PrimaryConnections®

Australian Academy of Science

Fully aligned with the Australian Curriculum

On the move

Foundation Year

Physical sciences

About this unit On the move

Why do things move? The universe, and everything in it, is continuously moving and changing. Movement and change are concepts that we need to understand to make sense of the world around us. They are linked to concepts of energy and force. Scientists and engineers apply these concepts to study the performance of athletes and in the design of toys, cars and spacecraft.

The *On the move* unit is an ideal way of linking science with literacy in the classroom. Students develop an understanding of how things move. They explore the push and pull forces they can use to move objects in ways such as sliding, bouncing and spinning. Through investigations, students observe and gather evidence about rolling objects and explore the idea of fair testing.

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Contents

Foreword

Never has there been a more important time for science in Australia. More than ever, we need a scientifically-literate community to engage in debates about issues that affect us all. We also need imaginative thinkers to discover the opportunities in our exponentially expanding knowledge base. Teachers play a vital role in nurturing the minds of our future citizens and scientists.

The Australian Academy of Science has a long, proud history of supporting science education. Our primary education program, Primary**Connections**: linking science with literacy, now has over 15 years' experience in supporting teachers to facilitate quality learning experiences in their classrooms. Regular evaluations demonstrate the significant impact the program can have on both teacher confidence and student outcomes.

Primary**Connections** has been developed with the financial support of the Australian Government and endorsed by education authorities across the country. It has been guided by its Steering Committee, with members from the Australian Government and the Australian Academy of Science, and benefitted from input by its Reference Group, with representatives from all states and territories.

Key achievements of the program include engaging over 24,000 Australian teachers in professional learning workshops, producing multi award-winning curriculum resources, and developing an Indigenous perspective framework that acknowledges the diversity of perspectives in Australian classrooms.

The Primary**Connections** teaching and learning approach combines guided inquiry, using the 5Es model, with hands-on investigations. It encourages students to explore and test their own, and others', ideas and to use evidence to support their claims. It focuses on developing the literacies of science and fosters lasting conceptual change by encouraging students to represent and re-represent their developing understandings. Students are not only engaged in science, they feel that they can do science.

This is one of 40 curriculum units developed to provide practical advice on implementing the teaching and learning approach while meeting the requirements of the Australian Curriculum: Science. Trialled in classrooms across the country and revised based on teacher feedback, and with the accuracy of the teacher background information verified by Fellows of the Academy, the experience of many brings this unit to you today.

I commend Primary**Connections** to you and wish you well in your teaching.

Professor John Shine, AC Pres AA
President (2018–2022
Australian Academy of Science

The Primary**Connections teaching and learning approach**

Primary**Connections** units embed inquiry-based learning into a modified 5Es instructional model. 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 explanation	**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.primaryconnections.org.au

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

Developing students' scientific literacy

The Primary**Connections** program supports teachers in 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

Reference: 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.

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

Science is ongoing and embedded in Primary**Connections** units. Assessment is linked to the development of literacy practices and products. Relevant understandings and skills are highlighted at the beginning of each lesson. Different types of assessment are emphasised in different phases:

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

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

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

Rubrics to help you make judgments against the relevant achievement standards of the Australian Curriculum are available on our website:
www.primaryconnections.org.au

Safety

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

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

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

Teaching to 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 2020).

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 including how current knowledge has developed over time through the actions of many people
Use and influence of science	How science knowledge, and applications affect people's lives, including their work, 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 about 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 this 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 Above material is sourced from the Australian Curriculum: Australian Curriculum Assessment and Reporting Authority (ACARA). (2020). *Australian Curriculum: Science*. www.australiancurriculum.edu.au

Primary**Connections** units support teachers to teach each Science Understanding detailed in the Australian Curriculum: Science from Foundation to Year 6. Units also develop students' skills and knowledge of the Science as a Human Endeavour and Science Inquiry Skills sub-strands, as well as specific sub-strands within the Australian Curriculum: English, Mathematics and Design and Technologies. Detailed information about its alignment with the Australian Curriculum is provided in each unit.

Unit at a glance — *On the move*

Phase	Lesson	At a glance
ENGAGE	**Lesson 1** Movers and shakers	To capture students' interest and find out what they think they know about how the way objects move depends on a variety of factors, including their size and shape To elicit students' questions about human movement
EXPLORE	**Lesson 2** On the hunt for things that move	To provide students with hands-on, shared experiences of things that move in the classroom, in the school grounds and outside the school grounds
	Lesson 3 Playground play	To provide students with hands-on, shared experiences of human movement and to identify the body parts involved
	Lesson 4 Toys that move	To provide students with hands-on, shared experiences of toys that move, the ways in which they move and the shapes that help them to move
EXPLAIN	**Lesson 5** Moving towards an explanation	To support students to represent and explain their understanding about movement, and to introduce current scientific view
ELABORATE	**Lesson 6** Rolling along ***Session 1*** Shape, rattle and roll ***Session 2*** Sizing it up ***Session 3*** Roll on	To support students to plan and conduct an investigation of the effects of shape, size and surface on how far things roll
EVALUATE	**Lesson 7** Showing what we know	To provide opportunities for students to represent what they know about how the way objects move depends on a variety of factors, including their size and shape, and to reflect on their learning during the unit

A unit overview can be found in Appendix 6, page 52.

On the move—Alignment with the Australian Curriculum

On the move is written to align to the Foundation level of the Australian Curriculum: Science. The Science Understanding, Science Inquiry Skills, and Science as a Human Endeavour strands are interrelated and embedded throughout the unit (see page xi for further details). This unit focuses on the Physical sciences sub-strand.

Foundation Year Science Understanding for the Physical Sciences:	**The way objects move depends on a variety of factors, including their size and shape (ACSSU005)**
Incorporation in *On the move:*	Students explore human movement, how and why some objects move and how they can make objects move. They use their senses to observe, gather information, make comparisons, describe, sort and classify movements and identify features involved in movement. They observe and explore how size, shape and surface will affect how far and how easily an object will roll and how objects can move in different ways.

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

Foundation Year Achievement Standard

The Australian Curriculum: Science Foundation Year achievement standard indicates the quality of learning that students should demonstrate by the end of Foundation Year.

> **By the end of the Foundation Year, students describe the** properties and behaviour **of familiar objects. They suggest how the environment affects** them and **other living things.**
>
> **Students share observations of familiar objects** and events.

The sections relevant to *On the move* are bolded above. By the end of the unit, teachers will be able to make evidence-based judgements on whether the students are achieving below, at or above the achievement standard for the sections bolded above. To assist teachers in making these judgements, assessment rubrics and work samples are provided on the PrimaryConnections website: **www.primaryconnections.org.au**

On the move—Australian Curriculum: Key ideas

In the Australian Curriculum: Science, there are six key ideas that represent key aspects of a scientific view of the world and bridge knowledge and understanding across the disciplines of science. The below table explains how these are represented in *On the move.*

Overarching idea	Incorporation in *On the move*
Patterns, order and organisation	Students observe and describe human movements and predict and observe things that move inside and outside the classroom. Through making observations and identifying patterns of similarities and differences in the size and shape of toys, the way they move, or in the parts that allow them to move, students classify a collection of toys.
Form and function	Students observe the behaviour and physical properties of things that move and explore how factors such as shape and size affect their use. They investigate the effect of surface on how far things roll.
Stability and change	The students observe and describe changes that occur when objects move. They explore how they can apply a force to change the movement of objects.
Scale and measurement	Students work with an informal scale related to their everyday experience. They compare how far two similar objects of different size roll, and then compare how far an object that rolls easily will roll on a smooth and on a rough surface.
Matter and energy	Students directly experience push and pull forces and observe the movement of humans and other things in their environment. They investigate rolling and observe the effect of shape, size and surface on movement and on how far things will roll.
Systems	Students explore, describe and analyse forces and motion and the components and observable features of familiar objects that move. This enables them to explain the movement of objects and to predict events involving movement.

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

On the move—Australian Curriculum: Science

On the move embeds all three strands of the Australian Curriculum: Science. For ease of reference, the table below outlines the sub-strands covered in *On the move*, the content descriptions for Foundation Year and the aligned lessons.

Strand	Sub-strand	Code	Foundation Year content descriptions	Lessons
Science Understanding (SU)	**Physical sciences**	ACSSU005	The way objects move depends on a variety of factors, including their size and shape	1–7
Science as a Human Endeavour (SHE)	**Nature and development of science**	ACSHE013	Science involves observing, asking questions about, and describing changes in, objects and events	1–7
Science Inquiry Skills (SIS)	**Questioning and predicting**	ACSIS014	Pose and respond to questions about familiar objects and events	1–7
	Planning and conducting	ACSIS011	Participate in guided investigations and make observations using the senses	1–7
	Processing and analysing data and information	ACSIS233	Engage in discussions about observations and represent ideas	1–7
	Communicating	ACSIS012	Share observations and ideas	1–7

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

General capabilities

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

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

On the move—Australian Curriculum general capabilities

General capabilities	Australian Curriculum description	*On the move* examples
Literacy	Literacy knowledge specific to the study of science develops along with scientific understanding and skills PrimaryConnections learning activities explicitly introduce literacy focuses and provide students with the opportunity to use them as they think about, reason and represent their understanding of science.	In *On the move* the literacy focuses are: • science journals • tables • word walls • labelled diagrams • Venn diagrams • graphs.
 **Numeracy**	Elements of numeracy are particularly evident in Science Inquiry Skills. These include practical measurement and the collection, representation and interpretation of data.	Students: • collect and represent data using tables • categorise toys according to movement, shape and size • collect data and with guidance represent it with a graph • make direct comparisons of length and size, and explain reasoning in everyday language • identify and name objects of similar shape from their environment.
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 digital photography to record movement • use digital photography for the word wall.
 **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: • discussing body movements • predict, and test predictions • pose and respond to questions • identify body parts involved in specific movements
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.
 **Personal and social competence**	Students develop personal and social competence as they learn to work effectively in teams, develop collaborative methods of inquiry, work safely, and use their scientific knowledge to make informed choices.	Students: • working in pairs to play, 'Simon Says' • work with partner to observe playground movement • participate in discussion • work collaboratively in teams.
 **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.

