PrimaryConnections®
Linking science with literacy

Fully aligned with the Australian Curriculum

All mixed up

Year 2

Chemical sciences

Primary**Connections project**

Australian Government

Australian Academy of Science

Professional learning program

The Primary**Connections** program includes a sophisticated professional learning component and exemplary curriculum resources. Research shows that this combination is more effective than using each in isolation.

Professional Learning Facilitators are available throughout Australia to conduct workshops on the underpinning principles of the program: the Primary**Connections** 5Es teaching and learning model, linking science with literacy, investigating, embedded assessment and collaborative learning.

The Primary**Connections** website has contact details for state and territory Professional Learning Coordinators, as well as additional resources for this unit. Visit the website at:
www.science.org.au/primaryconnections

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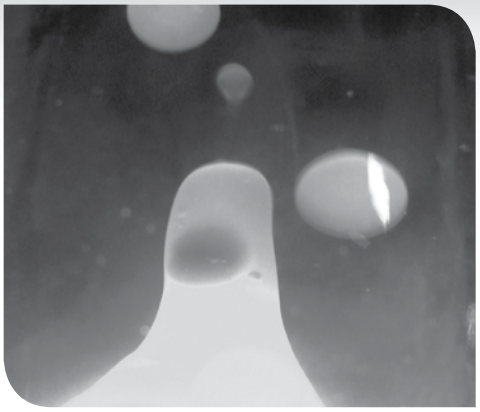


We are surrounded by mixtures — the air we breathe, the food we eat and drink, and our personal grooming products. Chefs try mixing ingredients in different ways to make tasty combinations and interesting textures. Through inquiry, scientists have developed mixtures that are useful for all kinds of purposes, such as alloys, amalgams and paints, to name but a few. Indeed, it can be surprising just how many things that we take for granted every day are the result of inquiry into mixtures. For example, how different our lives would be without the myriad of inks, glues and detergents at our disposal.

The *All mixed up* unit is an ideal way to link science with literacy in the classroom. Students learn about materials that don't mix well, and others that are difficult to separate. Through hands-on investigations, students explore how changing the quantities of materials in a mixture can alter its properties and uses.

Australian Government

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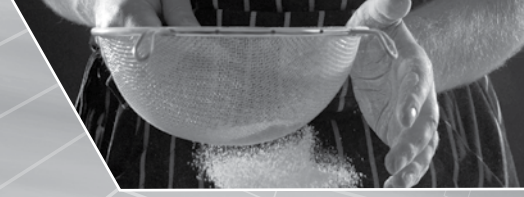

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Foreword

The Australian Academy of Science is proud of its long tradition of supporting and informing science education in Australia. 'Primary**Connections**: linking science with literacy' is its flagship primary school science program, and it is making a real difference to the teaching and learning of science in Australian schools.

The Primary**Connections** approach has been embraced by schools since its inception in 2004, and there is substantial evidence of its effectiveness in helping teachers transform their practice. It builds teacher confidence and competence in this important area, and helps teachers use their professional skills to incorporate elements of the approach into other areas of the curriculum. Beginning and pre-service teachers find the approach do-able and sustainable. Primary**Connections** students enjoy science more than in comparison classes and Indigenous students, in particular, show significant increases in learning using the approach.

The project has several components: professional learning, curriculum resources, research and evaluation, and Indigenous perspectives. With the development of an Australian curriculum in the sciences by ACARA in December 2010, it is an exciting time for schools to engage with science, and to raise the profile of primary science education.

Students are naturally curious. Primary**Connections** provides an inquiry-based approach that helps students develop deep learning, and guides them to find scientific ways to answer their questions. The lessons include key science background information, and further science information is included on the Primary**Connections** website.

Science education provides a foundation for a scientifically literate society, which is so important for engagement in key community debates, such as climate change, carbon emissions, and immunisation, as well as for personal decisions about health and well-being. The inquiry approach in Primary**Connections** prepares students well to participate in evidence-based discussions of these and other issues.

Primary**Connections** has been developed with the financial support of the Australian Government and has been endorsed by education authorities across the country. The Steering Committee, comprising the Department of Education, Employment and Workplace Relations and Academy representatives, and the Reference Group, which includes representatives from all stakeholder bodies including states and territories, have provided invaluable guidance and support over the last seven years. Before publication, the teacher background information on science is reviewed by a Fellow of the Academy. All these inputs have ensured an award-winning, quality program.

The Fellows of the Academy are committed to ongoing support for teachers of science at all levels. I commend Primary**Connections** to you and wish you well in your teaching.

Professor Suzanne Cory, AC PresAA FRS
President
Australian Academy of Science
2010–2013

The Primary**Connections program**

Primary**Connections** is an innovative program that links the teaching of science and literacy in the primary years of schooling. It is an exciting and rewarding approach for teachers and students, with a professional learning program and supporting curriculum resources. Further information about professional learning and other curriculum support can be found on the Primary**Connections** website: www.science.org.au/primaryconnections

Developing students' scientific literacy

The learning outcomes in Primary**Connections** contribute to developing students' scientific literacy. Scientific literacy is considered the main purpose of school science education and has been described as an individual's:

- scientific knowledge and use of that knowledge to identify questions, acquire new knowledge, explain scientific phenomena and draw evidence-based conclusions about science-related issues
- understanding of the characteristic features of science as a form of human knowledge and enquiry
- awareness of how science and technology shape our material, intellectual and cultural environments
- willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen (Programme for International Student Assessment & Organisation for Economic Co-operation and Development, 2009).

The Primary**Connections teaching and learning model**

This unit is one of a series designed to exemplify the Primary**Connections** teaching and learning approach, which embeds inquiry-based learning into a modified 5Es instructional model, with the five phases: *Engage, Explore, Explain, Elaborate* and *Evaluate* (Bybee, 1997). The relationship among the 5Es phases, investigations, literacy products and assessment is illustrated below:

Primary**Connections 5Es teaching and learning model**

Phase	Focus	Assessment focus
ENGAGE	Engage students and elicit prior knowledge	**Diagnostic assessment**
EXPLORE	Provide hands-on experience of the phenomenon	**Formative assessment**
EXPLAIN	Develop scientific explanations for observations and represent developing conceptual understanding Consider current scientific explanations	**Formative assessment**
ELABORATE	Extend understanding to a new context or make connections to additional concepts through a student-planned investigation	**Summative assessment** of the Science Inquiry Skills
EVALUATE	Students re-represent their understanding and reflect on their learning journey, and teachers collect evidence about the achievement of outcomes	**Summative assessment** of the Science Understanding

More information on Primary**Connections** 5Es teaching and learning model can be found at:
www.science.org.au/primaryconnections/teaching-and-learning

Assessment

Assessment against the year level achievement standards of the Australian Curriculum: Science (ACARA, 2010) is ongoing and embedded in Primary**Connections** units. Assessment is linked to the development of literacy practices and products. Relevant understandings and skills are highlighted at the beginning of each lesson. Different types of assessment are emphasised in different phases:

Diagnostic assessment occurs in the *Engage* phase. This assessment is to elicit students' prior knowledge so that the teacher can take account of this when planning how the *Explore* and *Explain* lessons will be implemented.

Formative assessment occurs in the *Explore and Explain* phases. This enables the teacher to monitor students' developing understanding and provide feedback that can extend and deepen students' learning.

Summative assessment of the students' achievement developed throughout the unit occurs in the *Elaborate* phase for the Science Inquiry Skills, and in the *Evaluate* phase for the Science Understanding.

Linking science with literacy

Primary**Connections** has an explicit focus on developing students' knowledge, skills, understanding and capacities in science and literacy. Units employ a range of strategies to encourage students to think about, reason and represent science.

Primary**Connections** develops the literacies of science that students need to learn and to represent their understanding of science concepts, processes and skills. Representations in Primary**Connections** are multi-modal and include text, tables, graphs, models, drawings and embodied forms, such as gesture and role-play. Students use their everyday literacies to learn the new literacies of science. Science provides authentic contexts and meaningful purposes for literacy learning, and also provides opportunities to develop a wider range of literacies. Teaching science with literacy improves learning outcomes in both areas.

Alignment with the Australian Curriculum: Science

The Australian Curriculum: Science has three interrelated strands — Science Understanding, Science as a Human Endeavour and Science Inquiry Skills — that together 'provide students with understanding, knowledge and skills through which they can develop a scientific view of the world (ACARA, 2010)'.

The content of these strands is described by the Australian Curriculum as:

Science Understanding	
Biological sciences	Understanding living things
Chemical sciences	Understanding the composition and behaviour of substances
Earth and space sciences	Understanding Earth's dynamic structure and its place in the cosmos
Physical sciences	Understanding the nature of forces and motion, and matter and energy
Science as a Human Endeavour	
Nature and development of science	An appreciation of the unique nature of science and scientific knowledge
Use and influence of science	How science knowledge and applications affect people's lives and how science is influenced by society and can be used to inform decisions and actions
Science Inquiry Skills	
Questioning and predicting	Identifying and constructing questions, proposing hypotheses and suggesting possible outcomes
Planning and conducting	Making decisions regarding how to investigate or solve a problem and carrying out an investigation, including the collection of data
Processing and analysing data and information	Representing data in meaningful and useful ways, identifying trends, patterns and relationships in data, and using evidence to justify conclusions
Evaluating	Considering the quality of available evidence and the merit or significance of a claim, proposition or conclusion with reference to that evidence
Communicating	Conveying information or ideas to others through appropriate representations, text types and modes

AC All the material in this table is sourced from the Australian Curriculum.

There will be a minimum of four Primary**Connections** units for each year of primary school from Foundation to Year 6 — at least one for each Science Understanding sub-strand of the Australian Curriculum. Each unit contains detailed information about its alignment with all aspects of the Australian Curriculum: Science and its links to the Australian Curriculum: English and Mathematics.

Safety

Learning to use materials and equipment safely is central to working scientifically. It is important, however, for teachers to review each lesson before teaching to identify and manage safety issues specific to a group of students. A safety icon 

is included in lessons where there is a need to pay particular attention to potential safety hazards. The following guidelines will help minimise risks:

- Be aware of the school's policy on safety in the classroom and for excursions.
- Check students' health records for allergies or other health issues.
- Be aware of potential dangers by trying out activities before students do them.
- Caution students about potential dangers before they begin an activity.
- Clean up spills immediately as slippery floors are dangerous.
- Instruct students never to taste, smell or eat anything unless they are given permission.
- Discuss and display a list of safe practices for science activities.

References

Australian Curriculum Assessment and Reporting Authority (ACARA). (2010). *Australian Curriculum: Science*. www.australiancurriculum.edu.au

Bybee, R.W. (1997). *Achieving scientific literacy: from purposes to practical action*. Portsmouth, NH: Heinemann.

Programme for International Student Assessment & Organisation for Economic Co-operation and Development. (2009). *PISA 2009 assessment framework: key competencies in reading, mathematics and science*. Paris: OECD Publishing.

Unit at a glance *All mixed up*

Phase	Lesson	At a glance
ENGAGE	**Lesson 1** Masters of mixing ***Session 1*** What's my mixture? ***Session 2*** Many mixtures	To capture students' interest and find out what they think they know about how different materials can be combined, including by mixing, for a particular purpose To elicit students' questions about mixtures and their uses
EXPLORE	**Lesson 2** Creative cooking	To provide hands-on, shared experiences of creating mixtures of solids
	Lesson 3 Sometimes slimy	To provide hands-on, shared experiences of creating mixtures of solids and liquids
	Lesson 4 Fun fluids	To provide hands-on, shared experiences of creating mixtures of liquids
EXPLAIN	**Lesson 5** Marvellous mixtures	To support students to represent and explain their understanding of how different materials can be mixed together for different purposes, and to introduce current scientific views
ELABORATE	**Lesson 6** Sifting solids ***Session 1*** Cook's dilemma ***Session 2*** Can we sift it?	To support students to plan and conduct an investigation of how to separate a mixture of solids
	Lesson 7 Interesting ink	To support students to plan and conduct an investigation of what different black inks are made of
EVALUATE	**Lesson 8** Musing on mixtures	To provide opportunities for students to represent what they know about how different materials can be combined, including by mixing, for a particular purpose, and to reflect on their learning during the unit

A unit overview can be found in Appendix 7, page 83.

Alignment with the Australian Curriculum: Science

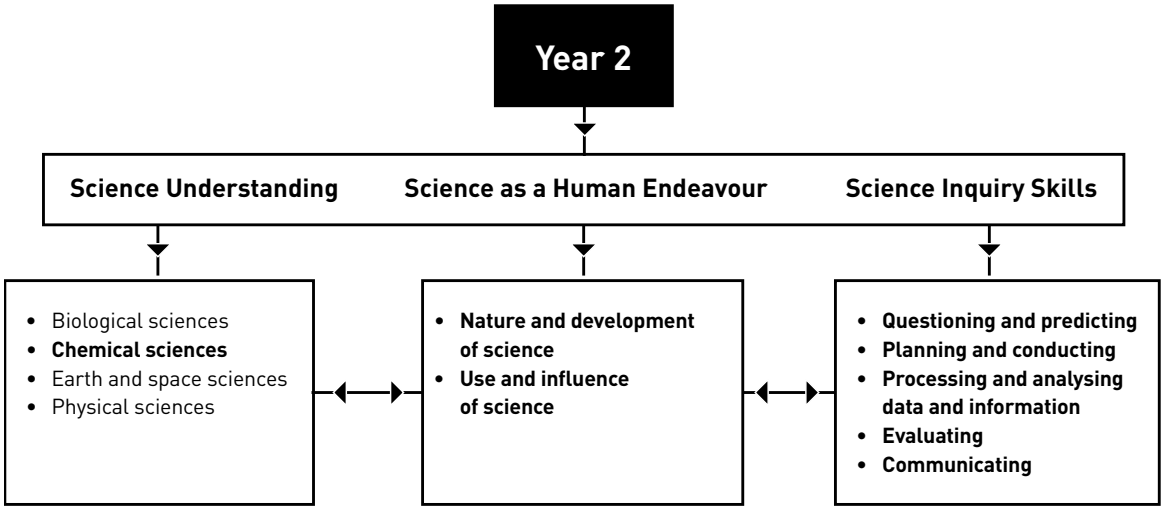
All mixed up embeds the three strands of the Australian Curriculum: Science. The particular sub-strands and their content for Year 2 that are relevant to this unit are shown below.

Strand	Sub-strand	Code	Year 2 content descriptions	Lessons
Science Understanding	**Chemical sciences**	ACSSU031	Different materials can be combined, including by mixing, for a particular purpose	1–8
Science as a Human Endeavour	**Nature and development of science**	ACSHE021	Science involves asking questions about, and describing changes in, objects and events	1, 4, 5, 6, 7
	Use and influence of science	ACSHE022	People use science in their daily lives, including when caring for their environment and living things	1, 2, 4, 5, 6, 7
Science Inquiry Skills	**Questioning and predicting**	ACSIS024	Respond to and pose questions, and make predictions about familiar objects and events	1, 2, 3, 4, 6, 7
	Planning and conducting	ACSIS025	Participate in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas, and accessing information sources	2, 3, 4, 6, 7
		ACSIS026	Use informal measurements in the collection and recording of observations, with the assistance of digital technologies as appropriate	6
	Processing and analysing data and information	ACSIS027	Use a range of methods to sort information, including drawings and provided tables	1, 5, 6
		ACSIS212	Through discussion, compare observations with predictions	5, 6, 7
	Evaluating	ACSIS213	Compare observations with those of others	6, 7
	Communicating	ACSIS029	Represent and communicate observations and ideas in a variety of ways, such as oral and written language, drawing and role-play	5, 6, 7

AC All the material in the first four columns of this table is sourced from the Australian Curriculum.

