# The nature and uses of materials

**Strand**
Natural and Processed Materials

**Key concepts**
The properties and structure of materials are interrelated.

Patterns of interactions between materials can be identified and used to predict and control further interactions.

The uses of materials are determined by their properties, some of which can be changed.

## Purpose

Activities in this module are designed to help students understand that different materials have different properties, can undergo changes and can be used in a variety of ways. Students have opportunities to:

- handle a variety of familiar materials;
- describe observable properties of familiar materials;
- describe observable changes that occur in materials;
- look for alternative ways that familiar materials can be used.

## Overview of activities

The following table shows the activities in this module and the way these are organised in **introductory**, **developmental** and **culminating** phases.

| Introductory ► | Developmental ► | Culminating |
|---|---|---|
| Liquids and solids | Popcorn | Mystery materials |
| Familiar materials | Cooking pikelets and eggs | Observation walk |
| Changes, changes | Chocolate crackles | |
| | Liquids change | |
| | Dissolving crystals | |
| | Change of texture | |
| | Change of colour | |
| | Change of sound | |
| | Materials have many uses | |

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## Core learning outcomes

This module focuses on the following core learning outcomes from the Years 1 to 10 Science Syllabus:

**Natural and Processed Materials**

**1.1 Students describe observable properties of familiar materials (including solids and liquids).**

**1.2 Students describe observable changes (including change of state) that occur in materials.**

**1.3 Students look for alternative ways that familiar materials can be used.**

**2.1** Students group materials on the basis of properties (including solubility, texture and hardness).

**2.2** Students recognise ways in which changes in properties of familiar materials occur (including temperature change and magnetism).

**2.3** Students explain why common materials are used in particular situations.

Activities in this module also provide opportunities for students to demonstrate a level of understanding before Level 1.

## Core content

This module incorporates the following core content from the syllabus:

**Natural and Processed Materials**

**Types of materials**
- solid, liquid

**Properties of materials**
- taste, odour, colour
- transparent, opaque
- density — light/heavy
- solubility
- strength, hardness, flexibility

**Nature of change**
- fast/slow
- requires heat

**Causes of change**
- heating/cooling

**Uses of materials**
- building
- tools
- clothing
- food
- cleaning

## Assessment strategy

Suggestions for gathering information about student learning are provided in each of the activities in this module. Once sufficient information has been collected, judgments can be made about students' demonstrations of outcomes. Typical demonstrations of this module's intended outcomes are provided here to indicate the pattern of behaviour to look for when making judgments.

**Natural and Processed Materials**

**Foundation Level**

**Students are developing and can communicate an understanding that familiar materials have different properties and particular uses, and that the properties of materials may change.**

Students may:

- group familiar materials as solids and liquids;
- identify a familiar food by its taste, smell, texture and colour;
- recognise a material after its properties have been changed;
- identify different uses of familiar materials.

**Natural and Processed Materials**

**1.1 Students describe observable properties of familiar materials (including solids and liquids).**

Students may:

- describe the observable properties of familiar materials using terms such as *looks like …*, *tastes like …*, *feels like …*, *smells like …*, *hard/soft*, *light/heavy*, *smooth/rough*, and terms for colour;
- group familiar objects according to their own criteria;
- describe a material as solid or liquid;
- make comparisons between solids and liquids.

**1.2 Students describe observable changes (including change of state) that occur in materials.**

Students may:

- draw conclusions that materials can change form, shape, colour, hardness, texture and size;
- draw conclusions that changes in materials can cause changes in the sounds made when they are struck;
- describe changes in materials using terms such as *melts*, *cooks*, *hardens*, *freezes*, *evaporates*, *dissolves*, *gets bigger*, *gets smaller*, *gets softer*;
- describe the conditions that cause change from solid to liquid and from liquid to solid.

**1.3 Students look for alternative ways that familiar materials can be used.**

Students may:

- draw conclusions that materials can be used in a variety of ways;
- name at least two ways of using familiar materials — for example, wood, glass, plastic, metal and water.

**Natural and Processed Materials**

**2.1 Students group materials on the basis of properties (including solubility, texture and hardness).**

Students may:

- explain reasons for grouping objects, using appropriate terminology to label the groupings;
- describe an object in terms of the properties of the materials used to make it.

**2.2 Students recognise ways in which changes in properties of familiar materials occur (including temperature change and magnetism).**

Students may:

- describe an experiment that demonstrates a change in the properties of materials;
- link the nature and cause of a change in the properties of materials — for example, melting due to heat.

**2.3 Students explain why common materials are used in particular situations.**

Students may:

- explain the properties of the materials that make them useful in particular situations.

# Background information

## Current scientific conceptions

Matter consists of basic building blocks (atoms) and observable changes in materials are due to changes in the arrangement of their atoms. New matter cannot be created nor can existing matter be destroyed. New materials are made by changing existing materials — for example, cream can be turned into butter; cooking creates new substances.

The properties of a material can be explained by considering the particles of which it is made. The three states of matter that exist naturally on Earth are solid, liquid and gas. Solids have a fixed volume and shape. Liquids have a fixed volume but take on the shape of the container in which they are placed. Gases do not have a fixed volume or shape — they take on the volume and shape of any container in which they are placed.

If a substance is heated it can change state. Heating a solid can cause it to melt, that is, change into a liquid. Further heating can cause the liquid to vaporise, that is, turn into a gas. Transfer of heat from a material at a high temperature to another at a lower temperature — cooling — can cause the reverse to happen. Condensation is a change from the gas state to the liquid state. Freezing or solidification is a change from the liquid to the solid state. During a change of state, the outward appearance of a substance changes. However, it is still the same substance.