Alignment with the Australian Curriculum: English and Mathematics

Strand	Sub-strand	Code	Foundation Year content descriptions	Lessons
English–Language	**Language for interaction**	ACELA1428	Explore how language is used differently at home and school depending on the relationships between people	1–7
	Text structure and organisation	ACELA1430	Understand that texts can take many forms, can be very short (for example an exit sign or quite long (for example an information book or film) and that stories and informative texts have different purposes	3, 4, 6, 7
		ACELA1431	Understand that some language in written texts is unlike everyday spoken language	1, 2, 3, 4, 6, 7
	Expressing and developing ideas	ACELA1435	Recognise that sentences are key units for expressing ideas	1, 2, 4, 7
		ACELA1434	Recognise that texts are made up of words and groups of words that make meaning	1–7
		ACELA1437	Understand the use of vocabulary in familiar contexts related to everyday experiences, personal interests and topics taught at school	1–7
English–Literature	**Examining literature**	ACELT1579	Replicate the rhythms and sound patterns in stories, rhymes, songs and poems from a range of cultures	3
English–Literacy	**Interacting with others**	ACELY1646	Listen to and respond orally to texts and to the communication of others in informal and structured classroom situations	1–7
		ACELY1784	Use interaction skills including listening while others speak, using appropriate voice levels, articulation and body language, gestures and eye contact	1–7
		ACELY1647	Deliver short oral presentations to peers	4, 7
	Interpreting, analysing, evaluating	ACELY1649	Read decodable and predictable texts, practising phrasing and fluency, and monitor meaning using concepts about print and emerging contextual, semantic, grammatical and phonic knowledge	5

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

Strand	Sub-strand	Code	Foundation Year content descriptions	Lessons
English–Literacy (Continued)	**Creating texts**	ACELY1651	Create short texts to explore, record and report ideas and events using familiar words and beginning writing knowledge	2, 4
		ACELY1653	Produce some lower case and upper case letters using learned letter formation	1, 2, 3, 4, 7
Mathematics–Number and Algebra	**Patterns and algebra**	ACMNA005	Sort and classify familiar objects and explain the basis for these classifications. Copy, continue and create patterns with objects and drawings	4, 7
Mathematics–Measurement and Geometry	**Using units of measurement**	ACMMG006	Use direct and indirect comparisons to decide which is longer, heavier or holds more, and explain reasoning in everyday language	6
	Location and transformation	ACMMG010	Describe position and movement	2
Mathematics–Statistics and Probablility	**Data representation and interpretation**	ACMSP011	Answer yes/no questions to collect information	2, 6, 7

AC All the material in the first four 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.

For further information see: www.australiancurriculum.edu.au

Aboriginal and Torres Strait Islander histories and cultures

The Primary**Connections** Indigenous perspectives framework supports teachers' implementation of Aboriginal and Torres Strait Islander histories and cultures in science. The framework can be accessed at: **www.primaryconnections.org.au**

On the move focuses on the Western science way of making evidence-based claims about the way living things and objects move.

Aboriginal and Torres Strait Islander Peoples might have other explanations for the phenomenon of movement in living and non-living things.

Primary**Connections** recommends working with Aboriginal and Torres Strait Islander community members to access local and relevant cultural perspectives. Protocols for engaging with Aboriginal and Torres Strait Islander community members are provided in state and territory education guidelines. Links to these are provided on the Primary**Connections** website.

Sustainability

The *On the move* unit provides opportunities for students to explore the things that effect movement, such as size, shape and the texture of a surface. Everything in their environment is constantly moving in one way or another, and developing an understanding of movement relates to developing an understanding of energy. Through their investigations, students test their ideas about factors that affect rolling, sliding, bouncing and spinning, and they explore human movement and the body parts involved. This contributes to students' understanding of the way humans interact with each other and the environment. This can assist them to develop knowledge, skills and values for making decisions about their actions for sustainable patterns of living.

Teacher background information

Introduction to movement

The universe, and everything in it, is continuously moving and changing. Objects fall, planets rotate, plants and animals move and atomic particles are in a continuous state of movement and change.

Movement is the change in position of an object over time, from one place to another. Movements can be fast or slow. Students are curious about how they move themselves and how they can make other things move.

Movement is a concept that assists students to make sense of the world around them. At this age, students are developing gross and fine motor skills. They are interested in what they can do and how they can do it. They have growing skeletons and muscles that allow them to move in many different ways, such as jumping, sliding, rolling and spinning.

Students' conceptions

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

Students might believe that forces are to do with living things, that for something to keep moving at the same speed, a constant force is needed, that the amount of motion is determined by force, that to move fast requires more force than to move slowly and/or that stationary objects are not subjected to any forces.

References

Tytler, R, Darby, L and Peterson, S. 'Movement and force', in Skamp,K. (Ed (2012. 4th edition, *Teaching primary science constructively*. Southbank, Victoria: Cengage Learning Australia. p.99

To access more in-depth science information in the form of text, diagrams and animations, refer to the Primary**Connections** Science Background Resource available on the Primary**Connections** website:
www.primaryconnections.org.au
Note: This background information is intended for the teacher only.

Lesson 1 Movers and shakers

AT A GLANCE

To capture students' interest and find out what they think they know about how the way objects move depends on a variety of factors, including their size and shape.

To elicit students' questions about human movement.

Students:

- experience movement by playing 'musical statues'
- explore and discuss moving, involuntary movements and being still.

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 about:

- how the way objects move depends on a variety of factors, including their size and shape, and how science involves exploring and observing the world using the senses. You will also monitor their developing science inquiry skills (see page xi).

Key lesson outcomes

Science

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

- identify and describe various voluntary and involuntary human movements
- identify and describe some body parts that enable humans to move.

Literacy

Students will be able to:

- use talk to report on observations and reflect on their experience of human movement
- contribute ideas for the class science journal.

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

Teacher background information

Humans move in a variety of ways. Some human movements are 'voluntary' (consciously controlled) while others are 'involuntary' (not consciously controlled). Voluntary movements include walking, waving arms, and wiggling toes and fingers. In oluntary movements include breathing, sneezing, coughing, blinking and shivering. In most cases, involuntary movements are important bodily functions that occur even when we are not concentrating on them. The brain makes the movements happen automatically. For example, when we are cold we shiver. Shivering generates body heat to keep our bodies warm. People can't make themselves shiver, and they usually can't stop it either.

Equipment

FOR THE CLASS

- class science journal
- 1 device for playing music
- appropriate music

FOR EACH STUDENT

- *optional:* science journal

Preparation

- Read 'How to use a science journal' (Appendix 2).

Lesson steps

1 Introduce and play 'musical statues', in which students move freely to music and attempt to stand still when the music stops. When the music starts again, students move about once more, stopping and starting with the music.

2 Introduce the idea of being still, such as:

- What do we mean by 'being still'?
- Have you ever had to be still?
- Where and when have you had to be still?

3 Explain that students are going to play a game of 'musical statues' with a partner. While one student moves to the music, the other student will observe their partner moving and being still.

4 Play 'musical statues' in pairs.

Ask one student from each pair to observe their partner moving to the music. Allow students several turns at observing and performing so they have the opportunity to observe and experience some of the movements that are not consciously controlled, such as, breathing, blinking.

5 Help students to become aware of involuntary movements by discussing their observations and asking questions such as:

- When the music stopped did your partner move at all?
- Did you see any part of their body move?
- What sorts of movements did you see?

Discuss how some body movements happen without us thinking about them, such as, breathing, blinking, swallowing, coughing and sneezing are movements that happen without us thinking about them.

6 Ask students to roll across the ground in different ways. Discuss the shapes that they made and why those shapes were able to roll.

Introduce and play 'Simon says' to allow students to demonstrate their understanding of body parts that can move. This is an opportunity for diagnostic assessment.

When 'Simon' gives a command preceded by 'Simon says … ', the students perform the command, for example, 'Simon says put your hands on your head'. You, or volunteer students, could play the role of 'Simon'.

If the command is not preceded by 'Simon says … ', students should not change and should remain in their previous position.

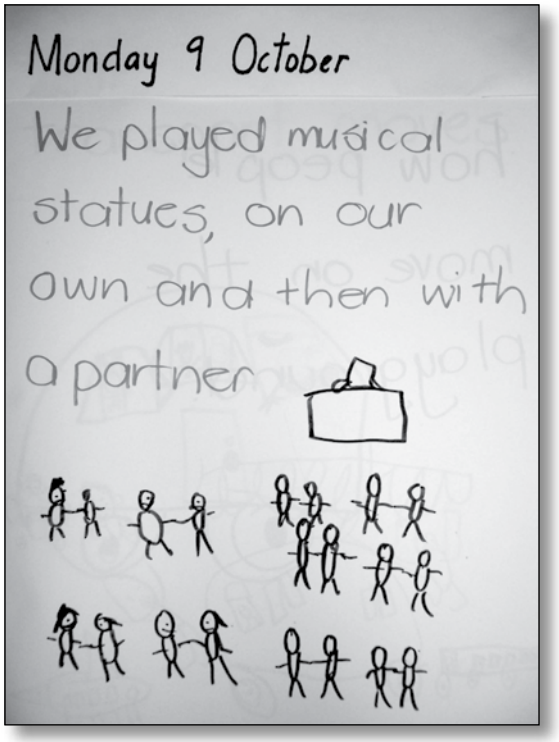
Play 'Simon says' in pairs with students taking turns to play the role of 'Simon'.

7 Ask students if they could roll if they were a star shape. Ask students to make a star shape and then roll across the ground. Discuss if it was easy or hard to roll and why.

Explain that in this unit students will investigate things that move and the ways they move. Introduce the class science journal and explain that it will be used to keep a record of what students know, what they think and how they can find out more about things that move.

Use students' ideas to model a science journal entry about what happened in the lesson.

Optional: Students complete individual science journal entries.



***On the move* class science journal entry**

8 *Optional:* Play a game of 'moving mirrors', in which students mirror one another's movements. Partners face each other and take turns to move a body part slowly, while the other partner mirrors the movement.

This activity requires students to observe and closely follow another's actions, making them more aware of how they and others move, and the body parts that enable them to move.

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, labelled diagrams, photographs, tables and graphs.

Curriculum links

Health and Physical Education

- Make and explore a cardboard human skeleton with moveable parts.

Indigenous perspectives

In Indigenous culture, dance is an important form of cultural and spiritual expression. Indigenous dances reflect different occasions and the diversity of Indigenous communities. Some dances are for entertainment while others are part of important and sacred rituals for specific members of the community.

