PrimaryConnections®
Linking science with literacy

Fully aligned with the Australian Curriculum

The PrimaryConnections program is supported by astronomer, Professor Brian Schmidt, 2011 Nobel Laureate

Spot the difference

Year 1

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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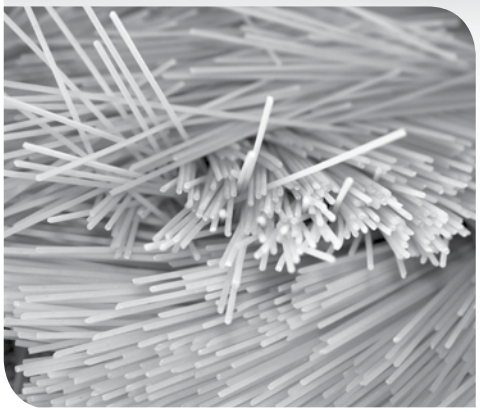

Changes are happening all around us. Chocolate melts in the sun, water evaporates from puddles and cement hardens in the open air. Predicting the changes that can happen to everyday materials is important in understanding the best way to manage things such as, food handling and cooking, construction and packaging.

The *Spot the difference* unit is an ideal way to link science with literacy in the classroom. By observing change, students glimpse the diversity of materials in their world. Students explore change through the context of food including spaghetti, chocolate and popcorn. Students learn about how heating or cooling a food can change its properties and whether the change can be reversed or not. An investigation about which type of chocolate melts the fastest will help students draw conclusions about how fast or slow changes can happen and the consequences of change.

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Contents

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 doable 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 (www.science.org.au/primaryconnections/science-background-resource/).

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 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, comprised of 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. Before publication, the science teacher background information on science is reviewed by a Fellow of the Academy of Science. 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

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 (Bybee, 1997), with the five phases: *Engage, Explore, Explain, Elaborate* and *Evaluate*. The relationship between 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/

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 [PISA & OECD], 2009).

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 and to 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.

Assessment

Assessment against the year level Achievement standards of the Australian Curriculum: Science (ACARA, 2012) is ongoing and embedded in Primary**Connections** units. Assessment is linked to the development of literacy practices and products. Relevant understandings and skills for each lesson 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 of the Science Inquiry Skills and of the Science Understanding in the *Evaluate* phase.

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, 2012).

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 ⚠ SAFETY 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 smell, taste 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). (2012). *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 — *Spot the difference*

Phase	Lesson	At a glance
ENGAGE	**Lesson 1** Change mystery	To capture students' interest and find out what they think they know about how everyday materials can be physically changed in a variety of ways To elicit students' questions about how foods change
EXPLORE	**Lesson 2** Spaghetti scientists ***Session 1*** Spaghetti fun ***Session 2*** Spaghetti towers	To provide students with hands-on, shared experiences of changes to the properties of spaghetti through cooking
	Lesson 3 Hot and cold	To provide students with hands-on, shared experiences of observable changes when foods are heated and cooled
EXPLAIN	**Lesson 4** Looking for change	To support students to represent and explain their understanding of how heating and cooling affect everyday materials, and to introduce current scientific views about how the properties of foods change when they are cooked
ELABORATE	**Lesson 5** Melting moments	To support students to plan and conduct an investigation of which type of chocolate bud melts the fastest
EVALUATE	**Lesson 6** Change champions	To provide opportunities for students to represent what they know about how everyday materials can be physically changed in a variety of ways, and to reflect on their learning during the unit

A unit overview can be found in Appendix 6, page 57

Alignment with the Australian Curriculum: Science

This *Spot the difference* unit embeds all three strands of the Australian Curriculum: Science. The table below lists sub-strands and their content for Year 1. This unit is designed to be taught in conjunction with other Year 1 units to cover the full range of the Australian Curriculum: Science content for Year 1.

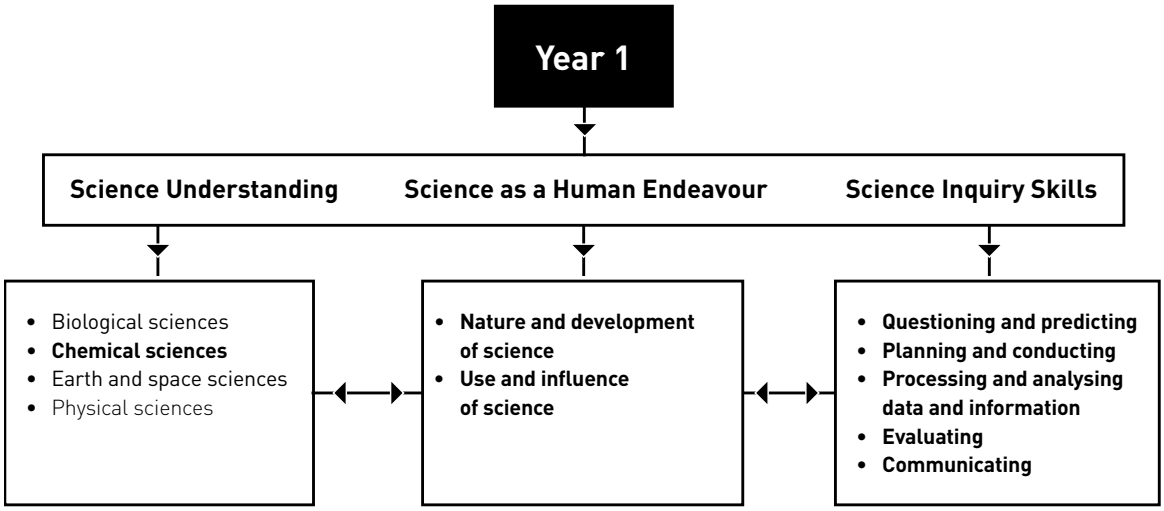
For ease of assessment the table below outlines the sub-strands and their aligned lessons.

Strand	Sub-strand	Code	Year 1 content descriptions	Lessons
Science Understanding	**Biological sciences**	ACSSU018	Everyday materials can be physically changed in a variety of ways	1–6
Science as a Human Endeavour	**Nature and development of science**	ACSHE021	Science involves asking questions about, and describing changes in, objects and events	1–6
		ACSHE022	People use science in their daily lives, including when caring for their environment and living things	1,2,3,4,6
Science Inquiry Skills	**Questioning and predicting**	ACSIS024	Respond to and pose questions, and make predictions about familiar objects and events	1–6
	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	2,3,5
		ACSIS026	Use informal measurements in the collection and recording of observations, with the assistance of digital technologies as appropriate	5
	Processing and analysing data and information	ACSIS027	Use a range of methods to sort information, including drawings and provided tables	2,3,5,6
		ACSIS212	Through discussion, compare observations with predictions	5
	Evaluating	ACSIS213	Compare observations with those of others	1,2,3,5
	Communicating	ACSIS029	Represent and communicate observations and ideas in a variety of ways, such as oral and written language, drawing and role-play	1–6

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 *Spot the difference*, these overarching ideas are represented by:

Overarching idea	Incorporation in *Spot the difference*
Patterns, order and organisation	Students observe and compare changes in everyday materials, in particular food. They use word chains to order the steps in a process of change, such as, cooking, melting or freezing.
Form and function	Students explore the uses of materials before and after changes. They investigate how changing the properties of a material can change its use, for example, the suitability for constructing a tower.
Stability and change	Students predict how heating and cooling can change foods. They explain that the properties remain the same at a set temperature. They describe how some changes can be reversed and others cannot.
Scale and measurement	Students measure, record and compare the amount of time required for different types of chocolate to melt.
Matter and energy	Students explore how the transfer of energy in the form of heat affects different materials and can change their properties.
Systems	

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 *Spot the difference*
Awareness of self and the local world	Students use their senses to observe and explore changes to everyday materials, such as spaghetti strands. They investigate and compare how different types of chocolate melt at different rates. They describe the effect of heating and cooling on the properties of different types of everyday foods.

Achievement standards

The achievement standards of the Australian Curriculum: Science indicates 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 the unit, teachers will be able to make evidence-based judgments on whether the students are achieving below, at or above the Australian Curriculum: Science Year 1 achievement standard. Rubrics to help teachers make these judgments will be 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 further information see: www.australiancurriculum.edu.au/GeneralCapabilities/Overview/General-capabilities-in-the-Australian-Curriculum

For examples of our unit-specific general capabilities information see the next page.

Spot the difference — Australian Curriculum General capabilities

General capabilities	Australian Curriculum description	*Spot the difference* examples
Literacy	Literacy knowledge specific to the study of science develops along with scientific understanding and skills. Primary**Connections** 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 *Spot the difference* the literacy focuses are: • science journals • word walls • annotated drawings • word chains • tables • drawings.
 **Numeracy**	Elements of numeracy are particularly evident in Science Inquiry Skills. These include practical measurement and the collection, representation and interpretation of data.	Students: • collaboratively use tables to organise data • interpret tables to compare observed changes.
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 analyse information.
 **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: • formulate, pose and respond to questions about how everyday materials change • speculate on different ways to change materials • give reasons to justify their responses to questions.
Ethical behaviour	Students develop ethical behaviour as they explore ethical principles and guidelines in gathering evidence and consider the ethical implications of their investigations on others and the environment.	Students: • ask questions respecting each other's point of view • consider the health and safety of others when working with food.
 **Personal and social competence**	Students develop personal and social competence as they 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 • participate in discussions • follow directions to work safely.
 **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 • Important contributions made to science by people from a range of cultures are highlighted.

