in marker pens.

(ii) The volume may appear to fall slightly as the investigation progresses. This could happen if drops of water are left on the insides of the container after the liquid has been poured back into the measuring cylinder. The children could check their results by pouring a certain volume into each container then pouring it back, rather than using the same water throughout the investigation.

You may wish to point out that, although the volume stays the same, the water level may vary widely due to the shape of the containers. This change in water level may lead some children to think that the volume has changed.

Name: ..... Form: .....

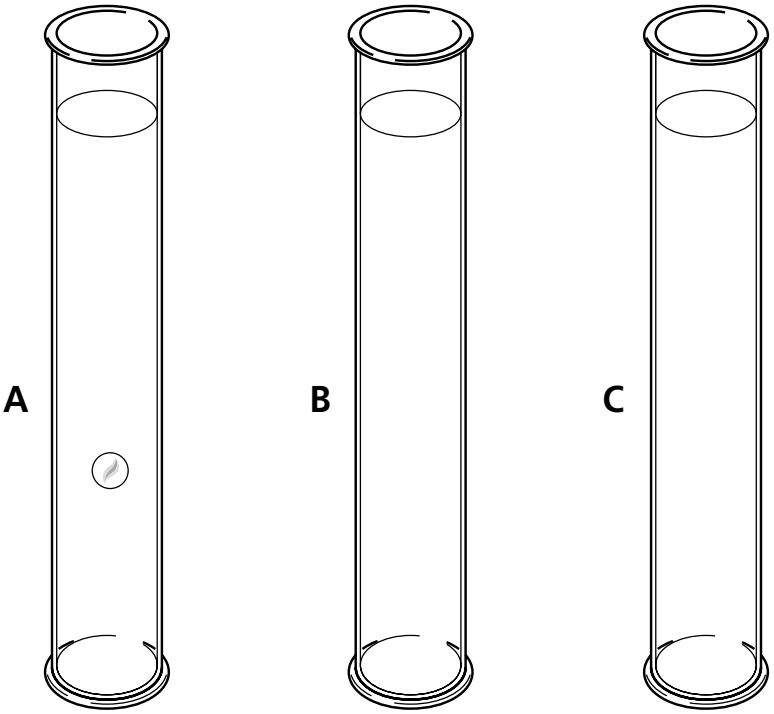
See **pages 12 and 13** of *Solids and liquids*

Runny liquids

Some liquids are runnier than others, but most can be made more runny by being warmed.

Q1. Jar A contains a liquid at the same temperature as the room. A marble is sinking in it. Jar B contains more of the same liquid, but it is hotter. A marble was dropped into this liquid at the same time as the one in jar A. Put an X in Jar B where you think the marble would be.

Q2. In jar C is more of the same liquid, but it is very cold. A marble was dropped into this liquid at the same time as the one in jar A. Put an X in Jar C where you think the marble would be.



Q3. The marbles were dropped in at the same time to make the test fair. State another way in which the test could be made fair.

✎.....

✎.....

Q4. If you tipped some water and some oil down a ramp, which liquid would get to the bottom first? Explain your answer.

✎.....

Q5. Where does lava come from?

✎.....

Q6. How does lava change as it flows?

✎.....

✎.....

Teacher's sheet: comprehension

See **pages 12 and 13** of *Solids and liquids*

Answers

1. **The X should be lower than the marble in jar A.**
2. **The X should be higher than the marble in jar A.**
3. **Ensure all the marbles were the same size. Have the same volume of liquid in each jar.**
4. **Water. It is runnier than oil.**
5. **From under the ground when a volcano erupts.**
6. **It changes from hot to cold, red to black, runny to sticky, liquid to solid.**

Complementary work

(a) The children can use secondary sources to find out which volcanoes are active today.

(b) The children can use secondary sources to find out about large eruptions of volcanoes in the past.

Teaching notes

The runniness or 'stickiness' of a liquid is known as its viscosity. Viscosity is an important property of oil that is used in machinery. If the oil is too viscous, it will not coat the moving parts and protect them from the effects of friction. As different machines work at different temperatures, so oils are designed to provide the correct viscosity for them. You may like to try the activity on the following pages with warm and cold syrup, or treacle.

C

5

Name: ..... Form: .....

Based on **pages 12 and 13** of *Solids and liquids*

Comparing tests

Try this...

1. Make a plan to test the runniness of two liquids.

✎.....

✎.....

✎.....

2. Make a table in which to record your results.

3. Show your plan and table to your teacher. If your teacher approves, try your test.

4. Make a plan to test how objects sink through two liquids.

✎.....

✎.....

✎.....

5. Make a table in which to record your results.

6. Show your plan and table to your teacher. If your teacher approves, try your test.

Looking at the results.

7. How do the results from the two tests compare?

✎.....

Teacher's sheet: activity

Based on **pages 12 and 13** of *Solids and liquids*

Introducing the activity

(a) Begin by telling the children that when scientists are trying to make discoveries, they try to find different experiments to test the same thing. The runniness of a liquid, or the speed at which objects sink in it, both test the 'stickiness' of the liquid. Challenge the children to try both tests and see if they produce the same results.

Using the sheet

(b) Give out the sheet, let the children fill in their names and form, and go through tasks 1 to 3.

(c) Let the children carry out tasks 1 to 3.

(d) If the children's plans are acceptable, let them try their tests (see note (i)).

(e) Go through tasks 4 to 6, then let the children carry them out.

(f) If the children's plans are acceptable, let them try their tests (see note (ii)).

Completing the activity

(g) Let the children try task 7.

(h) Ask the children how they could make more certain of their conclusion. Look for the answer that they should try more liquids. If time permits let them try two more liquids.

Conclusion

The 'stickiness' of a liquid can be found by testing for runniness, or for testing how quickly objects sink in them. The results of one test are confirmed by the other test.

Teaching notes

(i) A ramp should be made with a board or tray and wooden blocks. The same amount of liquid should be poured from the top of the ramp, and the time taken for it to reach the bottom, or a certain distance, should be recorded. The test could be repeated. The table should have two or more columns. The first column is headed 'Liquids'. The second column is headed 'Time to flow (secs)'. If the test is repeated, the second and subsequent columns may be headed 'Trial 1', 'Trial 2', etc. Some children may need reminding that they need a stop clock.