- Contact the local Indigenous Land Council or cultural heritage centre to make contact with local Indigenous community members. Invite them to speak with the students and demonstrate Indigenous dance if appropriate.
- Students describe body movements after watching a video clip of Indigenous dance. See: **https://aso.gov.au/titles/documentaries/mimi-evening-aboriginal-dance/clip3/**
- Primary**Connections** recommends working with Aboriginal and Torres Strait Islander community members to access local and relevant cultural perspectives. Protocols for engaging with Aboriginal and Torres Strait Islander community members are provided in state and territory education guidelines. Links to these are provided on the Primary**Connections** website: **www.primaryconnections.org.au**

Student using skeleton with moveable parts

Lesson 2 On the hunt for things that move

EXPLORE

AT A GLANCE

To provide students with hands-on, shared experiences of things that move in the classroom, in the school grounds and outside the school grounds.

Students:

- look for things that move in the classroom, in the school grounds and outside the school grounds
- describe their observations of how things move.

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:

- the movements of things in their environments and the ways they move, and how science involves exploring and observing the world using the senses. You will also monitor their developing science inquiry skills (see page xi).

Key lesson outcomes

Science

Students will be able to:

- identify and describe some things that move and the ways they move
- predict and observe things that move inside and outside the classroom
- identify factors that affect the way objects move, including their size and shape.

Literacy

Students will be able to:

- identify the broad purposes and features of a table
- ask questions and make predictions
- record ideas in a science journal
- participate in discussion to recount observations and experience relating to the ways in which things move.

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

Equipment

FOR THE CLASS

- class science journal
- word wall
- *optional:* digital camera

FOR EACH STUDENT

- science journal
- *optional:* old magazines to cut up
- *optional:* scissors, glue

Preparation

- Read 'How to use a word wall' (Appendix 3).
- Prepare a 'Things that move' table in the class science journal, for example:

Things that move

Where	Things that move
In the classroom	
In the school grounds	
Outside the school grounds	

- Prepare a class science journal page with the heading 'Our questions'.
- *Optional:* Arrange for a parent helper(s) or teacher's assistant to assist with the outdoor observation activity.

Lesson steps

1. Review the previous lesson. Explain that students are going to observe things that move in three different places:
   - in the classroom
   - in the school grounds, and
   - outside the school grounds.
2. Introduce the 'Things that move' table in the class science journal and explain that students' ideas will be recorded using the table. 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.

3 Ask students to predict things that they might see move in the classroom by closing their eyes and visualising.

Record students' predictions using one colour in the appropriate section of the 'Things that move' table.

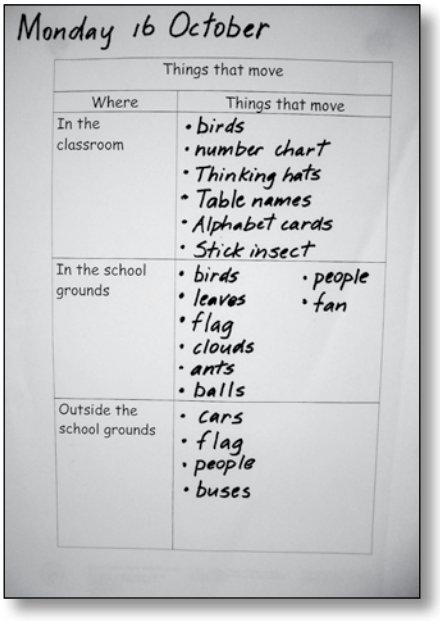
4 Ask students to begin observing things that move inside the classroom. You might like to provide students with a goal, such as, a time limit of two minutes, or a target number of objects.

Use a different colour to record students' observations using the 'Things that move' table. Compare students' predictions with their observations. Focus on the two colours to support students to understand the difference between predictions and observations.

5 Repeat the prediction and observation activity for things that move in the school grounds and things that move outside the school grounds. Record students' observations in the 'Things that move' table when you return to the classroom. When observing, students might identify the following things that move:

- in the classroom: pets, clock hands, other students, work hanging from a string
- in the school grounds: flags, tree branches and leaves, papers, birds, insects, grass, play equipment
- outside the school grounds: cars, prams, trains, buses, other people, animals.

Discuss students' observations and the different types of things they saw move.


Monday 16 October

Things that move

Where	Things that move
In the classroom	• birds • number chart • Thinking hats • Table names • Alphabet cards • Stick insect
In the school grounds	• birds • leaves • flag • clouds • ants • balls • people • fan
Outside the school grounds	• cars • flag • people • buses

'Things that move' table

6 Ask students to describe the way things move using questions such as:

Teacher: What do we mean by 'moving'?

Teacher: How would you describe the way an ant/tree branch/pram moves?

Student: It crawls/sways/rolls.

Teacher: Where did the object move to?

Teacher: How does the object's shape or size help it to move?

Student: The round wheels on the pram help it to roll. The branch moves slowly because it is very big.

7 Record students' descriptions of the ways in which things move, such as, 'walk', 'hop', 'jump', 'crawl', and use these descriptions to begin a word wall about movement.

Literacy focus

Why do we use a word wall?

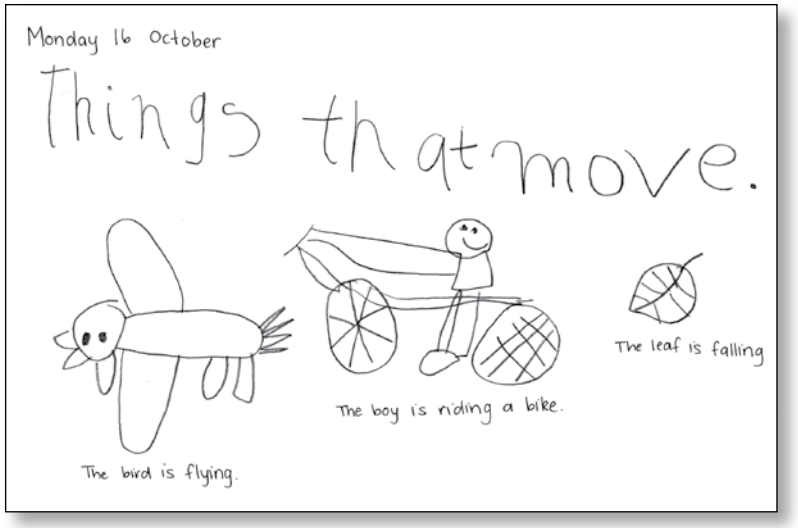
We use a **word wall** to record words we know or learn about a topic. We display the **word wall** in the classroom so that we can look up words we are learning about and see how they are spelt.

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.

8 Ask students to draw in their science journals something they saw moving inside the classroom, in the school grounds or outside the school grounds.

Using the word wall as a prompt, ask students to record (or you to scribe) the way they think the object moves, such as, 'the cat is stretching', 'the little girl is skipping'.



Sample of a student science journal entry

9 Model and discuss the difference between making a statement and asking a question. For example, 'I can run fast' is a statement while 'How fast can I run?' is a question. Introduce the heading 'Our questions' in the class science journal.

Ask students to think of questions they have about things that move or the way they move. Ask students to share their questions and record them in the class science journal.

Refer to the 'Our questions' page after each lesson to see if any of the students' questions have been answered, and record further questions students have about the ways in which things move.

10 *Optional:* Search for pictures of things that move in magazines. Add captions describing what is moving and how it is moving and make a display or add to the word wall.

11 *Optional:* Use digital photos or students' drawings to create a 'Things that move' class book.

Curriculum links

The Arts

- Encourage students to move as if they were the characters in musical themes, such as, Camille Saint-Saëns' Carnival of animals or Sergei Prokofiev's Peter and the wolf.
- Watch different dancers in action, either live or on film. Discuss their movements.
- Teach dance steps to students.

Indigenous perspectives

Some Indigenous children learn from their elders how to identify certain tracks or markings on the ground. A cleared place in the sand is used as the palette onto which the different tracks of animals, birds or even the footprints of other family members are drawn. Fingers, finger nails, palms and small drawing sticks are used as drawing implements.

- Use the school sandpit or a sand tray to recreate patterns or tracks in the sand that match different Australian native animals, such as the emu, possum, goanna and kangaroo. See www.aboriginalartstore.com.au/aboriginal-art-culture/aboriginal-symbols-glossary
- PrimaryConnections recommends working with Aboriginal and Torres Strait Islander community members to access local and relevant cultural perspectives. Protocols for engaging with Aboriginal and Torres Strait Islander community members are provided in state and territory education guidelines. Links to these are provided on the PrimaryConnections website: **www.primaryconnections.org.au**

Lesson 3 Playground play

AT A GLANCE

To provide students with hands-on, shared experiences of human movement and to identify the body parts involved.

Students:

- move on play equipment and observe a partner moving
- make a record of their observations
- discuss questions related to movement.

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:

- the way humans move and how body parts are used, and how science involves exploring and observing the world using the senses. You will also monitor their developing science inquiry skills (see page xi).

Key lesson outcomes

Science

Students will be able to:

- observe and describe movements made by humans
- identify and describe some ways in which humans move
- identify some body parts involved in human movement.

Literacy

Students will be able to:

- use talk to report on observations and reflect on their experiences
- write and illustrate simple descriptions of humans moving
- identify the broad features of a labelled diagram
- use role-play to represent different ways humans can move
- *optional:* recognise symbols and signs used to direct movement, for example, safety precautions.

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

Teacher background information

In order to move, humans have to push or pull against something. When walking or running, people use their legs and feet to push against the ground to move themselves forward, backward or sideways. When swimming, the hands, arms, feet and legs push against the water to propel the body.

Humans move their bodies using their musculoskeletal systems. The human body has more than 600 skeletal muscles. Contracting and relaxing the muscles in the right combination and sequence makes all the forms of human movement possible.

Equipment

FOR THE CLASS

- class science journal
- word wall
- digital or video camera

FOR EACH STUDENT

- student science journal

Preparation

- Organise a visit to a playground. (A local playground might provide access to a greater range of equipment than your school's.) Alternatively, you might like to explore human movement through a physical education or gymnastics lesson.

- Prepare a 'Moving parts' table in the class science journal, for example:

Moving parts

Movement	Body parts used

SAFETY

- Organise a parent helper or teacher's assistant to take photographs of students in action so you can focus on supervising students using playground equipment.

Lesson steps

1 Using the science journal, review the previous lesson. Ask students to locate and read words on the word wall.

2 Ask students to reflect on how they worked with a partner when they played 'musical statues'.

Explain that students are going to work with a partner to investigate how people move. Explain that one student from each pair will move on playground equipment while the other student observes them. Partners will then change roles.

Explain that when students return to the classroom they will draw a picture in their science journal showing their partner moving on the play equipment.

3 Form pairs and take students outside.

4 Provide students with time to observe each other moving on the play equipment. Ask a parent helper or teacher's assistant to take photographs of students moving while you supervise their play. Try to ensure all students are included in the photographs.