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

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

Spot the difference focuses on the Western science way of exploring everyday changes using physical senses and controlled investigations such as a fair test. Students sort information into tables and make comparisons to draw conclusions. They relate changes in materials to changes in ways in which objects can be used and explore how a physical process like heat can cause changes.

Indigenous cultures might have different ways of exploring and understanding the world around them. They might also have different explanations for the underlying processes causing change in objects and materials.

Primary**Connections** recommends working with Indigenous community members to access contextualised, relevant Indigenous perspectives.

Sustainability

In the *Spot the difference* unit students investigate how materials can physically change due to different processes, such as heating and cooling. This provides a basis for understanding how some human activities can affect the properties and use of certain materials. This understanding enables students to develop the knowledge, skills and values for making decisions about how their activities might impact on the environment around them.

Alignment with the Australian Curriculum: English and Mathematics

Strand	Sub-strand	Code	Year 1 content descriptions	Lessons
English–Language	**Language for interaction**	ACELA1444	Understand that language is used in combination with other means of communication, for example, facial expressions and gestures to interact with others	1–6
		ACELA1446	Understand that there are different ways of asking for information, making offers and giving commands	1–6
	Expressing and developing ideas	ACELA1451	Identify the parts of a simple sentence that represent 'What's happening?', 'Who or what is involved?' and the surrounding circumstances	1–6
		ACELA1454	Understand the use of vocabulary in everyday contexts as well as a growing number of school contexts, including appropriate use of formal and informal terms of address in different contexts	1–6
English–Literacy	**Interacting with others**	ACELY1656	Engage in conversations and discussions, using active listening behaviours, showing interest, and contributing ideas, information and questions	1–6
		ACELY1788	Use interaction skills including turn-taking, recognising the contributions of others, speaking clearly and using appropriate volume and pace	1–6
		ACELY1657	Make short presentations using some introduced text structures and language, for example opening statements	4
	Interpreting, analysing, evaluating	ACELY1658	Describe some differences between imaginative, informative and persuasive texts	1
	Creating texts	ACELY1661	Create short imaginative and informative texts that show emerging use of appropriate text structure, sentence-level grammar, word choice, spelling, punctuation and appropriate multimodal elements, for example illustrations and diagrams	2,4
Mathematics–Statistics and Probability	**Chance**	ACMSP024	Identify outcomes of familiar events involving chance and describe them using everyday language such as 'will happen', 'won't happen' or 'might happen'	1–6
	Data representation and interpretation	ACMSP262	Choose simple questions and gather responses	3,5

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/

Teacher background information

Introduction to changes to materials

Changes occur to many substances around us every day. These changes occur because of an input or removal of energy, such as removing heat energy to freeze water or adding mechanical energy to knead dough. Some changes are easily reversible, for example, a melted ice pole can be re-frozen. Others are difficult or impossible to reverse, for example, popcorn cannot be un-popped.

Objects are described according to their properties. Properties are the physical characteristics or attributes of objects and materials. Properties include colour, hardness, flexibility, density, shape and size. A physical change will have an effect on some of the object's properties but not others. For example, melting a piece of chocolate will change it from a solid to a liquid but won't change its colour.

Chemical changes are those that involve the formation of a new substance. These changes are generally very difficult or impossible to reverse. Cooking an egg is an example of a chemical change. The properties of the egg have changed because new substances have been formed and the changes cannot be reversed.

Further information about physical changes can be found on the Primary**Connections** Science Background CD and the Primary**Connections** website. www.science.org.au/primaryconnections

The skill of observing

From an early age, children use their senses to explore the diverse nature of the world around them. Such observation is a skill that is fundamental to science.

Observation involves the use of the five senses: touch, taste, hearing, sight and smell. Each sense provides different information about the properties of an object or material. Learning to observe scientifically also involves learning to communicate observations to others in different forms. This is an important skill; without accurate descriptions, no-one could replicate an investigation or build an identical structure.

In this unit of work, descriptive terms will be used by students to represent the properties of materials. A formal definition of properties is not provided as this might restrict students' use of descriptive terms. Properties of an object include weight, shape and size. Properties of a material include durability, hardness, elasticity, transparency, density, absorbency and flexibility.

Research indicates that providing students with scientific terms without first-hand experience does not lead to understanding of how scientists use these terms. Students need numerous first-hand experiences of materials and their properties to enable them to use the terms with understanding.

Students' conceptions

Taking account of students' existing ideas is important in planning effective teaching approaches which 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.

While students might have a good understanding of the concepts involved, they might not have developed suitable language to communicate their ideas. Similarly, some students might appear to use the language correctly but not have an accurate understanding. Students might have their own meaning for words describing material properties, such as 'strong' or 'weak'. Young students often link these terms to living things. They might also associate 'strong' with 'thick', 'hard' with 'heavy', and 'weak' with 'light' or 'soft'.

For changes such as melting, students might not understand that the materials an object is composed of might be unchanged when the object is altered. For example, an ice block (object) is made of water (material) and so the pool of liquid (new object) formed when the ice block melts is also made of water.

To access more in-depth science information in the form of text, diagrams and animations, refer to the Primary**Connections** Science Background Resource which has now been loaded on the Primary**Connections** website: www.science.org.au/primaryconnections/science-background-resource/

Note that this background information is intended for the teacher only.

Lesson 1 Change mystery

AT A GLANCE

To capture students' interest and find out what they think they know about how everyday materials can be physically changed in a variety of ways.

To elicit students' questions about how foods change.

Students:

- observe a melted ice pole
- share observations and ideas about the ice pole with a partner
- share and discuss explanations with the class.

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 account of 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 of:

- how everyday materials can be physically changed in a variety of ways and posing and responding to questions and describing the changes in food caused by heating and cooling.

Key lesson outcomes

Science

Students will be able to represent their current understanding as they:

- describe the properties of a food before and after a change
- explain the reasons for the change
- describe the time taken to change
- explain if the change can be reversed.

Literacy

Students will be able to:

- contribute to discussions about changes to a food
- record their current understanding of a change to food
- identify the purpose and features of a science journal
- identify the purpose and features of a word wall.

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

ENGAGE

Teacher background information

Changes to materials are often made deliberately, such as cooking spaghetti or freezing water to form ice blocks. Some changes occur without human input, such as an ice pole melting in the sun or water freezing on a windscreen on a cold night. Because so many changes occur to materials every day, it can be useful to have some understanding of how they occur and whether or not they are reversible. We might then be able to prevent the change occurring again or to reverse the change to regain the original materials.

Many substances occur as liquids at room temperature: for example water, milk and juice. If these substances are placed somewhere sufficiently cold, for example, a freezer, they will freeze to form solids. If the solids are then returned to room temperature they will melt to return to a liquid state. In this situation, the room temperature is above the melting point of ice and so can provide the heat necessary to cause the change of state. No additional heat source is required.

Most liquids will evaporate if left in an unsealed container. Liquids, for example water, will evaporate quickly if heat is applied but will also evaporate slowly at lower temperatures in appropriate conditions. This process can be accelerated by heat and wind. For example, a glass of cordial will evaporate quicker if placed outside in the sun on a windy day than if placed in a fridge. The sugar and colouring in the cordial will not evaporate at ordinary temperatures and a sticky, coloured residue will remain.

Students' conceptions

Water is a very common substance. Most students will have experiences of it in solid, liquid and gaseous form. Because of this familiarity, students will sometimes associate melting with water. They might also believe that melting will turn a substance into water or that melting involves mixing a substance with water. Similarly, some students think that water is the only liquid that will evaporate with heating and that other liquids remain the same as they get hotter or simply disappear.

Students might think that heat is required for any change to occur because many changes students see involve cooking or burning. Freezing is an example of a change to a material that involves removing heat rather than adding it. A slice of apple turning brown is another example of a change that does not require heat.

Equipment

FOR THE CLASS

- class science journal
- word wall
- 1 enlarged copy of 'What happened?' (Resource sheet 1)
- 1 enlarged copy of 'Think: Pair: Share' (Resource sheet 2)
- mystery object (a melted ice pole still in its wrapper)
- frozen ice pole

FOR EACH STUDENT

- 1 copy of 'What happened?' (Resource sheet 1)
- *Optional:* ice block or ice pole (see Lesson step 12)

Preparation

- Read 'How to use a science journal' (Appendix 2).
- Read 'How to use a word wall' (Appendix 3).
- Prepare a mystery object by allowing an ice pole to melt while still in its wrapper.
- Prepare an enlarged copy of 'What happened?' (Resource sheet 1) and 'Think: Pair: Share' (Resource sheet 2).
- Prepare a 'Spot the difference' chart in the class science journal (see Lesson step 9).
- *Optional:* Display 'What happened?' (Resource sheet 1), 'Think: Pair: Share' (Resource sheet 2), the class science journal and the word wall on an interactive whiteboard or on 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 to students the prepared mystery object. Tell the students that you found this outside in the playground and you would like them to help you solve the mystery of what has happened.