Dissolving is not the same as melting. When a substance dissolves, the particles of the substance move in between the particles of the liquid. The mass of the final solution equals the mass of the original liquid as well as the mass of the substance that was dissolved, that is, there is conservation of mass.

When water is first heated small bubbles may appear within the liquid. This is dissolved air coming out of solution. The large bubbles in boiling water are formed as the water vaporises; they are not bubbles of air or heat.

### What happens when popcorn pops?

'Popping' corn is one of several types of corn. Its kernels have a much harder seed coating and contain less soft starch tissue than other types of corn. It contains about 13% water by weight.

When the corn kernel is heated to a high enough temperature, the water inside it turns to steam. The hard seed coat allows quite high pressures to build up inside the seed. When the pressure becomes too great, the seed coating gives way and the seed explodes. High pressure water vapour escapes from within the starchy tissues of the corn seed causing them to expand to form fluffy popped corn.

## Students' prior understandings

Students' prior understandings may differ from current scientific conceptions in a range of ways.

Some students may think that:

- liquids or gases are not matter and that matter is concrete and solid. Hence they may not consider water and steam to be matter.
- matter is made up of a material 'core' and has non-material properties such as colour, smell or weight. Hence students may consider that a material can disappear and leave its other properties behind. For example, nail polish remover disappears but leaves its smell attached to the container; or the smell may escape from a substance and leave the substance without any smell; or sugar disappears when it dissolves but leaves its sweetness in the liquid. Dissolving may incorrectly be seen as a form of melting.
- matter exists only when there is some evidence of its existence. Hence students may believe that air exists only if it is moving or exerting pressure, as wind or in a blown-up balloon; an empty cupboard or box has no air in it; water changes into air or nothing when it boils; air and steam are the same thing.
- the weight of a substance can change with a change of state. Hence students may think that gases have no weight; gases always weigh less than solids or liquids; a solution of sugar dissolved in water will weigh no more than the original weight of the water.

Teachers can help students build on and expand their concepts about matter by providing activities where students can:

- become aware of and clarify their own ideas about matter, the properties of matter and the states of matter;
- challenge their current concepts — for example, by considering 'discrepant events' (activities that have surprising or unexpected results);
- test their ideas with hands-on activities to confirm or challenge their current concepts;
- explore language use that may be different from everyday use, taking care to distinguish between the scientific and everyday use of words such as 'disappear', 'melt', 'dissolve' and 'evaporate'.

### Terminology

Terms associated with properties of materials, changes to materials and uses of materials are essential to the activities in this module — for example:

| | | | | |
|---|---|---|---|---|
| condense | gas | melt | reaction | solid |
| cook | glass | metal | ripens | steam |
| dissolve | harden | opaque | rough | texture |
| evaporate | heat | plastic | smooth | transparent |
| freeze | liquid | properties | soft | weight |

Students may already be familiar with some of these terms and understand their meanings and use in scientific contexts. If so, the activities in this module will provide opportunities for them to evaluate current usage. If not, these activities will provide opportunities for students to develop their understandings.

### School authority policies

Teachers need to be aware of and observe school authority policies that may be relevant to this module.

Safety policies are of particular relevance to the activities that follow. It is essential that demonstrations and student activities are conducted according to procedures developed through appropriate risk assessments at the school.

In this module, teachers need to consider safety issues relating to:

- the use of heating appliances including electric frying pan, electric kettle, popcorn maker and hotplate;
- the use of glass containers, jars and beakers;
- correct storage of ingredients for cooking to ensure lowered risk of contamination;
- tasting materials — what is safe to taste and when;
- preventing the spread of germs and bodily fluids.

## Support materials and references

Harlan, J. 1992, *Science Experiences for the Early Childhood Years*, Merrill Publishing, New York.

Williams, R. A., Rockwell, R. E. & Sherwood, E. A. 1987, *Mudpies to Magnets — A Preschool Science Curriculum*, Gryphon House, Maryland, USA.

ACTIVITY

# Liquids and solids

*Introductory*

## Focus

This activity provides opportunities for students to observe and identify some of the differences between solids and liquids.

## Materials

For the class:

- butcher's paper
- magazines
- glue

For each small group of students, a variety of materials that could include:

- solids — wood, plastic, metal, glass
- liquids — water, cooking oil, soft drink, custard, shampoo, conditioner

## Working scientifically

Time: 30 minutes

**Exploring phenomena**
**Handling materials**
**Examining and evaluating**
**Making comparisons**
**Relating**
**Supporting decisions**

▶ In groups of two or three, students sort the provided materials using their own criteria for grouping. They explain to the rest of their group how they have sorted the items and why, and then report to the class their reasons for sorting the items the way they have done.

▶ As a whole class, students consider the terms 'liquid' and 'solid'. They brainstorm the properties of liquids and solids for recording on a sheet of butcher's paper. Questions to encourage brainstorming could include:

- How do liquids feel when you touch them?
- How do solids feel when you touch them?
- What happens when a liquid is placed in a container?
- What happens to a liquid if it is not placed in a container (for example, when it spills)?
- How can a liquid be moved from one container into another?
- What sounds might be made as the liquid is poured?
- What happens to the liquid if the new container is a different shape from that of the old container?
- What happens when a solid is placed in a container?
- What happens to a solid if it is not placed in a container?
- How can sounds be made using a solid?
- Can liquids be used in the same way to make a sound? Why or why not?