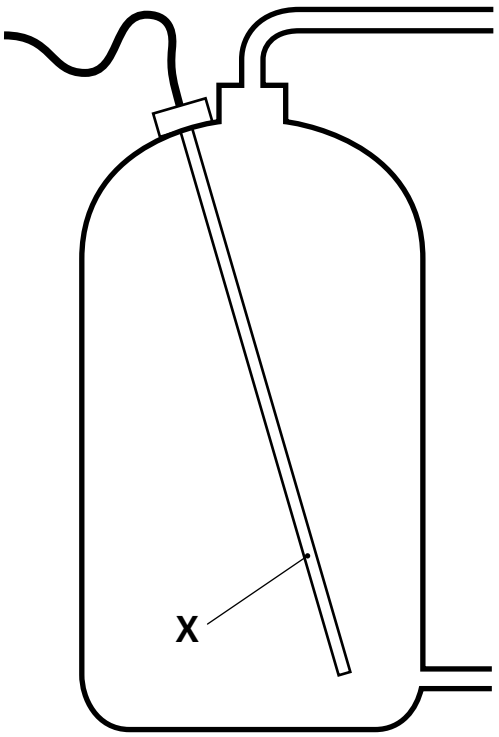
(ii) The same amount of liquid should be used for both tests. The object should be dropped from the same height above the liquid surface. If there is sufficient equipment, both liquids could be compared at the same time. If there is not enough equipment, one liquid can be tested after the other. The table should have two or more columns. The first column is headed 'Liquids'. The second column is headed 'Time to sink (secs)'. If the test is repeated, the second and subsequent columns may be headed 'Trial 1', 'Trial 2', etc.

Name: ..... Form: .....

See **pages 14 and 15** of *Solids and liquids*

Hot liquids rise, cold liquids sink

When a liquid becomes warm, it gets lighter and rises; when it cools it becomes heavier and sinks.



Q1. What is the purpose of the electrical appliance in the diagram?

✎.....

✎.....

Q2. Draw arrows to show the path of water through the pipes and tank.

Q3. Shade in the part where the water is the coldest.

Q4. What is the part labelled X?

✎.....

Q5. When does a liquid (a) swell up, (b) shrink?

(a) ✎.....

(b) ✎.....

Q6. When water swells up, does it rise or sink? ✎.....

Q7. Explain your answer to question 5.

✎.....

✎.....

✎.....

✎.....

✎.....

✎.....

✎.....

Teacher's sheet: comprehension

See **pages 14 and 15** of *Solids and liquids*

Answers

1. **To provide warm water for the home.**
2. **Near the lower pipe should be an arrow pointing to the left. Inside the tank there should be arrows pointing upwards. An arrow pointing to the right should be by the top pipe.**
3. **The bottom of the tank should be shaded.**
4. **A rod-shaped heater.**
5. **(a) When it is warm, (b) when it is cold.**
6. **It rises.**
7. **The water takes up more space, but still weighs the same. This makes it lighter than the surrounding water, so it rises. The particles in the warm water spread out and make the warm water less dense than the surrounding water. The less dense water rises.**

Complementary work

(a) The children could use secondary sources to find out about cold water systems and hot water systems in a home.

Teaching notes

The terms 'less dense' and 'more dense' are introduced in this unit. The children may have already come across the word 'dense' in other contexts. Here it should be clearly linked to the amount of matter in a certain space. When a material swells up, it still has the same amount of matter, but it is spread out over a greater volume. If you were to take a sample of the material in its expanded form you would find that it weighed less than a sample of the same volume in its unexpanded form, simply because it has fewer particles of matter in it.

The density of a material is a measure of the amount of matter in a certain volume of it. The weight of a substance is a measure of its mass. The density of a substance is found by measuring the mass of a substance and dividing it by the volume of the substance. The children do not need to know about density at this level, but you may feel that using the terms less dense and more dense in your explanations may help their vocabulary.

Children may be puzzled that warm water rises to the surface, because it is at the surface where ice forms. Water is an unusual liquid in that its density does not increase as it freezes, at 0°C. Water is densest at 4°C. Below this temperature, the water begins to expand again and become less dense. This explains why ice forms on the surface of pools and not at the bottom of them. When water freezes, it expands more and becomes less dense than the water from which it formed. This means that ice floats on water instead of sinking.

6

Name: ..... Form: .....

Based on **pages 14 and 15** of *Solids and liquids*

Rising and sinking water

Try this…

1. Use a piece of string to tie a loop around the neck of a very small jar.

2. Fill a larger jar with cold water.

3. Pour warm water into the very small jar until it almost reaches the top.

4. Add a few drops of food colouring to the warm water.

5. Hold the small jar up by its string and wait for it to stop turning.

6. Lower the small jar into the jar of cold water and watch for the movement of the dye.

7. Describe how the dye moved.

✎.....

✎.....

8. Fill a jar with warm water.

9. Put an ice cube containing food colouring in the water.

10. Watch for the movement of the dye.

11. Describe how the dye moved.

✎.....

✎.....

12. Stir a small amount of talc into a jar of warm water. When the water has stopped moving, add an ice cube.

13. What changes do you see in the water? Explain your answer.

✎.....

✎.....

✎.....

Teacher's sheet: activity

Based on **pages 14 and 15** of *Solids and liquids*

Introducing the activity

(a) Ask the children how they could get some warm water to the bottom of a jar of cold water. Let them try and think of complicated methods, then suggest that they might just lower some warm water in a small jar. Some children may think that this is too simple, so challenge them to try it by doing this activity.

Using the sheet

(b) Give the children the sheet, let them write their names and form on it, then go through tasks 1 to 7 with them (see note (i)).

(c) Let the children carry out tasks 1 to 7.

(d) Go through tasks 8 to 11 with the children.

(e) Let the children carry out tasks 8 to 11.

(f) Go through tasks 12 and 13, then let the children carry them out (see note (ii)).

Completing the activity

(g) Let the children compare their observations and explanations.

Conclusion

Warm water that is sunk into cold water in a small jar rises to the surface.