Interrelationship of the Science strands

The interrelationship between the three strands (Science Understanding, Science as a Human Endeavour and Science Inquiry Skills) and their sub-strands is shown below. Sub-strands covered in this unit are in bold.



AC All the terms in this diagram are sourced from the Australian Curriculum.

Relationship to Overarching ideas

In the Australian Curriculum: Science, six Overarching ideas support the coherence and developmental sequence of science knowledge within and across year levels. In *All mixed up* these Overarching ideas are represented as follows:

Overarching idea	Incorporation in *All mixed up*
Patterns, order and organisation	Students classify mixtures according to different criteria, including the purpose that they might serve in their lives.
Form and function	Students explore how the different substances that form a mixture contribute to determining its form, which can in turn influence its use.
Stability and change	Students explore whether different mixtures can be easily separated or not, and therefore how stable the mixtures are.
Scale and measurement	Students consider relative scale of substances when recording observations of mixtures.
Matter and energy	Students explore how mixtures are combinations of substances that do not change and can be separated again. These experiences form the foundation for distinguishing simple mixtures from chemical reactions.
Systems	Students identify observable components within the simple system of a mixture. They find that some substances that appear uniform, such as black ink, are in fact mixtures.

Curriculum focus

The Australian Curriculum: Science is described by year level, but provides advice across four year groupings on the nature of learners. Each year grouping has a relevant curriculum focus.

Curriculum focus Years F–2	Incorporation in *All mixed up*
Awareness of self and the local world	Students use direct observations to gather information, describe, sort and make comparisons of the properties and purposes of mixtures

Achievement standards

The achievement standards of the Australian Curriculum: Science indicate the quality of learning that students typically demonstrate by a particular point in their schooling, for example, at the end of a year level. These standards will be reviewed regularly by ACARA and are available from the ACARA website.

By the end of this unit, teachers will be able to make evidence-based judgements on whether the students are achieving below, at or above the Australian Curriculum: Science Year 2 achievement standard. Rubrics to help teachers make these judgements are available on the website: www.science.org.au/primaryconnections/curriculum-resources

General capabilities

The skills, behaviours and attributes that students need to succeed in life and work in the 21st century have been identified in the Australian Curriculum as General capabilities. There are seven General capabilities and they are embedded throughout the units. For unit-specific information see the next page. For further information see: www.australiancurriculum.edu.au/generalcapabilities

All mixed up — Australian Curriculum General capabilities

General capabilities	Australian Curriculum description	*All mixed up* examples
Literacy	Literacy knowledge specific to the study of science develops along with scientific understanding and skills. PrimaryConnections learning activities explicitly introduce literacy focuses and provide students with the opportunity to use them as they think about, reason and represent their understanding of science.	In *All mixed up* the literacy focuses are: • science journals • ideas maps • word walls • tables • annotated drawings • procedural texts • T-charts • role-plays.
Numeracy	Elements of numeracy are particularly evident in Science Inquiry Skills. These include practical measurement and the collection, representation and interpretation of data.	Students: • collect, interpret and represent data about mixtures • measure ingredients to prepare a mixture.
Information and communication technology (ICT) competence	ICT competence is particularly evident in Science Inquiry Skills. Students use digital technologies to investigate, create, communicate, and share ideas and results.	Students are given optional opportunities to: • use interactive resource technology to view, record and discuss information • use the internet to research further information about materials and how they might be used.
Critical and creative thinking	Students develop critical and creative thinking as they speculate and solve problems through investigations, make evidence-based decisions, and analyse and evaluate information sources to draw conclusions. They develop creative questions and suggest novel solutions.	Students: • use reasoning to develop questions for inquiry • formulate, pose and respond to questions • develop evidence-based claims.
Ethical behaviour	Students develop ethical behaviour as they explore principles and guidelines in gathering evidence and consider the implications of their investigations on others and the environment.	Students: • ask questions of others, respecting each other's point of view.
Personal and social competence	Students develop personal and social competence as they learn to work effectively in teams, develop collaborative methods of inquiry, work safely, and use their scientific knowledge to make informed choices.	Students: • work collaboratively in teams • listen to and abide by rules of a new game • follow a procedural text for working safely • participate in discussions.
Intercultural understanding	Intercultural understanding is particularly evident in Science as a Human Endeavour. Students learn about the influence of people from a variety of cultures on the development of scientific understanding.	• 'Cultural perspectives' opportunities are highlighted where relevant. • Important contributions made to science by people from a range of cultures are highlighted where relevant.

AC All the material in the first two columns of this table is sourced from the Australian Curriculum.

Cross curriculum priorities

There are three cross curriculum priorities identified by the Australian Curriculum:

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability.

Two of these are embedded within this unit as described below. For further information see: www.australiancurriculum.edu.au/CrossCurriculumPriorities

Aboriginal and Torres Strait Islander histories and cultures

PrimaryConnections has developed an Indigenous perspective framework that has informed practical reflections on intercultural understanding. It can be accessed at: www.science.org.au/primaryconnections/indigenous

All mixed up focuses on the Western science way of making evidence-based claims about how different materials can be combined and separated and for what purpose.

Indigenous cultures might have different explanations for how different things are mixed together and for what purpose.

PrimaryConnections recommends working with Indigenous community members to access contextualised, relevant Indigenous perspectives. Protocols on seeking out and engaging Indigenous community members are discussed in state and territory Indigenous education policy documents, and can be found on the PrimaryConnections website.

Sustainability

In *All mixed up,* students explore whether or not mixtures can be easily separated. The recognition that some materials are more or less easy to separate is important when considering our impact on the environment. A simple mixture of sugar and cocoa powder can be difficult to separate. Explorations of water and oil can also provide a framework for better understanding the effects of oil spills.

Alignment with the Australian Curriculum: English and Maths

Strand	Sub-strand	Code	Year 2 content descriptions	Lessons
English – Language	**Language variation and change**	ACELA1460	Understand that spoken, visual and written forms of language are different modes of communication with different features, and their use varies according to the audience, purpose, context and cultural background.	2, 3, 4, 5, 8
	Language for interaction	ACELA1461	Understand that language varies when people take on different roles in social and classroom interactions, and how the use of key interpersonal language resources varies depending on context.	1–8
	Text structure and organisation	ACELA1463	Understand that different types of texts have identifiable text structures and language features that help the text serve its purpose.	1, 2, 3
		ACELA1466	Know some of the features of text organisation including page and screen layouts, alphabetical order and different types of diagrams, for example, timelines.	2, 3, 4
	Expressing and developing ideas	ACELA1468	Understand that nouns represent people, places, things and ideas, and can be, for example, common, proper, concrete and abstract, and that noun groups can be expanded using articles and adjectives.	6
		ACELA1470	Understand the use of vocabulary about familiar and new topics, and experiment with and begin to make conscious choices of vocabulary to suit audience and purpose.	2, 8
	Interaction with others	ACELY1666	Listen for specific purposes and information, including instructions, and extend students' own and others' ideas in discussions.	2–8
		ACELY1789	Use interaction skills including initiating topics, making positive statements and voicing disagreement in an appropriate manner, speaking clearly, and varying tone, volume and pace appropriately.	1, 2, 3, 4, 5, 8
		ACELY1667	Rehearse and deliver short presentations on familiar and new topics.	5, 8
	Creating texts	ACELY1671	Create short imaginative, informative and persuasive texts using growing knowledge of text structures and language features for familiar and some less familiar audiences, selecting print and multi-modal elements appropriate to the audience and purpose.	6, 8
Maths	**Statistics and probability**	ACMSP049	Collect, check and classify data.	1, 2, 5
		ACMSP050	Create displays of data using lists, tables and timelines, and interpret them.	1, 2, 5, 6, 7

AC All the material in the first four columns of this table is sourced from the Australian Curriculum.

Other links are highlighted at the end of lessons where possible. These links will be revised and updated on the website: www.science.org.au/primaryconnections/curriculum-resources

Introduction to mixtures

Teacher background information

Scientists use the word 'material' to refer to all matter in the universe. All matter is made up of very small particles called atoms. These atoms can join with other atoms to form molecules. In this unit the following differentiation is made:

- an object, for example, a drink bottle, is made of material(s)
- a material, for example, plastic, is composed of substance(s)
- a substance, for example, polyethylene, is composed of (contains) one or more atoms or molecules.

In chemistry a 'mixture' refers to a material that is made of two or more substances (or materials) mixed together without combining chemically together. Baking soda dissolved in water is a mixture since the particles of baking soda are present in the water and retain their properties. When baking soda and vinegar are mixed together, they react and create new substances so there is no longer a mixture of baking soda and vinegar.

Mixtures that are uniform in composition are called 'homogeneous'. Two random samples of these mixtures would have the same quantities of materials, for example, well mixed flour and sugar or well stirred vinegar and water create homogeneous mixtures. Mixtures that are not uniform are called 'heterogeneous'. Such mixtures can have very different elements, such as a mixture of stones and sand, or may have clear zones between the two elements, such as oil and water. (**Note:** These terms are for teacher background information only.)

Some mixtures are easy to separate using the properties of the materials. For example, if the substances have particles of different sizes they can be separated using a sieve. However, if the two substances do not have properties sufficiently different from each other, then it is very difficult to separate the mixture. For example, it is difficult to separate a mixture of icing sugar and cocoa powder. Scientists use many different properties of substances to separate them, for example, their boiling points, movement through filter paper or ability to dissolve into different solvents.

Many everyday objects are made of materials that are mixtures. Sometimes it might not be evident that a material is a mixture until a change happens. For example, fresh milk naturally separates, however, modern processes homogenise (from the Greek *homo* = the same) the mixture of fats and water so that it no longer separates.

Students' conceptions

Taking account of students existing ideas is important in planning effective teaching approaches that help students learn science. Students develop their own ideas during their experiences in everyday life and might hold more than one idea about an event or phenomenon.

Students are often unable to name mixtures in their everyday lives. While they can name some obvious mixtures, such as cake mixture, many do not recognise other substances, such as ink, milk or self-raising flour, are in fact mixtures.

Students might think some mixtures are not mixtures since they are labelled as ‘pure’. Chemists might use the term ‘pure’ to indicate a material that is composed of only one substance. However, in everyday language ‘pure’ can mean ‘containing only the substances that should be in the mixture’.

References

Driver, R., Squires, A., Rushworth, P. & Wood-Robinson, V. (1994). *Making sense of secondary science: research into children’s ideas*. London: Routledge.

Skamp, K. (Ed.). (2012). *Teaching primary science constructively* (4th Edn). South Melbourne: Cengage Learning Australia.

To access more in-depth science information in the form of text, diagrams and animations, refer to the Primary**Connections** Science Background CD, which has now been loaded on the Primary**Connections** website: www.science.org.au/primaryconnections. Note that this background information is intended for the teacher only.

Lesson 1 Masters of mixing

AT A GLANCE

To capture students' interest and find out what they think they know about how different materials can be combined, including by mixing, for a particular purpose.

To elicit students' questions about mixtures and their uses.

Session 1 What's my mixture?

Students:

- discuss similarities and differences between images of characters creating mixtures
- explain why they think different characters are creating mixtures
- brainstorm what they know about mixtures and their uses.

Session 2 Many mixtures

Students:

- observe, record and report on mixtures that they can see around their home.

Lesson focus

The focus of the *Engage* phase is to spark students' interest, stimulate their curiosity, raise questions for inquiry and elicit their existing beliefs about the topic. These existing ideas can then be taken into account in future lessons.

Assessment focus

Diagnostic assessment is an important aspect of the *Engage* phase. In this lesson you will elicit what students already know and understand about:

- how different materials can be combined, including by mixing, for a particular purpose.

Key lesson outcomes

Students will be able to represent their current understanding as they:
• explain and draw their ideas of how materials can be mixed together for different purposes
• contribute to discussions about how people from different professions, including scientists, might use mixtures
• identify the purpose and features of a science journal and word wall
• identify questions about mixtures and what they are used for
• identify mixtures in their everyday lives
• record findings in a table and discuss their observations.

This lesson also provides opportunities to monitor the development of students' General capabilities (highlighted through icons, see page 5).

Teacher background information

In chemistry, a mixture is the combination of two or more different substances, for example, flour and sugar, that do not combine chemically. Mixtures can be made for all sorts of purposes. Generally their properties depend on the relative quantities of substances that make them up. Therefore, people often measure substances when making a mixture, either formally or informally (by 'eye'). In this lesson, students are given pictures of three different characters creating a mixture.

The three characters

In each picture, the character has the same pose, a mixing implement, some sort of mixing bowl, a measuring jug and three jars with substances they are using to create a mixture. Each picture has different substances written on the jars, reflecting the different mixtures that students will be exploring in the unit.

The profession of each character is different, as demonstrated by the changing clothes. This invites questioning as to the purpose and methods of the mixture:

- One character appears to be a cook or chef so their mixture is probably for eating. The three substances are all edible and when mixed together with desiccated coconut and melted copha form chocolate crackles. Cooks and chefs use both formal and informal measurements when creating their mixtures, and might follow recipes or be creative.
- One character is dressed in fancy dress. This can be interpreted as a 'wizard creating a potion' or an 'actor in costume making props for their set'. The possible motives therefore vary but the mixture would be made for a specific use by following a recipe and measuring carefully.
- One character is dressed in a lab coat and safety goggles, common clothing for a scientist working in a laboratory. They might be creating the mixture in order to test its properties. They would be following experimental procedure, varying the quantity of the

different substances in successive tests in order to see how that affects the properties of the mixture. Scientists also create simple mixtures following a recipe but only when the mixture itself is not the subject of analysis, for example, when preparing agar gels to migrate and study DNA.

The three characters were chosen to elicit students' understanding of mixtures based on familiar professions. The inclusion of the scientist helps students explore how scientists study mixtures. However, if there are characters that students are more likely to identify with than a cook/chef and someone making a potion, provide stimulus pictures of those persons instead.

Students' conceptions

Students might identify many different things as being 'mixtures', for example, different stationery items in a pencil case or different clothes in an ensemble. These are all examples of things being combined for a particular purpose, and if students discuss these after their home task encourage them to make claims about the purpose of creating that combination. However, the mixtures that are being explored in this unit are mixtures as defined by chemists — the combination of two materials, such as water and detergent, rather than the combination of two objects, such as a pencil and a pen.

Session 1 What's my mixture?

Equipment

FOR THE CLASS

- class science journal
- word wall
- 1 enlarged copy of 'Mix masters' (Resource sheet 1)
- 1 enlarged copy of 'Looking in the bowl' (Resource sheet 2)
- samples of materials (see 'Preparation')
- 8 or more small ziplock bags or containers with lids
- 1 large sheet of paper (see 'Preparation')

FOR EACH STUDENT

- science journal
- 1 copy of 'Looking in the bowl' (Resource sheet 2)

Preparation

- Read 'How to use a science journal' (Appendix 2).
- Read 'How to use a word wall' (Appendix 3), and prepare a word wall for the class.
- Write 'Mixtures' in the middle of the large sheet of paper.
- Enlarge a copy of 'Mix masters' (Resource sheet 1) and 'Looking in the bowl' (Resource sheet 2).
- Collect samples of each of the materials that the characters are using: puffed rice, cocoa powder, icing sugar, cornflour, water, red food colouring, dishwashing detergent and oil. Decide how you will introduce these for students to examine, for example, by putting them in containers that students can look through and shake.
- *Optional:* Display the science journal, word wall, ideas map, 'Mix masters' (Resource sheet 1) and 'Looking in the bowl' (Resource sheet 2) on an interactive whiteboard or a computer connected to a projector. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed: www.science.org.au/primaryconnections

Lesson steps

1 Introduce the enlarged copy of 'Mix masters' (Resource sheet 1). Ask students to identify what is similar and different about what is happening in the three pictures.

2 Allow time for students to compare the pictures. Ask questions such as:

- What is similar about the pictures?
- What is different?
- What about…?
- Is there anything else?
- Did you notice that?