▶ The observable properties of solids and liquids are recorded and students illustrate the brainstorming chart with pictures they have drawn or collected.

## Gathering information about student learning

Sources of information could include:

- students' contributions to brainstorming and creation of the chart;
- students' suggestions about the different properties of liquids and solids.

ACTIVITY

# Familiar materials

*Introductory*

## Focus

This activity provides opportunities for students to identify and describe properties of familiar materials.

## Materials

For the whole class:

- cardboard word cards
- re-useable adhesive
- butcher's paper — several sheets
- markers
- samples of materials and items made from various materials including: plastic, glass (playing marbles), wood (pencil, blocks used in maths), paper, water, milk, custard, soft drink, play dough, fibres (wool, cotton, polyester, cottonwool), metal (coins, nails, paperclips, scissors), clay (garden pots), sand (sandpaper), sponge.

## Teaching considerations

Set up learning centres with samples of materials and objects made from materials with different properties so that students can move freely to observe and handle them.

Prepare a chart on butcher's paper with two columns marked 'Solid' and 'Liquid'.

Consider using adult helpers to assist at learning centres.

If students have not participated in the previous introductory activity 'Liquids and solids', a discussion of the characteristics of these two states of matter may be required.

## Working scientifically

Time: Part 1, 30 minutes; Part 2, 45 minutes

### Part 1

**Handling materials**
**Suggesting**
**Illustrating**

▶ Students discuss ideas to clarify their thinking about the difference between the properties of an object and the properties of the material from which it is made.

▶ Students make a list of familiar materials. The names of the materials are recorded on strips of cardboard and attached to the blackboard. Ensure that as many materials as possible are included. The following prompts could be used to encourage discussion:

- Think about the things around us — what materials are they made of?
- Are all materials solids, that is, do they keep their shape when you touch them?
- Suggest some materials that are liquids.

▶ Through class discussion, students allocate the word cards to either of two columns headed 'Solid' and 'Liquid' on the prepared butcher's paper chart. If students are unsure where to place a card it could be put in a 'not sure' pile or column for further investigation. Students discuss strategies they could use to find out more about the materials in the 'not sure' category.

▶ Students create lists of words to describe materials and then organise them under the following headings: 'Looks like'; 'Feels like'; 'Sounds like'; 'Smells like'; 'Other'.

Questions to facilitate formulating the lists might include:

- What words could we use to describe how a material looks? What is its shape and colour?
- Suggest ways of telling others about the way that something feels. Is it soft or hard, liquid or solid, heavy or light, rough or smooth?
- What words could you use to describe materials that you can see through and those that you cannot?
- What type of sound is made when the material is hit with wood or with metal?
- What words could you use to describe the smell of the material?
- Why do you think the sense of taste is not being used in this activity?

▶ Students read and review the lists.

**Part 2**

▶ Working in small groups students move round the learning centres and handle the sample materials. They identify some observable properties of the materials and record their observations in a table like the one below:

**Familiar materials**

| Draw and name the material | Observations | | | | |
|---|---|---|---|---|---|
| | It looked like … | It felt … | I heard … | It smelt like … | Other properties |
| | | | | | |

▶ Students report their findings to the class. The report could be in different formats — for example, groups could choose one object, name it and draw it on a large sheet and record their observations around their drawing for display in the classroom. Groups could also present to the class an oral report of their observations of the properties of a particular material.

### Gathering information about student learning

Sources of information could include:

- students' contributions to discussions;
- students' contributions to the list of words that describe materials;
- students' observations of familiar materials.

ACTIVITY

# Changes, changes

*Introductory*

## Focus

This activity provides opportunities for students to observe changes in the properties and uses of materials and to discuss changes they have observed in familiar materials in the past.

## Materials

- cream
- electric beaters

## Teaching considerations

Because butter-making is affected by a number of factors, teachers should practise the following procedure before doing this activity with students.

Butter is made by beating cream until it separates into butter and 'buttermilk'. This may take several minutes. The beaters could be stopped a few times during the process, providing opportunities for discussion of words that describe the physical properties of the cream as it turns into butter. When the separation is complete, pour off the buttermilk and pat little pieces of butter together with a wooden spatula or spoon.

## Working scientifically

Time: 30 minutes

**Exploring phenomena**
**Examining and evaluating**
**Clarifying ideas and concepts**
**Describing**

▶ Students describe the observable properties of cream and its uses. They make observations as the teacher demonstrates butter being made from cream. They use terminology introduced in other activities to describe the changes that they see occurring in the cream.

▶ Students suggest uses for butter and discuss how and why these are different from the uses for cream that they suggested earlier. Suggestions to guide discussion could include:

- Would you spread your bread with cream? Why or why not?
- Describe how the properties of the cream have changed.

▶ Students discuss changes that they have observed in other materials. Suggestions to stimulate discussion could include paper burning; a dry sponge getting wet; the rubber of a balloon after it has been blown up and then let down; and cake mix being cooked. The teacher records students' observations. Students then record ideas in their think books or journals about one material and how it can be changed.

## Gathering information about student learning

Sources of information could include:

- students' contributions to class discussions about the uses of cream and butter and how these relate to their observable properties;
- students' contributions to discussions about materials changing;
- students' think books or journal entries about changes in materials.

ACTIVITY

# Popcorn

*Developmental*

## Focus

This activity provides opportunities for students to describe changes occurring to the observable properties of kernels of popping corn when they are heated.