Cold water from an ice cube sinks through warm water. If there are particles in the warm water, the path of the sinking cold water can be seen, from the way it moves the particles.

Teaching notes

(i) This works well if the jars of cold water have been put in a fridge for an hour. If you do this, the children will have to rub the condensation off as they look through the side of the jar. The children should put a piece of white paper behind the jar so that they can see the movement of the dye more clearly.

(ii) Only a tiny amount of talc is needed. It should just make the water cloudy. If too much is used, the ice cube and the sinking current of water will not be seen.

In tasks 8 to 11, the movement of the cold water is seen because of the dye it contains. In this activity, the movement of cold water is seen indirectly through its action on particles suspended in the water.

Name: ..... Form: .....

See **pages 16 and 17** of *Solids and liquids*

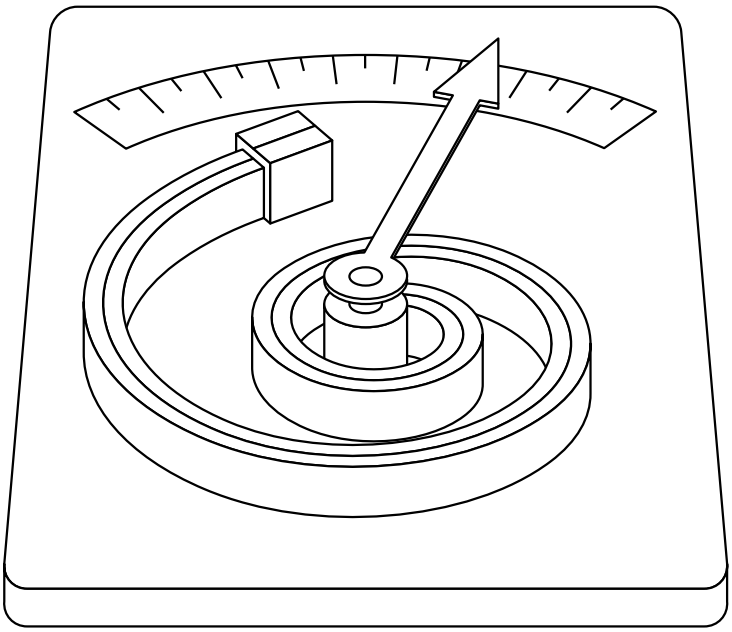
Swelling and shrinking

Both solids and liquids change in size as they become hotter and colder.

Q1. Does the coiled strip curl or uncurl when it gets hotter?

✎.....

Q2. Name two metals that are used in strips like the one in the diagram.



✎.....

✎.....

Q3. A bottle completely full of water has a straw sticking through its cork and into the water. What happens when the bottle is put in a bowl of hot water?

✎.....

Q4. Explain your answer to question 3.

✎.....

Q5. 'Expand' and 'contract' are two words that describe how materials behave.

(a) What does expand mean, and when do materials expand?

✎.....

✎.....

✎.....

(b) What does contract mean, and when do materials contract?

✎.....

✎.....

✎.....

Teacher's sheet: comprehension

See **pages 16 and 17** of *Solids and liquids*

Answers

1. **It uncurls.**
2. **Steel and brass.**
3. **Water rises up the straw.**
4. **The water in the bottle swells up.**
5. **(a) Expand means become larger, or swell. Materials expand when they become hotter.**

   (b) Contract means become smaller, or shrink. Materials contract when they become cooler.

Complementary work

(a) Let the children use secondary sources to find out how large metal bridges are kept from expanding and buckling in hot weather.

Teaching notes

This unit provides you with a further opportunity to compare solids and liquids. The children may have come across expansion before in their study of rocks and soils (*3D Rocks and soil*). Rocks are made to crumble by the way water expands when it freezes. The water trapped in cracks in rocks forms ice. This presses on the rock and makes it crack.

Water is unusual in that it expands when it freezes. You could also use photographs of milk bottles in winter, which show the frozen milk pushing out of the top of the bottle, to make this point.

The introduction on page 12 of this guide mentions expansion and contraction in thermometers, and relates this to the children's work on weather earlier in their school life. In *4C Keeping warm and cool*, thermometers are studied in much greater detail. You may use this unit as an introduction to the study of thermometers or for revision after thermometers have been studied.

Children are aware of air, but do not study it formally until *5C Gases around us*. Although the main focus of the practical activity is on how water expands when heated, a simple study of air is also included. This study is very striking, as the warm air makes the balloon stand up and helps the children to remember that air is a substance, and prepares them for future work on gases.

7

Name: ..... Form: .....

Based on **pages 16 and 17** of *Solids and liquids*

When substances get warm

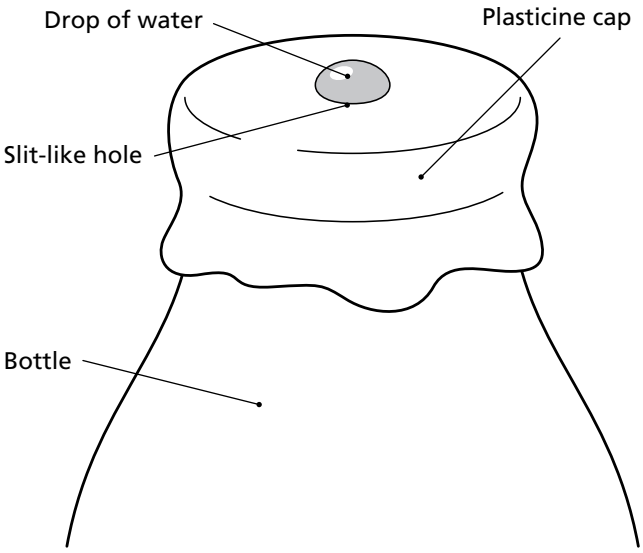
Try this…

1. Fill a bottle with cold water.

2. Use Plasticine to make a cap over the top of the bottle. Fit the cap tightly and make a small hole in its centre.

3. Press down on the cap very gently until a small drop of water appears on the cap.

4. Predict what may happen to the water on the cap when you put the bottle into a bowl of hot water.



✎.....

5. Put the bottle into a bowl of hot water and watch the drop of water on the cap.

6. Describe any change you see in the water drop.

✎.....

7. Explain the change you saw in the water drop.

✎.....