2 Introduce the enlarged copy of 'What happened?' (Resource sheet 1). Read through and discuss each of the questions.

3 Introduce the enlarged copy of 'Think: Pair: Share' (Resource sheet 2). Read through and discuss the chart with students.

4 Organise students into pairs to do the Think: Pair: Share activity. Ask them to find a place to sit together in the classroom. Remind students that they will be doing the 'Think' part first; this means no-one will talk and everyone is to think about the possible answers for 20 seconds.

5 Tell students that it is now time to 'Pair' and take turns to listen to each other's ideas, agree on one idea per question and then write their answers on the resource sheet.

6 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.

What does a science journal include?

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

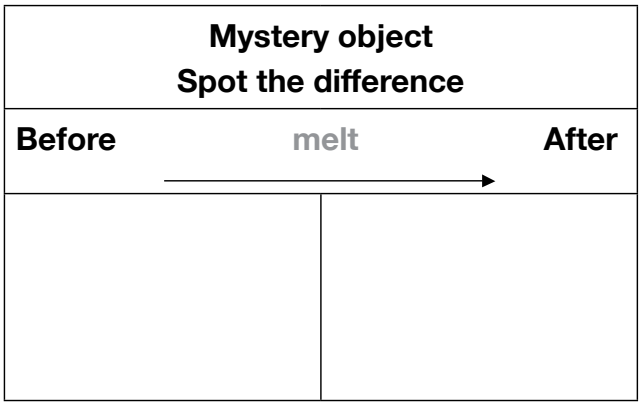
7 Ask each pair to 'Share' with the rest of the class. Record responses to each question in the class science journal.

8 Encourage further thinking by asking questions, such as:

- What clues helped you to decide what it was before?
- Do you think it changed quickly or slowly? (Depends on how hot it was that day.)
- What do you think the person who left it there would think when they came back? Do you think it is the same as when they left it?
- Will the person still be able to eat it?
- Can it be changed back to how it was before? Why or why not?
- How could we change it back? (Freezing it.)

Note: In the *Engage* phase, do not provide formal definitions or correct students' answers as the purpose is to elicit students' prior knowledge. This is an opportunity for diagnostic assessment, to observe what students think they know about change.

9 Ask students to think of words to describe the mystery object and add these to the 'After' column of the 'Spot the difference' chart in the class science journal. Ask students what word describes what happened between 'Before' and 'After'. Encourage students to consider how the object was changed from one to the other. Add 'melt' to the 'Spot the difference' chart (use a different colour).



10 Ask students to think about what the mystery object was before it changed and add these words to the 'Before' column.

11 Introduce the frozen ice pole and ask for any further words to describe the ice pole for the 'Before' section.

12 *Optional:* Make ice poles using orange juice, an ice block tray and popsticks to make the 'Before' part of the mystery or have pre-prepared ice poles and give one to each student.

13 Introduce the word wall and discuss its purposes and features. Write the title 'Spot the difference' on the word wall to help focus on the concept of change and looking at differences before and after the change.

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** includes a topic title or picture and words that we have seen or heard about the topic.

Brainstorm words or phrases about change and record them on the word wall, for example, melt and freeze. Add images to support literacy learning.

Curriculum links

Science

- Brainstorm other ways where change occurs. Examples might include sunny weather changing to rainy, shadows getting longer, shoes wearing out, baking a cake, fruit ripening, and using and hardening clay. Discuss whether the changes are reversible or irreversible.

English

- Write a story about how a strange object that you found had changed overnight while you were asleep.
- Read and discuss imaginative and informative texts about changes.

History

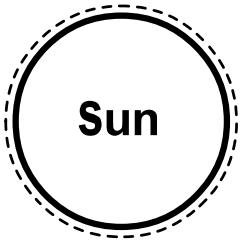
- Find out about materials that were used commonly in the past and that might not be readily available now.

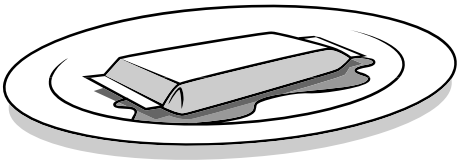
Intercultural understanding

- Find out about materials that are used in different cultures, for example, the natural materials used by traditional Australian Indigenous cultures and how they are worked and changed.

What happened?

Name: _____ **Date:** _____





Can you help solve the mystery?

What was it before? Can you describe it?
Why did it change?
Did it change slowly or quickly?
Could you make it go back to how it was before? Why or why not?

Think: Pair: Share

1 **Think** about the question without speaking. Think of as many answers as you can.

2 **Pair** up with a partner and take turns to listen to each other's ideas. Are your ideas different or the same? Agree on one answer.

3 **Share** your answer with the rest of the group.

Lesson 2 Spaghetti scientists

EXPLORE

AT A GLANCE

To provide hands-on, shared experiences of changes to the properties of spaghetti through cooking.

Session 1 Spaghetti fun

Students:

- read a poem about spaghetti
- explore the properties of cooked spaghetti
- create an annotated drawing using cooked spaghetti.

Session 2 Spaghetti towers

Students:

- explore the properties of uncooked spaghetti
- create a tower using uncooked spaghetti
- create a word chain about cooked and uncooked spaghetti.

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 everyday materials such as spaghetti can by physically changed by heating.
  You will also monitor their developing science inquiry skills (see page 2).

Key lesson outcomes

Science

Students will be able to:

- explore and describe the properties of uncooked spaghetti
- explore and describe the properties of cooked spaghetti
- compare the properties of cooked and uncooked spaghetti.

Literacy

Students will be able to:

- discuss what they know about the properties of spaghetti and how they can change by cooking
- contribute to a class chart describing the properties of cooked and uncooked spaghetti
- create an annotated drawing using spaghetti
- create a word chain about cooked and uncooked spaghetti.

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

Teacher background information

Bending, twisting, stretching and squashing will cause an object to change shape. Different materials will be altered in different ways depending on their properties. For example, rubber bands will return to their original shape and size if stretched, copper wires can be bent and will keep their new shape, glass might break if twisted. These are all examples of physical changes. Some physical changes are reversible, such as melting or freezing. Other physical changes, for example, snapping a piece of uncooked spaghetti, are not reversible.

Changing an object will change its properties. A physical change will cause changes to some of its properties but not others. For example, melting an ice pole will change it from a solid to a liquid but won't change its colour. The properties of objects are often changed to suit particular needs, such as melting chocolate to mix into a cake mix or cooking an egg to put on a sandwich.

Cooking spaghetti involves placing it in boiling water for about 10 minutes. The heat of the water helps it to soak into the pasta, making it flexible and increasing its size. The heat also causes a chemical change, cooking the protein in the flour. Leaving cooked spaghetti exposed to the air will allow the moisture to evaporate and the pasta becomes hard again. Dried cooked spaghetti might look similar to uncooked spaghetti but has undergone an irreversible chemical change.

Students' conceptions

Students will often forcibly stretch a material without consideration as to whether the material is able to be stretched or not. When the material is damaged, students are often surprised.

Session 1 Spaghetti fun

Equipment

FOR THE CLASS

- class science journal
- word wall
- team roles chart
- team skills chart
- poem about spaghetti (see Lesson step 2)
- 'Spaghetti—Spot the difference' chart (see 'Preparation')

FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- each team member's science journal
- cooked spaghetti (see 'Preparation')
- plastic plate or sheet of plastic or paper

Preparation

- Cook 500 g of spaghetti and keep in an airtight container.
- Divide the spaghetti so that each team will have the same amount of spaghetti.
- Ensure that the spaghetti has cooled before distributing it to students.
- Prepare a large 'Spaghetti—Spot the difference' chart (see Lesson step 6).
- *Optional:* Display the 'Spaghetti—Spot the difference' chart on an interactive whiteboard or on 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 and information recorded in the class science journal.
2. Read a poem about spaghetti (Silverstein, S. (2002). 'Spaghetti'. In S. Silverstein, *Where the Sidewalk Ends*. London: Harpercollins).
3. Explain to students that they will be making a spaghetti picture but first they need to find out more about spaghetti.
4. Introduce and discuss the 'Spaghetti—Spot the difference' chart. Explain that students will be working in collaborative learning teams and using their senses to investigate cooked spaghetti. Ask students to think about what they can do with the spaghetti, such as, bend, stretch and twist. Ask one team member to keep a record of the words to describe what the spaghetti can do.

   SAFETY

   Remind students not to eat the spaghetti for allergy and hygiene reasons.

   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 wear role wristbands or badges to help them (and you) know which role each team member has. Draw students' attention to the equipment table and discuss its use. Explain that this table is where the Managers will collect and return equipment.

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

6 When teams have completed the activity, ask the teams to share their observations. Write the words on the right-hand side of the 'Spaghetti—Spot the difference' chart.

Spaghetti **Spot the difference**	
	Cooked spaghetti →
	sticky bends smells nice stretches rolls soft curls

7 Revisit the poem from Lesson step 2. Ask students which part of the poem they might like to illustrate, such as, a bathtub full of spaghetti, spaghetti under the chairs, spaghetti up to my elbows. Alternatively students might think of another spaghetti scene, for example, spaghetti all over my cat.