## Materials

- popping corn
- cooking oil
- all-glass or glass-lidded saucepan or popcorn maker
- hotplate

## Teaching considerations

***Safety***

Inform students about safe practices for using electrical appliances, stoves and hot cooking utensils

## Working scientifically

Time: 30 minutes

**Exploring phenomena**
**Predicting**
**Making comparisons**
**Making links**
**Describing**
**Explaining ideas and decisions**

▶ Students suggest materials that change shape and what is done to them to make them change shape.

▶ Students handle the uncooked popping corn and describe its properties.

▶ Students predict what will happen when popping corn is heated and then observe the teacher making the popcorn. Questions to encourage discussion of their observations could include:

- What is happening to the corn?
- What might be causing the noise?
- What can you smell?
- How has the feel of the popcorn changed?
- How could you explain the changes that you see?

▶ Students record their observations and explanations for any changes in their notebooks or journals.

## Gathering information about student learning

Sources of information could include:

- students' contributions to discussions;
- students' entries in their notebooks or journals about their observations of, and explanations for, changes in the popping corn.

ACTIVITY

# Cooking pikelets and eggs

*Developmental*

## Focus

This activity provides opportunities for students to observe and describe changes that occur as materials are mixed and heated during cooking.

## Materials

- Resource Sheet 1, 'Pikelets'
- ingredients for making pikelets listed on Resource Sheet 1
- electric frying pan or frying pan and hotplate
- bowl
- whisk or electric beaters
- tablespoon
- containers for samples that students examine — paper cups for flour and sugar, plates for eggs

## Teaching considerations

Alternative cooking activities could include making gingerbread figures or making bread in a bread-making machine.

Ensure students wash and dry their hands before preparing and handling food. Keep eggs, milk and butter refrigerated until required.

Working in small groups gives individuals better opportunities to observe and describe the changes in the cooking ingredients.

Consider using adult helpers with group work.

***Safety***

Inform students about safe practices for using electrical appliances, stoves and hot cooking utensils.

Some students may have food intolerances. Diabetics may need to monitor the sugar content of their food.

## Working scientifically

Time: Part 1, 45 minutes; Part 2, 15 minutes

**Handling materials**
**Identifying**
**Applying ideas and concepts**
**Making comparisons**
**Creating presentations**
**Discussing thinking**

### Part 1

▶ Students discuss the observable properties of individual ingredients used for making pikelets. Discussion questions could include:

- How would you describe the following:
  - flour
  - sugar
  - sodium bicarbonate
  - egg
  - milk
  - vinegar
  - butter (both before and after melting)?

- Is it a solid or a liquid?
- What does it feel like?
- Which of the ingredients would not be easy to mix in its present form?
- What can we do to that ingredient to make it easier to mix with the other ingredients?

Resource Sheet 1

▶ Students make pikelets according to the recipe and procedure on Resource Sheet 1. They describe what appears to be happening at each stage. Questions to support observations could include:

- What were the changes when we added the wet (liquid) ingredients to the dry ones?
- How would you describe the batter? Is it solid or liquid?
- What happens when the batter is heated?
- Where do you think the bubbles come from?
- How would you describe the pikelet? Is it solid or liquid?

**Part 2**

▶ Students observe and identify the major features of an egg — the shell, white and yolk. They handle an egg that has been removed from the shell and discuss its tactile properties.

▶ Students describe observable changes as the teacher or adult helper cracks an egg into the hot frying pan and the egg begins to cook. Questions to facilitate observations and descriptions could include:

- What changes can you see happening to the yolk and to the white of the egg?
- What do you think is causing these changes?
- What could we do to make the changes happen more quickly?
- What could we do to make the changes happen more slowly?
- What might happen to the egg if it is cooked for a very long time?
- What does the egg feel like after it has been cooked and cooled?

▶ Students draw labelled pictures of an egg before and after cooking and display these in the classroom with the captions 'Before heating' and 'After heating'.

### Gathering information about student learning

Sources of information could include:

- students' contributions to discussions;
- students' contributions to group activities;
- students' labelled drawings of changes due to cooking.

ACTIVITY

# Chocolate crackles

*Developmental*

## Focus

This activity provides opportunities for students to observe and describe changes that occur as materials melt and solidify.

## Materials

- Resource Sheet 2, 'Chocolate crackles'
- ingredients listed on Resource Sheet 2
- electric frying pan or saucepan and hotplate

## Teaching considerations

Ensure students wash and dry their hands before preparing and handling food. Keep the Copha refrigerated until required.

Working in small groups gives individuals better opportunities to observe and describe the changes in the cooking ingredients.

Consider using adult helpers with group work.

***Safety***

Inform students about safe practices for using electrical appliances, stoves and hot cooking utensils.

Some students may have food intolerances. Diabetics may need to monitor the sugar content of their food.

## Working scientifically

Time: Part 1, 40 minutes; Part 2, 20 minutes

### Part 1

**Handling materials**
**Identifying**
**Applying ideas and concepts**
**Making comparisons**
**Describing**
**Explaining ideas and decisions**

▶ Students discuss the properties of individual ingredients. Discussion questions could include:

- How would you describe the following:
  - Copha
  - puffed rice
  - cocoa
  - coconut?
- Is it a solid or a liquid?
- Which of the ingredients would not be easy to mix in its present form?
- What can we do to the Copha to make it easier to mix with the other ingredients?