Note: In the *Engage* phase, do not provide any formal definitions or correct answers, as the purpose is to elicit students' prior knowledge.

3 Introduce the class science journal and discuss its purpose and features.

Literacy focus

Why do we use a science journal?

We use a **science journal** to record what we see, hear, feel and think so that we can look at it later to help us with our claims and evidence.

What does a science journal include?

A **science journal** might include dates and times, written text, drawings, measurements, labelled diagrams, photographs, tables and graphs.

Record students' thoughts in the class science journal.

4 Discuss the similarity that in all of the pictures people appear to be mixing things together. Introduce the samples of the materials they are mixing together and allow students to explore them (see 'Preparation').

5 Introduce the enlarged copy of 'Looking in the bowl' (Resource sheet 2). Explain that students are going to record their ideas they have now, and that throughout the unit they will be working like scientists to investigate mixing things and exploring to find out whether they can separate them again.

6 Model how to complete an entry on the enlarged copy of 'Looking in the bowl' (Resource sheet 2).

7 Ask students to individually record their ideas on their copy of 'Looking in the bowl' (Resource sheet 2). If students are not confident writers, ask them to provide their thoughts orally. Ask students to share their ideas with the rest of the class.

8 Introduce the large piece of paper with 'Mixtures' written in the middle (see 'Preparation'), and explain the purpose and features of an ideas map.

Literacy focus

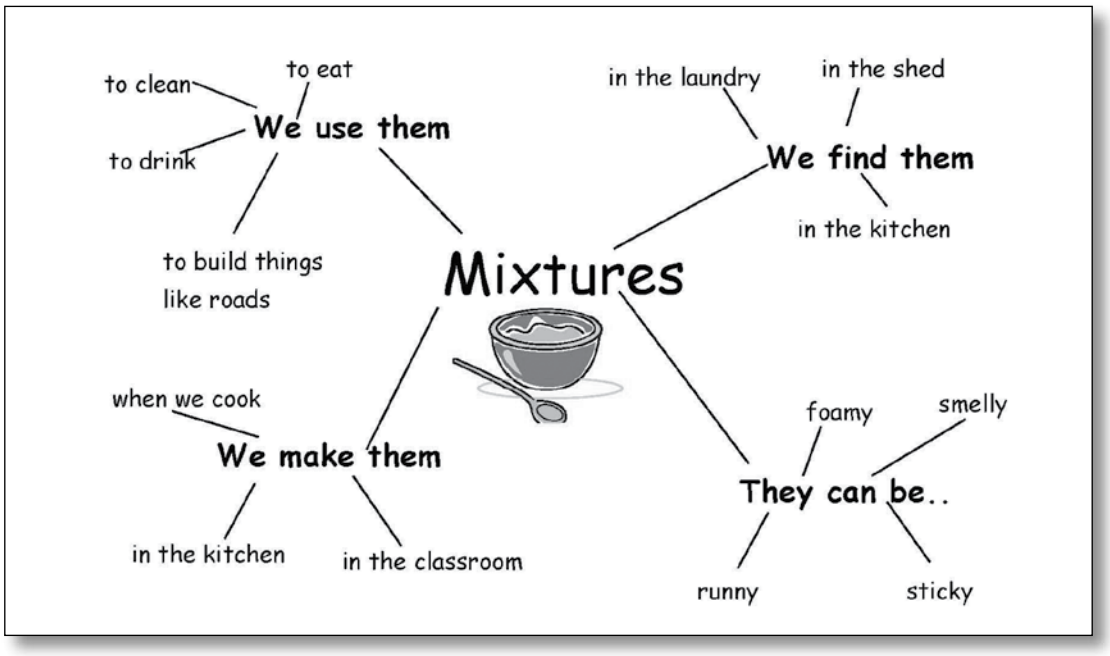
Why do we use an ideas map?

We use an **ideas map** to show our thoughts about a topic.

What does an ideas map include?

An **ideas map** includes a title in the centre. Ideas are written around it and arrows are drawn between similar ideas. An **ideas map** might include pictures and symbols.

Optional: Colour-code entries on the ideas map rather than using sub-headings.



Sample of an ideas map

9 Discuss with students that when all the things are mixed together in the bowl it is called a 'mixture'. Brainstorm with the students an ideas map about mixtures and their uses.

10 Ask students what questions they have about mixtures and their uses, and record them in the class science journal. Revisit these throughout the unit to see what questions have been answered.

11 Introduce the word wall and its title *All mixed up*. Discuss the purpose and features of a word wall.

Literacy focus

Why do we use a word wall?

We use a **word wall** to record words we know or learn about a topic. We display the word wall in the classroom so that we can look up words we are learning about and see how they are spelt.

What does a word wall include?

A **word wall** might include a topic title or picture and words that we have seen or heard about the topic.

12 Ask students what words from today's lesson would be useful to place on the word wall.

Australian Curriculum links

Science

- Further discuss what scientists are and do, and that both men and women can be scientists.

English

- Read fiction books about mixtures, for example, *George's marvellous medicine* by Roald Dahl or *Professor Puffendor's secret potions* by Robin Tzannes and Korky Paul.
- Discuss safety aspects to be considered when creating new mixtures.
- Read factual texts about mixtures.

Mix masters

Mix masters

Mix masters

Looking in the bowl

Name: _____ **Date:**_____

He is a _____ and he is

making _____.

In the bowl I think it looks like this:

He is a _____ and he is

making _____.

In the bowl I think it looks like this:

She is a _____ and she is

making _____.

In the bowl I think it looks like this:

Session 2 Many mixtures

Equipment

FOR THE CLASS

- class science journal
- word wall
- 1 enlarged copy of 'Information note for families' (Resource sheet 3)
- 1 enlarged copy of 'My mixtures' (Resource sheet 4)

FOR EACH STUDENT

- science journal
- 1 copy of 'Information note for families' (Resource sheet 3)
- 1 copy of 'My mixtures' (Resource sheet 4)
- 1 'My mixtures' folder (see 'Preparation')

Preparation

- Decide when the students will need to present the information they collect (the information will be needed during the *Explain* phase). Write this information on the 'Information note for families' (Resource sheet 3).
- Make a 'My mixtures' folder for each student, including 'Information note for families' (Resource sheet 3) and 'My mixtures' (Resource sheet 4).
- *Optional:* Display 'Information note for families' (Resource sheet 3) and 'My mixtures' (Resource sheet 4) on an interactive whiteboard or a computer connected to a projector. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed: www.science.org.au/primaryconnections

Lesson steps

1 Review the previous session using the class science journal and word wall, focusing students' attention on how they will be exploring mixtures and their uses.

2 Brainstorm with students some examples of mixtures that they might use at home, for example, muesli, seed mix, salad or paint. Record students' answers in the class science journal.

3 Introduce the enlarged copy of 'Information note for families' (Resource sheet 3). Read through it with the class and discuss the details of the task.

4 Discuss how students might ask family members to help them find mixtures and determine what is in the mixtures and what they are used for. They could be used at home, for example, in the kitchen or for cleaning, and possibly workplaces.

SAFETY

Remind students that they are never to taste, smell or eat anything unless they are given adult permission.

5 Discuss other ways of finding out if things are mixtures, for example, reading information on the packaging.

6 Introduce the enlarged copy of 'My mixtures' (Resource sheet 4), and discuss how students will use it to record information. Discuss the purpose and features of a table.

Literacy focus

Why do we use a table?

We use a **table** to organise information so that we can understand it more easily.

What does a table include?

A **table** includes a title, columns with headings and information organised under each heading.

7 Discuss with students different ways to record the information, for example, lists, drawings, pictures from magazines, photos and bringing samples to share with the class.

8 Model how to record a written observation, for example, 'A cup of tea is a mixture of sugar, hot water and tea-leaves', 'The tea is made for drinking'. Ask students to write labels for any samples or pictures they bring in.

9 Explain that students will share with the class what they find at home as the unit progresses. Remind students when the task is due.

10 Update the class word wall with words and images.

Information note for families

Introducing the 'My mixtures' project

This term our class is exploring everyday mixtures and their uses. As part of the science unit *All mixed up*, students will investigate simple mixtures in their home.

Examples of simple mixtures in the home might include breakfast cereals, seed mix and detergent mixed with water.

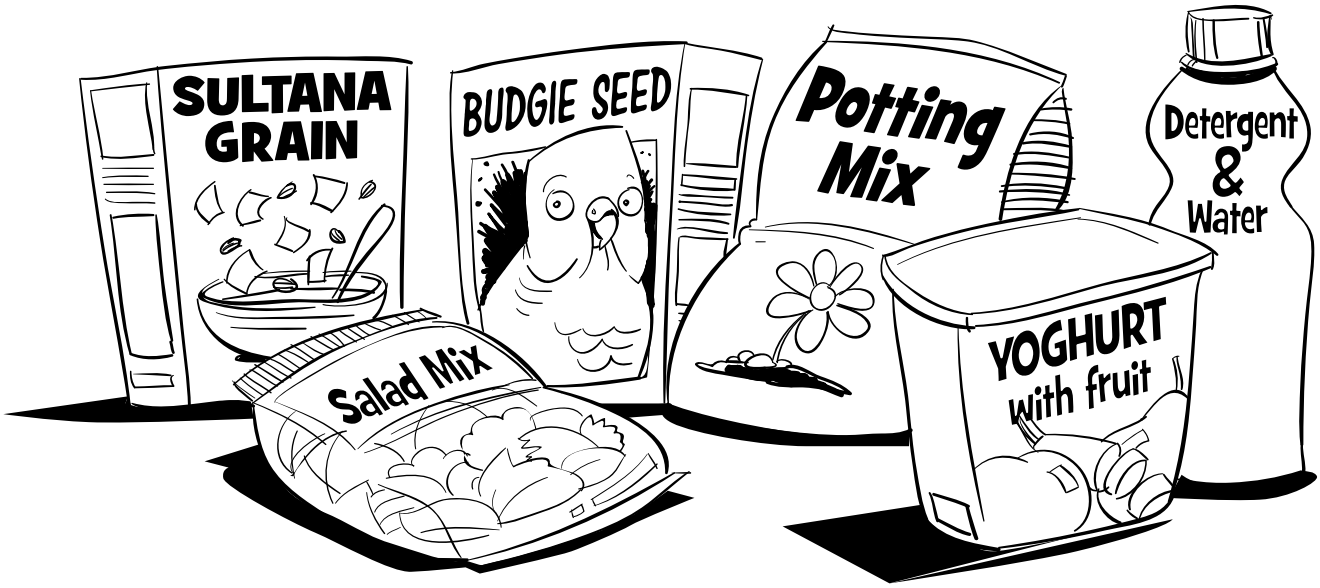
Students are asked to complete their resource sheet 'My mixtures' and are also encouraged to take photos, draw pictures or bring some of the items to school for a display.

Reinforce with the student that some mixtures might be poisonous and they are not to taste, smell or eat anything unless they are given adult permission.

Students will be asked to share their observations with their classmates on

_____

Class teacher



My mixtures

Name: _____ **Date:**_____

Find some simple mixtures around your home. Write or draw your answers.

What is the mixture called?	What is in the mixture?	What is the mixture for?
cup of black tea 	tea-leaves water sugar	to drink

Lesson 2 Creative cooking

AT A GLANCE

To provide hands-on, shared experiences of creating mixtures of solids.

Students:

- work in teams to observe different materials being mixed together
- record their observations in a table and discuss them.

Lesson focus

The *Explore* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Explore* phase ensures all students have a shared experience that can be discussed and explained in the *Explain* phase.

Assessment focus

Formative assessment is an ongoing aspect of the *Explore* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of:

- how different materials can be combined, including by mixing, for a particular purpose.

Key lesson outcomes

Students will be able to:
• describe different mixtures of solids and what they might be used for
• work in collaborative learning teams to complete a guided exploration of different mixtures of solids
• record observations using an annotated drawing in a table
• discuss and compare observations.

This lesson also provides opportunities to monitor the development of students' General capabilities (highlighted through icons, see page 5).

Teacher background information

The ingredients

Cocoa powder is made from the seeds of the cocoa tree (*Theobroma cacao*). The seeds are harvested, fermented, dried and then ground together. The resulting chocolate liquor is then pressed to remove most of the fat (cocoa butter) leaving behind a cake that is ground into a fine powder. This cocoa powder may clump slightly, which is why recipes recommend sifting to re-separate the particles of powder.

Icing sugar comes from sugar cane or sugar beet, which are ground and processed to remove the sucrose (sugar). The sugar is then allowed to crystallise and dry. This creates granulated sugar, which is then ground into a fine powder. A little cornstarch is added to prevent caking, however some might still occur. As with cocoa powder, the clumps can be removed by passing the powder through a fine sieve to separate the particles.

Puffed rice is formed by heating rice kernels under high pressure. There are many variations on this method with slightly different results. The type used in this lesson is the type favoured by Australian breakfast cereal manufacturers which makes large air-filled puffed rice.

The mixtures

When powdered icing sugar is well mixed with powdered cocoa, it forms a homogeneous mixture; the mixture is the same throughout. It is very difficult to separate such a mixture using a simple sieve.

When the fine powder of icing sugar and cocoa powder is mixed with puffed rice, a heterogeneous mix is formed; it is possible to sample a small part of the mixture and obtain only powder and then sample again and have a piece of puffed rice. It is easier to separate the materials based on size using a sieve. The sieve will let the powders through but not the puffed rice.

The skill of observing

From an early age, students use their senses to explore the diverse nature of the world around them. They do so mainly through observation, a skill that is fundamental to science and technology. Observation can involve the use of the five senses: touch, taste, hearing, sight and smell. Each sense provides different information about what we are observing.

Learning to observe involves learning to communicate observations to others, by representation or description. This is an important skill so others can replicate an investigation or identify a described mixture. Students might need practice and assistance through questioning to work together to make and record observations.

Equipment

FOR THE CLASS

- class science journal
- word wall
- team skills chart
- team roles chart
- 1 enlarged copy of 'Crazy cooking' (Resource sheet 5)

FOR EACH TEAM

- each team member's science journal
- role wristbands or badges for Manager and Speaker
- 1 copy of 'Crazy cooking' (Resource sheet 5)
- 3 cups
- 1 tablespoon
- 3 tablespoons icing sugar
- 2 tablespoons cocoa powder
- 2 tablespoons puffed rice
- protective covering for work areas (see 'Preparation')
- 1 magnifying glass

Preparation

- Read 'How to organise collaborative learning teams' (Appendix 1). Display an enlarged copy of the team skills chart and team roles chart in the classroom. Prepare role wristbands or badges and the equipment table.
- Ensure students can recognise which ingredients are which, for example, by placing labels on the equipment table.
- Arrange protective covering for students' work areas, for example, a tray or newspaper.

Check for student allergies or intolerances to the ingredients described in 'Teacher background information'.

- Enlarge a copy of 'Crazy cooking' (Resource sheet 5).
- *Optional:* Display 'Crazy cooking' (Resource sheet 5) on an interactive whiteboard or a computer connected to a projector. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed: www.science.org.au/primaryconnections
- *Optional:* Make chocolate crackles to eat after the investigation. Students should not eat the mixtures that they are investigating for hygiene reasons.

Lesson steps

1 Review the previous lesson using the class science journal and word wall. Focus students' attention on the picture of the chef and what they thought of the mixture being made on their copy of 'Looking in the bowl' (Resource sheet 2).

2 Explain that students will be working in collaborative learning teams to examine what happens when the things (substances) pictured with the chef are mixed together.

3 Introduce the enlarged copy of 'Crazy cooking' (Resource sheet 5), and read through with students. Explain that students will be creating each of the three mixtures described.

4 Demonstrate how to use the tablespoon to measure out the things (substances), put the substances in the cup and mix them together.