✎.....

8. Empty the bottle and let it cool, then put a balloon over its neck.

9. Put the bottle in a bowl of hot water and watch the balloon.

10. Describe how the balloon changed.

✎.....

11. Why did the balloon change?

✎.....

✎.....

Teacher's sheet: activity

Based on **pages 16 and 17** of *Solids and liquids*

Introducing the activity

(a) Look at the bottle thermometer on page 16 with the children. Tell them that it is quite difficult to make a hole in a cork for a straw, but there is a very simple way to see if water will expand when it is warm.

Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through tasks 1 and 2 (see note (i)).

(c) Let the children try tasks 1 and 2.

(d) Go through tasks 3 and 4, then let the children try them (see note (ii)).

(e) Go through tasks 5 to 7, then let the children try them (see note (iii)).

(f) Go through tasks 8 to 11, then let the children try them (see note (iv)).

Completing the activity

(g) Let the children compare their results and explanations.

Conclusion

When a bottle of cold water is placed in hot water, it warms up and the water inside expands. The drop on the Plasticine top of the bottle becomes larger due to the water expanding and pushing out of the hole.

When a bottle of cool air is placed in a bowl of hot water, the air warms up and expands. It pushes its way into the balloon that is attached to the top. The expansion of the air makes the balloon inflate and stand up.

Teaching notes

(i) Check your school policies on the use of glass with children before you include this activity in your plans. This experiment works with glass and not plastic because glass does not expand or soften. It may help if you make a cap to show the children how it is done. The seal should be water tight, but you do not have to test it by turning it upside down. The hole can be made with a paper clip.

(ii) The children should push down very gently so that just a small drop appears. They must not push hard as this will release too much water and probably break the seal around the neck.

(iii) Use hot water in accordance with your school policies. The bottle should be immersed up to its lower neck.

(iv) You may wish to put the balloons on the bottles for the children. The bottles should be immersed to the same depth of water as in the first part of the activity. They will have to be held down in the water, otherwise they will float.

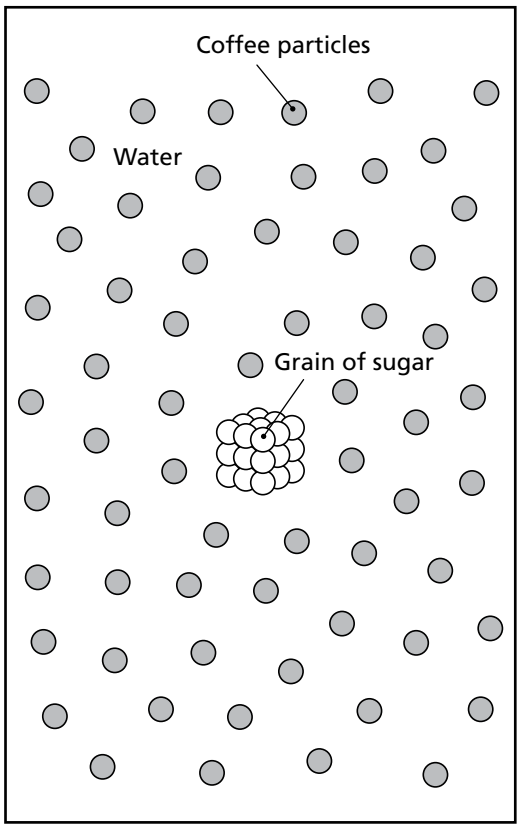
8

Name: ..... Form: .....

See **pages 18 and 19** of *Solids and liquids*

Mixtures

When you mix some materials together, they do not change, and so you can sometimes separate them out again.



Q1. The diagram shows particles of coffee in water. A grain of sugar is added. In the box below right, draw how the sugar particles are arranged when the sugar has dissolved.

Q2. Name two liquids that can be mixed.

✎.....

✎.....

Q3. How do you mix flour grains and sugar crystals?

✎.....

Q4. What is the word for a clear liquid mixture?

✎.....

Q5. What is the process in which a solid mixes with a liquid and disappears into it?

✎.....

Q6. (i) Is there a limit to how much solid you can

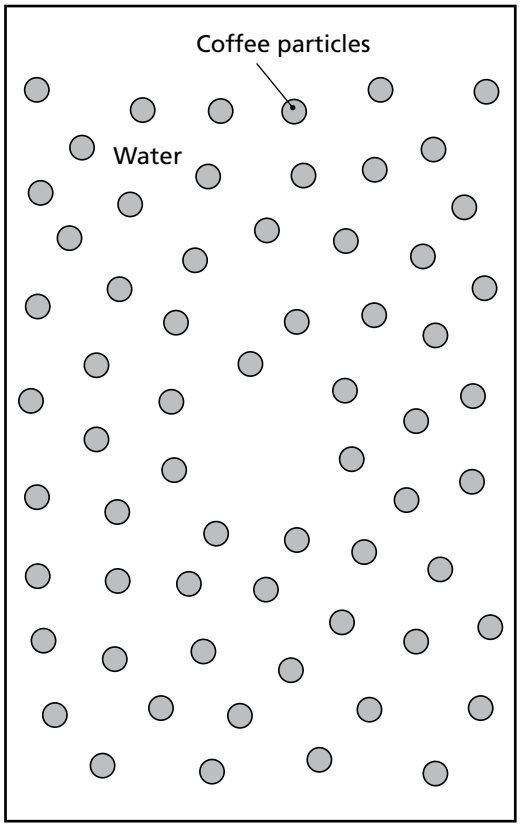
(a) mix with another solid? ✎.....

(b) mix with a liquid? ✎.....

(ii) How can you tell when the limit is reached?

✎.....

✎.....



Teacher's sheet: comprehension

See **pages 18 and 19** of *Solids and liquids*

Answers

1. **The particles of sugar should be drawn completely mixed with the particles of coffee and no cube left.**
2. **Water and orange juice, etc.**
3. **By stirring them together.**
4. **Solution.**
5. **Dissolving.**
6. **(i) (a) no; (b) yes. (ii) The undissolved solid stays at the bottom of the liquid.**

Complementary work

(a) The children can use secondary sources to find out about the ingredients in bread, cakes and biscuits. They could look at the ingredients in recipes from around the world.