5 On returning to the classroom, ask students to make a record of their observations by drawing a picture of their partner moving in the playground or by accessing digital photographs.

6 Ask students to record (or you to scribe) a sentence in their science journal about the movement they observed, such as, 'Luca is sliding down the slide', 'Brooke is swinging on the monkey bars'.

Student sharing playground movement observations

EXPLORE

7 Ask students to share their drawing of their partner moving on the playground equipment. Use students' observations and drawings to discuss how people move.

Ask questions such as:

- How did your partner move?
- What body parts did they use?

Record students' observations in the 'Moving parts' class table, for example:

Moving parts

Movement	Body parts used
Slide	Arms, bottom and legs
Run	Legs, feet and arms
Swing	Legs and arms
Hop	Legs, feet and arms

EXPLORE

8 Model how to draw a labelled diagram of a person to identify the body parts used to move. Discuss the purpose and features of a labelled diagram. Ask the students to add labels to their drawings.

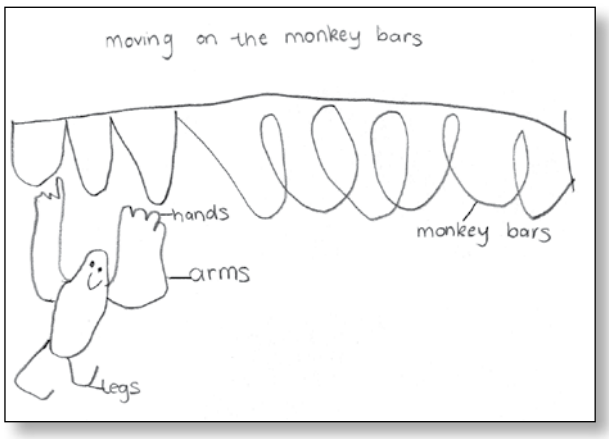
Literacy focus

Why do we use a labelled diagram?

We use a **labelled diagram** to show the shape, size and features of an object.

What does a labelled diagram include?

A **labelled diagram** might include a title, an accurate drawing, a scale to show the object's size and labels showing the main features. A line or arrow connects the label to the feature.



Sample labelled diagram of partner moving on playground equipment

9 Model a type of movement, such as, running or jumping, and ask students questions such as:

- When would be a good time to move like this?
- Where would be a good place to move like this?

10 Provide students with different scenarios and ask them to model an appropriate way to move, given the time or location, for example:

- A baby is asleep. How can you move around without waking the baby?

11 Reinforce the idea that different movements are appropriate for different situations. Focus attention on the need to move in different ways at different times by asking questions, for example:

- Why do we move in different ways at different times?

Optional: You might like to discuss the way different areas are marked for movement, such as, a pedestrian crossing, a tennis court or a road. You might also like to consider looking at different signs in the area that direct movement, for example, road signs.

12 Add any new movement vocabulary, such as, 'skip', 'sway' or 'swing', to the word wall. Discuss these words with the class.

Review the question page in the class science journal and add any new questions students have.

Curriculum links

English

- Share poems and rhymes about how people move.

Health and Physical Education

- Play movement games such as 'Follow the leader'.
- Participate in gross motor activities such as obstacle courses.
- Discuss the ways people move in sport and gymnastics.
- Discuss the ways people protect themselves when playing sports.

The Arts

- Sing and act out movement songs such as 'Dingle Dangle Scarecrow' and 'Hokey Pokey'.
- Students create a moveable puppet with split-pin joints.

Indigenous perspectives

Indigenous culture has a rich history of children's games and pastimes.

- Invite local Indigenous community members, Indigenous education officers and/or Indigenous students to share their knowledge about and participate in Indigenous games. See From ochres to eel traps for games involving movement. (Halling, H. (Ed.) (1999). *From ochres to eel traps* (2nd edition). Canberra: Science Educators Association ACT, pages 43-51)
- Primary**Connections** recommends working with Aboriginal and Torres Strait Islander community members to access local and relevant cultural perspectives. Protocols for engaging with Aboriginal and Torres Strait Islander community members are provided in state and territory education guidelines. Links to these are provided on the Primary**Connections** website: **www.primaryconnections.org.au**

Lesson 4 Toys that move

EXPLORE

AT A GLANCE

To provide students with hands-on, shared experiences of toys that move, the ways in which they move and the shapes that help them to move.

Students:

- observe and describe toys that move
- predict and identify the ways in which toys can move
- group toys according to specific features of movement.

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:

- the ways toys move and the parts that allow forces to move them, and how science involves exploring and observing the world using the senses. You will also monitor their developing science inquiry skills (see page xi).

Key lesson outcomes

Science

Students will be able to:

- observe moving toys
- predict, identify and describe the ways in which toys move
- identify specific features of toys that move, including the shape of various parts
- group toys in categories.

Literacy

Students will be able to:

- use talk to predict, question, make distinctions and report observations
- use appropriate language to describe different types of movement
- *optional:* with support, create a Venn diagram to present information.

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

Teacher background information

Moving toys have been popular for thousands of years. At least 3,500 years ago, the Incas had wheeled children's toys. Balls, spinning tops and marbles have been objects of amusement for a long time in many cultures. Today, moving toys also include yo-yos, wind-up toys and remote-controlled and battery-powered cars.

Students like playing with toys they can push and pull to cause movements such as bouncing, sliding, rolling and spinning. For an object to move, it has to overcome the effect of friction. Friction is a force that occurs when two things rub against each other.

Balls bounce because they are elastic. They rapidly resume their original shape when squashed. When a ball is dropped and hits the ground, it is temporarily squashed out of shape (deformed). As the ball springs back to its original shape, stored elastic energy is released and the ball bounces into the air.

Toys driven by springs are also moved by the release of stored elastic energy. That energy can be released suddenly, as in a jack-in-the-box, or more slowly, as in a wind-up car.

Spinning tops can stay upright for the same reason that it is easier to balance on a moving bicycle than a stationary one. When a wheel is spinning around a point (axis), it resists changes to its orientation—so the spinning top and the cyclist tend to stay upright until they stop moving. The faster the object spins, the more stable it becomes.

Batteries that power toys store energy as chemical energy. The chemical energy of the battery is transformed into electrical energy when the circuit inside the toy is complete. Modern batteries can store a lot of energy and can keep a toy moving for a long time.

Equipment

FOR THE CLASS

- class science journal
- word wall
- a range of moving toys (see 'Preparation')
- *optional:* 2 hoops or 2 skipping ropes
- *optional:* digital camera

FOR EACH STUDENT

- *optional:* science journal

Preparation

- Collect a range of toys that move in different ways, such as:
  - bouncing: tennis ball, basketball
  - rolling: toy car, marbles, rocking horse
  - spinning: spinning top, yo-yo
  - jumping: jack-in-the-box

A range of toys that move in different ways

EXPLORE

Lesson steps

1 Place a range of moving toys on the equipment table. Ask students to look at the toys and suggest ways they can make them move, such as, 'I can make the car roll' and 'I can make the ball bounce'. Record any new vocabulary to add to the word wall.

2 Select a toy and ask students to describe the parts they observe that allow them to make the toy to move, such as, wheels, springs.

3 Explain that students will work in pairs to closely observe a toy. Explain that students will make the toy move, describe the way the toy moves, for example, 'rolls', and identify the parts and their shape that help it move, for example, 'round wheels'. Explain that after pairs have made their observations, they will share their thinking with the class.

4 Discuss the use of the equipment table. Explain that this is where one student from each pair will collect a toy for observation and then return it for others to use.

5 Form pairs and invite one member of each to select a toy from the equipment table for observation and discussion.

6 After allowing time for pairs to observe and discuss, ask the second member of each pair to share their pair's observations.

Record students' observations in the class science journal, such as, 'The pram rolls because it has round wheels', 'The top spins on its tip'.

Record any new words, such as, 'wheels', 'handle', 'pointy' and add them to the word wall.

Optional: Add labelled photographs of the toys to the word wall. This will provide students with a context for reading, speaking and writing with new vocabulary.

7 Explain that, as a class, students will look at the similarities between the toys they observed by arranging them in groups. The toys can be grouped according to:

- the way they move,
- their similar shaped parts that allow them to move, or
- the action that makes them move.

Ask students to make suggestions and for volunteers to group the toys accordingly.

8 *Optional:* Lie two hoops (or two skipping ropes, each forming a circle) on the floor. Invite students to place toys that are moved by pushing in one circle, and any that are moved by pulling in the other circle.

Ask students if any of the toys in the circles move by both pushing and pulling. Discuss how this could be shown and lead students to see that by overlapping the circles such toys can be placed in the new space created by the overlap while also remaining in their original circle.

Explain that this is called a Venn diagram and is named after John Venn, who first used one in England about 100 years ago. (John Venn was an English logician who lived from 1834 until 1923.)

Discuss the purpose and features of such a diagram. For example, discuss how scientists group things to help them understand and explain things. Scientists use diagrams to show information and ideas to others.

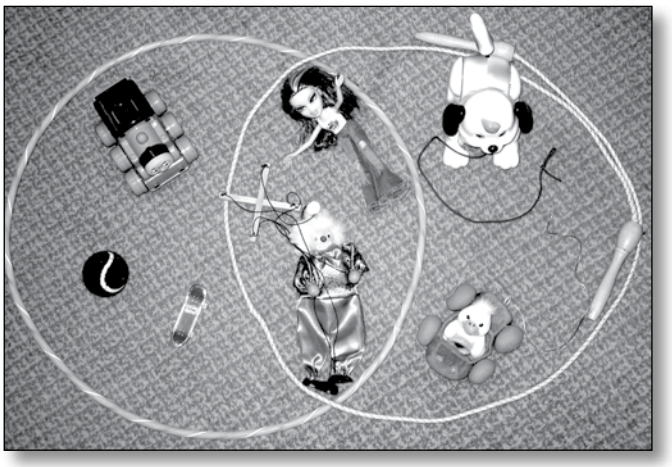
Literacy focus

Why do we use a Venn diagram?

We use a **Venn diagram** to show how the properties of different things are similar and different.

What does a Venn diagram include?

A **Venn diagram** includes overlapping circles. Things with a particular property are placed in a particular circle. Things with more than one of the properties are placed in the area where the circles overlap.



Example of a Venn diagram representing toys that can be pushed and/or pulled

9 Update students' question page in the class science journal.

10 *Optional:* Review the features of a labelled diagram as introduced in Lesson 3. Arrange for students to draw or take pictures of the toys they observed to create a labelled diagram. Ask students to write (or you to scribe) something about the way the toy moves, such as, 'The toy train rolls', 'The tennis ball bounces', and label its special features or moving parts. You can support students by highlighting appropriate vocabulary on the word wall for easy reference.