5 Discuss what students might observe, for example, the texture, colour and smell of the ingredients.

Ask students not to eat/taste any of the materials for allergy and hygiene reasons.

6 Discuss what words the students might use to describe their mixtures and add them to the word wall, for example, 'smooth', 'gritty', 'brown', 'white' and 'lumpy'.

7 Demonstrate how to use the magnifying glass to assist students in observing the mixtures.

8 Explain that students will be recording their observations using an annotated drawing. Discuss the features and purpose of an annotated drawing.

Literacy focus

Why do we use an annotated drawing?

We use an **annotated drawing** to show an idea or object.

What does an annotated drawing include?

An **annotated drawing** includes a picture and words or descriptions about the idea or object.

9 Model completing an observation on the enlarged copy of 'Crazy cooking' (Resource sheet 5).

10 Form teams and allocate roles. If students are using collaborative learning teams for the first time, introduce and explain the team skills chart and the team roles chart. Explain that students will use role wristbands or badges to help them (and you) know which role each member has.

11 Ask Managers to collect team equipment.

12 Allow time for teams to complete their investigations. Ask questions such as:

- How would you describe…?
- Why do you think it looks like that?

EXPLORE

13 Ask Speakers to share their team's findings. Ask questions such as:

- How is it different to…?
- How is it similar to…?
- What might this mixture be used for?
- Did it remind you of other mixtures? What are they used for?

14 As a class discuss how mixtures are used for cooking. Discuss some examples of cooking from different cultures, including types of mixtures that are created and how they are created.

15 Update the word wall with words and images.

Australian Curriculum links

Science

- Explore how to observe using all the senses by conducting investigations, such as blindfold tests.

Crazy cooking

Team members: _____ **Date:** _____

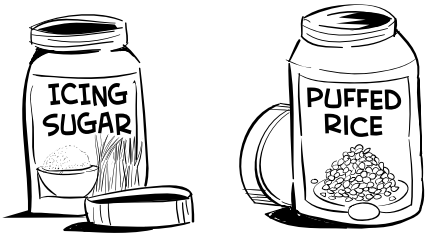
Mix together

1 tablespoon each of

Mixture 1

Mix together

1 tablespoon each of

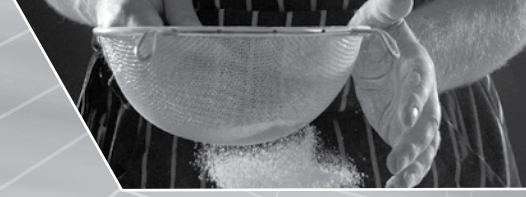


Mixture 3

Mix together

1 tablespoon each of

Mixture 3



Lesson 3 Sometimes slimy

AT A GLANCE

To provide hands-on, shared experiences of creating mixtures of solids and liquids.

Students:

- work in teams to explore what happens when cornflour is mixed with water
- discuss and compare their observations
- identify that the properties of mixtures can depend on the quantities of materials used.

Lesson focus

The *Explore* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Explore* phase ensures all students have a shared experience that can be discussed and explained in the *Explain* phase.

Assessment focus

Formative assessment is an ongoing aspect of the *Explore* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of how:

- different materials can be combined, including by mixing, for a particular purpose.

Key lesson outcomes

Students will be able to:
• identify that the properties of a mixture can depend on the relative amounts of substances it contains
• work in collaborative learning teams to follow a procedural text for making a mixture of solids and liquids
• record their observations using annotated drawings
• discuss and compare observations.

This lesson also provides opportunities to monitor the development of students' General capabilities (highlighted through icons, see page 5).

Teacher background information

Mixing powders and water is not an easy task, as most bakers have found. Care needs to be taken to ensure that the water molecules can surround each particle of the powder. Lumps of powder can be formed, surrounded by a layer of humidified powder that creates a barrier between the dry powder inside and the water outside. If there is a lot more water than powder in the mixture, the powder will be suspended while the solution is being stirred, but will gradually sediment under the effect of gravity when the solution is still.

When cornflour and water are mixed together, the molecules of starch in the cornflour are separated with a thin layer of water. This allows the particles to slide slowly past each other. However, if they are pushed together too quickly, for example, by punching the liquid, then the molecules of starch come into contact again and friction stops them moving past each other. The harder the liquid is stirred (or hit), the more solid it becomes. As this is not typical for a liquid, it is called a 'slime'. If there is more than enough water in the mixture, the molecules will always easily glide past each other, therefore a mixture of cornflour and water is only a slime when the relative quantities are right.

Equipment

FOR THE CLASS

- class science journal
- word wall
- team skills chart
- team roles chart
- 1 enlarged copy of 'Just add water' (Resource sheet 6)
- extra water
- *Optional:* coloured cornflour slime (see 'Preparation')

FOR EACH TEAM

- each team member's science journal
- role wristbands or badges for Manager and Speaker
- 1 copy of 'Just add water' (Resource sheet 6)
- 1 tablespoon
- ½ cup water in a cup
- ¼ cup cornflour
- 1 mixing bowl
- 1 mixing spoon
- extra ½ cup water
- protective covering for work areas (see 'Preparation')

Preparation

- Arrange protective covering for students' desks, for example, a tray or newspaper. As this activity can be messy, consider finding an area outside.

SAFETY

Check for student allergies or intolerances to cornflour.

- *Optional:* Make a tub of coloured cornflour slime for the class using the proportions of half as much cornflour to water and add some food colouring.

  Note: Keep in the refrigerator and do not make too far in advance, as it will start to smell strongly after a week.

  Note: Do not pour the cornflour mixture into the sink as it could block the drain. Allow it to dry out and dispose of it in the bin.
- Enlarge a copy of 'Just add water' (Resource sheet 6).
- *Optional:* Display 'Just add water' (Resource sheet 6) on an interactive whiteboard or a computer connected to a projector. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed: www.science.org.au/primaryconnections

Lesson steps

1 Review the previous lesson using the class science journal and word wall. Focus students' attention on Picture 2 from Lesson 1 and what they thought of the mixture being made.

2 Suggest that the person might be an actor preparing a potion for a television show. Discuss why mixtures are made for some movies, for example, make-up for the actors and mixtures of pretend blood.

3 Review students' ideas about the mixture on their copy of 'Looking in the bowl' (Resource sheet 2). Explain that students will be working in collaborative learning teams to examine what happens when the cornflour and water are mixed together.

4 Introduce the enlarged copy of 'Just add water' (Resource sheet 6), and discuss the purpose and features of a procedural text.

Literacy focus

Why do we use a procedural text?

We use a **procedural text** to find out how something is done.

What does a procedural text include?

A **procedural text** includes a title, a list of materials that we need to do a task and a sequence of steps to follow. It might include labelled diagrams.

EXPLORE

5 Model completing the steps of the procedural text.

Remind students not to taste the flour or water for allergy and hygiene reasons.

6 Form teams and allocate roles. Ask Managers to collect team equipment.

7 Allow teams time to make their observations and record them in their science journals. Add vocabulary they need to the word wall.

8 As a class, discuss the slime that students have made, asking questions such as:

- How difficult was it mixing only a tablespoon of water into the cornflour?
- What words would you use to describe the mixture that you have made?
- What does mixing cornflour and water together remind you of?
- What were your original thoughts about this mixture? Is what you have found similar? Why or why not?

Remind students that scientists sometimes change their ideas based on their investigations.

Optional: Introduce the coloured slime (see 'Preparation'), and explain that you have added food colouring to the mixture. Ask questions such as:

- Is this the same mixture? How is it similar/different?
- Why do we add food colouring to mixtures?

9 Ask students to predict what would happen if twice as much water was added to their slime and provide reasons for their predictions. Record students' predictions in the class science journal.

10 Allow time for teams to add an extra half-cup of water to their mixing bowls and make observations.

11 Discuss the investigation, asking questions such as:

- What happened when we added more water?
- Did that match our predictions? Why or why not?
- When making a mixture, why is it important to pay attention to the quantity of things mixed together?

Record students' thoughts in the class science journal.

12 Update the word wall with words and images.

Australian Curriculum links

Science

- Investigate how the 'stickiness' of glue made from combining flour and water is affected by the relative proportions of flour and water, by creating mixtures with different proportions and gluing pieces of paper together.
- Measure the quantities used during the investigation.

Mathematics

- Measure the amounts of water and cornflour needed to make a good slime.

Just add water

Team members: _____ **Date:** _____

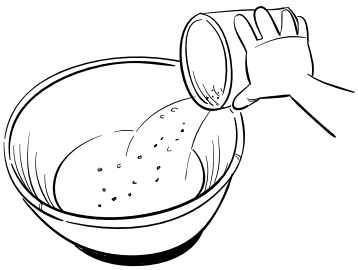
Question

What happens when **cornflour** and **water** are mixed together?

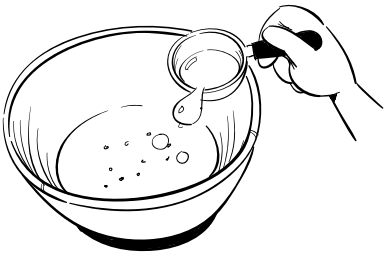
Equipment

- 1 tablespoon
- ½ cup water in a cup
- ¼ cup cornflour
- 1 mixing bowl
- 1 mixing spoon

Activity steps

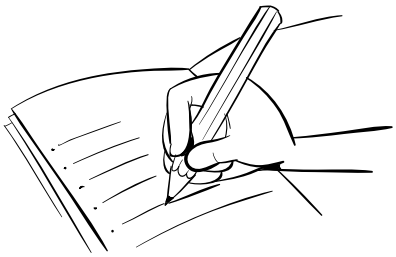


1 Put the cornflour into the mixing bowl.



2 Add one tablespoon of water to the bowl.

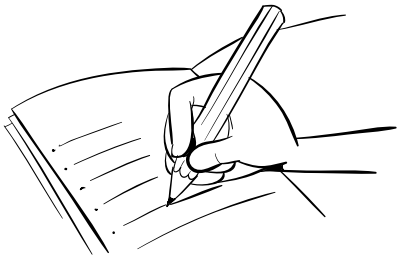
3 Mix together with the mixing spoon.



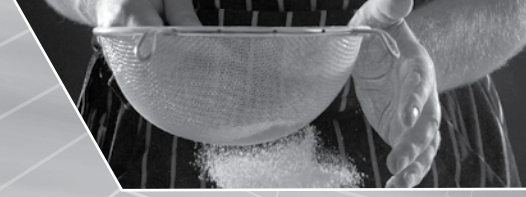
4 Think of words to describe the mixture.

5 Add the rest of the water to the bowl.

6 Mix until smooth.



7 Think of words to describe the new mixture.



Lesson 4 Fun fluids

AT A GLANCE

To provide hands-on, shared experiences of creating mixtures of liquids.

Students:

- work as a class to investigate what happens when oil, water and detergent are mixed together
- discuss their recorded observations and make evidence-based claims.

Lesson focus

The *Explore* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Explore* phase ensures all students have a shared experience that can be discussed and explained in the *Explain* phase.

Assessment focus

Formative assessment is an ongoing aspect of the *Explore* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of:

- how different materials can be combined, including by mixing, for a particular purpose.

Key lesson outcomes

Students will be able to:
• identify that not everything can mix together
• predict what will happen when different substances are mixed together
• work as a class to follow a procedural text for making a mixture of liquids
• record their observations using labelled drawings
• discuss and compare observations
• identify ways in which scientists work, including refining mixtures for everyday purposes.

This lesson also provides opportunities to monitor the development of students' General capabilities (highlighted through icons, see page 5).

Teacher background information

We often mix liquids into water, for example, we mix concentrated cordial with water to make a drink. However, not all liquids mix well with water. Water molecules are polarised —this means they have a small positive charge at one end and a small negative charge at the other end. The positive ends of water molecules are attracted to the negative ends of other water molecules and therefore, water is very cohesive. They also interact well with the positive and negative charges of salts and powders, helping certain substances dissolve in water. Substances that mix easily with water are called 'hydrophilic' (from the Greek *hydros* = water and *phillia* = love). Substances that do not mix well are called 'hydrophobic'.

Molecules of oil usually do not have a charge and are more attracted to each other than to molecules of water. Therefore, oil and water do not mix, they are known as 'immiscible'. Oil is less dense than water (it has less mass per volume, that is, a spoonful of water weighs more than a spoonful of oil, which means it floats on top of water. Oil spills float on the top of the sea, however they soak into the feathers and pelts of sea animals that have layers of oil to protect them from water.

If you shake oil and water together, the force of shaking may mix the two liquids temporarily, but when the liquid is left to settle it will quickly separate again. In order to mix oil and water, it is necessary to have an emulsifier. These are molecules that are half hydrophilic (charged and attracted to water) and half hydrophobic (non-charged and attracted to oil). When an emulsifier is mixed into an oil and water solution, the hydrophobic end attaches itself to the oil, and the hydrophilic end tries to get as far away from the oil as possible. If the mixture is well mixed, droplets of oil are suspended in the water surrounded by emulsifier molecules (or vice versa) and therefore, they do not join up again.

Equipment

FOR THE CLASS

- class science journal
- word wall
- 1 enlarged copy of 'Slick oil' (Resource sheet 7)
- 1 cup vegetable oil
- 1 cup water
- 3 tablespoons dishwashing detergent
- 4 cups
- 4 mixing spoons or pop sticks
- measuring cup with ¼ marked on it
- protective covering for work area

FOR EACH STUDENT

- each student's science journal
- 1 copy of 'Slick oil' (Resource sheet 7)

Preparation

- Enlarge a copy of 'Slick oil' (Resource sheet 7).
- *Optional:* Display 'Slick oil' (Resource sheet 7) on an interactive whiteboard or a computer connected to a projector. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed: www.science.org.au/primaryconnections

Lesson steps

1 Review the previous lesson using the class science journal and word wall. Focus students' attention on the picture of the scientist in Lesson 1 and what they thought of the mixture being made.

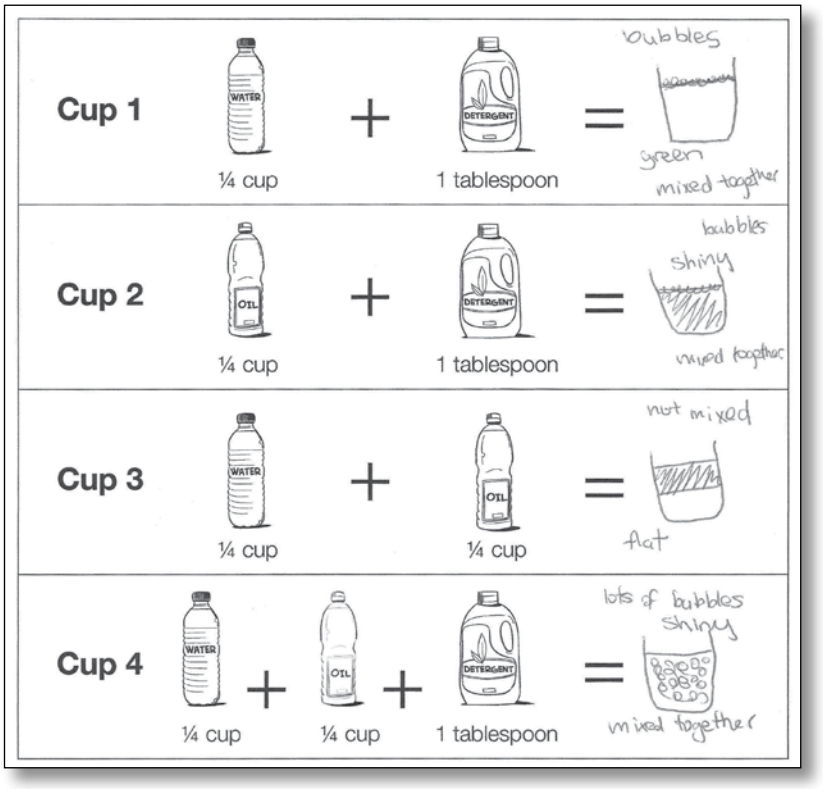
2 Discuss why scientists might be interested in studying oil and water, for example, to study oil spills or investigate how much detergent is necessary to clean an oily plate.