8 Ask students why cooked spaghetti can be used to make the picture. Refer students to the 'Spaghetti—Spot the difference' chart. Ask students to think about how they will stick the spaghetti to the paper. (The spaghetti will be sticky enough to stick to the paper. Leave flat overnight and the spaghetti will harden and stick.)

9 Model for students how to create an annotated drawing using the strands of spaghetti and words. Encourage students to draw their picture and write the words before adding the spaghetti.

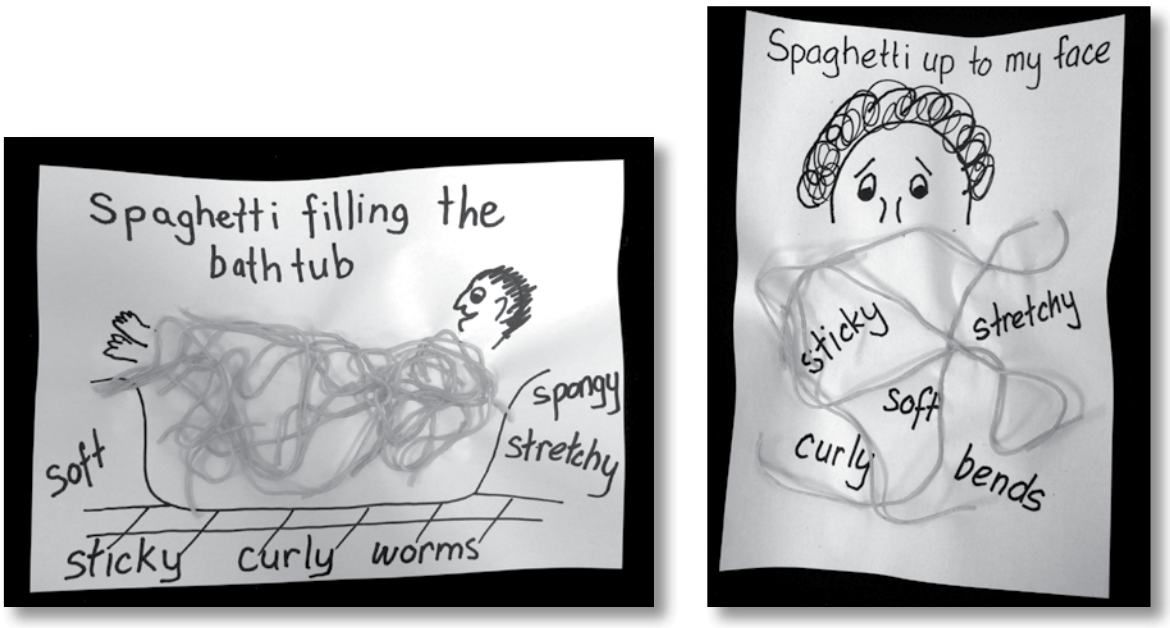
Literacy focus

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.



Work samples of annotated drawings

10 Update the word wall with words and images.

EXPLORE

Curriculum links

Science

- Compare various types of pasta and noodles using the same 'before' and 'after' process.

English

- Source and read poems, narratives and factual texts about spaghetti and other foods that change when heated.
- Write a poem about spaghetti, describing it both before and after cooking.

Mathematics

- Measure and record the length and mass of spaghetti before and after cooking.

Session 2 Spaghetti towers

Equipment

FOR THE CLASS

- class science journal
- word wall
- team roles chart
- team skills chart
- 'Spaghetti—Spot the difference' chart
- several pieces of cooked spaghetti
- several small marshmallows
- 8 blank cards (see 'Preparation')

FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- each team member's science journal
- uncooked spaghetti (see 'Preparation')
- small marshmallows (see 'Preparation')
- 4 large marshmallows

Preparation

- Divide a 500 g packet of spaghetti so that each team will have the same amount of spaghetti.
- Divide 200 g of small marshmallows so that each team will have the same amount of marshmallows.
- Prepare eight cards for the word chain example in Lesson step 10. Either print the words on the cards using the example shown or have blank cards to write on as students suggest words.

Lesson steps

1 Review the previous session and information recorded in the class science journal.

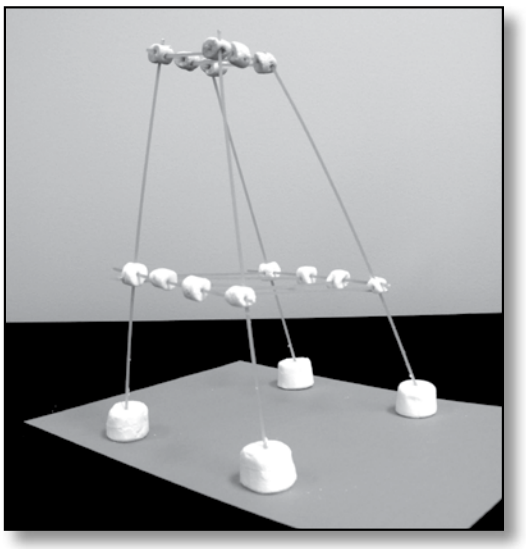
2 Show students some marshmallows and cooked spaghetti and explain that you are going to build a tower with the spaghetti and marshmallows. Model an attempt at connecting the materials and building a tower.

3 Ask students if they notice any problems with the technique. Ask students why the spaghetti isn't suitable. Refer students back to the 'Spaghetti—Spot the difference' chart from the previous session. Ask students what would be better to use.

4 Explain that students will be working in collaborative learning teams and use uncooked spaghetti and small marshmallows to create a tower. Each team will have the same amount of spaghetti and marshmallows to create the tower.

Remind students not to eat the spaghetti or marshmallows for allergy and hygiene reasons.

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



Example of a spaghetti tower

EXPLORE

6 Ask each team to present their tower to the class. Ask Speakers to talk about how they used the spaghetti to create the tower. Encourage them to talk about the properties of the materials.

7 Add descriptive words about the uncooked spaghetti to the 'Spaghetti—Spot the difference' chart. Ask students if they can think of any other words that could be added.

Spaghetti Spot the difference	
Uncooked spaghetti → cook	**Cooked spaghetti**
hard	sticky
snap	bends
no smell	smells nice
brittle	stretches
pointy	rolls
	soft
	curls

8 Discuss with students questions about their explorations with spaghetti, such as:

- What are the differences between the uncooked and cooked spaghetti?
- What happened to the spaghetti for it to change from hard to soft ? (It was cooked in water.) Where on the chart can we add this word to show the change?
- Why did we use the uncooked spaghetti to build the towers?
- What could you do with the cooked spaghetti that you couldn't do with the uncooked spaghetti?
- If we ran out of uncooked spaghetti, could we change the cooked spaghetti back?

9 Introduce students to a word chain. Discuss the purposes and features of a word chain.

Literacy focus

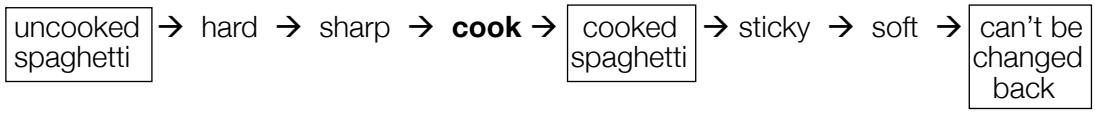
Why do we use a word chain?

We use a **word chain** to show the steps in a process.

What does a word chain include?

A **word chain** includes keywords or pictures in a specific order. Arrows are drawn between the words or pictures to show the sequence.

10 Explain to the students that a word chain can be used to describe how spaghetti changes. Demonstrate using words the students have contributed to the 'Spaghetti—Spot the difference' chart. Write the words on the blank cards (or use pre-prepared cards). Jumble the words and talk through the change process, with students finding the correct word for each step. Explain to students that the important word is how the food changes, such as melt, heat, cool, cook or freeze.



Note: The students might notice that when the spaghetti dries on their spaghetti picture it looks like uncooked spaghetti. Discuss with the students that although it might look similar, there are changes that have happened to the spaghetti during cooking that we cannot see.

11 Glue the word chain in the class science journal or display in the classroom.

12 Update the word wall with words and images.

Optional: Put all words from 'Spaghetti—Spot the difference' chart on cards for students to create word chains.

EXPLORE

Curriculum links

English

- Use the word chain to create a spaghetti story.

Mathematics

- Challenge students to build the tallest tower with spaghetti. Measure and graph results.

Lesson 3 Hot and cold

EXPLORE

AT A GLANCE

To provide hands-on, shared experiences of observable changes when foods are heated and cooled.

Students:

- observe samples of bread, popcorn and chocolate before and after heating and compare their properties
- describe observed changes to heated and cooled foods
- discuss whether different changes to foods are reversible.

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 E*xplain* 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 heating and cooling can physically change everyday materials in a variety of ways, and investigating what happens when foods are heated and cooled.
  You will also monitor their developing science inquiry skills (see page 2).

Key lesson outcomes

Science

Students will be able to:

- predict how heating and cooling can change foods
- identify how a food changes when heated and cooled.

Literacy

Students will be able to:

- use talk to share observations with the class
- describe changes in the properties of food when heated and cooled.