Resource Sheet 2

▶ Students make chocolate crackles following the recipe and procedure on Resource Sheet 2. They describe and discuss what happens to the Copha as it is heated. Questions to encourage discussion could include:

- What can you see happening to the Copha?
- What colour is the Copha now?
- What colour was the Copha before you started heating it?
- What was the smell of Copha before and after heating?
- Is it still a solid? What is it becoming?
- How could we speed up the change?
- How might we change the Copha back to the way it was?
- Can you think of other materials that react to heat in the same way?

▶ Students describe and discuss changes that occur as ingredients are mixed. They hypothesise about what will happen to the texture when the chocolate crackles are placed in the refrigerator. Students explain the reasons for their ideas.

**Part 2**

▶ Students describe changes to the chocolate crackles after they have been in the refrigerator. Questions to encourage discussion could include:

- What has happened to the texture of the chocolate crackles?
- Why do you think this happened?
- What change is there in the colour of the chocolate crackles?
- How could we change the chocolate crackles to the way they were before?
- Can you think of other materials that can melt and set or solidify?

▶ Students suggest ways of using materials that solidify when cooled — for example, wax in candles, chocolate or jelly in moulds, plastics for toys.

### Gathering information about student learning

Sources of information could include:

- students' observations of changes in the Copha and chocolate crackle mixture when heated and then refrigerated;
- students' contributions to discussions about the use of materials that solidify when cooled.

ACTIVITY

# Liquids change

*Developmental*

## Focus

This activity provides opportunities for students to observe changes that may occur in liquids, including evaporation, condensation, freezing and melting, and to consider how these changes affect their use.

## Materials

**Part 1**

- plastic container in which to freeze water
- water
- butcher's paper and pens (optional)

**Part 2**

- black cardboard
- electric kettle or jug
- sheet of glass

**Part 3**

- water
- food colouring (optional)
- large shallow clear-sided container or bowl
- masking tape
- ruler
- Resource Sheet 3, 'Evaporation experiment: Teacher demonstration'

**Part 4**

- large beaker or glass jar
- very cold water

## Teaching considerations

Access to a freezer is necessary for Part 1.

***Group size***

Working in small groups gives individual students more opportunity to observe and describe the changes of state of water.

Consider using adult helpers with group work.

The length of time over which observations in Part 1 are made will depend on the room temperature at the time of the experiment and the size of the block of ice that is made.

***Safety***

Inform students about safe practices for using electrical appliances, heating water and handling hot objects.

## Working scientifically

Time: Part 1, 20 minutes plus observation periods; Part 2, 20 minutes; Part 3, 20 minutes; Part 4, 20 minutes

**Exploring phenomena**
**Handling materials**
**Predicting**
**Hypothesising**
**Reflecting and considering**
**Discussing thinking**

**Part 1: Water freezes; ice melts**

▶ Students discuss some changes that they know can happen to water and how these changes affect its use. The teacher may record the list of changes on butcher's paper for later reference. Questions to guide discussion about the properties and uses of water could include:

- Where do we find water?
- What do we use water for?
- What does water feel, taste and smell like?
- How could the observable properties of water be changed?
- What makes or helps these changes happen?
- How does that change the way we use water?

▶ Students observe water in a plastic container and suggest how it could be changed into a solid. They discuss the effects of heating and cooling on other familiar materials.

▶ Students place the container of water in the freezer and leave it until the water is frozen. They observe and handle the frozen water and discuss what has happened to it. Questions to focus discussion on the properties and uses of ice could include:

- What has happened to the water?
- When water is frozen (that is, turned to a solid) we give it a special name. What name do we give solid water?
- Why would the name be changed when we didn't add anything to the water in the container?
- Apart from the coldness, how would you describe the observable properties of the ice?
- Do you think it is a solid or a liquid? Why do you think this?
- What do we use ice for?

▶ Students remove the ice from the plastic container and place it in a large shallow dish in a convenient place in the classroom. They predict what might happen to the ice if it is allowed to stand at room temperature.

▶ Students observe changes to the block of ice over a predetermined period of time and describe and record their observations on a table like the following:

**Changes in ice**

| Write the time | Draw what you saw | Explain what you saw |
|---|---|---|
| | | |

Questions to encourage discussion about ice melting could include:

- What changes can you see or feel on the surface of the ice?
- What changes are there to the shape of the ice block?

- Why do you believe these changes are happening?
- How could we slow the process down?
- How could we make it happen faster?

**Part 2: Steam**

▶ Students observe steam coming from the spout of a boiling electric kettle or jug that the teacher has set up in front of a sheet of black cardboard. Questions to encourage discussion about boiling could include:

- What can you see coming out of the spout of the kettle (jug)?
- Of what do you think it is made?
- What has caused it to appear?
- Is it a solid, like ice, a liquid, like water, or a gas?
- When water boils, the gas that comes off it is given a special name. What name do we give the gas that comes off boiling water?
- Why would the name be changed when we did not add anything to the water in the kettle (jug)?
- What do we use steam for?

▶ Students observe what occurs when the teacher holds the sheet of glass in the steam as the kettle boils. Questions to encourage discussion about condensation could include:

- What can you see or feel on the glass?
- Where do you think it came from?
- Can you explain what is happening on the glass?

Students record in their notebooks or journals what they have learned during this investigation.

**Part 3: Water evaporates**

Resource Sheet 3

▶ Students handle water and describe its observable properties. They discuss the investigation described on Resource Sheet 3 and hypothesise about changes that may occur to the water in the dish. Questions to facilitate discussion about evaporation could include:

- What might happen if we leave the dish outside in a warm position for a few days?
- Why do you believe this could happen?