Teaching notes

This unit introduces the children to the mixing of materials. It is important to stress that the properties of the materials in a mixture do not change just because they are mixed together. You could emphasise this by picking pieces out of the muesli you made earlier, and showing the children that they are just like some other pieces that you have not put in the mixture.

A mixture is a simple combination of materials. It may be made in preparation for making a new material. For example, the mixture in a cake mix can be separated but, after heating, a new material forms and the original materials cannot be separated. The heat has made the materials in the mixture undergo a change, which has bound them together in such a way that a new material is made. The new material has properties that are different from those of the materials in the mixture.

The term solution is introduced here as related to the mixing of liquids. This is done for simplicity, but in the next unit, liquids which do not mix are introduced.

The term dissolving is introduced here in relation to a solid dissolving in a liquid. It is important to remember that all three states of matter – solids, liquids and gases, dissolve in liquids and form solutions. A solution has two parts. They are the solvent and the solute. The solvent is the liquid that dissolves the material, and the solute is the material that is dissolved. The children do not need to know these terms but they may have encountered the word solvent before.

Name: ..... Form: .....

Based on **pages 18 and 19** of *Solids and liquids*

Comparing how salt and sugar dissolve

Try this…

Dissolving salt

1. Measure out a volume of water and put it in a jar.

2. Add a level spoonful of salt to the water and stir it in.

3. Put the jar over a piece of black paper and look for undissolved crystals in the bottom of the jar.

4. If there are no undissolved crystals, repeat steps 2 and 3 until you see undissolved crystals at the bottom of the jar.

5. Write down the number of spoonfuls of salt you added before no more salt would dissolve. ✎.....

Dissolving sugar

6. Measure out the same volume of water as in step 1 and put it in a jar.

7. Add a level spoonful of sugar to the water and stir it in.

8. Put the jar on a piece of black paper and look for undissolved crystals in the bottom of the jar.

9. If there are no undissolved crystals, repeat steps 7 and 8 until you see undissolved crystals at the bottom of the jar.

10. Write down the number of spoonfuls of sugar you added before no more sugar would dissolve. ✎.....

Looking at your results.

11. What do your results show?

✎.....

12. How could you make the investigation more accurate?

✎.....

Teacher's sheet: activity

Based on **pages 18 and 19** of *Solids and liquids*

Introducing the activity

(a) Begin by asking how many people like to put sugar in their tea and coffee. Ask them about how much sugar other people in their home use. Ask the children to describe what happens to the sugar when they put it in their drinks (see note (i)).

Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through tasks 1 to 5 (see note (ii)).

(c) Let the children perform tasks 1 to 5.

(d) Check that the children have successfully completed tasks 1 to 5, and kept their table tidy, before letting them move on to tasks 6 to 10.

Completing the activity

(e) Let the children try tasks 11 and 12 (see note (iii)).

Conclusion

More sugar than salt dissolves in a given volume of water. Sugar is more soluble in water than salt is.

Teaching notes

(i) You may digress to talk about the effect of sugar on health, or remind the children to ask you about it at another time. In the description of sugar dissolving, watch for the children using the word 'melting', and correct this misconception.

(ii) Tell the children to use less than 75cm^3. This will require about four spoonfuls of salt and seven or more of sugar. Ask the children why they must use the black paper, and look for an answer which implies that the white crystals can be seen most easily against a black background.

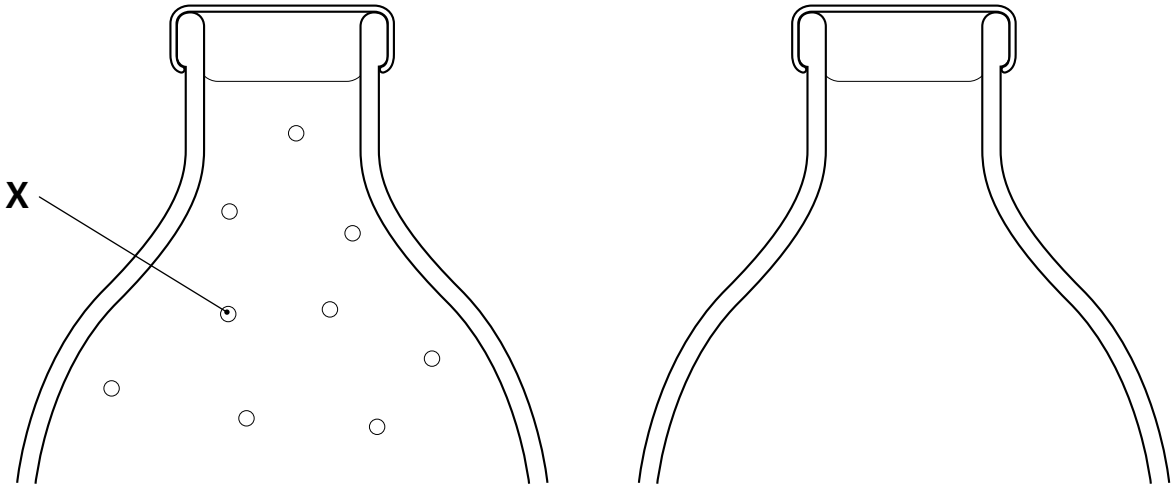
(iii) The investigation can be made more accurate by making sure that the two samples of water are at the same temperature, and that the experiment is repeated twice more to check the results.

Name: ..... Form: .....

See **pages 20 and 21** of *Solids and liquids*

Soluble and insoluble

Some liquids and solids seem to disappear in other liquids. These are called soluble substances. Not all substances are soluble.



Q1. (i) The diagram above shows some milk that has just been put in a bottle. What are the parts of the milk labelled X?

✎.....

(ii) In the second bottle, draw how the milk will appear after it has been left to stand for a while.

(iii) What is the substance you have drawn in the bottle? ✎.....

Q2. Name another substance, besides sugar, that dissolves in water.

✎.....

Q3. What is the name of the solution that is used to help plants grow?

✎.....

Q4. What is the name given to a material that does not dissolve?

✎.....

Q5. Name four substances that do not dissolve in water.

✎..... ✎.....

✎..... ✎.....