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

Teacher background information

Heating a substance might cause it to change from one state to another. This includes changing from solid to liquid, and liquid to gas. The material remains the same but has a different appearance or shape. By removing heat, the change can often be reversed, that is, the material will change from liquid to solid or gas to liquid. For example, when chocolate is heated sufficiently it changes from a solid to a liquid. When the melted chocolate is cooled it changes back to a solid. In this case, the change is reversible as a new substance was not formed: the liquid is still chocolate.

Heating a substance might cause an irreversible change. These changes happen when a chemical reaction has occurred, forming a new substance or substances. For example, when an egg is cooked new substances are formed and cooling will not change the egg back to its original state.

Some physical changes are also irreversible, for example, snapping a piece of uncooked spaghetti. The resulting pieces are still made of spaghetti so no new substances have been formed. However, the two pieces cannot be put back together to form one piece. Popcorn kernels contain small amounts of water. When the popcorn is heated, this water heats up and forms steam. Steam takes up more space than water so the kernel explodes or pops. The starchy material inside the kernel continues to expand, forming the fluffy white part of popcorn. A physical change has occurred (the water has changed from a liquid to a gas) but the change to the popcorn is irreversible. Kernels of popcorn will not pop if they contain insufficient water or if the steam is allowed to escape slowly rather than bursting the kernel's shell.

Equipment

FOR THE CLASS

- class science journal
- word wall
- team roles chart
- team skills chart
- 1 slice of bread
- 1 slice of toast
- 1 enlarged copy of 'Heat and cool' (Resource sheet 3)

FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- each team member's science journal
- 1 copy of 'Heat and cool' (Resource sheet 3) per team member
- 1 plastic resealable bag
- 1 milk chocolate bud
- a few uncooked popcorn kernels
- a few pieces of cooked popcorn
- *Optional*: cooled melted chocolate and cooled popcorn (see Lesson step 9)

Preparation

- Prepare an enlarged copy of 'Heat and cool' (Resource sheet 3).
- Prepare a page in the class science journal based on 'Heat and cool' (Resource sheet 3) using bread as the subject.

  Note: It is more effective to have popcorn that is freshly cooked and still warm so that students can observe it immediately after cooking.
- *Optional:* Display 'Heat and cool' (Resource sheet 3) on an interactive whiteboard or on 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

EXPLORE

1 Review previous lessons using the class science journal and the word wall.

2 Show students a slice of bread and a slice of toast. Ask students:

- Why do we toast bread?
- How can we tell that bread has been toasted?
- What are the differences between bread and toast?
- What do we do to bread to change it to toast?
- Can we change toast back into bread? Why or why not?

Record students' responses in the class science journal.

3 Introduce the enlarged copy of 'Heat and cool' (Resource sheet 3). 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.

4 Model how to complete the table using the prepared page in the class science journal. Demonstrate how to use comparative language, such as browner, crisper, softer.

5 Show students each of the foods they will be using to compare. Explain to students that they will be working in collaborative learning teams to observe what happens to each food when it is heated and then cooled again.

6 Explain that students will need to melt the chocolate bud to observe how it changes. Ask students for ideas about how they might be able to do that. List students' suggestions in the class science journal. If a suggestion is to melt it in their hands, ask students how they can do that without getting melted chocolate on their hands. (Put the chocolate bud in a plastic resealable bag.)

Remind students not to eat the chocolate for allergy and hygiene reasons.

Photo showing how to melt chocolate in a resealable bag

7 Discuss with students how they will know if the chocolate bud is melted when it is in their hands. Students might need to test the chocolate by pushing it to see if it is melted. Discuss how students will decide when it is fully melted, for example, when there are no hard lumps of chocolate.

8 Form teams and allocate roles. Ask Managers to collect team equipment. Allow time for the teams to observe and compare samples and complete the 'Before heating' and 'After heating' sections of the resource sheet.

9 Allow time for the samples to cool. (It might be necessary to refrigerate the samples.)

Optional: Prepare a sample of cooled melted chocolate and cooled popcorn for each team to use for the 'After cooling' section of the resource sheet.

10 Allow time for students to record observations of the cooled food samples.

11 Display the enlarged copy of 'Heat and cool' (Resource sheet 3). Ask Speakers to report to the class about their team's findings. Complete the enlarged resource sheet using the team reports.

12 Discuss with students the similarities and differences between the different sections of the resource sheet. Ask students if answers in any of the sections are similar or the same, for example, the 'Before heating' and 'After cooling' sections. Students might notice that the chocolate is almost the same after cooling as before heating, but the popcorn is not.

13 Ask students if they can think of other foods that are very different after heating and stay like that after they have cooled, such as bread and toast, cheese and melted cheese, raw egg and boiled egg. Ask students if they can think of any foods which seem to change back to what they were after heating and cooling, for example, water and ice. Ask students how knowing about changes to foods helps us.
For example, would you buy warm popcorn at the movies if you knew that when it cooled down it changed back to kernels of popcorn?

14 Update the word wall with words and images.

Curriculum links

Science

- Explore heating and cooling of other foods, for example, ice-cream.

History

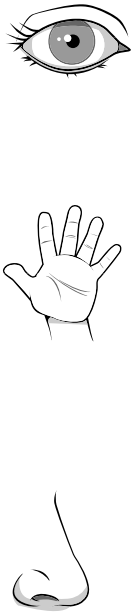
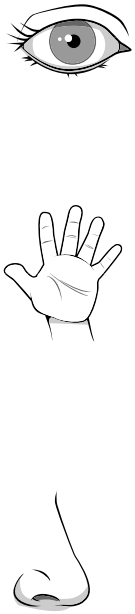
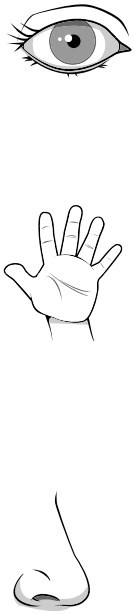
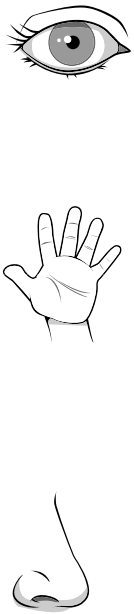
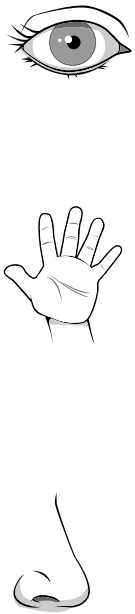
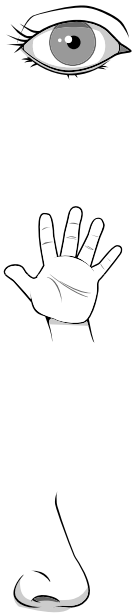
- Find out about ways of cooking, heating, cooling and keeping foods safe to eat in the past. Discuss the impact of these activities on people's daily lives.

Intercultural understanding

- Find out about foods from other cultures, for example, Australian bush tucker; how the foods change when heated, cooked or cooled; and alternative ways of heating, cooking and cooling foods.

Heat and cool

Name: _____ **Date:** _____

	Before heating	After heating	After cooling
Chocolate			
Popcorn			

Lesson 4 Looking for a change

AT A GLANCE

To support students to represent and explain their understanding of how heating and cooling affect everyday materials, and to introduce current scientific views about how the properties of foods change when they are cooked.

Students:

- discuss the properties of eggs and how they can be changed
- identify problems in pictures about changing eggs.

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.

EXPLAIN

Assessment focus

Formative assessment is an ongoing aspect of the *Explain* 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 everyday materials such as eggs can be physically changed by adding or removing heat, and that science involves asking questions about changes. You will also monitor their developing science inquiry skills (see page 2).

Key lesson outcomes

Science

Students will be able to:

- describe an egg and its properties
- identify errors in the explanations about eggs and their properties.

Literacy

Students will be able to:

- use talk to contribute to a class discussion about eggs and their properties
- draw and explain how eggs can change.

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

Teacher background information

Sometimes changing an object's properties can be useful. For example, frying an egg changes it from a liquid to a solid and makes it easier to put on a sandwich. Such a change can be made deliberately. Other reasons for changing food items include freezing bread to prevent mould development or cooking meat to kill bacteria. Cooking can also change the flavour of foods and make them more appealing to eat.

Cooking an egg is a chemical change that cannot be reversed. However, there are sometimes aspects of the egg that appear similar to the original material. For example, a boiled egg and a fried egg still contain a distinct egg yolk and egg white even though they have different properties to those in a raw egg. Because a chemical change has occurred, new substances have been formed. These new substances can only be formed from particular materials and through particular processes. For example, placing an orange in boiling water will not change it into a boiled egg, nor will placing a raw egg in the fridge change it into a fried egg.

Different changes occur at different rates. A major factor in most change processes is the temperature. Many changes will occur at a faster rate if the temperature is raised. For example, chocolate will melt faster over boiling water than in a person's hand. Similarly, some changes will not occur at all if the temperature is too low, such as cooking an egg or melting cheese.

Equipment

FOR THE CLASS

- class science journal
- word wall
- team roles chart
- team skills chart
- 1 enlarged copy of 'Silly eggs!' (Resource sheet 4)

FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- each team member's science journal
- 1 copy of 'Silly eggs!' (Resource sheet 4) per team member

Preparation

- Prepare an enlarged copy of 'Silly eggs!' (Resource sheet 4).
- *Optional:* Display 'Silly eggs!' (Resource sheet 4) on an interactive whiteboard or on 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 the word wall.