3 Review students' ideas about the mixture on their copy of 'Looking in the bowl' (Resource sheet 2). Explain that as a class they will be examining what happens when oil, water and detergent are mixed together.

4 Read through 'Slick oil' (Resource sheet 7) and discuss how students will compare the substances when mixed together two at a time, and then when all are mixed together.

5 Ask students to predict what they think will happen when each mixture is made. Record students' predictions in the class science journal.

6 Explain that students will be recording their observations by writing words to describe each mixture.



Work sample of 'Slick oil' investigation

7 Complete the activity, asking individual, students to make each mixture.

8 As a class discuss the investigation, asking questions such as:

- What happened when…?
- What did you notice…?
- What have we learned about mixtures?
- Did our results match our predictions? Why do you think that?

Record students' answers in the class science journal.

9 Discuss liquids that mix well with water and liquids that don't. Explain that since the detergent was partly like water and partly like oil, it helped the oil and water to mix. Explain that this is why detergent is used to wash dishes that are oily.

10 Ask students what questions a scientist might investigate, for example, which detergent removes the most oil from dishes, or how much detergent is necessary to remove a certain amount of oil from a plate.

Optional: Support students to conduct an investigation of one of the questions.

11 Update the word wall with words and images.

Australian Curriculum links

Mathematics

- Ask students to compare the amounts of water and oil in the cups by using informal measurements, for example, using finger length.
- Discuss common fractions, such as a quarter.

Slick oil

Name: _____ **Date:**_____

Question

What happens when oil, water and detergent are mixed together?

Equipment

- 1 cup vegetable oil
- 1 cup water
- 3 tablespoons dishwashing detergent
- 4 cups
- 4 mixing spoons or pop sticks
- measuring cup with ¼ marked on it
- protective covering for work area

Activity steps

Cup 1

¼ cup + 

1 tablespoon =

Cup 2

¼ cup + 

1 tablespoon =

Cup 3

¼ cup +

¼ cup =

Cup 4

¼ cup +

¼ cup +

1 tablespoon =

Lesson 5 Marvellous mixtures

AT A GLANCE

To support students to represent and explain their understanding of how different materials can be mixed together for different purposes, and to introduce current scientific views.

Students:

- discuss mixtures they have explored and the purposes of the mixtures
- sort mixtures according to their purposes using a T-chart
- describe what the term 'mixture' means.

Lesson focus

In the *Explain* phase students develop a literacy product to represent their developing understanding. They discuss and identify patterns and relationships within their observations. Students consider the current views of scientists and deepen their own understanding.

Assessment focus

Formative assessment is an important aspect of the *Explain* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you are looking for evidence that students are developing an understanding about:

- how different materials can be combined, including by mixing, for a particular purpose.

You are also able to look for evidence of students' sorted images to represent what they know about mixtures, and give them feedback on how they can improve their representations.

Key lesson outcomes

Students will be able to:
• present their findings about mixtures in their homes and discuss with the class
• identify what a mixture is and what it can be used for
• observe and compare the different mixtures and their purposes
• listen to and follow a set of rules to create a T-chart to represent what they know about their mixtures.

This lesson also provides opportunities to monitor the development of students' General capabilities (highlighted through icons, see page 5).

Teacher background information

A 'mixture' in chemistry is two or more substances (or materials) that are intermingled in the same area. Cordial mixed with water is a mixture, since the individual substances of the cordial and the water are still present. Cordial is also a mixture, including substances such as sugar, water, fruit extract, colours and flavours. Some of these substances can also be classified as mixtures. Scientists often work to isolate 'pure substances', that is, substances that are not mixtures. However, the definition of what is 'pure' can vary depending on the scientist's subject of analysis.

Creating mixtures can be very useful, as they can have properties that the individual substances do not. But the properties of the individual substances determine whether or not they mix together, for example, water does not mix with oil unless there is another substance, such as detergent, present. Scientists work to find ways of mixing new substances that might produce mixtures which are of use to us. They also work to investigate how to stop the mixtures from separating, for example, they have found a technique for homogenising milk so that it does not separate back into its constituent parts.

Equipment

FOR THE CLASS

- word wall
- class science journal
- students' mixtures from home (see 'Preparation')
- 1 enlarged T-chart
- 6 pieces of A5 paper
- *Optional:* research materials

FOR EACH STUDENT

- science journal

Preparation

- Ask students to complete their home activity from Lesson 1 and prepare a display. If students have not completed the activity, bring in a selection of everyday mixtures, such as cordial, medicinal liquids, detergent, toothpaste, make-up remover, fruit juice, washing powder, soft drink, potting mix, jam, shaving cream, bubble mix, dry cake mix, pesto, salad dressing and jars of baby food.
- *Optional:* Prepare research materials for students to learn about different mixtures and how they are used in situations other than those they experienced during the *Explore* lessons. Include different text types, such as books, posters, videos and multimedia activities.
- *Optional:* Display pictures of mixtures on an interactive whiteboard or a computer connected to a projector. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed: www.science.org.au/primaryconnections

Lesson steps

1 Review the previous lessons using the class science journal and word wall. Focus students' attention on the different types of mixtures they have explored.

2 As a class, review and discuss the different mixtures that students have brought in from home. Ask questions such as:

- How do we know if it is a mixture? (We can see the separate substances; we could separate the substances out.)
- What is this mixture used for?

3 Brainstorm ways the mixtures could be grouped and record students' ideas in the class science journal, for example, by colour, texture, uses, size of grains.

Optional: Introduce the research materials (see 'Preparation'), and ask students to report on different mixtures and their uses.

4 Introduce the T-chart (see 'Preparation'), and explain that the class is going to create a T-chart to sort the mixtures according to their purpose. Discuss the purpose and features of a T-chart.

Literacy focus

Why do we use a T-chart?

We use a **T-chart** to organise information so that we can understand it more easily.

What does a T-chart include?

A **T-chart** includes two columns with headings. Information is put into the columns based on the headings.

Brainstorm some uses that could be used as headings for the T-chart, for example:

- to eat
- to clean
- to have fun.

5 Choose two uses and record them on the A5 pieces of paper for headings. Place the headings on the T-chart. Ask students to place each mixture under the headings, if possible. Ask if any mixtures could go in either column of the T-chart.

6 As a class review the T-chart, asking questions such as:

- Are there purposes that we have not represented here? Which ones?
- What other mixtures can you think of for this group?

Record students' answers in the class science journal.

Optional: Repeat Lesson steps 5 and 6 with different uses.

7 Write the term 'mixture' in the class science journal and ask students to describe what they think the term means. Record an agreed definition of the term in the class science journal. Ask questions such as:

- According to our description is _____ a mixture?
- Can you think of other examples of mixtures?
- Are there other ways in which the word 'mixture' is used? What about 'mix'?

8 Ask students how they can be sure if something is a mixture, for example, by seeing it being made, by a label or being able to see/separate the different substances.

9 Discuss with students what they have learned about mixtures after sorting the mixtures using the T-chart. Record students' answers in the class science journal.

10 Update the word wall with words and images.

Australian Curriculum links

Indigenous perspectives

- The sorting and analysing of mixtures as described by scientists is one way to organise the world. Indigenous people may have their own way of understanding the world around them. Contact local Indigenous community members and/or Indigenous Officers to access relevant, local Indigenous knowledge. Protocols are available on the website: www.science.org.au/primaryconnections/indigenous

Lesson 6 Sifting solids

AT A GLANCE

To support students to plan and conduct an investigation of how to separate a mixture of solids.

Session 1 Cook's dilemma

Students:

- make predictions about how mixtures can be separated
- investigate what mixtures can be separated using different tools.

Session 2 Can we sift it?

Students:

- represent the results of their investigation through a game
- make evidence-based claims about separating mixtures.

Lesson focus

In the *Elaborate* phase students plan and conduct an open investigation to apply and extend their new conceptual understanding in a new context. It is designed to challenge and extend students' Science Understanding and Science Inquiry Skills.

Assessment focus

Summative assessment of the Science Inquiry Skills is an important focus of the *Elaborate* phase. Rubrics are available on the website to help you monitor students' inquiry skills.

ELABORATE

Key lesson outcomes

Students will be able to:
• respond to and pose questions about how a mixture can be separated
• predict whether ingredients can be separated from a mixture using different techniques
• complete a guided investigation
• record their observations using a table with annotated drawings
• through discussion and a game, compare observations with others
• discuss future questions for investigation.

This lesson also provides opportunities to monitor the development of students' General capabilities (highlighted through icons, see page 5).

Teacher background information

Not all mixtures can easily be separated once they have mixed together. Mixtures are difficult to separate when the properties that distinguish them are not easily discernable. For example, if the main difference between two substances in a mixture is particle size, then finding a sieve with holes that are just the right size will allow you to separate one from the other. However, trying to separate two powders with the same sized grains is more difficult. Chemists sometimes use different boiling points of substances to separate them.

When powdered icing sugar is mixed well with powdered cocoa, it forms a homogeneous mixture; the mixture is the same throughout. It is very difficult to separate such a mixture using a simple sieve. When icing sugar and cocoa powder are mixed with desiccated coconut and puffed rice, a heterogeneous mix is formed; a sieve will let the powders through (and the coconut if it is ground fine enough) but not the puffed rice.

Session 1 Cook's dilemma

Equipment

FOR THE CLASS

- class science journal
- word wall
- 1 enlarged copy of 'Sifting investigation results' (Resource sheet 8)
- 3 tablespoons icing sugar
- 3 tablespoons cocoa
- 3 tablespoons coconut
- 3 tablespoons puffed rice
- 3 large bowls
- 1 mixing spoon
- protective covering for work areas
- 1 colander
- 1 sieve
- paper towel
- 1 jar

FOR EACH STUDENT

- each team member's science journal
- 1 copy of 'Sifting investigation results' (Resource sheet 8)

Preparation

- Read 'How to conduct a fair test' (Appendix 5).
- Draw an investigation planner in the class science journal, for example:

Sifting investigation planner

Question: Does the size of the sieve holes affect what can be separated in a mixture?
We will **change**
We will **observe**
We will keep the **same**

- Prepare three bowls of dry mixture using three tablespoons each of icing sugar, cocoa powder, coconut and puffed rice.

SAFETY

Check for student allergies or intolerances to ingredients. You can use different ingredients but you will need two powders mixed together with two other ingredients with different sized pieces.

- Prepare an area where the ingredients can be sifted — protect against spillages using sheets of newspaper or a large sheet.

ELABORATE

- Enlarge a copy of 'Sifting investigation results' (Resource sheet 8).
- *Optional:* Display the investigation planner and 'Sifting investigation results' (Resource sheet 8) on an interactive whiteboard or a computer connected to a projector. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed: www.science.org.au/primaryconnections

Lesson steps

1 Review previous lessons using the class science journal and word wall, focusing students' attention on the usefulness of mixtures and how their properties change depending on the relative amounts of its substances or ingredients.

2 Pass the bowls of prepared mixture around and ask students to identify the ingredients in them.

Remind students not to taste any of the ingredients for allergy or hygiene reasons.

3 Ask students what they could do if there was someone in the class who was allergic to one of the ingredients and that ingredient had to be removed from the mixture? Ask students if they can think of ways to separate a mixture and discuss how they could investigate their ideas. Record students' suggestions in the class science journal.

4 Introduce the colander, sieve and paper towel. Discuss how the colander is a type of sieve. Ask students to describe how they are used. Record students' ideas in the class science journal.

Note: Discuss with students that the **sieve** is what we use (noun), and **sift** is what we do (verb).

5 Ask what is the same and what is different about each sieve and the paper towel (focus on the different sized holes).

6 Explain that the class will be working together to investigate the question 'Does the size of sieve holes affect what is separated in a mixture?'.

7 Introduce the investigation planner in the class science journal (see 'Preparation'). Discuss and record on the investigation planner things teams will:

- **change:** size of sieve holes
- **observe:** which ingredients are separated
- keep the **same:** the type of mixture.

8 Ask why is it important to change only one thing at a time (so we know what caused the changes). Discuss why it is necessary to keep everything else the same in order for a test to be fair, asking questions such as:

- Would it be fair to change what is in the mixtures?

9 Introduce the enlarged copy of 'Sifting investigation results' (Resource sheet 8), and read through with students. Explain that you will ask some students to sift the mixture using each of the items. The students will observe what happens and record which ingredients stay in and which ingredients go through. Model how to complete an entry on the resource sheet.

10 As students to predict what they think will happen and why. Record students' predictions in the class science journal.

11 Sift the mixtures using the three different types of sieves. Ask students to help with the sifting. Allow time for students to record their observations after each sift.

12 Discuss the results of the investigation, asking questions such as:

- Which sieve let the largest sized ingredients through? Why did that happen?
- Which sieve let the smallest sized ingredients through? Why did that happen?
- What is the answer to our question 'Does the size of the sieve holes affect what can be separated in a mixture?'. What evidence do we have for our answer?
- Discuss why people sieve mixtures.

13 Update the word wall with words and images.

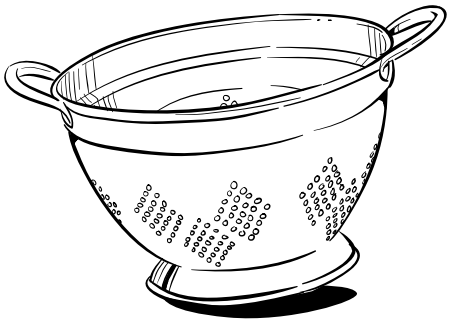
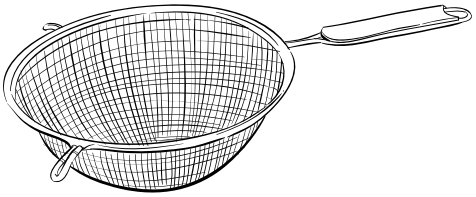
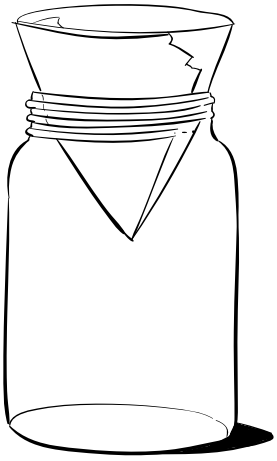
Australian Curriculum links

Science

- Investigate whether a mixture of cornflour and water can be separated using filter paper or paper towel. Include water as an ingredient in the next session.

Sifting investigation results

Name: _____ **Date:**_____

What **stayed in**?	 **colander**	What **went through**?
What **stayed in**?	 **sieve**	What **went through**?
What **stayed in**?	 **paper towel**	What **went through**?

Session 2 Can we sift it?

Equipment

FOR THE CLASS

- class science journal
- word wall
- ½ cup icing sugar in clear plastic container or bag
- ½ cup coconut in clear plastic container or bag
- ½ cup cocoa powder in clear plastic container or bag
- ½ cup puffed rice in clear plastic container or bag
- 'Sifting game labels' (Resource sheet 9) (see 'Preparation')
- clothes pegs (see 'Preparation')
- 1 colander
- 1 sieve
- 1 piece of paper towel

FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- completed copy of 'Sifting investigation results' (Resource sheet 8)

Preparation

- Organise an area for the class game.
- Create labels using 'Sifting game labels' (Resource sheet 9).
- Ensure that there are enough copies of each label so that a quarter of the class has each label. Pegs will be used to attach labels to students' clothing.