Display students' work or make it into a class book. Share the book with the class and encourage students to read it at other times.

11 *Optional:* Model how to write a 'What am I?' page for a class book. Emphasise the importance of appropriate language to describe:

- features of the toy, and
- the way the toy moves.

Ask students to choose a toy and write clues, such as:

- a feature of the toy: My toy has ...
- a way that the toy can move: My toy can ...

Curriculum links

Studies of Society and Environment

- Explore the changes in moving toys over time, for example, how some have changed little (marbles, balls, spinning tops) while others are much newer (remote-controlled toys) and have many moving parts.

Indigenous perspectives

Indigenous people have used both natural and man-made materials to create toys.

- Play a traditional Indigenous game using a tin-can roller. See page 125 of the following resource: **https://www.qld.gov.au/__data/assets/pdf_file/0021/13548/indigenous-games-yulunga.pdf**
  Note: This game is suitable for students in Year 3 and over, so may require modification for Foundation Year students.
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Lesson 5 Moving towards an explanation

AT A GLANCE

To support students to represent and explain their understanding about movement, and to introduce current scientific views

Students:

- experience pushing, pulling, bouncing, sliding, rolling and spinning
- discuss different ways to represent movement
- play a 'chance dance'.

Lesson focus

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

Assessment focus

Formative assessment is an 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 the way objects move depends on a variety of factors, including their size and shape, and how science involves exploring and observing the world using the senses. You will also continue to monitor their developing science inquiry skills (see page xi).

You are also able to look for evidence of students' use of appropriate ways to represent what they know and understand about how things move and give them feedback about how they can improve their representations.

Key lesson outcomes

Science

Students will be able to:

- identify and describe pushing, pulling, bouncing, sliding, rolling and spinning
- identify and describe the effect of shape on movement.

Literacy

Students will be able to:

- use language to make distinctions, speculate and question
- participate in discussion to recount observations and experience relating to movement
- follow instructions to play the 'chance dance'
- physically represent their understanding of different types of movement.

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

Teacher background information

Push and pull forces cause movements such as bouncing, sliding, rolling and spinning.

Push: A push is a type of force. Pushing involves moving something away from you.

Pull: A pull is a type of force. Pulling involves moving something towards you.

Equipment

FOR THE CLASS

- class science journal
- word wall
- resources developed during the unit (eg, tables, class books)
- 2 'chance dance' cubes (see 'Preparation')
- 1 device for playing music
- music appropriate for the 'chance dance'

Preparation

- Prepare the 'Chance dance cubes' (Resource sheet 1 and Resource sheet 2).
- *Optional:* Cover the cubes with material such as contact or fabric.

'Chance dance' cubes

Lesson steps

1 Review the class science journal and the word wall. Review students' observations by asking questions such as:

- What are some ways humans can move?
- What are some ways toys can move?
- What are the parts that help them (humans/toys) move?
- What shapes are those parts?

2 Introduce the cube with the words 'push', 'pull', 'bounce', 'slide', 'roll' and 'spin'. Roll the cube and ask a volunteer to demonstrate the word displayed, for example, 'push'. Ask the class to comment on the volunteers' demonstration of that word. Invite students with different ideas to demonstrate how they think the word is best represented.

As each word is demonstrated, ask students to describe the body parts used to enact the movement. Repeat this process until each of the words on the cube has been explained.

SAFETY

Discuss the need for students to have a safe amount of space around them while demonstrating the movements. This will avoid accidents and collisions.

3 Discuss the different ways students have represented each of the words, such as, pushing can be demonstrated using the arms, the legs, or the arms and legs. The 'Word demonstrations' table below provides examples that you can use to support students to extend their understanding of pushing, pulling, bouncing, sliding, rolling and spinning.

4 Introduce the cube with the adverbs. Repeat the procedure outlined in Lesson step 2 to demonstrate and explain the adverbs on the second cube.

5 After the words and adverbs have been explained, introduce the 'chance dance' activity. This activity requires students to move to music in the way specified by the roll of the cubes.

Table 3: Word demonstrations

Cube word	Demonstrations
Push	Pushing a swing, wheelbarrow, trolley, pram Riding a bike Rowing a boat
Pull	Tug of war Climbing Using playground equipment (for example, the monkey bars) Rowing a boat Human seesaw (for example, holding hands and touching feet with a partner while pushing and pulling their arms)
Bounce	Bouncing balls Sit and bounce on large ball (for example, fitness ball) Small jumps on the balls of the feet
Slide	Skiing or snowboarding Using playground equipment (for example, a slide Standing slide (for example, sliding feet backwards and forwards or from left to right Seal slide (for example, lie face down with hands under shoulders, straighten arms to lift upper body and walk hands forward, slide body forward Inch worms (for example, bend forward from a standing position, place hands on the floor , walk hands forward and slide the feet)
Roll	Rolling balls and toys Body roll (for example, extending arms and legs and rolling from side to side) Sitting roll (for example, knees pulled up with arms around knees, rolling side to side) Roly-poly (for example, rolling the hands around each other)
Spin	Spinning top Body spin (for example, with arms extended) Seated spin (for example, knees pulled to chest, using hands and arms to spin the body)

6 Play two or three rounds of the 'chance dance' using the first cube before introducing the adverbs into the game. When the two cubes are rolled together, students perform in the way specified by the second cube, such as, push slow, spin low.

7 Bring the class together to discuss their experiences in this lesson. Add the 'chance dance' words and adverbs to the word wall.

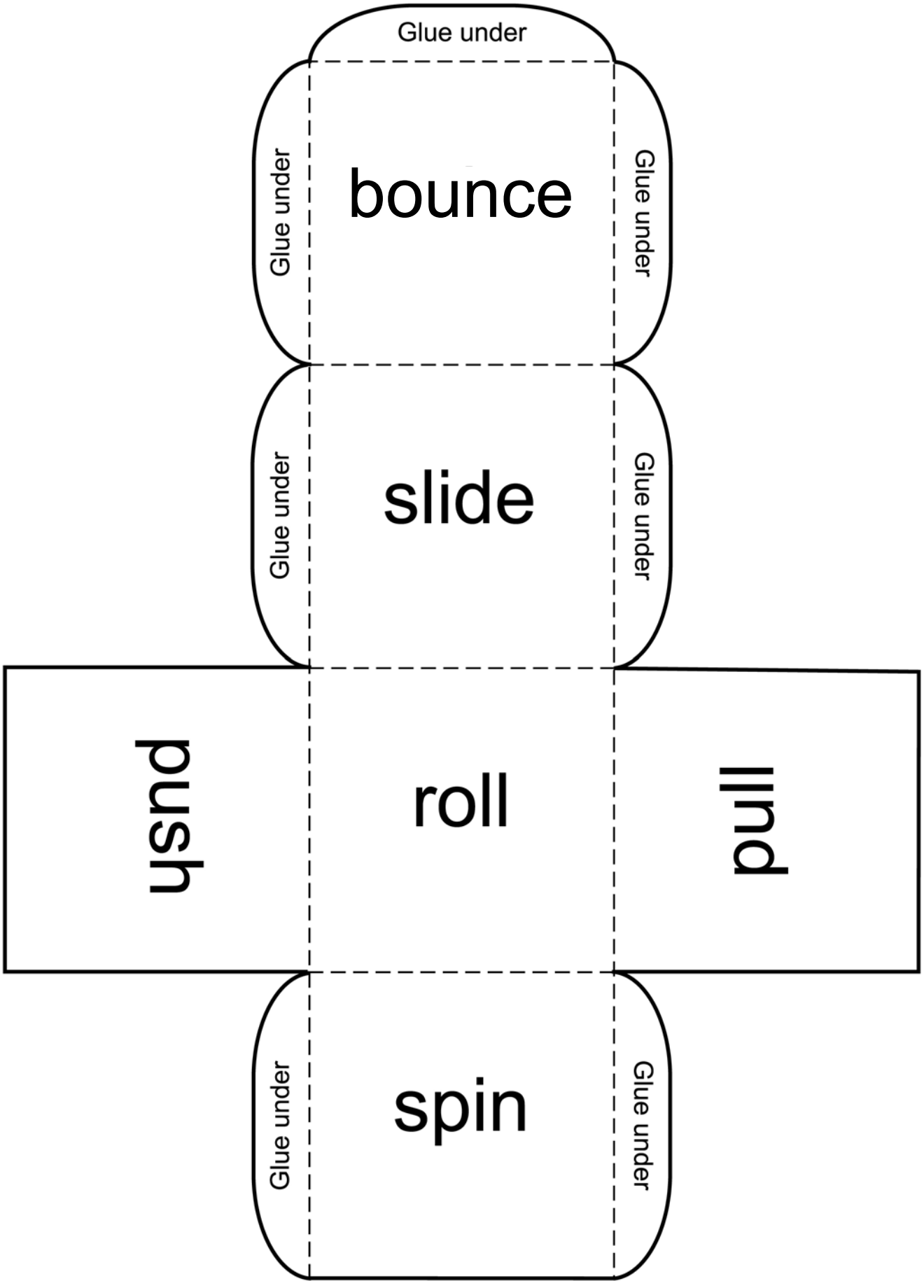
Optional: Include photographs or pictures of students moving on the word wall.