Teacher's sheet: comprehension

See **pages 20 and 21** of *Solids and liquids*

Answers

1. **(i) fat globules; (ii) the neck of the bottle is full of fat globules; (iii) cream.**
2. **Salt, etc.**
3. **Liquid fertiliser.**
4. **Insoluble.**
5. **Soil, fat, metals, pottery, glass, greasy substances.**

Complementary work

(a) The children can use secondary sources to find out how paints are made. They could find out about how early people made paints, and how paints are made today.

Teaching notes

In the previous unit, the concept of mixtures was introduced. This unit examines how solids and liquids may or may not mix, and introduces the terms soluble and insoluble. It is important to note that when insoluble particles are mixed with a liquid they may behave in one of two ways. If the particles are very small, they may remain suspended in the liquid for some time, perhaps up to a day or more. These particles form a suspension in the liquid. When soil is mixed with water, for example, any clay present forms a suspension. If the particles are quite large, they sink to the bottom of the liquid and form a sediment. Sand grains in a soil, for example, form a sediment when the soil is mixed with water.

9

Name: ..... Form: .....

Based on **pages 20 and 21** of *Solids and liquids*

Which substances are soluble in water?

Try this…

1. Make a collection of substances to test.

2. Fill in the first column of the table.

Substance	Prediction	Result

3. Predict whether each substance is soluble or insoluble in water, and record your predictions in the second column of the table.

4. Plan how you will test your prediction here.

✎.....

✎.....

✎.....

5. Show your teacher your plan, then try it if your teacher agrees.

Looking at your results.

6. How accurate were your predictions?

✎.....

Teacher's sheet: activity

Based on **pages 20 and 21** of *Solids and liquids*

Introducing the activity

(a) Ask the children to define the terms soluble and insoluble. Ask how they could tell if a substance was soluble or insoluble in water (see note (i)).

Using the sheet

(b) Give out the sheet and let the children fill in their names and form, then go through tasks 1 to 3 (see note (ii)).

(c) Let the children try tasks 4 and 5 (see note (iii)).

Completing the lesson

(d) Let the children compare their results.

(e) You may like to ask the children to test tea leaves and plaster of Paris (see note (iv)).

Conclusion

Some substances are soluble in water and some substances are insoluble in water.

Teaching notes

(i) As soluble and insoluble are new terms, it is important to make sure that the children know what they mean and how to apply them.

(ii) Instead of making a collection on their table, you may want the children to test each one in turn by taking a small sample from your table when they need it. The collection could include these soluble substances: bath salts, bicarbonate of soda, Epsom salts, coffee grains; and these insoluble substances: sand, chalk, aluminium foil, marble chip, metal paper clip, plastic paper clip.

(iii) The plan should mention using the same size sample of each substance. A different sample of water must be used for each test, but the volume of the water sample must be the same in all tests. Each substance must be stirred in the water for the same amount of time.

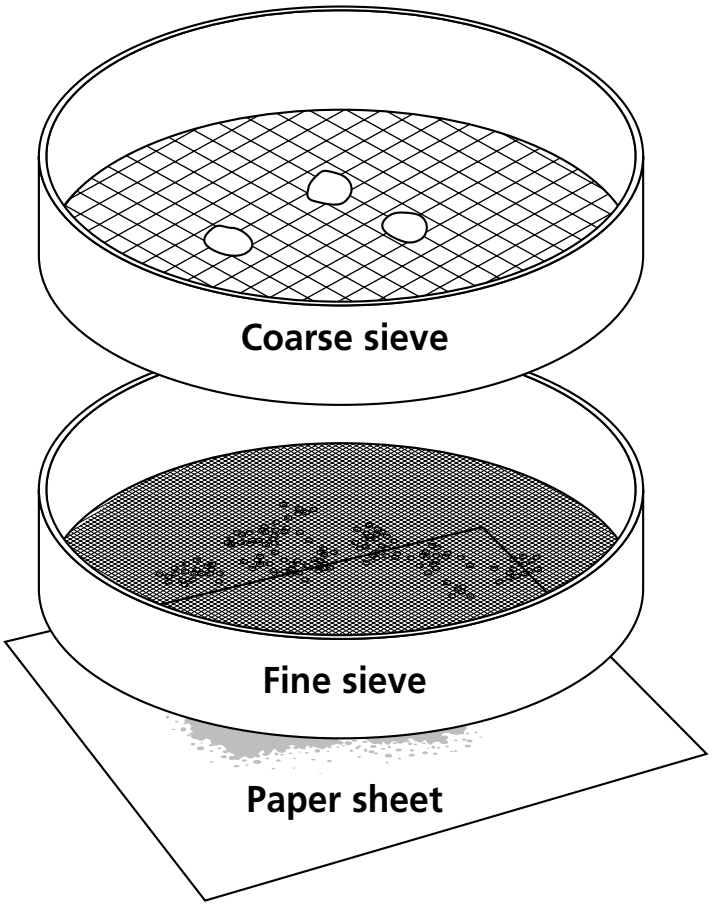
(iv) The children will discover that part of the tea leaf is soluble – it dissolves in the water and colours it – and part is insoluble. When scientists perform experiments, they sometimes encounter something which does not fit in with their plans or theories, and a new discovery may be made. You could give the children a sense of this by letting them test plaster of Paris. Try the test beforehand so that only a small amount of powder and water are used and a solid can be made. You may feel it is appropriate for the children to wear eye protection. The mixing of water and plaster of Paris is examined again in *6D Changes in materials*.

Name: ..... Form: .....

See **pages 22 and 23** of *Solids and liquids*

Separating mixtures

It is possible to separate out mixtures into the substances that make them up. Some are easier to separate than others.



Q1. A mixture of clay, stones and sand is passed through the two sieves in the diagram. Draw an X where clay is found, a Y where stones are found and a Z where sand is found.

Q2. If a sieve is made of a mesh with a large number of wires, does it have large holes or small holes?

✎.....

Q3. What is a filter?

✎.....

Q4. What is a filter normally made from? ✎.....

Q5. What is a filter designed to do?

✎.....

✎.....

Q6. What does (a) a tea bag separate; (b) a tea strainer separate?

(a) ✎.....

✎.....

(b) ✎.....