▶ The teacher sets up the investigation described on Resource Sheet 3. Students discuss the results of the investigation. Discussion questions could include:

- What have you noticed about the amount of water in the tray?
- How could you explain this change?
- Where do you think the water might have gone?
- Where have you seen other examples of this happening?
- What might happen if we left the water out in a warm position longer?
- What differences would you expect in the results if the water container were placed in a cool position?
- What differences would you expect in the results if the water container were covered?

▶ Students record what they learnt from the investigation in their notebooks or journals.

**Part 4: Condensation**

▶ Students pour very cold water into the beaker so that it is three-quarters full. They mark the water level on the beaker, place it on a paper towel and leave it for approximately half an hour. Students predict what may happen.

▶ After half an hour students observe the beaker and identify any changes that may have occurred. They draw the observed changes in their notebooks or journals and write (with help if necessary) about what is observed.

▶ Students discuss, in their groups, what has happened. Guides for discussion about condensation may include:

- What changes did you observe?
- How could you explain these changes?
- Have you seen these changes happen in other situations?
- Where might the water droplets have come from?
- What has happened to the paper towel that the beaker was sitting on?
- Compare what happened when a sheet of glass was held in the steam from a boiling kettle with what happened to the outside of the beaker of cold water.

### Gathering information about student learning

Sources of information could include:

- students' observations and explanations of melting;
- students' contributions to discussions about, and explanations of, condensation, evaporation and boiling;
- students' entries in their notebooks or journals.

ACTIVITY

# Dissolving crystals

*Developmental*

## Focus

This activity provides opportunities for students to observe and describe changes to salt and sugar when these are added to warm water.

## Materials

For each small group of students:

- Resource Sheet 4, 'Dissolving sugar and salt'
- materials listed on Resource Sheet 4

## Teaching considerations

Consider using adult helpers with group work.

If students use the words 'dissolving' and 'melting' interchangeably, discuss the differences between these two phenomena. Melting is a change of state from solid to liquid; there is no change in the composition of the substance. When a substance dissolves into a liquid a homogenous mixture is formed.

## Working scientifically

Time: 30 minutes

**Seeking reasons**
**Formulating and elaborating ideas**
**Using scientific terminology**


▶ Students working in small groups follow the instructions on Resource Sheet 4. During the activity the teacher moves around the groups asking questions to encourage discussion. Questions could include:

- What happened when you added the sugar (salt) to the water?
- What happened when you stirred the water?
- What has happened to the sugar (salt)?
- Where is the sugar (salt) now?
- How could you test this idea?
- What would happen if the water was hotter (or colder)?
- Where else have you seen dissolving occur?

▶ Students record what they now know about dissolving in their notebooks or journals.

## Gathering information about student learning

Sources of information could include:

- students' contributions to discussions;
- students' entries in their notebooks or journals about dissolving.

ACTIVITY

# Change of texture

*Developmental*

## Focus

This activity provides opportunities for students to handle an unusual mixture and to describe its observable properties and how these change.

## Materials

- ingredients for mercury dough
- plastic plates, one for each student

## Teaching considerations

This activity is best done outside as it is messy.

Prepare mercury dough prior to the activity by mixing 2 cups of cornflour, 1 cup of salt, water and food colouring to create a stiff mixture. Place a tablespoonful of the mixture on each student's plate. Allow extra quantities of dry ingredients for students to examine. Mercury dough is made using cornflour, salt and water only. It is so named because its texture is like that of mercury. The mixture can be 'refreshed' when it dries out by adding a small amount of water.

## Working scientifically

Time: 30 minutes

**Handling materials**
**Suggesting**
**Discussing thinking**

▶ Students handle the ingredients of mercury dough (cornflour, salt, water), describing and discussing the observable properties of each.

▶ Students handle mercury dough, describing and discussing its observable properties. Questions to encourage discussion could include:

- What does it look, feel and smell like?
- Which of the ingredients does it most feel like?
- How does it move? Would you describe it as liquid or solid?
- What happens if you roll it between your hands?
- What happens if you stop rolling it?

▶ Students suggest words to describe the observable properties of mercury dough. These words are used to create a class wordbank.

▶ Students use words from the wordbank, pictures, or both to record their observations in their notebooks or journals.

## Gathering information about student learning

Sources of information could include:

- students' contributions to discussion about observable properties and changes;
- students' entries in their notebooks or journals.

ACTIVITY

# Change of colour

*Developmental*

## Focus

This activity provides opportunities for students to observe and describe changes to the colour of fruit as it ripens.

## Materials

- unripe tomatoes, bananas, pears or peaches

## Teaching considerations

The colour changes in this activity can be recorded by drawing and colouring. Photographs can be taken and displayed.

Any familiar fruits that change colour as they ripen could be used in this activity. If possible, allow the fruit to ripen naturally on the plant. This may take longer than it will if the fruit is picked and kept in a warm position in the classroom, but there is less chance of the fruit rotting when ripened naturally.

Leaves that change colour could be used as an alternative in this activity. Leaves of many native species change colour as they mature — for example, the leaves of Eucalypts, bottlebrush (*Callistemon*) and lilly pilly (*Syzigium*) are red when young and green when mature.

As leaves die, they change colour to yellow, red or brown before they fall. The leaves of deciduous trees from Europe and North America change colour in autumn and fall from the trees in winter. Many native trees drop some leaves throughout the year and leaves of various colours can be seen at any time. Students could collect and draw leaves to show the changing colours.