Curriculum links

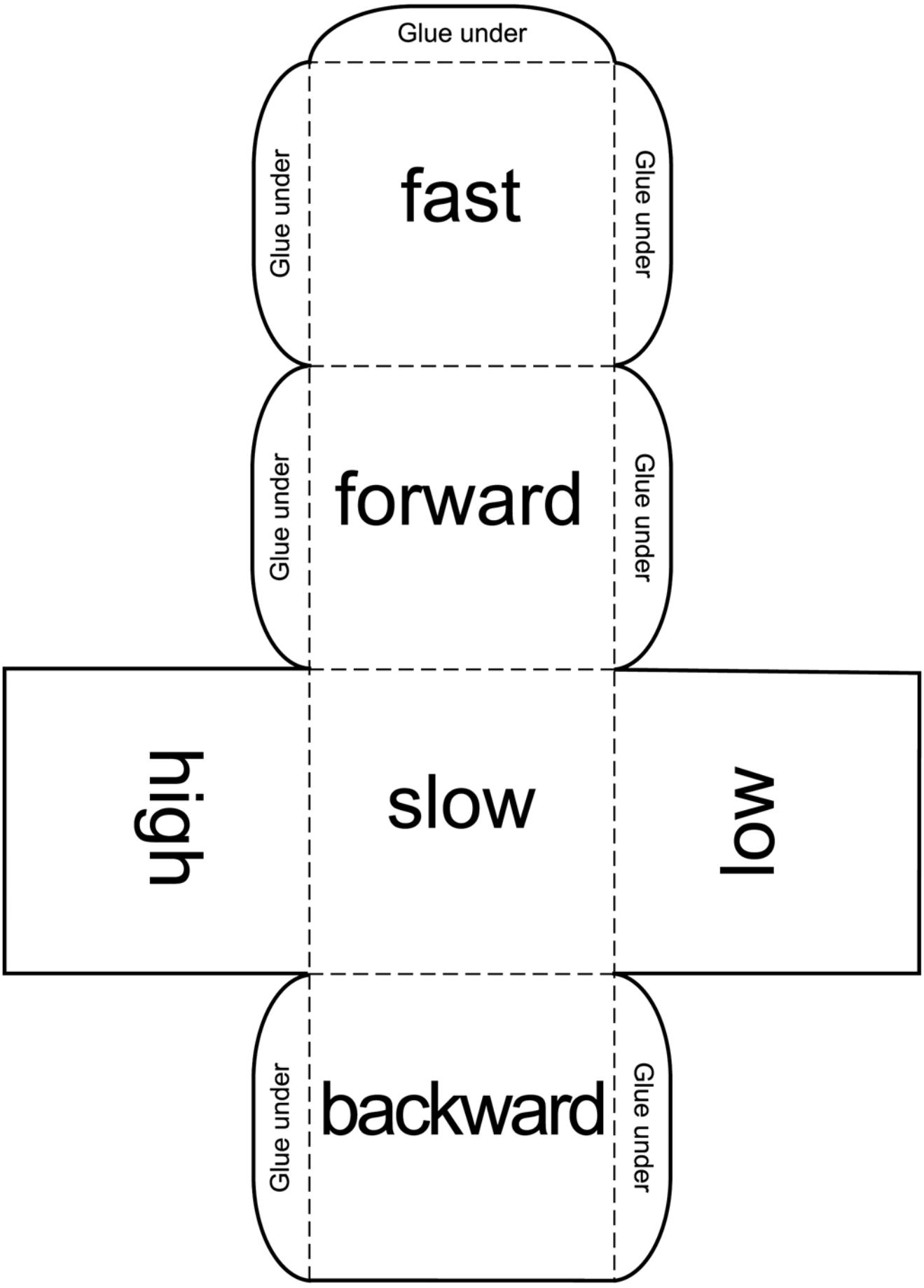
Indigenous perspectives

- Invite local Indigenous community members, Indigenous education officers and/or Indigenous students to share their knowledge and language related to movement. Add these movement words to the 'Chance dance cube 1' (Resource sheet 1) and 'Chance dance cube 2' (Resource sheet 2).
- Primary**Connections** recommends working with Aboriginal and Torres Strait Islander community members to access local and relevant cultural perspectives. Protocols for engaging with Aboriginal and Torres Strait Islander community members are provided in state and territory education guidelines. Links to these are provided on the Primary**Connections** website: **www.primaryconnections.org.au**

Chance dance cube 1



Chance dance cube 2



Lesson 6 Rolling along

AT A GLANCE

To support students to plan and conduct an investigation of the effects of shape, size and surface on how far things roll.

Session 1 Shape, rattle and roll

Students:

- investigate how they can move their bodies by rolling
- investigate objects to determine the effect that shape has on rolling
- record findings in the class science journal.

Session 2 Sizing it up

Students:

- investigate how the size of an object affects its ability to roll
- record findings in the class science journal.

Session 3 Roll on

Students:

- investigate how far things roll on different surfaces
- record findings in the class science journal.

ELABORATE

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 xi). Rubrics are available on the website to help you monitor students' inquiry skills.

You are looking for evidence that the students understand that:

- the way objects move depends on a variety of factors, including their size and shape, and that science involves exploring and observing the world using the senses.

Key lesson outcomes

Science

Students will be able to:

- with support, investigate how the shape of an object affects its ability to roll
- with support, investigate how the size of an object affects its ability to roll
- with support, investigate how far things roll on different surfaces.

Literacy

Students will be able to:

- participate in discussion to generate explanations, compare ideas and relate evidence to explanations about rolling
- physically represent their understanding of rolling.

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

Teacher background information

Rolling is a form of movement that allows an object to move over a surface with very little loss of energy due to friction. The more round an object is, the more easily it will roll. For example, a smooth, spherical ball bearing will roll easily compared with a rough, uneven rock.

The surface over which an object moves also determines how easily it rolls. Rough, uneven surfaces reduce the ease with which an object rolls. Soft, easily deformed surfaces, such as shag-pile carpet or muddy ground, also make it difficult for an object to roll. Hard, smooth surfaces make rolling easy because there are fewer bumps to slow down the rolling object.

An object rolling along a surface will eventually be slowed down by the force of friction and will stop. (The friction is mainly between the object and the surface. However, there is also some friction between the object and the air.)

Session 1 Shape, rattle and roll

Equipment

FOR THE CLASS

- class science journal
- a range of objects that roll
- a range of different sized balls and marbles
- 1 book

FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- objects that will roll easily (eg, a toy car, a cardboard roll, a round plastic bottle)
- objects that do not roll easily (eg, a block, a shoe, a lunch box)

Preparation

- Read 'How to organise collaborative learning teams' (Appendix 1). Display an enlarged copy of the team skills chart and the team roles chart in the classroom. Prepare role wristbands or badges and the equipment table.
- Organise an area where students can safely roll around, such as, a hall with mats laid out or a lawn. The physical part of this activity could be incorporated into a movement or physical education lesson.
- Prepare a 'How did it roll?' table in the class science journal, for example:

How did it roll?

Object	Easily	Not easily	Why?
Toy car			
Shoe			
Cardboard roll			
Block			

- Place a range of objects that can be used to demonstrate rolling on the equipment table.

Lesson steps

1. Review the previous lesson and the different ways humans can move their bodies, such as, spinning, sliding. Discuss whether humans can roll, such as, by lying down and stretching out or by curling into a ball.
2. Explain that students are going to focus on rolling their bodies. They will work with a partner in a collaborative learning team to practise ways to shape and move their bodies for rolling. Explain that one team member at a time will roll while the other team member provides them with support.

SAFETY

Discuss the need to be careful with the body, especially the head and neck, when doing this activity. Explain that students should not place any pressure directly on their head or neck (that is, no balancing on heads or unsupervised tumbling).

3 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.

4 Form teams and allocate roles. Ask team Managers to collect role wristbands or badges.

5 After teams have had time to practise, bring the class together and discuss the ways they shaped their bodies to roll and how they made their bodies roll.

6 Review the objects on the equipment table. Discuss what the objects are used for and ask volunteers to demonstrate how the objects can be made to roll.

Objects that can demonstrate rolling and sliding

7 Review what is meant by the term 'rolling'. Ask students to observe what happens as you push a ball and a book along the ground. Discuss the way that the ball turns over and over as it moves, while the book slides over the floor. Discuss if it changes when you roll different size balls or marbles.

Repeat the activity, asking students to watch carefully for the difference.

8 Explain that students are going to work in collaborative learning teams to investigate objects that are easy to roll or hard to roll. Model rolling an easy-to-roll object and a hard-to-roll object and discuss the difference.

9 Re-form teams. Review the role of the equipment table and explain that this is where Managers will collect objects, one at a time, for observation and then return them for others to use. Explain how many objects each team will investigate in total, for example, four.

10 After the investigation, invite each team speaker to share what they learned about the objects that were easy to roll and hard to roll. Record teams' findings on the 'How did it roll?' table in the class science journal. Review the purpose and features of a table as introduced in Lesson 2.

11 Discuss students' ideas about why some objects were easy to roll while others were hard to roll, such as:

Teacher: Why do you think the car rolled easily?

Student: It has round wheels that can turn.

Teacher: Why do you think the block did not roll easily?

Student: Because it's square and has edges.

Record students' ideas in the class science journal, such as, 'Two teams found the car hard to roll because the wheels didn't move', 'Everybody found the cardboard roll easy to roll because of its round shape'.

12 Review and update the students' questions page in the class science journal.

Session 2 Sizing it up

Equipment

FOR THE CLASS

- class science journal
- *optional:* digital camera

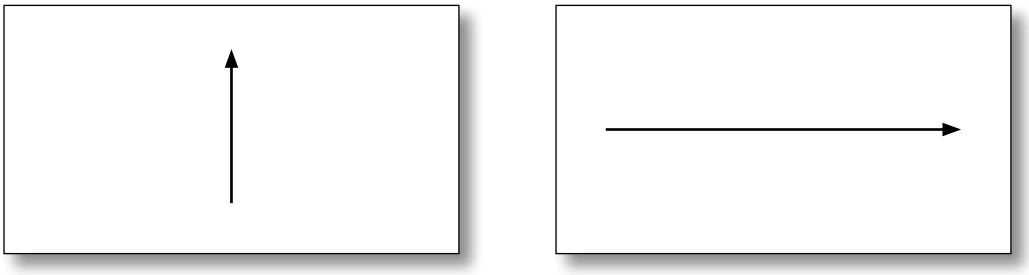
FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- 2 marbles of different sizes
- 2 identical balls of different sizes (eg, tennis ball and oversized tennis ball)
- 2 pieces of A4 cardboard
- piece of stiff ca dboard and small book for the ramp
- streamers
- scissors
- large sheet of paper
- ruler
- glue
- self-adhesive tape

ELABORATE

Preparation

- Read 'How to conduct a fair test' (Appendix 4)
- Prepare a page in the class science journal or IWB with the heading 'Our question for investigation'.
- Make two rollers for each group using the A4 cardboard. Each roll would be rolled in the directions like the diagrams opposite, then secured with sticky tape with a 5 cm overlap on each.