✎.....

Teacher's sheet: comprehension

See **pages 22 and 23** of *Solids and liquids*

Answers

1. **X is written in the paper sheet, Y is written in the coarse sieve, Z is written in the fine sieve.**
2. **Small holes.**
3. **A much finer kind of sieve.**
4. **Paper.**
5. **To separate an insoluble solid from water containing a dissolved solid.**
6. **(a) Ground tea leaves from water containing the part of the tea that has dissolved. (b) Whole tea leaves from the water containing the part of the tea that has dissolved.**

Complementary work

(a) Let the children use secondary sources to find out about how white, brown and wholemeal flour are made.

Teaching notes

The children may have encountered sieving before in the Unit 9 practical activity of *3C Rocks and soil*. If they have, revise their work with them then set it in the wider context explored here as a means of separating mixtures and making discoveries about them.

If children watch television programmes on archeology, they may see large sieves being used to separate pieces of pottery, metal and bone from the soil. You may like to use this aspect of sieving in a history project.

The link between the sieve and the filter should be made clearly, so the children can see how a solid and liquid can be separated. The limitation of the sieve, in separating undissolved solids from a liquid, should be emphasised. The filter's inability to separate dissolved solids from their solvent should be discussed. Later, when the children have studied evaporation, they will find that evaporation can be used to separate a dissolved solid from its solvent.

Name: ..... Form: .....

Based on **pages 22 and 23** of *Solids and liquids*

Using a sieve

Try this…

1. Put some sugar in a sieve and shake the sieve from side to side.

Describe the pieces of sugar left behind in the sieve.

✎.....

2. Predict what you may find when you sieve icing sugar.

✎.....

3. Put some icing sugar in a sieve and shake the sieve from side to side.

Describe the pieces of icing sugar left behind in the sieve.

✎.....

4. Predict what you may find when you sieve plain flour.

✎.....

5. Put some plain flour in a sieve and shake the sieve from side to side.

Describe the pieces of flour left behind in the sieve.

✎.....

6. Look at some wholemeal flour.

How is it different from plain flour?

✎.....

7. Predict what will happen when you sieve wholemeal flour.

✎.....

8. Put some wholemeal flour in a sieve and shake the sieve from side to side.

9. Compare what you find with what you predicted.

✎.....

Teacher's sheet: activity

Based on **pages 22 and 23** of *Solids and liquids*

Introducing the activity

(a) Show the children the sugar, icing sugar and flour. Tell the children that the three white substances are all made of small particles, but challenge the children to find out if they contain any lumps (see note (i)).

Using the sheet

(b) Give out the sheet and let the children write their names and form, then go through task 1 (see note (ii)).

(c) Let the children try task 1.

(d) Go through tasks 2 and 3, then let the children try them (see note (iii)).

(e) Go through tasks 4 and 5, then let the children try them (see note (iv)).

(f) Go through tasks 6 to 9, then let the children try them (see note (v)).

Completing the activity

(g) Ask the children to assess the accuracy of their predictions, and to explain their predictions (see note (vi)).

Conclusion

When sugar is sieved, some large lumps with a rough surface may be left behind in the sieve. They are made by crystals sticking together.

When icing sugar is sieved, the large lumps are rounded.

When plain flour is sieved, the large lumps are rounded.

When wholemeal flour is sieved, a large number of broken drown grain coats may be left in the sieve. There may also be some small, rounded lumps of flour.

Teaching notes

(i) The children should respond by saying that they will use a sieve. You may wish to introduce the word sifting as an alternative verb to sieving. You may add that this activity is to test their powers of observation. Ask the children what may help them with their observations, then issue them with magnifying glasses.

(ii) The sieve should be gently shaken side to side.

(iii) The children may predict that it will have lumps with rough surfaces, like the granulated sugar, and may be surprised to find there is a difference.

(iv) The children may predict that the flour will have lumps like the icing sugar because it has similar-sized grains.

(v) The children should estimate that some of the grain coats will not go through the sieve. Some children may also predict that wholemeal flour will contain some lumps, as in plain flour.

(vi) They may show how the results of the earlier tasks helped shape their predictions in later tasks.

REVISION QUESTIONS

Name: ..... **Form:** .....

Q1. What are two properties of a solid?

Tick two boxes:

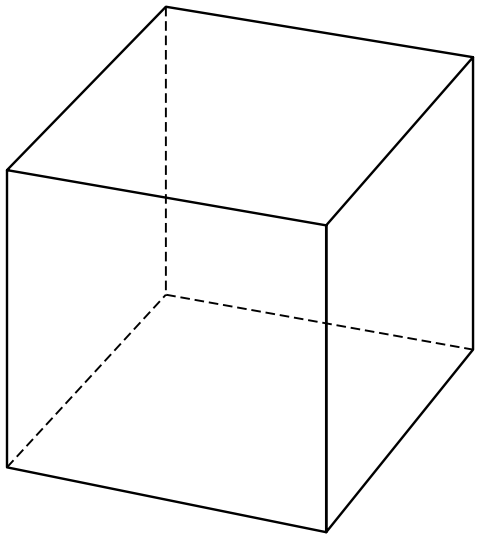
Has a fixed shape ☐ Changes size ☐ Flows ☐ Has a fixed size ☐

Q2. Arif has some butter. It is hard.

How could he make the butter soft enough to spread on a slice of bread?

✎.....

Q3. What kind of solid is shown in the picture?



Tick one box:

A powder ☐ A crystal ☐

A fibre ☐ A cloth ☐

Q4. (i) Jane has dry sand in her hands. She lets it flow through a gap in her fingers. The sand piles up on the ground.

What shape does the sand form?

Tick one box:

Dome ☐ Cube ☐ Cone ☐ Pancake ☐

(ii) Jane wetted the sand a little and tried her test again.

What do you think happened?

✎.....

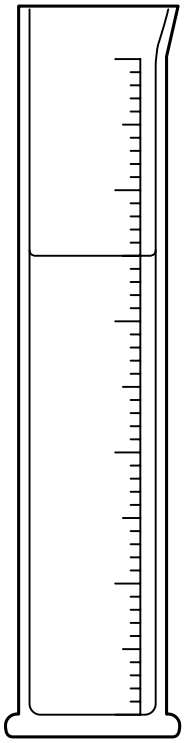
Name: ..... **Form:** .....