2 Ask students to brainstorm all the different things they know about eggs, their properties, how eggs can change and different ways of cooking them. Write students' responses in the class science journal.

3 Introduce an enlarged copy of 'Silly eggs!' (Resource sheet 4) and discuss each picture with the class. Tell students that each picture has something incorrect in it about eggs and how they change.

4 Explain to students that they will be working in collaborative learning teams to identify the problem, discuss it and draw a picture that is more appropriate. Discuss the purposes and features of a drawing.

Literacy focus

Why do we use a drawing?

We use a **drawing** to illustrate an idea or an object.

What does a drawing include?

A **drawing** includes lines to represent a likeness, image, plan or design, usually using a pen, pencil or crayon.

EXPLAIN

5 Explain to students they will draw a more appropriate picture for each situation in the box next to it and write an explanation underneath. Model the activity using the first picture.

6 Form teams and allocate roles. Ask Managers to collect team equipment. Allow time for teams to complete the activity.

7 Invite selected teams to report back to the class, by explaining the problem that they identified in the picture and why the picture needed to be changed.

8 Write students' responses in the class journal. Compare the different responses and how each response relates to scientific understanding. For students who have retained non-scientific ideas, ask questions, such as:

- Could you tell me more about that?
- What do you mean by that?

  *(**Note to teacher:** Scientists have found that:*

  Changes to foods, such as cooking, can be useful, for example, frying an egg makes it tastier.

  Some changes to foods cannot be reversed, for example, a cooked egg cannot be changed back to a liquid raw egg.

  Sometimes cooking changes the look and taste of foods, but this depends on the types of foods and the types of changes. For example, placing an orange in boiling water will not change it into a boiled egg, nor will placing a raw egg in the fridge change it into a fried egg.)
- How do these statements fit with your ideas?

9 Ask students to review and update their responses based on the discussion. Paste their completed copy of 'Silly eggs!' (Resource sheet 4) into their science journal.

10 *Optional:* Review factual texts about changes to foods. See the Primary**Connections** website: www.science.org.au/primaryconnections

11 Update the word wall with words and images.

Curriculum links

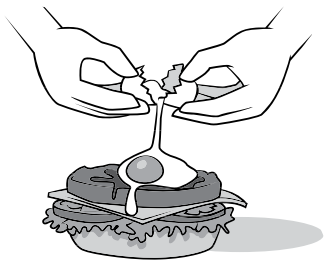
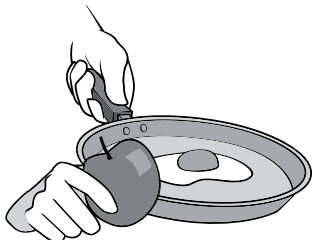
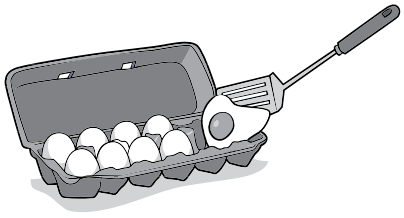
English

- Source and read recipes that use eggs in various ways and discuss how the eggs might change.
- Write and publish stories about 'Silly eggs!'.
- Make a set of pairs of cards about changes to introduce the idea of how things change to a younger child or to students in another year one class.

Silly eggs!

Name: _____ **Date:** _____

What's wrong with these pictures? Draw the correct picture next to each one and write words to match.

Lesson 5 Melting moments

AT A GLANCE

To support students to plan and conduct an investigation of which type of chocolate bud melts the fastest.

Students:

- review what they know about foods and how foods can change
- work in collaborative learning teams to investigate melting different types of chocolate buds
- discuss observations and results of the investigation.

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 (see page 2). Rubrics will be available on the website to help you monitor students' inquiry skills.

Key lesson outcomes

Science

Students will be able to:

- predict which type of chocolate will melt fastest
- observe and compare the melting times of different types of chocolate.

Literacy

Students will be able to:

- describe observations of chocolate buds before and after they have changed
- participate in a class discussion about which type of chocolate will melt fastest.

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

Teacher background information

If chocolate absorbs sufficient energy, in the form of heat from its surroundings, it will melt. The size of the piece of chocolate and the surrounding temperature are factors that affect how fast the chocolate will melt. A smaller piece of chocolate will melt faster than a large piece because the heat does not have to penetrate as far. A piece of chocolate in a hot place, for example, in the sun, will melt faster than a piece of chocolate in a cooler place, for example, in the shade. In order to melt, the temperature of a substance must be raised above its melting point. For this reason, chocolate will never melt in a refrigerator.

The human body maintains an internal temperature of about 37°C. However, the measured body temperature can vary. This might be due to the time of day, the timing of physical activity or where on the body the temperature is measured. Body temperature might be cooler in the morning after sleep than later in the day after exercise and eating. Measuring temperature after exercise might show a higher temperature due to increased energy usage. Infections might also cause an increase in body temperature, which is why doctors might measure the temperature of their patients. For these reasons, different students will have different temperatures when completing this investigation so the same type of chocolate will not all melt at the same rate.

Some substances will melt more easily than others. For example, chocolate will melt if left in the sun but an apple will not. Different types of chocolate contain different proportions of ingredients and will not melt at the same rate. Unlike many substances, when chocolate is melted it will generally maintain its shape unless it is pushed or pulled. For example, a chocolate bud melted on a flat plate will look much like a solid chocolate bud until it is stirred.

Students' conceptions

Students might believe that 'hotness' is a property of objects rather than having an understanding that the temperature of an object can be changed. Students might not understand that if the air temperature is sufficiently warm, some substances will melt without a specific heat source. Students might not realise the heat from their bodies melts the chocolate. Students might also have difficulty with the concept that the chocolate that melted the fastest took less time to melt.

Students might associate how easily an object melts with how strong it is. Students might also confuse melting with shrinking or drying up. Some students might claim something melting is dissolving. This confusion might relate to language use or might be due to a lack of conceptual understanding.

Equipment

FOR THE CLASS

- class science journal
- word wall
- team roles chart
- team skills chart
- 1 white chocolate bud
- 1 small plastic resealable bag

FOR EACH TEAM

- each team member's science journal
- role wristbands or badges for Manager and Speaker
- 1 each of a dark and white chocolate bud
- 2 small plastic resealable bags

Preparation

- Read 'How to conduct a fair test' (Appendix 4).
- Prepare a white chocolate bud by placing it in a plastic resealable bag.
- Draw an investigation planner in the class science journal, allowing sufficient space for text and pictures, for example:

Investigation planner

Question: Which type of chocolate melts fastest?		
We will **change**		
We will **observe** which type of chocolate melts fastest		
We will keep the **same**		
What we found out		

Note: If white chocolate is not available, students can compare milk chocolate and dark chocolate. There is only a small difference between the melting times of milk and white chocolate buds.

- *Optional:* Display the investigation planner on an interactive whiteboard or on 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 Show students a white chocolate bud in a plastic resealable bag and ask students to describe the chocolate bud. Ask students to predict how they could change the chocolate bud. Ask questions, such as:

- What changes do you think can happen to the chocolate? (Melting, breaking.)
- Why do you think that?
- What does the chocolate need to melt? (Heat.)
- How can we do that? (Put it in our hands, in the microwave, on the stove.)

2 Ask students if they think the type of the chocolate will make a difference to how fast it melts. Show students the dark and white chocolate buds and ask them to predict which might melt fastest. Record students' responses in the class science journal.

3 Explain that students will be working in collaborative learning teams to investigate the question 'Which type of chocolate melts fastest?' Explain to students that they will be using plastic resealable bags to hold the chocolate bud in while it melts. Model how to melt the chocolate bud in the plastic resealable bag. Discuss with students how they will be able to tell when the chocolate bud has melted. Suggestions might include: the bud will be flat, there will be no lumps.

4 Introduce the investigation planner in the class science journal. Read the question for investigation.

Discuss and record on the investigation planner what teams will:

- **change:** the type of chocolate
- **observe:** which type of chocolate melts fastest
- **keep the same:** the size of the piece of chocolate, the number of chocolate buds, the way the chocolate is held, the time the melting starts.

5 Discuss why it is important to change the type of chocolate but keep everything else the same.

Ask students questions, such as:

- Would it be fair if the white chocolate bud were bigger than the dark chocolate bud?
- Would it be fair if one person started melting their chocolate bud before the other person did?
- Would it be fair if one chocolate bud were really cold and the other warm before the investigation begins?
- Would it be fair if one team member had lots of chocolate buds to melt and the other team member only one?
- Would it be fair if one team member kept checking the chocolate and the other didn't?

6 Explain that Managers will have a dark chocolate bud and Speakers a white chocolate bud for their investigation. Remind students that both team members should begin melting their buds at the same time and both should check at the same time to see if their bud has melted.

SAFETY

Remind students not to eat the chocolate for allergy and hygiene reasons.

7 Form teams and allocate roles. Ask Managers to collect team equipment and allow time for students to complete the activity.

Optional: Ask students to repeat the activity with new chocolate buds, with Managers melting the white chocolate bud and Speakers melting the dark chocolate bud.