Lesson steps

1 Review the previous lessons using the class science journal and word wall, focusing students' attention on the investigation that they completed.

2 Explain that the class is going to represent their findings by taking part in a whole class role-play. Discuss the purpose and features of a role-play.

Literacy focus

Why do we use a role-play?

We use a **role-play** to show how something works by acting it out.

What does a role-play include?

A **role-play** might include speech, actions and props.

3 Introduce the 'Sifting game labels' (Resource sheet 9) and the coloured clothes pegs (see 'Preparation'). Explain that pegs will be used to attach the labels to students' clothes.

4 Explain the game:

- Half the class will be given randomly selected labels and clothes pegs, and will represent the ingredients in a mixture. The other half of the class will form a circle with joined hands.
- When you call 'All mixed up!' the students representing ingredients (see 'Preparation') will enter the circle and walk around randomly to represent being mixed together.

After 'All mixed up!' is called

- You will call 'Colander!', 'Sieve!' or 'Paper towel!' and hold up an example. Students think about whether their ingredient would pass through it, and if it does they leave the circle.
- *Optional:* Represent the size of the holes by having students release their linked hands for 'Colander', hold their linked hands high for 'Sieve' and down low for 'Paper towel'.

After 'Sieve!' is called

- If a student representing an ingredient leaves the circle at the wrong time or is the last one out, they join the students in the circle.

ELABORATE

5 Introduce the colander, sieve and paper towel. Explain that you will hold them up as you call them out so that students can remember them.

6 Repeat the game several times, giving students the opportunity to participate at least twice as different ingredients.

7 As a class, discuss the results of the game. Ask questions such as:

- What did the game represent well about our investigation?
- What did the game not represent?
- Could you separate that mixture into all its parts?
- What kinds of mixtures can you separate?
- What kinds of mixtures can't you separate?

Record students' thoughts in the class science journal.

8 Explain that scientists use many different properties for sorting substances, one of which is the size of the particles of the mixture. Explain that depending on the method, scientists might not always be able to separate a mixture completely.

9 Update the word wall with words and images.

Australian Curriculum links

Science

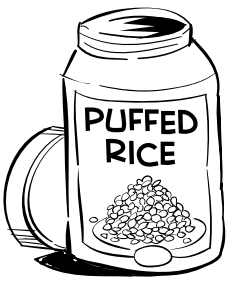
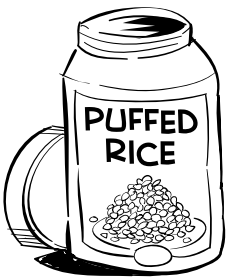
- Investigate other ways of separating mixtures, for example, by using magnetism to separate a mixture of paper clips and sand or rubber bands.

History, intercultural understanding

- Explore traditional ways of separating and sorting solids, for example, using centrifugal force in bowls or panning for gold. Some Indigenous peoples used winnowing to separate husks of grain from flour.

ELABORATE

Sifting game labels

icing sugar 	**icing sugar** 
cocoa powder 	**cocoa powder** 
coconut 	**coconut** 
puffed rice 	**puffed rice** 

Lesson 7 Interesting ink

AT A GLANCE

To support students to plan and conduct an investigation of what different black inks are made of.

Students:

- make predictions about how black inks can be separated
- work in teams to investigate what different black inks are made of.

Lesson focus

In the *Elaborate* phase students plan and conduct an open investigation to apply and extend their new conceptual understanding in a new context. It is designed to challenge and extend students' Science Understanding and Science Inquiry Skills.

Assessment focus

Summative assessment of the Science Inquiry Skills is an important focus of the *Elaborate* phase. Rubrics are available on the website to help you monitor students' inquiry skills.

Key lesson outcomes

Students will be able to:
• respond to and pose questions about how a mixture of liquids can be separated
• predict what black ink is made of
• work in collaborative learning teams to complete a guided investigation
• through discussion, compare observations with others and with their predictions
• discuss future questions for investigation.

This lesson also provides opportunities to monitor the development of students' General capabilities (highlighted through icons, see page 5).

Teacher background information

Chromatography is the separation of mixtures by running them over or through another substance. For example, water-soluble inks on paper run if they are wet. The word 'chromatography' comes from the Greek *chroma* = colour and *graphein* = to write. Scientists use various forms of chromatography in different ways, for example, to separate mixtures of DNA on gels. Gas chromatography machines allow scientists to separate mixtures of gas. Often the molecules that scientists are investigating are not naturally coloured so it can be necessary to stain them to identify where they are.

In this lesson, the chromatography principle used is that water travels through filter paper by capillary action. When the water meets the ink on the paper, it dissolves the ink creating a mixture. As the mixture travels, the different substances in the ink start to travel at different speeds. This is because the different substances of the ink mixture travel through the paper at different rates. It is important that the paper does not touch the sides of the glass or the passage of the liquid will be changed and will affect the separation of the mixture.

Chromatography is used to find what different substances are in natural or made mixtures. It was first developed in 1906 by a botanist working on plant pigments. Today, chromatography is used in a variety of ways including forensic investigation and pollution monitoring. It is useful for identifying components of a mixture, particularly when there are very small amounts. However, it is not useful for separating mixtures in large quantities for future use.

Equipment

FOR THE CLASS

- class science journal
- word wall
- team skills chart
- team roles chart
- 1 enlarged copy of 'Travelling ink' (Resource sheet 10)
- self-adhesive note

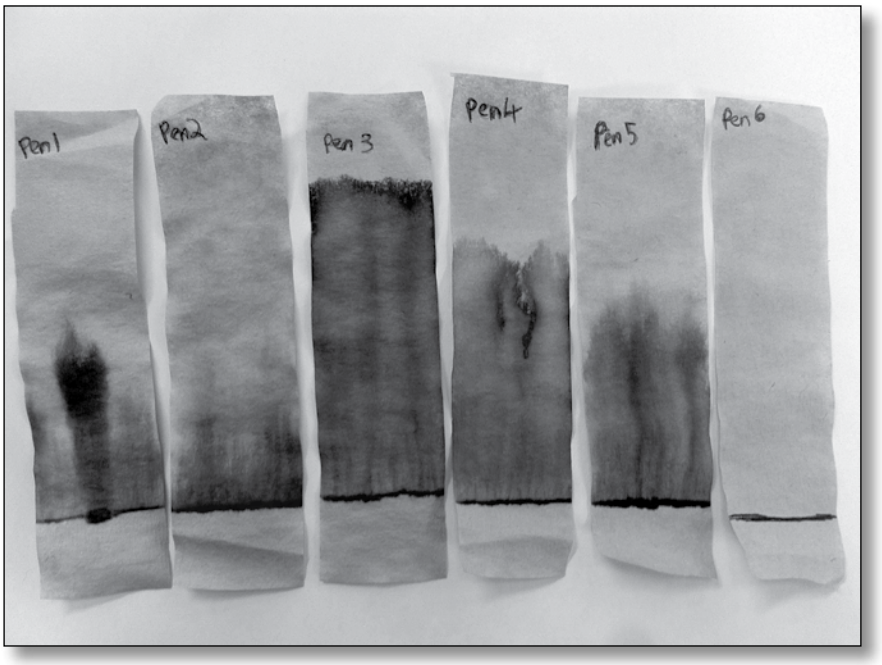
FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- each team member's science journal
- 1 copy of 'Travelling ink' (Resource sheet 10)
- 1 blank piece of A4 paper
- 1 cup
- 2 strips of filter paper (see 'Preparation')
- 2 different pens with soluble black ink (see 'Preparation')
- protective covering for work area (see 'Preparation')
- water

Preparation

- Prepare strips of filter paper 10cm high by 3cm wide. Filter paper for brewing coffee can be found at most supermarkets. Alternatively strips of paper towel can be used.

  Optional: Ask students to prepare their own filter strips.
- Collect different brands of black felt tip pens with soluble ink. It is recommended to conduct the investigation beforehand to check that the inks are soluble and produce different results.



Sample results of ink investigation

- Provide a tray or newspaper to protect each team's work area.
- *Optional:* This investigation is similar to a forensic investigation, where students can work out which type of pen was used to make a sign or write a letter. You could devise a detective mystery for students to solve, and students could test more than two pens.
- Draw an investigation planner in the class science journal, for example:

Ink investigation planner

Question: What are different black inks made of?
We will **change**
We will **observe** what happens to the ink on the paper
We will keep the **same**

- *Optional:* Display 'Travelling ink' (Resource sheet 10) on an interactive whiteboard or a computer connected to a projector. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed: www.science.org.au/primaryconnections

Lesson steps

1 Review previous lessons using the class science journal and word wall, focusing students' attention on how they separated a mixture of solids using sieves.

2 Introduce the black pens (see 'Preparation'). Ask students what they think they know about what the black ink is made of and ways they could find out. Record students' ideas in the class science journal.

3 Explain that students will be working in collaborative learning teams to investigate what different black inks are made of.

4 Introduce the enlarged copy of 'Travelling ink' (Resource sheet 10), and read through with students. Model how to perform each step.

5 Brainstorm things that might affect what happens to the ink of the pens and record students' answers on self-adhesive notes. Suggestions might include the type of filter paper, the amount of water, where the ink is put on the paper, how the paper is held and how long the paper is dipped into the water.

6 Introduce the investigation planner in the class science journal (see 'Preparation'). Discuss and record on the investigation planner things teams will:

- **change:** the type of ink
- **observe:** what happens to the ink
- keep the **same:** the type of filter paper, the amount of water, where the ink is put on the paper, how the paper is held, and how long the paper is dipped into the water.

Note: The variables on the self-adhesive notes brainstormed in Lesson step 5 can be moved to the relevant sections on the planner.

7 Ask why is it important to change only one thing at a time (so we know what caused the changes). Discuss why it is necessary to keep everything else the same (in order for a test to be fair).

Note: The finished strips of the filter paper are the 'record'. They could be dried and taped into the students' journals.

8 Form teams and allocate roles. Ask Managers to collect team equipment.

9 Allow time for teams to conduct the investigation and record their results.

10 Ask Speakers to share their team's findings. Encourage students in the audience to use 'Science question starters' (see Appendix 4) to ask teams about their investigation.

11 As a class review the investigation, asking questions such as:

- What did we learn?
- Which inks were similar?
- Which inks were different?
- What could this be used for? (For example, to help determine the type of pen a message was written in, to find out what a mixture is made of such as a blood sample).

Brainstorm a generalisation of the class findings and record it in the class science journal.

12 Update the word wall with words and images.

Australian Curriculum links

Science

- Set up an investigation to find out whether you can separate a mixture of cornflour and water using filter paper or paper towel. Include water as an ingredient in the next session.

Travelling ink

Team members: _____ **Date:** _____

Question

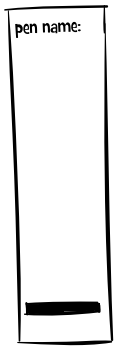
What are different black inks made of?

Equipment

- 1 cup
- 2 strips of filter paper
- 2 different pens with black ink
- water
- desk protection

Activity steps for each pen

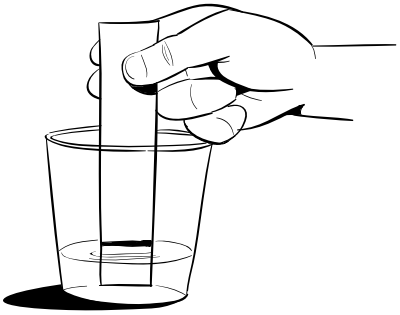
1 Colour a line near the bottom of the filter paper.



2 Write the name of the pen at the top.

3 Put water up to two fingers high in the bottom of a cup.

4 Hold the filter paper in the middle of the cup with just the bottom of the paper in the water. Don't let the water touch the ink!



5 Leave the paper in the water until the filter paper is wet almost up to the top.

6 Record what you find in your science journal.

Lesson 8 Musing on mixtures

AT A GLANCE

To provide opportunities for students to represent what they know about how different materials can be combined, including by mixing, for a particular purpose, and to reflect on their learning during the unit.

Students:

- brainstorm a new ideas map about mixtures
- complete a page about a mixture for a class book.

Lesson focus

In the *Evaluate* phase students reflect on their learning journey and create a literacy product to re-represent their conceptual understanding.

Assessment focus

Summative assessment of the Science Understanding descriptions is an important aspect of the *Evaluate* phase. In this lesson you will be looking for evidence of the extent to which students understand how:

- different materials can be combined, including by mixing, for a particular purpose.

Literacy products in this lesson provide useful work samples for assessment using the rubrics provided on the Primary**Connections** website.

Key lesson outcomes

Students will be able to:
• participate in a class discussion about mixtures and contribute ideas for an ideas map
• create a page for a class book using appropriate sentence structures
• express their thoughts about their learning journey.

This lesson also provides opportunities to monitor the development of students' General capabilities (highlighted through icons, see page 5).

Equipment

FOR THE CLASS

- class science journal
- word wall
- A4 folder (see 'Preparation')
- 1 enlarged copy of 'Mixed up' (Resource sheet 11)

FOR EACH STUDENT

- each student's science journal
- 1 copy of 'Mixed up' (Resource sheet 11)

Preparation

- Ensure each student has a mixture to describe for the class book, for example, by having students' mixtures from home on display or other mixtures if the examples are not sufficient.
- Decorate an A4 folder to become the class book about mixtures.

Lesson steps

1 Review previous lessons using the class science journal and word wall. Remind students of the ideas map that they created in Lesson 1.

2 As a class review the ideas map, asking questions such as:

- Do you still think that? What do you think now? Why?
- Have we learned more about _____?
- Does this fit our description of a mixture? Why do you think that is?

Record students' thoughts on the class ideas map.

3 Introduce the decorated A4 folder (see 'Preparation'), and explain that students will each be creating one page for a mix and match class book about mixtures.

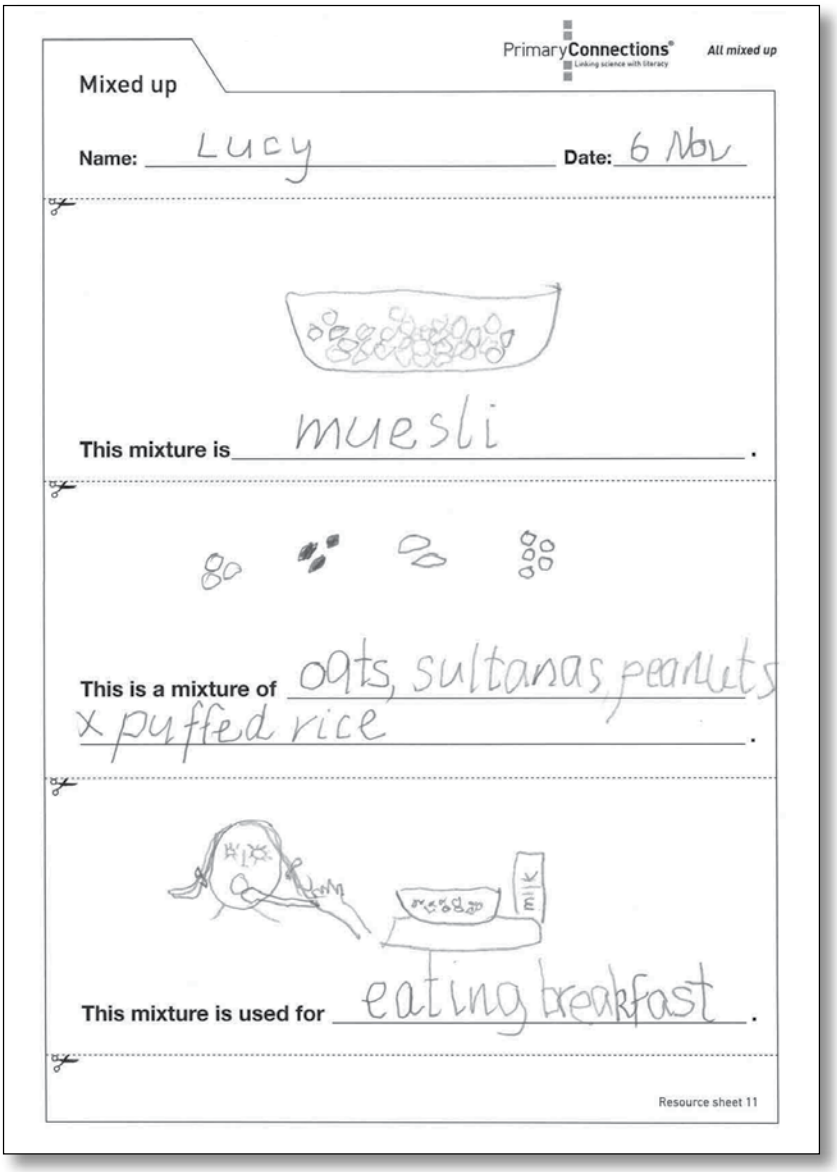
4 Introduce the mixtures (see 'Preparation'), and explain that each student will choose a mixture to describe for the class book.