Q5. Paul puts some water in a measuring cylinder. The cylinder measures in ml (1,000ml makes 1 litre).

(i) How much water is in the measuring cylinder?

✎.....

(ii) Paul pours 5ml out of the measuring cylinder. Draw the new water level on the diagram.



Q6. What are two properties of a liquid?

Tick two boxes:

Has a fixed shape ☐ Changes size ☐ Flows ☐ Has a fixed size ☐

Q7. (i) What happens to a substance when it melts?

✎.....

(ii) What happens to a substance when it freezes?

✎.....

Q8. Mina has put some water in a syringe. She puts a finger over the end of the syringe and pushes in the piston. What happens to the water?

Tick one box:

☐ The water is squashed into a smaller space.

☐ The water does not change.

☐ The water swells up.

REVISION QUESTIONS

Name: ..... **Form:** .....

Q9. Paul put 400ml of shampoo into a tall jar.

He dropped a ball of Plasticine into the shampoo and timed how long it took to reach the bottom of the jar.

He repeated his test with 400ml of treacle and 400ml of honey.
Here are his results.

Liquid	Time for ball to fall (seconds)
Shampoo	10
Treacle	60
Honey	80

(i) Make a bar chart of this data on the graph paper below.

(ii) How did Paul make the test fair?

✎.....

✎.....

(iii) Do you think the ball would fall faster or slower in water?

✎.....

Name: ..... Form: .....

Q10. Mina set up a ramp. She timed how long it took different liquids to run 15 centimetres down the ramp. Here are her results.

Liquid	Time to run 15cm (seconds)
Washing-up liquid	20
Honey	120
Custard	75
Cooking oil	6

(i) Which liquid moved the fastest down the ramp?

✎.....

(ii) Which liquid moved the slowest down the ramp?

✎.....

(iii) Mina made the ramp steeper. How would this affect the way the liquids flowed?

✎.....

(iv) Mina warmed the liquids up. How would this affect the way the liquids flowed?

✎.....

(v) Mina cooled the liquids down. How would this affect the way the liquids flowed?

✎.....

Q11. Arif put an ice cube in a glass of water.

(i) Where did the ice cube stay in the water?

✎.....

(ii) As the ice melted, where did the cold water go?

✎.....

REVISION QUESTIONS

Name: ..... **Form:** .....

Q12. When sugar and water are mixed, the sugar disappears into the water.

What is the name of this process?

Tick one box:

Evaporating ☐ Dissolving ☐ Filtering ☐ Condensing ☐

Q13. Paul added a spoon of sugar to a jar of water and stirred it up. The water went clear. He kept adding spoons of sugar and stirring them into the water. After adding a few spoonfuls he found that sugar settled at the bottom of the jar. Why did this happen?

✎.....

Q14. Name three substances that are soluble in water.

Tick three boxes:

Sand ☐ Salt ☐ Sugar ☐ Metal ☐ Glass ☐ Bath salts ☐

Q15. Jane has two sieves. One has large holes and the other has small holes.

(i) Which sieve should she use to separate sand from soil?

✎.....

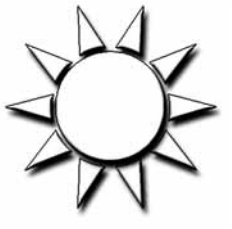
(ii) Which sieve should she use to separate stones from soil?

✎.....

Q16. What kind of paper is used to separate a solid from a liquid?

Tick one box:

Tissue paper ☐ Blotting paper ☐ Newspaper ☐ Filter paper ☐



REVISION QUESTIONS

Name: ..... **Form:** .....

Q17. A pot of tea has been made using tea leaves 5 millimetres across.

The tea is poured onto a tea strainer which is resting on the top of a cup.

The tea strainer has holes that are 3 millimetres across.

(i) What will happen to the tea leaves when they reach the tea strainer?

✎.....

(ii) Explain your answer.

✎.....

✎.....

(iii) What will happen to the liquid tea?

✎.....

(iv) Explain your answer.

✎.....

✎.....

Q18. What happens to the volume of a liquid when it gets warmer?

✎.....

Q19. What happens to the volume of a solid when it gets warmer?

✎.....

Q20. What happens to the volume of a solid when it gets colder?

✎.....

ANSWERS
REVISION QUESTIONS

1. Has a fixed shape, has a fixed size. *2 marks*

2. He could put it in a warm place (not melt it). *1 mark*

3. A crystal. *1 mark*

4. (i) Cone. *1 mark*
(ii) It did not flow. *1 mark*

5. (i) 35ml. *1 mark*
(ii) The line should be at 30ml. *1 mark*

6. Flows, has a fixed size. *2 marks*

7. (i) It turns from a solid into a liquid. *1 mark*
(ii) It turns from a liquid into a solid. *1 mark*

8. The water does not change. *1 mark*

9. (i) The time to fall in seconds should be marked and labelled 0 to 100 on the left hand side. The times should be marked on the chart. *2 marks*
(ii) He used the same volume of liquid for each test. *1 mark*
(iii) It would fall faster. Water is runnier than the other liquids. *2 marks*

10. (i) Cooking oil. *1 mark*
(ii) Honey. *1 mark*
(iii) They would flow faster. *1 mark*
(iv) They would flow faster. *1 mark*
(v) They would flow slower. *1 mark*

11. (i) At the surface. *1 mark*
(ii) It sank. *1 mark*

12. Dissolving. *1 mark*

13. No more sugar would dissolve in the water. *1 mark*

14. Sugar, salt, bath salts. *3 marks*

15. (i) Sieve with small holes. *1 mark*
(ii) Sieve with large holes. *1 mark*

16. Filter paper. *1 mark*

17. (i) They stay in the strainer. *1 mark*
(ii) The tea leaves are too large to pass through the holes. *1 mark*
(iii) It passes through the strainer into the cup. *1 mark*
(iv) The holes are large enough to let the liquid through. *1 mark*

18. Increases or expands. *1 mark*

19. Increases or expands. *1 mark*

20. Decreases or contracts. *1 mark*

Total marks: 40