8 Ask students to write in their science journal which type of chocolate melted fastest.

9 Invite teams to report and discuss their results to the class. Ask questions, such as:

- Stand up if your team found the dark/white chocolate bud melted first. (Record results as a table in class journal.)
- Which type of chocolate melted the fastest for most teams?
- Which type of chocolate would last longer in your hand before melting?
- Did you have any problems doing the investigation?
- What would you do differently if you did the investigation again?

Add observations and results to the investigation planner.

10 Update the word wall with words and images.

Curriculum links

Science

- Compare the melting rates of three types of chocolate: milk, white and dark.

English

- Write a procedural text about ways of melting chocolate.

Mathematics

- Use a stopwatch to time how long it takes each chocolate bud to melt. Graph results.

Lesson 6 Change champions

AT A GLANCE

To provide opportunities for students to represent what they know about how everyday materials can be physically changed in a variety of ways, and to reflect on their learning during the unit.

Students:

- describe what they know about a food
- describe how the properties of the food can change through heating and cooling.

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 everyday materials can be physically changed in a variety of ways, and that people use science in their daily lives such as in cooking.

Key lesson outcomes

Science

Students will be able to:

- describe the properties of different foods
- describe how foods can change through heating and cooling.

Literacy

Students will be able to:

- participate in a class discussion about the properties of foods
- use words and pictures to describe changes to different foods.

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
- 1 enlarged copy of 'Food changes' (Resource sheet 5)

FOR EACH STUDENT

- science journal
- 1 copy of 'Food changes' (Resource sheet 5)

Preparation

- Prepare an enlarged copy of 'Food changes' (Resource sheet 5).
- *Optional:* Display 'Food changes' (Resource sheet 5) on an interactive whiteboard or on 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 unit using the class science journal and the word wall, particularly the descriptive and comparative language.

2 Read through the enlarged copy of 'Food changes' (Resource sheet 5). Remind students about word chains by looking at the word chains they created when exploring spaghetti (Lesson 2, Session 2). Discuss how the word chains began with the food and showed what changes happened to the spaghetti, as well as what caused the changes.

3 Explain to students that they will be cutting the sheet into boxes then making three word chains that show how three foods change. Each word chain should have one of each number from one to six. Once the students have sorted the words they then paste the word chains into their science journal. Remind students to draw arrows between the words.

4 Model an example of a word chain in the class science journal using bread and toast.

bread → soft white → **cook** → toast → crispy brown → can't be changed back

5 Allow students time to complete the activity.

Optional: Ask students to illustrate their word chains.

6 Ask students to share their completed word chains with the class and discuss the answers.

7 Review the 'Spot the difference' unit with the class, asking questions, such as:

- Which activity did you most enjoy? Why?
- What ideas about food changes have you changed? Why? What made you change your ideas?
- What new ideas have you developed?

Record students' responses in the class science journal.

EVALUATE

1 melted ice pole	2 runny sticky	3 freeze	4 frozen ice pole	5 cold hard	6 It can be changed back
1 popcorn kernels	2 small hard	3 cook	4 popped popcorn	5 white fluffy	6 It can't be changed back
1 chocolate	2 smooth yummy	3 melt	4 melted chocolate	5 runny yummy	6 It can be changed back

Word chain answer sheet

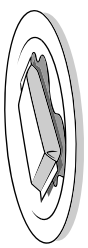
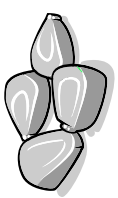
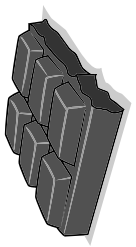
Curriculum links

English

- Make a class 'big book' about changes to share with others.
- Create a word chain for a favourite food and include images as part of the word chain to explain the change processes.

Food changes

Cut out the boxes to make word chains about changing these three foods.

6 It can be changed back	6 It can't be changed back	6 It can be changed back
5 cold hard	5 white fluffy	5 runny yummy
4 popped popcorn	4 frozen ice pole	4 melted chocolate
3 freeze	3 melt	3 cook
2 smooth yummy	2 runny sticky	2 small hard
1 melted ice pole 	1 popcorn kernels 	1 chocolate 

Appendix 1
How to organise collaborative learning teams (F–Year 2)

Introduction

Students working in collaborative teams is a key feature of the PrimaryConnections 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.

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

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 experience working together successfully.
- 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 F–Year 2, teams consist of two students: Manager and Speaker. (For Year 3–Year 6, 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, such as a wristband, badge, or coloured clothes peg. 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 might 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
- Stay with your team
- Take turns.

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.

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 **Stay with your team**

3 **Take turns**

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 students' learning and plan future learning activities in science and literacy.

Development of a science journal aligns to descriptions in the Australian Curriculum: Science and English. See pages 2 and 7.

Using a science journal

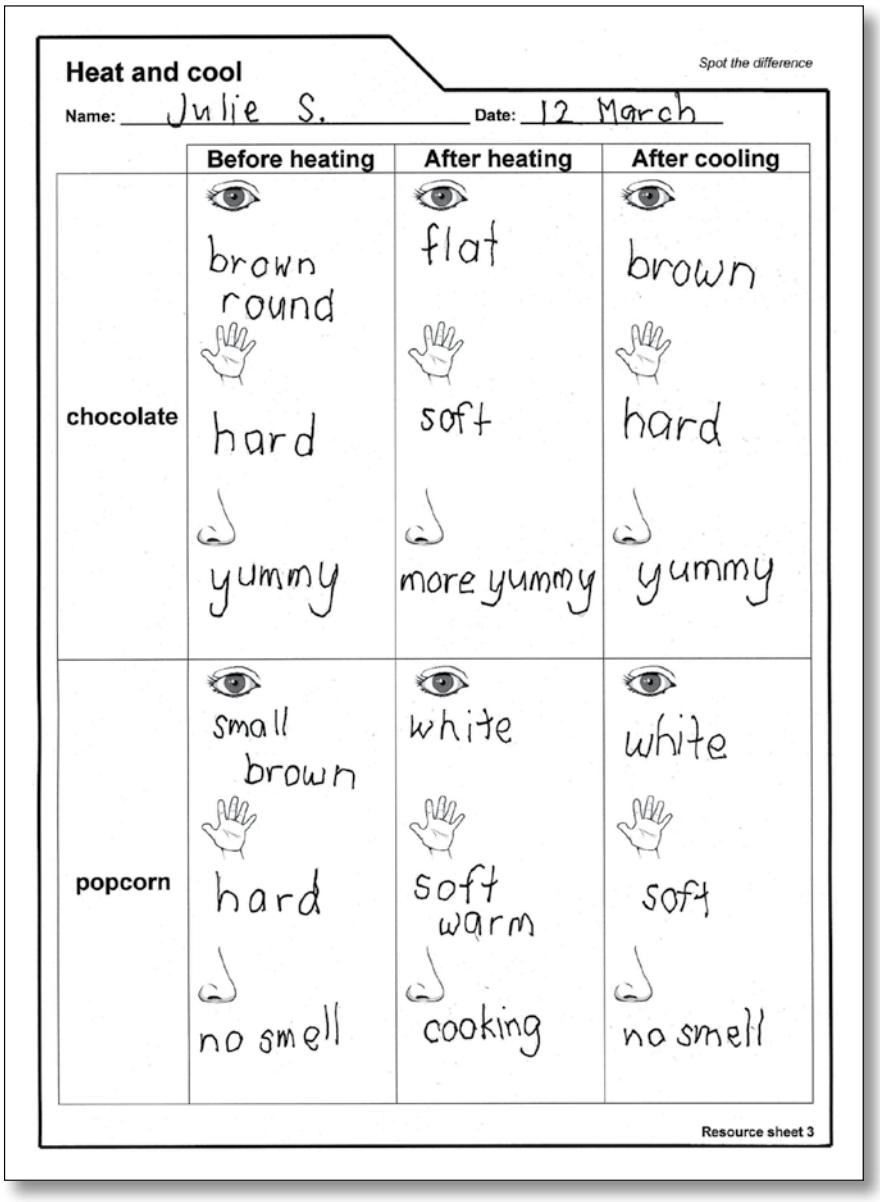
1. At the start of the year, or before starting a science unit, provide each student with a notebook or exercise book for their science journal or use an electronic format. Tailor the type of journal to fit the needs of your classroom. Explain to students that they will use their journals to keep a record 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 year levels 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, such as 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.



***Spot the difference* science journal**

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.

Creating a class word wall, including words from regional dialects and other languages, aligns to descriptions in the Australian Curriculum: English. See page 7.

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

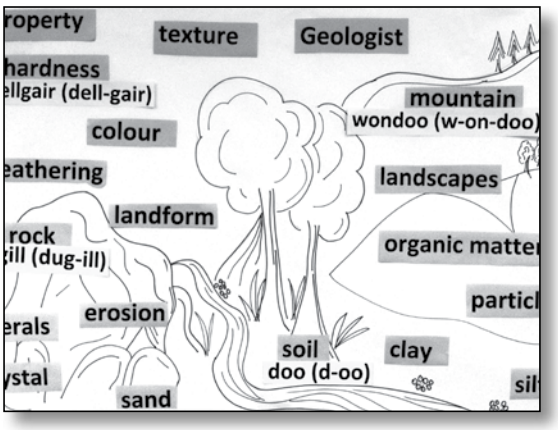
Position the word wall so that students have easy access to the words. They need to be able to see, remove and return word cards to the wall. A classroom could have one main word wall and two or three smaller ones, each with a different focus, for example, high-frequency words.