Lesson steps

1. Review the previous session and discuss teams' findings about how the shape of an object affects its ability to roll.
2. Show students two different sized marbles and balls made from the same materials. Introduce the question, 'What is the difference between the two marbles?' Ask the same question for the balls. 'Can the big marble move the same way as the smaller marble'?' 'Can both balls move in the same way?'
3. Show the students the prepared A4 rolls.
4. 'What is the difference between these rolls?' Show that they come from identical pieces of A4 paper. Establish that they have different size circumferences. Ask, 'How might this be the same as some of their toys?' Brainstorm answers such as wheels on cars and trucks, dolls' prams, bikes and trikes.
5. Explain that the class is going to investigate how far each object will roll over the same surface. Record the question, 'How far will similar objects of different sizes roll along the same surface?'
6. Model how to set up a ramp over a smooth surface using a book and a stiff piece of cardboard. (See photograph 1 in Elaborate- Session 3)
7. Ask the students to predict which object will roll the furthest. Record their predictions and reasons in the class science journal.
8. Model an unfair test by releasing one of the objects halfway down the ramp and then releasing the other object from the top of the ramp. Ask the students if this is fair.
9. Discuss what is meant in science by the word 'fair' (the same things need to be kept the same). Ask students to suggest how to make the modelled situation fair. For example, release both objects from the top of the ramp.
10. Discuss other ways to keep the test fair, such as making sure they are rolled down the ramp the same way, having the same inclination on the ramp, having the same surface to roll onto.
11. Discuss how only one thing at a time is changed to keep the investigation fair. (It is only by conducting a fair test that the students can be sure that what they have changed in the investigation has affected what is being measured /observed.)
12. Explain that students will roll both objects and use streamers to measure how far they roll after being released from the top of the ramp.
13. Demonstrate how to use place the streamer at the end of the ramp and then tear or cut the streamer at the place where the object stops.
14. Review how to keep the test fair and record their ideas in the class science.

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

Optional: Take photographs of teams' investigation results.

16 After the investigation, discuss what teams found out about how far each object rolled by comparing streamers.

Optional: Repeat tests with similar balls of different sizes or marbles of different sizes.

17 Discuss results by posing questions about size and how far an object rolls. Ask students how their results compared to their predictions.

18 Draw pictures in their individual journals and write captions.

Session 3 Roll on

Equipment

FOR THE CLASS

- class science journal
- *optional:* digital camera

FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- 1 object that rolls easily (eg, toy car or marble)
- a smooth surface (eg, paper)
- a bumpy surface (eg, carpet)
- piece of stiff ca dboard and small book for the ramp
- streamers
- scissors
- large sheet of paper
- ruler
- glue

ELABORATE

Preparation

- Read 'How to conduct a fair test' (Appendix 4).
- Prepare a page in the class science journal with the heading 'Our question for investigation'.

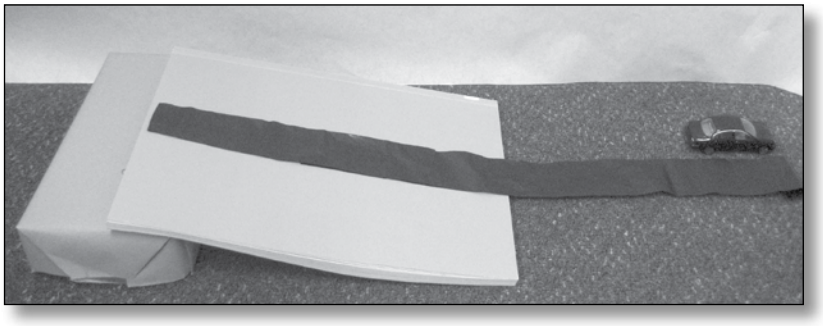
Lesson steps

1 Review the previous session and discuss teams' findings about how the shape of an object affects its ability to roll.

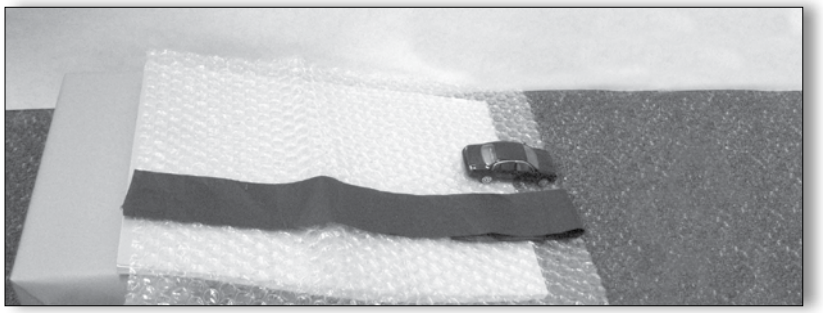
2 Discuss students' experiences of moving over different surfaces, such as, smooth, grassy, sandy or gravelly surfaces. Introduce the question for investigation, 'How far do things roll on different surfaces?'. Record the question for investigation and students' ideas in the class science journal.

3 Explain that students are going to investigate how far an object rolls over two different surfaces. Introduce the investigation equipment. Model how to set up a ramp (small book and stiff ca dboard) for the smooth surface (eg, paper) (Photograph 1). Model how to leave the ramp the same for testing the bumpy surface (eg, bubble wrap) (Photograph 2).

4 Discuss the difference between the surfaces, for example, one is smooth while the other is bumpy. Ask students to predict how the object will be affected by the different surfaces and discuss the reasons for their ideas. Record predictions and reasons in the class science journal.



Photograph 1 – Smooth surface



Photograph 2 – Bumpy surface

5 Model an 'unfair' test by releasing the object halfway down the ramp on the smooth surface and at the top of the ramp on the bumpy surface. Ask students if they think this is fair.

6 Discuss what is meant in science by the word 'fair' (that some things need to be kept the same). Ask students to suggest how the modelled situation could be made fair. For example, release the object from the same position on the ramp for each surface.

7 Discuss other ways to keep the test fair, such as releasing the object onto the ramp rather than releasing it onto one ramp and pushing it for the other, keeping the incline of the ramp the same for both surfaces, using the same object for both surfaces.

Discuss how only one thing at a time is changed to keep the investigation fair. Discuss why it is important for the investigation to be fair. (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.)

8 Explain that students will roll their object on the two surfaces and use streamers to measure how far the object goes.

Demonstrate using one surface; roll the object down the ramp onto the surface, place one end of the streamer at the end of the ramp (the beginning of the test surface), then tear or cut the streamer where the object stopped on the test surface.

9 Review how students will make it a fair test and record their ideas in the class science journal.

10 Form teams and allocate roles. Ask managers to collect team equipment.

Optional: Take photographs of teams' investigation results.

11 After the investigation, discuss what teams found out about how far the object rolled on different surfaces. Record responses in the class science journal.

12 Explain to students that they will be creating a graph to show how far the object rolls on the different surfaces. Discuss the purpose and features of a graph.

Literacy focus

Why do we use a graph?

We use a **graph** to show information so we can look for patterns. We use different types of **graphs**, such as picture, column, or line graphs, for different situations.

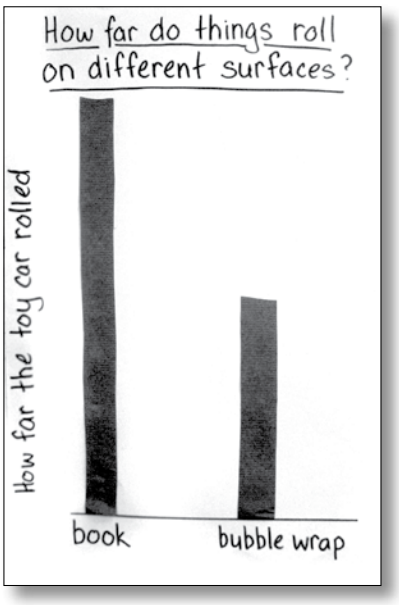
What does a graph include?

A **graph** includes a title, axes with labels on them and the units of measurement.

13 Demonstrate how to create a graph by using a large sheet of paper and two different sized streamers. Ask the students:

- How can we show what we found out using the streamers? (Paste them onto the large sheet of paper.)
- Where should we paste the streamers on the paper so that it is fair? (They go in the same direction and start from the same line.) Rule a line across the bottom of the paper leaving room for labels and paste on the two streamers.
- What was our investigation question? (How far do things roll on different surfaces?) Write this as the title on the graph.
- What does the length of streamer show? (How far the toy car rolled.) Write this label on the vertical axis.
- What two surfaces did we roll the toy car over? (Smooth surface and bumpy surface, or paper and carpet.) Write these labels under the appropriate streamer.

14 Discuss what students learned about how far things roll on different surfaces. Record students' findings in the class science journal, for example, 'The car went further on the smooth surface than on the bumpy surface', and compare with their predictions.



Team graph showing how far a toy car rolls on different surfaces

15 *Optional:* Ask students to predict how far the toy car would travel on another surface, for example, fabric. Ask students to justify their predictions. Test the predictions as a class.

16 Update the word wall with words and images.

Curriculum links

English

- Explore the use of comparative language to describe the investigation findings, such as, shorter/longer, smaller/bigger, faster/slower.

Technology

- With support, design, make and appraise a toy that moves using a push or pull force.

The Arts

- Roll marbles in paint to create marble pictures.

Indigenous perspectives

Traditional and contemporary ball games are played in Indigenous communities throughout Australia.

- Organise for students to play Indigenous ball games. See **https://www.qld.gov.au/__data/assets/pdf_file/0021/13548/indigenous-games-yulunga.pdf**
- Primary**Connections** recommends working with Aboriginal and Torres Strait Islander community members to access local and relevant cultural perspectives. Protocols for engaging with Aboriginal and Torres Strait Islander community members are provided in state and territory education guidelines. Links to these are provided on the Primary**Connections** website: **www.primaryconnections.org.au**

Lesson 7 Showing what we know

AT A GLANCE

To provide opportunities for students to represent what they know about how the way objects move depends on a variety of factors, including their size and shape, and to reflect on their learning during the unit.

Students:

- review the unit using the science journal, word wall and other resources developed during the unit
- represent their ideas about movement
- reflect on their learning during the unit.

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:

- the way objects move depends on a variety of factors, including their size and shape, and how science involves exploring and observing the world using the senses.

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

EVALUATE

Key lesson outcomes

Science

Students will be able to:

- identify and describe some things that move, the ways they move and the parts that enable them to move
- describe the effect of shape and size on the way things move.

Literacy

Students will be able to:

- use language to report on observations, clarify understanding and reflect on their experience of movement
- represent their understanding about movement through drawing and writing.

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

Equipment

FOR THE CLASS

- class science journal
- word wall
- other resources developed during the unit (eg, tables, class books)
- optional: familiar objects that can roll (eg, toy car), slide (eg, book, slide puzzle), spin (eg, spinning top) and bounce (eg, ball)
- *optional:* cardboard or paper strips (see 'Preparation')

FOR EACH STUDENT

- 1 sheet of A4 paper

Preparation

- *Optional:* Consider how you will organise the sorting activity with your class, such as, individually or in pairs. Prepare a set of cards with the words 'bounce', 'slide', 'roll' and 'spin' for each pair/individual.