5 Introduce the enlarged copy of 'Mixed up' (Resource sheet 11). Read through with students and model how to record their thinking.

6 Allow time for students to create their page and to share it by reading it to a partner. Provide feedback.

7 Cut each page along the lines so that the pages can be mixed up. Place pages into the A4 folder to create a mix and match book.

8 Read through the class book asking students to find the matching three sections for each mixture.



Work sample of 'Mixed up'

EVALUATE

Optional: Share the book with another class.

9 Ask students to reflect on their learning journey through the unit. Ask questions such as:

- What were the most interesting things you have learned about mixtures?
- Which activities did you enjoy? Why?
- What helped you to learn?
- What did you learn about working in teams?
- What did you learn about listening to other people's ideas?
- What are you still wondering about?

Record students' responses in the class science journal. Revisit the questions students asked about mixtures and their uses in Lesson 1 and brainstorm ways students might investigate their outstanding questions.

Mixed up

Name: _____ **Date:**_____

This mixture is_____ **.**

This is a mixture of _____

_____ **.**

This mixture is used for _____ **.**

Appendix 1
How to organise collaborative learning teams (Foundation-Year 2)

Introduction

Students working in collaborative teams is a key feature of the Primary**Connections** inquiry-based program. By working in collaborative teams students are able to:

- communicate and compare their ideas with one another
- build on one another's ideas
- discuss and debate these ideas
- revise and rethink their reasoning
- present their final team understanding through multi-modal representations.

Opportunities for working in collaborative learning teams are highlighted throughout the unit.

Students need to be taught how to work collaboratively. They need to work together regularly to develop effective group learning skills.

Team structure

The first step towards teaching students to work collaboratively is to organise the team composition, roles and skills. Use the following ideas when planning collaborative learning with your class:

- Assign students to teams rather than allowing them to choose partners.
- Vary the composition of each team. Give students opportunities to work with others who might be of a different ability level, gender or cultural background.
- Keep teams together for two or more lessons so that students have enough time to learn to work together successfully.
- If you cannot divide the students in your class into teams of three, form two teams of two students rather than one team of four. It is difficult for students to work together effectively in larger groups.
- Keep a record of the students who have worked together as a team so that by the end of the year each student has worked with as many others as possible.

Team roles

Students are assigned roles within their team (see below). Each team member has a specific role but all members share leadership responsibilities. Each member is accountable for the performance of the team and should be able to explain how the team obtained its results. Students must therefore be concerned with the performance of all team members. It is important to rotate team jobs each time a team works together so that all students have an opportunity to perform different roles.

For Foundation—Year 2, teams consist of two students—Manager and Speaker.
(For Year 3–Year 6, the teams consist of three students—Director, Manager and Speaker.)
Each member of the team should wear something that identifies them as belonging to that role, for example, a colour-coded peg, badge or wristband. This makes it easier for you to identify which role each student is doing, and it is easier for the students to remember what they and their team mates should be doing.

Manager

The Manager is responsible for collecting and returning the team's equipment. The Manager also tells the teacher if any equipment is damaged or broken. All team members are responsible for clearing up after an activity and getting the equipment ready to return to the equipment table.

Speaker

The Speaker is responsible for asking the teacher or another team's Speaker for help. If the team cannot resolve a question or decide how to follow a procedure, the Speaker is the only person who may leave the team and seek help. The Speaker shares any information they obtain with team members. The teacher may speak to all team members, not just to the Speaker. The Speaker is not the only person who reports to the class; each team member should be able to report on the team's results.

Director (Year 3–Year 6)

The Director is responsible for making sure that the team understands the team investigation and helps team members focus on each step. The Director is also responsible for offering encouragement and support. When the team has finished, the Director helps team members check that they have accomplished the investigation successfully. The Director provides guidance but is not the team leader.

Team skills

Primary**Connections** focuses on social skills that will help students work in collaborative teams and communicate more effectively.

Students will practise the following team skills throughout the year:

- move into your teams quickly and quietly
- speak softly
- stay with your team
- take turns
- perform your role.

To help reinforce these skills, display enlarged copies of the team skills chart (see the end of this Appendix) in a prominent place in the classroom.

The development of these team skills aligns to descriptions in the Australian Curriculum: English. See page 7.

Supporting equity

In science lessons, there can be a tendency for boys to manipulate materials and girls to record results. Primary**Connections** tries to avoid traditional social stereotyping by encouraging all students, irrespective of their gender, to maximise their learning potential. Collaborative learning encourages each student to participate in all aspects of team activities, including handling the equipment and taking intellectual risks.

Observe students when they are working in their collaborative teams and ensure that both girls and boys are participating in the hands-on activities.

TEAM SKILLS

1 Move into your teams quickly and quietly

2 Speak softly

3 Stay with your team

4 Take turns

5 Perform your role

TEAM ROLES

Manager

Collects and returns all materials the team needs

Speaker

Asks the teacher and other team Speakers for help

Appendix 2
How to use a science journal

Introduction

A science journal is a record of observations, experiences and reflections. It contains a series of dated, chronological entries. It can include written text, drawings, labelled diagrams, photographs, tables and graphs.

Using a science journal provides an opportunity for students to be engaged in a real science situation as they keep a record of their observations, ideas and thoughts about science activities. Students can use their science journals as a useful self-assessment tool as they reflect on their learning and how their ideas have changed and developed during a unit.

Monitoring students' journals allows you to identify students' alternative conceptions, find evidence of their learning and plan future learning activities in science and literacy.

Representing their ideas in a science journal gives students a purposeful task for writing and reading in English. For additional information on how to help students who are learners of English as an additional language or dialect, please see the Australian Curriculum resources.

Using a science journal

1. At the start of the year, or before starting a science unit, provide each student with a notebook or exercise book for their science journal or use an electronic format. Tailor the type of journal to fit the needs of your classroom. Explain to students that they will use their journals to keep a record of their observations, ideas and thoughts about science activities. Emphasise the importance of including pictorial representations as well as written entries.
2. Use a large project book or A3 paper to make a class science journal. This can be used at all stages to model journal entries. With younger students, the class science journal can be used more frequently than individual journals and can take the place of individual journals.
3. Make time to use the science journal. Provide opportunities for students to plan procedures and record predictions, and their reasons for predictions, before an activity. Use the journal to record observations during an activity and reflect afterwards, including comparing ideas and findings with initial predictions and reasons. It is important to encourage students to provide evidence that supports their ideas, reasons and reflections.
4. Provide guidelines in the form of questions and headings, and facilitate discussion about recording strategies, for example, note-making, lists, tables and concept maps. Use the class science journal to show students how they can modify and improve their recording strategies.
5. Science journal entries can include narrative, poetry and prose as students represent their ideas in a range of styles and forms.

6 In science journal work, you can refer students to display charts, pictures, diagrams, word walls and phrases about the topic displayed around the classroom. Revisit and revise this material during the unit. Explore the vocabulary, visual texts and ideas that have developed from the science unit, and encourage students to use them in their science journals.

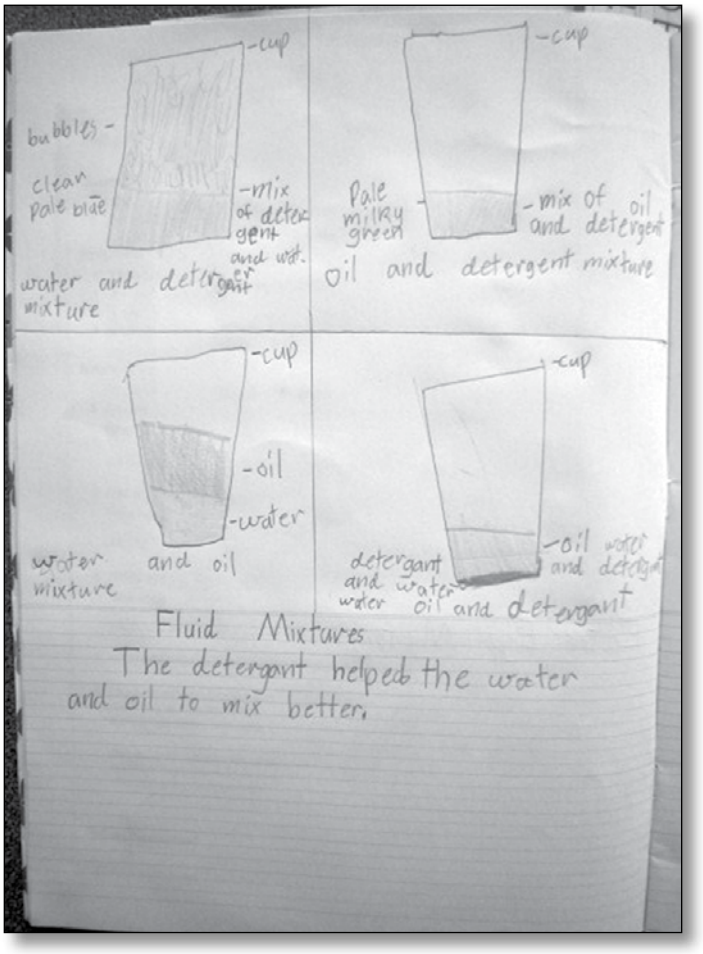
7 Combine the use of resource sheets with journal entries. After students have pasted their completed resource sheets in their journal, they might like to add their own drawings and reflections.

8 Use the science journal to assess student learning in both science and literacy. For example, during the *Engage* phase, use journal entries for diagnostic assessment as you determine students' prior knowledge.

9 Discuss the importance of entries in the science journal during the *Explain* and *Evaluate* phases. Demonstrate how the information in the journal will help students develop literacy products, such as posters, brochures, letters and oral or written presentations.

***All mixed up* Science journal entries**

Annotated drawing



Labelled diagram

Appendix 3
How to use a word wall

Introduction

A word wall is an organised collection of words and images displayed in the classroom. It supports the development of vocabulary related to a particular topic and provides a reference for students. The content of the word wall can be words that students see, hear and use in their reading, writing, speaking, listening and viewing.

Goals in using a word wall

A word wall can be used to:

- support science and literacy experiences of reading, viewing, writing and speaking
- provide support for students during literacy activities across all key learning areas
- promote independence in students as they develop their literacy skills
- provide a visual representation to help students see patterns in words and decode them
- develop a growing bank of words that students can spell, read and/or use in writing tasks
- provide ongoing support for the various levels of academic ability in the class
- teach the strategy of using word sources as a real-life strategy.

Organisation

Position the word wall so that students have easy access to the words. They need to be able to see, remove and return word cards to the wall. A classroom could have one main word wall and two or three smaller ones, each with a different focus, for example, high-frequency words.

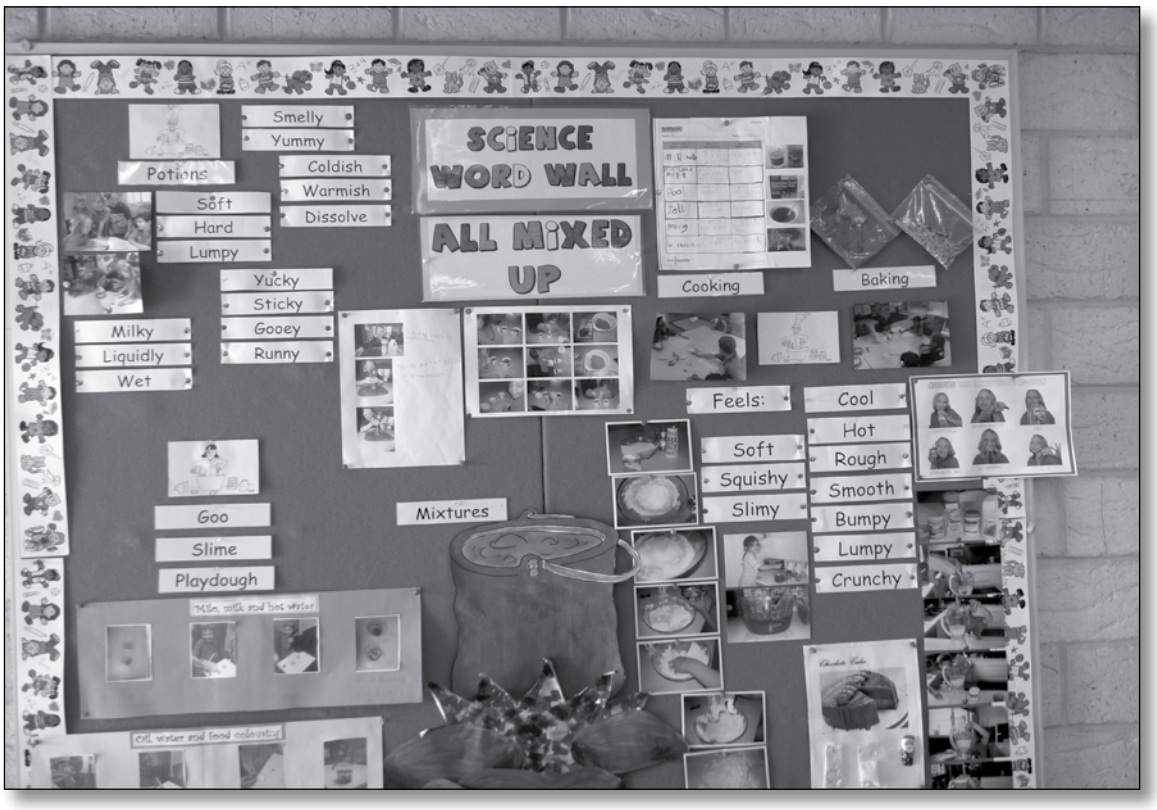
Choose robust material for the word cards. Write or type words on cardboard and perhaps laminate them. Consider covering the wall with felt-type material and backing each word card with a self-fastening dot to make it easy for students to remove and replace word cards.

Word walls do not need to be confined to a wall. Use a portable wall, display screen, shower curtain or window curtain. Consider a cardboard shape that fits with the unit, for example, an animal silhouette for an animal characteristics unit.

The purpose is for students to be exposed to a print-rich environment that supports their science and literacy experiences.

Organise the words on the wall in a variety of ways. Place them alphabetically, or put them in word groups or groups suggested by the unit topic, for example, words for an *All mixed up* unit might be organised using headings, such as ‘We make them’, ‘We use them’, ‘We find them’ and ‘They can be...’.

Invite students to contribute words from different languages to the word wall. Group words about the same thing, for example, different names of the same animal, on the word wall so that students can make the connections. Identify the different languages used, for example, by using different coloured cards or pens to record the words.