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-adhesive dot to make it easy for students to remove and replace word cards.

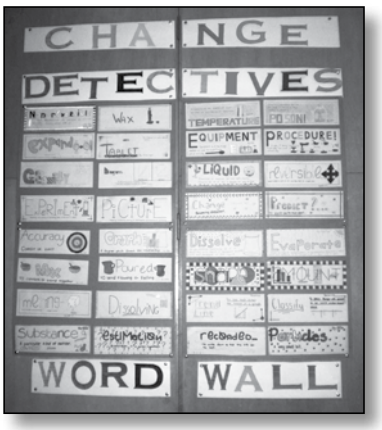
Word walls do not need to be confined to a wall. Use a portable wall, display screen, shower curtain or window curtain. Consider a cardboard shape that fits with the unit, for example, an apple for a needs unit. The purpose is for students to be exposed to a print-rich environment that supports their 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 a *Spot the difference* unit might be organised using headings, such as ‘Properties’, ‘Changes’ and ‘Descriptions’.

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.'



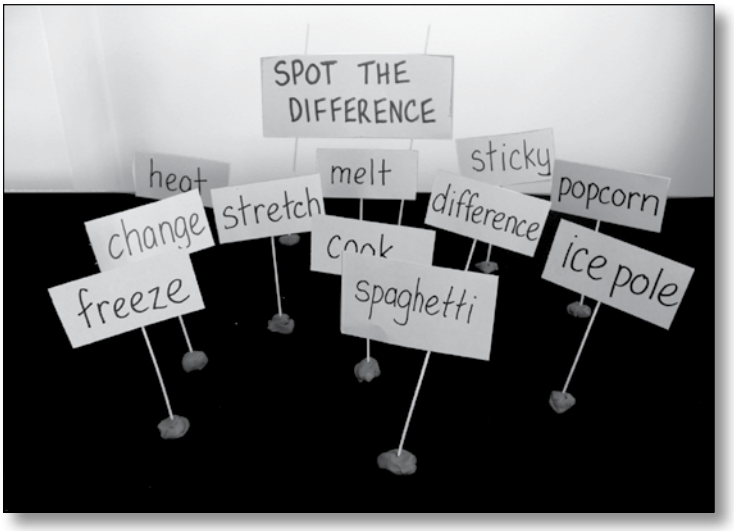
***Smooth moves* word wall**



***Change detectives* 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 individual students during literacy experiences. Organise multi-level activities to cater for the individual needs of students.



***Spot the difference* word wall**

Appendix 4
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 *Spot the difference*, students investigate things that affect how quickly a chocolate bud melts. 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.

Note: It is not intended that Year 1 students be introduced to the word 'variable'.

'**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) and

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

To investigate which type of chocolate bud melts fastest, students could:

CHANGE	the type of chocolate bud (white or dark)	Independent variable
MEASURE/OBSERVE	which type of chocolate buds melts first	Dependent variable
KEEP THE **SAME**	the size of the chocolate bud, the number of buds, the way the chocolate is held	Controlled variables

Appendix 5
Spot the difference equipment list

EQUIPMENT ITEM	QUANTITIES	Lesson	1	2		3	4	5	6
		Session		1	2				
Equipment and materials									
bag, plastic and resealable	1 per team					●			
bag, plastic and resealable	1 per class							●	
bag, plastic and resealable	2 per team							●	
bread	1 slice per class					●			
bread, toasted	1 slice per class					●			
cards, blank	8 per class				●				
chocolate bud, dark	1 per team							●	
chocolate bud, milk	1 per team					●			
chocolate bud, white	1 per class/team							●	
frozen ice pole	1 per class		●						
ice pole, *optional*	1 per student		●						
marshmallows, large	4 per team				●				
marshmallows, small	several per class				●				
marshmallows, small	200 g per 30 students				●				
mystery object (a melted ice pole still in its wrapper)	1 per class		●						
plastic plate or sheet of plastic or paper	1 per team			●					
poem about spaghetti	1 per class			●					
popcorn kernels, cooked	several pieces per team					●			
popcorn kernels, uncooked	several pieces per team					●			
spaghetti, cooked	several pieces per class				●				

EQUIPMENT ITEM	QUANTITIES	Lesson	1	2		3	4	5	6
		Session		1	2				
spaghetti, cooked	500 g per 30 students			●					
spaghetti, uncooked	500 g per 30 students				●				
'Spaghetti—Spot the difference' chart	1 per class			●	●				
Resource sheets									
'What happened' (Resource sheet 1), enlarged	1 per class		●						
'What happened' (Resource sheet 1)	1 per student		●						
'Think: Pair: Share' (Resource sheet 2), enlarged	1 per class		●						
'Heat and cool' (Resource sheet 3), enlarged	1 per class					●			
'Heat and cool' (Resource sheet 3)	1 per student					●			
'Silly eggs!' (Resource sheet 4), enlarged	1 per class						●		
'Silly eggs!' (Resource sheet 4)	1 per student						●		
'Food changes' (Resource sheet 5), enlarged	1 per class								●
'Food changes' (Resource sheet 5)	1 per student								●
Teaching Tools									
class science journal	1 per class		●	●	●	●	●	●	●
team roles chart	1 per class			●	●	●	●	●	
team skills chart	1 per class			●	●	●	●	●	
student science journal	1 per student			●	●	●	●	●	●
word wall	1 per class		●	●	●	●	●	●	●
wristbands or badges	1 set per team			●	●	●	●	●	

Appendix 6
Spot the difference unit overview

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to represent their current understandings as they:	Students will be able to:	Students:	
ENGAGE	**Lesson 1** Change mystery	• describe the properties of a food before and after a change • explain the reasons for the change • describe the time taken to change • explain if the change can be reversed.	• contribute to discussions about changes to a food • record their current understanding of a change to food • identify the purpose and features of a science journal • identify the purpose and features of a word wall.	• observe a melted ice pole • share observations and ideas about the ice pole with a partner • share and discuss explanations with the class.	**Diagnostic assessment** • Science journal entries • Class discussions • Word wall contributions • 'What happened?' (Resource sheet 1) • 'Think: Pair: Share' (Resource sheet 2)

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
EXPLORE	**Lesson 2** Spaghetti scientists ***Session 1*** Spaghetti fun ***Session 2*** Spaghetti towers	• explore and describe the properties of uncooked spaghetti • explore and describe the properties of cooked spaghetti • compare the properties of cooked and uncooked spaghetti.	• discuss what they know about the properties of spaghetti and how they can change by cooking • contribute to a class chart describing the properties of cooked and uncooked spaghetti • create an annotated drawing using spaghetti • create a word chain about cooked and uncooked spaghetti.	***Session 1*** ***Spaghetti fun*** • read a poem about spaghetti • explore the properties of cooked spaghetti • create an annotated drawing using cooked spaghetti. ***Session 2*** ***Spaghetti towers*** • explore the properties of uncooked spaghetti • create a tower using uncooked spaghetti • create a word chain about cooked and uncooked spaghetti.	**Formative assessment** • Science journal entries • Class discussions • Word wall contributions • Annotated drawings • Word chains

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
EXPLORE	**Lesson 3** Hot and cold	• predict how heating and cooling food can change foods • identify how a food changes when heated and cooled.	• use talk to share observations with the class • describe changes in the properties of food when heated and cooled.	• observe samples of bread, popcorn and chocolate before and after heating and compare their properties • describe observed changes to heated and cooled foods • discuss whether different changes to foods are reversible.	**Formative assessment** • Science journal entries • Class discussions • Word wall contributions • 'Heat and cool' (Resource sheet 3)
EXPLAIN	**Lesson 4** Looking for a change	• describe an egg and its properties • identify errors in the explanations about eggs and their properties.	• use talk to contribute to a class discussion about eggs and their properties • draw and explain how eggs can change.	• discuss the properties of eggs and how they can be changed • identify problems in pictures about changing eggs.	**Formative assessment** • Science journal entries • Class discussions • Word wall contributions • 'Silly eggs!' (Resource sheet 4) • Drawings

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
ELABORATE	**Lesson 5** Melting moments	• predict which type of chocolate will melt fastest • observe and compare the melting times of different types of chocolate.	• describe observations of chocolate buds before and after they have changed • participate in a class discussion about which type of chocolate will melt fastest.	• review what they know about foods and how foods can change • work in collaborative learning teams to investigate melting different types of chocolate buds • discuss observations and results of the investigation.	**Formative assessment** • Science journal entries • Class discussion • Word wall contributions
EVALUATE	**Lesson 6** Change champions	• describe the properties of different foods • describe how foods can change through heating and cooling.	• participate in a class discussion about the properties of foods • use words and pictures to describe changes to different foods.	• describe what they know about a food • describe how the properties of the food can change through heating and cooling.	**Summative assessment** the Science Understanding • Science journal entries • Class discussions • Word wall contributions • 'Food changes' (Resource sheet 5) • Word chains

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

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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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