## Working scientifically

Time: 15 minutes, plus observations over several days

**Exploring phenomena**
**Predicting**
**Generalising**
**Describing**

▶ Students handle the fruit and describe its observable properties. Questions to encourage observation and sharing of ideas could include:

- What colour is it?
- What colour is it usually when it is ready to eat?
- How would you describe the feel and smell of the fruit?

▶ Students predict the changes that might occur in the fruit over the next few days. Questions to encourage prediction could include:

- What changes might we see happening?
- How could you explain these changes?
- How do you know this?

▶ Students draw and colour the fruit as they observe it ripening over several days. They discuss their observations. Discussion questions could include:

- What changes did you observe in the colour, texture and smell of the fruit?
- Can you explain why these changes occurred?

## Gathering information about student learning

Sources of information could include:

- students' contributions to discussions about the changes in the fruit;
- students' diagrams of the changes observed as the fruit ripened.

ACTIVITY

# Change of sound

*Developmental*

## Focus

This activity provides opportunities for students to use sound to identify changes in the observable properties of materials.

## Materials

For each group of 4–5 students:

- clear glass jar or bottle
- jug with pouring lip
- coloured water
- wooden stick or ruler
- student-suggested materials for Part 1 — for example, sand, cotton wool, rice, flour, soil, edible vegetable oil, cordial and soft drink
- tape-recorder and blank tape
- jelly crystals
- stirrers

## Teaching considerations

Some students with hearing impairment may need assistance for this activity. Seek advice from their support teacher.

If they are unable to hear the sounds produced in this activity, students could watch for the ripples formed on the surface of the water (or jelly) as the side of the container is tapped. The relationship between sound and visible ripples (waves) could be discussed.

## Working scientifically

Time: Part 1, 30 minutes; Part 2, 20 minutes plus 10 minutes after the jelly sets

**Engaging with problems**
**Exploring phenomena**
**Hypothesising**
**Formulating and elaborating ideas**
**Making links**
**Describing**
**Listening and questioning**

### Part 1

▶ Students place a jar in the centre of their workspace and fill it about one-quarter full of water. They listen to and record (using the tape-recorder) the sound produced by gently tapping on the side of the jar with a wooden stick or ruler. They discuss the sounds that were made and suggest ways that they could be changed. Changes they suggest might include:

- changing the amount of water in the jar;
- using something other than a piece of wood to tap the side of the jar;
- filling the jar with something other than water.

▶ Students test their predictions. They tape-record or write about their predictions and findings in their notebooks or journals.

### Part 2

▶ Students tape-record the sound produced when a beaker or glass jar that the teacher has half-filled with hot water is tapped gently with a ruler or wooden stick.

▶ Students add jelly crystals to the hot water and mix well. Once again they tape-record the sound made when the container is tapped gently with a ruler or wooden stick. Students compare and discuss changes in the sounds produced in Part 2 with those produced in Part 1.

▶ Students predict what changes may occur in the sound when the jelly has set. Discussion questions could include:

- What do you think might happen to the sound as the jelly sets?
- Will it become higher or lower, softer or louder?
- Why do you believe this might happen?

▶ When the jelly has set students tape-record the sound produced when the container is tapped with the same striker(s) used earlier. They then replay all the tape-recordings to compare the sounds produced. Discussion questions could include:

- Has the sound changed in any way?
- How has it changed?
- How accurate were your predictions?
- What sound might you expect if the jelly could melt again?

▶ Students hypothesise about the relationship between the properties of a material and the sounds produced when that material is struck. They suggest uses for materials that make different sounds.

**Gathering information about student learning**

Sources of information could include:

- students' contributions to discussions;
- students' entries in notebooks or journals.

ACTIVITY

## Materials have many uses

*Developmental*

### Focus

This activity provides opportunities for students to identify alternative uses for familiar materials.

### Materials

- butcher's paper
- pens
- magazines
- scissors and glue

### Teaching considerations

Rule up butcher's paper into columns that may be headed with words such as 'Wood', 'Glass', 'Plastic', 'Metal', 'Milk' and 'Air', depending on the materials selected for study by students.

### Working scientifically

Time: 30 minutes

**Collecting information**
**Identifying**
**Making links**
**Creating presentations**
**Summarising and reporting**

▶ Students recall the types of materials that they have learned about during previous activities and create a list. They brainstorm with a partner a number of alternative uses for particular materials.

▶ Students share with the class their suggested alternative uses for familiar materials. These are recorded on a chart prepared by the teacher.

▶ Students work in small groups to make a pictorial list of the suggested uses of a particular material by drawing or cutting out pictures from magazines and labelling the illustrations. They report back to the class about the types of uses for their chosen material.

▶ Students collect items from the classroom and from home (if appropriate) to make a labelled display of the different uses of materials.

### Gathering information about student learning

Sources of information could include:

- students' contributions to discussions;
- students' contributions to group work.

ACTIVITY

# Mystery materials

*Culminating*

## Focus

This activity provides opportunities for students to apply their ideas and concepts to identify a particular material.

## Materials

- box for a 'Mystery Box'
- variety of materials identifiable by verbal descriptions of their observable properties

## Teaching considerations

Choose 'mystery materials' appropriate to the students' level of understanding.

Once the material has been identified, open the box to show the item.