***All mixed up* word wall**

Using a word wall

1. Limit the number of words to those needed to support the science and literacy experiences in the classroom.
2. Add words gradually and include images where possible, such as drawings, diagrams or photographs. Build up the number of words on the word wall as students are introduced to the scientific vocabulary of the unit.
3. Encourage students to interact with the word wall. Practise using the words with students by reading them and playing word games. Refer to the words during science and literacy experiences, and direct students to the wall when they need a word for writing. Encourage students to use the word wall to spell words correctly.
4. Use the word wall with the whole class, small groups and individually during literacy experiences. Organise multi-level activities to cater for the individual needs of students.

Appendix 4
How to facilitate evidence-based discussions

Introduction

Argumentation is at the heart of what scientists do—they pose questions, make claims, collect evidence, debate with other scientists and compare their ideas with others in the field.

In the primary science classroom, argumentation is about students:

- articulating and communicating their thinking and understanding to others
- sharing information and insights
- presenting their ideas and evidence
- receiving feedback (and giving feedback to others)
- finding flaws in their own and others' reasoning
- reflecting on how their ideas have changed.

It is through articulating, communicating and debating their ideas and arguments that students are able to develop a deep understanding of science content.

Establish norms

Introduce norms before starting a science discussion activity. For example:

- Listen when others speak.
- Ask questions of each other.
- Criticise ideas not people.
- Discuss all ideas before selecting one.

Question, claim, evidence and reasoning

In science, arguments that make claims are supported by evidence. Sophisticated arguments follow the **QCER** process:

Q What **question** are you trying to answer? For example, 'How does the size of sieve holes affect what is separated in mixtures?'

C The **claim**. For example, 'Different substances separate depending on the size of the holes of the sieve'.

E The **evidence**. For example, 'When I sifted the same mixture through different sieves, different substances were separated. The larger the holes, the more substances in the mixture that went through'.

R The **reasoning**. How the evidence supports the claim. In this unit, students are required to make claims and collect evidence only.

Students need to be encouraged to move from making claims only to citing evidence to support their claims. Older students develop full conclusions that include a claim, evidence and reasoning. This is an important characteristic of the nature of science and an aspect of scientific literacy. Using 'Science question starters' (see below) helps to promote evidence-based discussion in the classroom.

Science question starters

Science question starters can be used to model how to discuss a claim and evidence for students. Teachers encourage team members to ask these questions of each other when preparing their claim and evidence. They might also be used by audience members when a team is presenting its results (see The Primary**Connections** 5Es DVD, Chapter 5).

Science question starters

Question type	Question starter
Asking for evidence	I have a question about... . What is your evidence to support your claim? Do you have any other evidence to support your claim?
Agreeing	I agree with _____ because _____.
Disagreeing	I disagree with _____ because _____. One difference between my idea and yours is _____.
Questioning more	I wonder what would happen if...? I have a question about... . I wonder why...? What caused...? How would it be different if...? What do you think will happen if...?
Clarifying	I'm not sure what you meant there. Could you explain your thinking to me again?

DISCUSSION SKILLS

1 Listen when others speak

2 Ask questions of each other

3 Criticise ideas not people

4 Discuss all ideas before selecting one

Appendix 5
How to conduct a fair test

Introduction

Scientific investigations involve posing questions, testing predictions, planning and conducting tests, interpreting and representing evidence, drawing conclusions and communicating findings.

Planning a fair test

In *All mixed up* students investigate:

- the sifting of a mixture of solids
- the separation of a mixture of liquids using chromatography.

These investigations are used to answer questions for inquiry about mixtures and how they can be separated.

All scientific investigations involve *variables*. Variables are things that can be changed (independent), measured/observed (dependent) or kept the same (controlled) in an investigation. When planning an investigation, to make it a fair test, we need to identify the variables.

It is only by conducting a fair test that students can be sure that what they have changed in their investigation has affected what is being measured/observed.

'**C**ows **M**oo **S**oftly' is a useful scaffold to remind students how to plan a fair test:

Cows: **Change** one thing (independent variable)

Moo: **Measure/Observe** another thing (dependent variable)

Softly: keep the other things (controlled variables) the **Same**.

To answer the inquiry question 'Can we separate this mixture of solids?' students could investigate what effect sifting the mixture through sieves with different sized holes has on the separation of the mixture. Students could:

CHANGE	The size of the holes of the sieve	Independent variable
MEASURE/ OBSERVE	Which ingredients are separated	Dependent variable
KEEP THE **SAME**	The ingredients of the mixture, the relative quantities in the mixture, the sieve	Controlled variables

Note: When choosing variables to 'keep the **Same**' we sometimes make decisions about variables that we think will affect the outcome, as it is not always feasible to keep everything the same. For example, scientists might prioritise keeping the humidity and composition of the mixture constant rather than the overall size and colour of the sieve and the colour bowl the mixture is being sifted into.

Appendix 6
All mixed up equipment list

EQUIPMENT ITEM	QUANTITIES	Lesson	1	1	2	3	4	5	6	6	7	8
		Session	1	2					1	2		
Equipment and materials												
A4 folder	1 per class											●
A4 folder	1 per student			●								
A4 paper	1 per student											●
A5 paper	6 per class							●				
clothes pegs	1 per student									●		
cocoa powder	2 tablespoons per team				●							
cocoa powder	3 tablespoons per class								●			
coconut	3 tablespoons per class								●			
coconut — ½ cup in zip-lock bag	1 per class									●		
cocoa powder — ½ cup in zip-lock bag	1 per class									●		
colander	1 per class								●	●		
cornflour	¼ cup per team					●						
cornflour slime mixture (optional)	1 per class					●						
cup	3 per team				●							
cup	4 per class						●					
cup	1 per team										●	
desk protective covering (eg newspaper)	1 per team				●	●	●		●		●	
desk protective covering (eg newspaper)	1 per class											
dishwashing detergent	3 tablespoons per class						●					
filter paper or paper towel	1 x 20cm square per class								●	●		
filter paper	2 strips per team										●	
icing sugar	3 tablespoons per team				●							

EQUIPMENT ITEM	QUANTITIES	Lesson	1	1	2	3	4	5	6	6	7	8
		Session	1	2					1	2		
icing sugar	3 tablespoons per class								●			
icing sugar — ½ cup in zip-lock bag	1 per class									●		
jar	1 per class								●			
magnifying glass	1 per team				●							
measuring cup with ¼ marked on it	1 per class						●					
mixing bowl	1 per team					●						
mixing bowls, large	3 per class								●			
mixing spoon	1 per team					●						
mixing spoons	4 per class						●					
mixing spoons	1 per class								●			
paper, large sheet	1 per class		●						●			
paper towel	1 piece per class								●	●		
pens, black felt tip (soluble ink)	2 different pens per team										●	
puffed rice	2 tablespoons per team				●							
puffed rice	3 tablespoons per class								●			
puffed rice — ½ cup in zip-lock bag	1 per class									●		
research materials	per team							●				
samples of materials (puffed rice, cocoa powder, icing sugar, cornflour, water, red food colouring, dishwashing detergent, vegetable oil)	1 per class		●									
self-adhesive notes	1 set per class										●	
sieve	1 per class								●	●		
tablespoon	1 per team				●	●						
vegetable oil	1 cup per class						●					
water	1 cup per team					●					●	
water	1 cup per class						●					
ziplock bags, small	at least 8 per class		●									

EQUIPMENT ITEM	QUANTITIES	Lesson	1	1	2	3	4	5	6	6	7	8
		Session	1	2					1	2		
Resource sheets												
'Mix masters' (RS1), enlarged	1 per class		●									
'Looking in the bowl' (RS2)	1 per student		●									
'Looking in the bowl' (RS2), enlarged	1 per class		●									
'Information note for families' (RS3)	1 per student			●								
'Information note for families' (RS3), enlarged	1 per class			●								
'My mixtures' (RS4)	1 per student			●								
'My mixtures' (RS4), enlarged	1 per class			●								
'Crazy cooking' (RS5)	1 per team				●							
'Crazy cooking' (RS5), enlarged	1 per class				●							
'Just add water' (RS6)	1 per team					●						
'Just add water' (RS6), enlarged	1 per class					●						
'Slick oil' (RS7)	1 per student						●					
'Slick oil' (RS7), enlarged	1 per class						●					
'Sifting investigation results' (RS8)	1 per student								●	●		
'Sifting investigation results' (RS8), enlarged	1 per class								●			
'Sifting game labels' (RS9)	1 per student									●		
'Travelling ink' (RS10)	1 per team										●	
'Travelling ink' (RS10), enlarged	1 per class										●	
'Mixed up' (RS11)	1 per class											●
'Mixed up' (RS11), enlarged	1 per student											●
Teaching tools												
class science journal	1 per class		●	●	●	●	●	●	●	●	●	●
role wristbands or badges	1 set per team				●	●					●	
team roles chart	1 per class				●	●					●	
team skills chart	1 per class				●	●					●	
student science journal	1 per student		●	●	●	●	●	●	●		●	●
word wall	1 per class		●	●	●	●	●	●	●	●	●	●

Appendix 7
All mixed up unit overview

		LESSON SUMMARY	LESSON OUTCOMES*	ASSESSMENT OPPORTUNITIES
		Students	Students will be able to	
ENGAGE	**Lesson 1** Masters of mixing	• discuss similarities and differences between images of characters creating mixtures • explain why they think different characters are creating mixtures • brainstorm what they know about mixtures and their uses • observe, record and report on mixtures that they can see around their home.	represent their current understandings as they: • explain and draw their ideas of how materials can be mixed together for different purposes • contribute to discussions about how people from different professions, including scientists, might use mixtures • identify the purpose and features of a science journal and word wall • identify questions about mixtures and what they are used for • identify mixtures in their everyday lives • record findings in a table and discuss their observations.	**Diagnostic assessment** • Science journal entries • Class discussions • Ideas map • 'Looking in the bowl' (Resource sheet 2) • 'My mixtures' (Resource sheet 4)

* These outcomes are **aligned** with relevant **descriptions** of the Australian Curriculum: Science and are provided at the beginning of each lesson.

		LESSON SUMMARY	LESSON OUTCOMES*	ASSESSMENT OPPORTUNITIES
		Students	Students will be able to	
EXPLORE	**Lesson 2** Creative cooking	• work in teams to observe different materials being mixed together • record their observations in a table and discuss them.	• describe different mixtures of solids and what they might be used for • work in collaborative learning teams to complete a guided exploration of different mixtures of solids • record observations using an annotated drawing in a table • discuss and compare observations.	**Formative assessment** • Science journal entries • Class discussions • Annotated drawings • 'Crazy cooking' (Resource sheet 5)
EXPLORE	**Lesson 3** Sometimes slimy	• work in teams to explore what happens when cornflour is mixed with water • discuss and compare their observations • identify that the properties of mixtures can depend on the quantities of materials used.	• identify that the properties of a mixture can depend on the relative amounts of substances it contains • work in collaborative learning teams to follow a procedural text for making a mixture of solids and liquids • discuss and compare observations.	**Formative assessment** • Science journal entries • Class discussions

* These outcomes are **aligned** with relevant **descriptions** of the Australian Curriculum: Science and are provided at the beginning of each lesson.

		LESSON SUMMARY	LESSON OUTCOMES*	ASSESSMENT OPPORTUNITIES
		Students	Students will be able to	
EXPLORE	**Lesson 4** Fun fluids	• work as a class to investigate what happens when oil, water and detergent are mixed together • discuss their recorded observations and make evidence-based claims.	• identify that not everything can mix together • predict what will happen when different substances are mixed together • work as a class to follow a procedural text for making a mixture of liquids • record their observations using labelled diagrams • discuss and compare observations • identify ways in which scientists work, including refining mixtures for everyday purposes.	**Formative assessment** • Science journal entries • Class discussions • 'Slick oil' (Resource sheet 7)
EXPLAIN	**Lesson 5** Marvellous mixtures	• discuss mixtures they have explored and the purposes of the mixtures • sort mixtures according to their purposes using a T-chart • describe what the term 'mixture' means.	• present their findings about mixtures in their homes and discuss with the class • identify what a mixture is and what it can be used for • observe and compare the different mixtures and their purposes • listen to and follow a set of rules to create T-charts to represent what they know about their mixtures.	**Formative assessment** • Science journal entries • Class discussions • T-charts

* These outcomes are **aligned** with relevant **descriptions** of the Australian Curriculum: Science and are provided at the beginning of each lesson.

		LESSON SUMMARY	LESSON OUTCOMES*	ASSESSMENT OPPORTUNITIES
		Students	Students will be able to	
ELABORATE	**Lesson 6** Sifting solids	• make predictions about how mixtures can be separated • investigate what whether mixtures can be separated using different tools • represent the results of their investigation through a game • make evidence-based claims about separating mixtures.	• respond to and pose questions about how a mixture can be separated • predict whether ingredients can be separated from a mixture using different techniques • complete a guided investigation • record their observations using a table with annotated drawings • through discussion and a game, compare observations with others • discuss future questions for investigation.	**Summative assessment** of the Science Inquiry Skills • Science journal entries • Class discussions • 'Sifting investigation results' (Resource sheet 8) • Annotated drawings
ELABORATE	**Lesson 7** Interesting ink	• make predictions about how black inks can be separated • work in teams to investigate what different black inks are made of.	• respond to and pose questions about how a mixture of liquids can be separated • predict what black ink is made of • work in collaborative learning teams to complete a guided investigation • through discussion, compare observations with others and with their predictions • discuss future questions for investigation.	**Summative assessment** of the Science Inquiry Skills • Science journal entries • Class discussions • 'Travelling ink (Resource sheet 10)

* These outcomes are **aligned** with relevant **descriptions** of the Australian Curriculum: Science and are provided at the beginning of each lesson.

		LESSON SUMMARY	LESSON OUTCOMES*	ASSESSMENT OPPORTUNITIES
		Students	Students will be able to	
EVALUATE	**Lesson 8** Musing on mixtures	• brainstorm a new ideas map about mixtures • complete a page about a mixture for a class book.	• participate in a class discussion about mixtures and contribute ideas for an ideas map • create a page for a class book, using appropriate sentence structures • express their thoughts about their learning journey.	**Summative assessment** of the Science Understanding • Science journal entries • Class discussions • Ideas map • 'Mixed up' (Resource sheet 11)

* These outcomes are **aligned** with relevant **descriptions** of the Australian Curriculum: Science and are provided at the beginning of each lesson.

PrimaryConnections®
Linking science with literacy

Australian Academy of Science

Professional learning

*Primary**Connections:** linking science with literacy* is an innovative program linking the teaching of science with the teaching of literacy in primary schools. The program includes a professional learning component and curriculum units aligned to the Australian Curriculum: Science.

Research has shown that the professional learning component of the Primary**Connections** program significantly enhances the implementation of the curriculum units. Professional Learning Facilitators are available throughout Australia to conduct a variety of workshops. At the heart of the professional learning program is the Curriculum Leader Training Program.

Primary**Connections Curriculum Leader Training Program**

Held annually, this two-day workshop develops a comprehensive understanding of the Primary**Connections** program. Participants receive professional learning resources that can be used to train others in Primary**Connections**.

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Year	Biological sciences	Chemical sciences	Earth and space sciences	Physical sciences
F	*Staying alive*	*What's it made of?*	*Weather in my world*	*On the move*
1	*Schoolyard safari*	*Spot the difference*	*Up, down and all around*	*Look! Listen!*
2	*Watch it grow!*	*All mixed up*	*Water works*	*Push pull*
3	*Feathers, fur or leaves?*	*Melting moments*	*Night and day*	*Heating up*
4	*Plants in action*	*Material world*	*Beneath our feet*	*Smooth moves*
	Friends and foes	*Package it better*		
5	*Desert survivors*	*What's the matter?*	*Earth's place in space*	*Light shows*
6	*Marvellous micro-organisms*	*Change detectives*	*Earthquake explorers*	*It's electrifying*
				Essential energy

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