## Working scientifically

Time: 30 minutes

**Handling materials**
**Identifying**
**Applying ideas and concepts**
**Drawing conclusions**
**Clarifying ideas and concepts**
**Discussing thinking**

▶ Students recall the types of materials that they discussed during previous activities. They try to identify an unknown material hidden in the mystery box by listening to verbal clues about its observable properties. For example, clues for glass may include:

- the material is hard and shiny;
- the material will break if dropped;
- the material can be seen through, that is, it is transparent;
- the material can be used for making windows and things to drink from.

▶ Students take turns to provide clues for other students to identify other mystery materials.

## Gathering information about student learning

Sources of information could include:

- students' identification of a material given only verbal clues;
- accuracy and usefulness of clues given by individual students to describe a particular material.

ACTIVITY

# Observation walk

*Culminating*

## Focus

This activity provides opportunities for students to apply their knowledge of the properties of materials to identify materials used within the school community.

## Materials

For each group of students:

- pencils
- paper
- clipboard

## Working scientifically

Time: 45 minutes

**Collecting information**
**Constructing meaning**
**Suggesting**

▶ Students recall the types and uses of materials covered in previous activities. They form groups to focus on one particular material such as glass, wood, plastic, metal, paper, milk or air. Students list, draw and label as many uses for their chosen material as they can think of.

▶ Students then move around the school grounds, adding to their list any more uses that they see or think of. Questions to help guide observations may include:

- Can you see any things made using your material?
- What might _____ be made of?
- How do you know? How can you tell?

▶ Students share their lists and drawings with the class and relate to them their most surprising finding.

▶ They suggest alternative uses that could be made of their chosen material and illustrate their suggestions.

## Gathering information about student learning

Sources of information could include:

- students' observations during the school walk of the ways materials are used in their school environment;
- students' illustrations of suggestions for possible alternative uses of materials.

# Pikelets



## Ingredients

- 1 cup self-raising flour
- 1/4 cup caster sugar
- 1/4 teaspoon sodium bicarbonate
- 1 egg
- 3/4 cup milk
- 1 teaspoon white vinegar
- 15 g butter, melted

## Method

1. Sift flour, sugar and bicarbonate of soda into a medium bowl. Make a well in the centre.
2. Combine egg, milk and vinegar in a separate bowl.
3. Gradually mix the liquid ingredients into the dry ingredients, stirring the mixture until it is smooth. Stir in the melted butter.
4. Heat the frying pan to medium and lightly grease it evenly with butter.
5. Gently drop batter, a tablespoonful at a time, into the pan. Allow room between each spoonful for spreading.
6. Just before the bubbles burst, turn pikelets over. Cook until golden brown on the underside.

# Chocolate crackles

Resource Sheet 2

## Ingredients

- 250 g Copha
- 1 1/2 cups puffed rice
- 3 tablespoons cocoa & 250g Icing sugar
- 1 cup desiccated coconut
- patty papers

## Method

1. Melt Copha in a saucepan over low heat.
2. Mix all dry ingredients in a large bowl.
3. Pour melted Copha into the dry ingredients and stir until well mixed.
4. Spoon the chocolate crackle mixture into patty papers.
5. Place in the refrigerator to set.

# Evaporation experiment: Teacher demonstration



## Materials

- large shallow container made of transparent material
- masking tape
- ruler
- water
- food colouring (optional)

## Method

**1.** Fill the container with water to a depth of 3–4 centimetres. (Some food colouring in the water will make it easier to see the water level.)

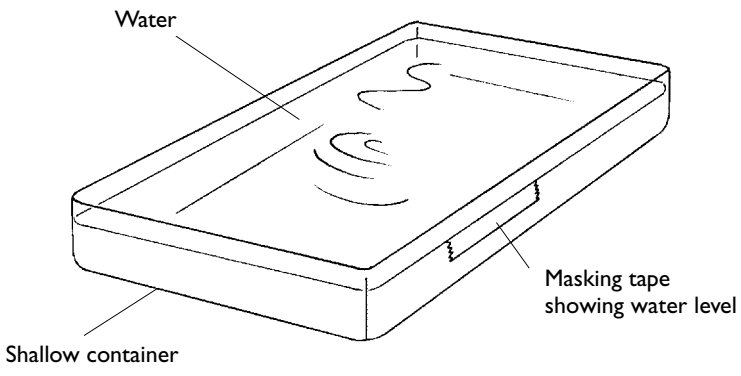
**2.** Use a strip of masking tape to indicate the water level at the start of the experiment.

**3.** Place the uncovered container in a protected area where it will be exposed to direct sunlight.

**4.** After a few days, mark the water level with another piece of masking tape.

**5.** Examine the two markers to see if there is a difference in water levels.

**6.** Use the ruler to measure the difference in water levels.



# Dissolving sugar and salt


Resource Sheet 4

## Materials

- 2 beakers or glass jars
- $^1/_2$ teaspoonful sugar
- $^1/_2$ teaspoonful salt
- warm water
- stirrers

## Method

**1.** Half-fill one beaker or glass jar with warm water.

**2.** Add $^1/_2$ teaspoonful of sugar.

**3.** Stir well.

**4.** Half-fill one beaker or glass jar with warm water.

**5.** Add $^1/_2$ teaspoonful of salt.

**6.** Stir well.

Write about what you did and saw in your notebook. You may draw a picture to help show what you did.

## Acknowledgments

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**This sourcebook module should be read in conjunction with the following Queensland School Curriculum Council materials:**

*Years 1 to 10 Science Syllabus*
*Years 1 to 10 Science Sourcebook: Guidelines*
*Science Initial In-service Materials*

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