Lesson steps

1. Review the resources developed during the unit, such as, class science journal, class books. Review the word wall for vocabulary that students can use to complete the following tasks.
2. Repeat the 'chance dance' or the game 'Simon says' to revise students' understanding of push, pull, bounce, slide, roll and spin, and parts and their shapes that enable things to move.

3 Explain that students are going to show how much they have learnt by drawing and writing their ideas about the words 'bounce', 'slide', 'roll' and 'spin'. Model how students will fold a piece of paper in half, then in half again to make four boxes for drawing and writing.

Explain that in each box the students will draw and caption (or you will scribe) pictures that represent the words.

Ask students to label (or you to scribe) the parts that are involved in movement, for example, 'round wheels'.

4 After students have completed their representations, arrange for them to share and discuss them with another student.

5 *Optional:* Explain that students will work with a partner (or individually) to group objects under the headings 'bounce', 'slide', 'roll' and 'spin'. Objects might be located on the equipment table or around the classroom.

Provide pairs of students with a set of cards with the words 'bounce', 'slide', 'roll' and 'spin' and explain that they will group objects under the appropriate headings. As students group objects, move around the class and talk with pairs (or individuals) about the reasons for their classification

6 Review the *On the move* unit with the class, asking questions such as:

- Which activity did you enjoy doing? Why?
- What new things have you learned?
- What did you learn about working in pairs?

Record students' responses in the class science journal.

Curriculum links

Indigenous perspectives

- Demonstrate to another class or at a school assembly some of the Indigenous games played during the unit. Use Standard Australian English and local Indigenous words on cards when demonstrating movements in the games.
- Primary**Connections** recommends working with Aboriginal and Torres Strait Islander community members to access local and relevant cultural perspectives. Protocols for engaging with Aboriginal and Torres Strait Islander community members are provided in state and territory education guidelines. Links to these are provided on the Primary**Connections** website: **www.primaryconnections.org.au**

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

Introduction

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

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

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

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

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

Team structure

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

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

Team roles

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

For Foundation–Year 2, teams consist of two students—Manager and Speaker. (For Year 3–Year 6, the teams consist of three students—Director, Manager and Speaker. Each member of the team should wear something that identifies them as belonging to that role, for example, a 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 may speak to all team members, not just to the Speaker. The Speaker is not the only person who reports to the class; each team member should be able to report on the team's results.

Director (Year 3–Year 6)

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

Team skills

PrimaryConnections 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. PrimaryConnections 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 ROLES

Manager

Collects and returns all materials the team needs

Speaker

Asks the teacher and other team speakers for help

TEAM SKILLS

1 Move into your teams quickly and quietly

2 Stay with your team

3 Take turns

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.

Maintaining a science journal aligns to descriptions in the Australian Curriculum: Science and English. See pages xi and xiii.

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

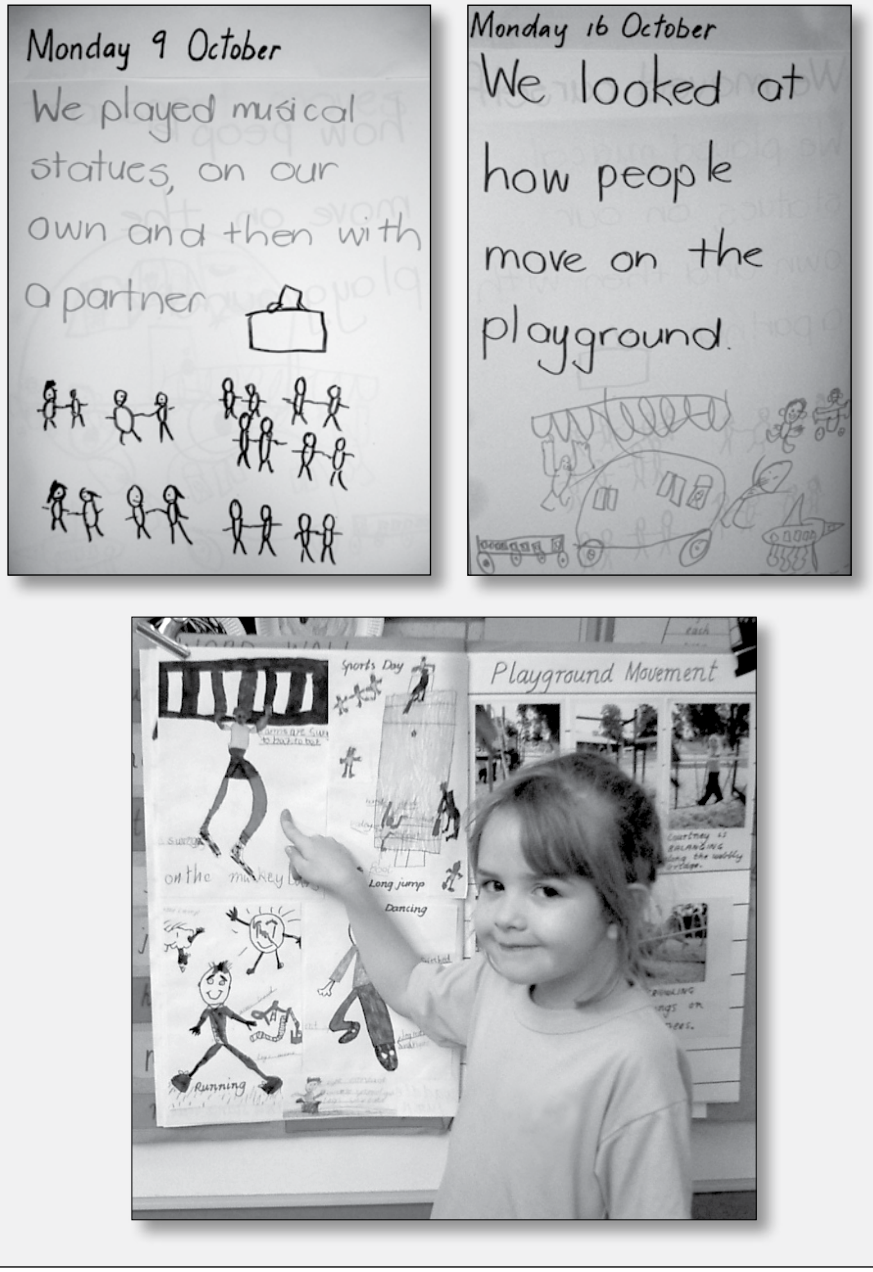
revise this material during the unit. Explore the vocabulary, visual texts and ideas that have developed from the science unit, and encourage students to use them in their science journals.

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.

***On the move* 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 different dialects and languages, aligns to descriptions in the Australian Curriculum: English. See page xiii.

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.

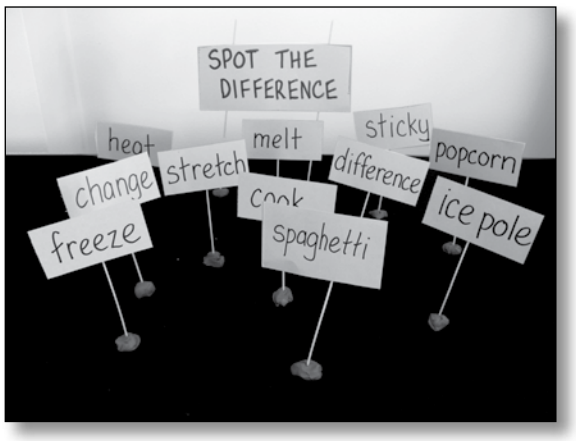
Word walls do not need to be confined to a wall. Use a portable wall, display screen, shower curtain or window curtain. Consider a cardboard shape that fits with the unit, for example, an apple for a needs unit.

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 the *On the move* unit might be organised using headings, such as ‘The way I can move’, ‘The ways things move’, ‘Ways toys move’, ‘Things that roll easily’ and ‘Things that slide’.

Invite students to contribute words from different languages to the word wall. Group words about the same thing, for example, different names for the same toy type, 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.

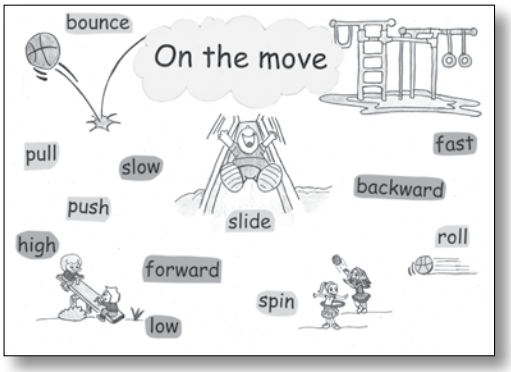
***Watch it grow* word wall**



***Spot the difference* 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.



***On the move* word wall**

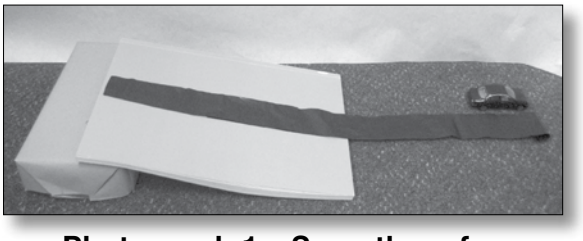
Appendix 4
How to conduct a fair test

Introduction

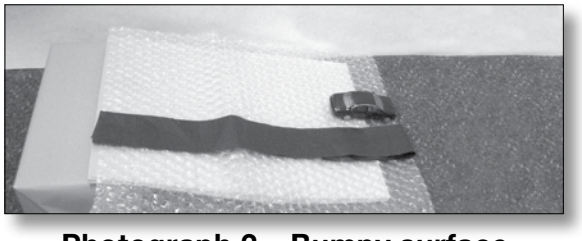
Scientific investigations involve posing questions, testing predictions, planning and conducting tests, interpreting and representing evidence, drawing conclusions and communicating findings.

Planning a fair test

In *On the move*, students investigate how far an object rolls on two different surfaces.



Photograph 1 – Smooth surface



Photograph 2 – Bumpy surface

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.

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

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

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

Cows: **Change** one thing (independent variable)
Moo: **Measure/Observe** another thing (dependent variable) and
Softly: keep the other things (controlled variables) the **Same**.

To investigate how far the object rolls on different surfaces, students could:

CHANGE	The surface	Independent variable
MEASURE/OBSERVE	How far the objects roll	Dependent variable
KEEP THE **SAME**	The ramp height and size, the launch technique and the rolling object used.	Controlled variable

Appendix 5
On the move equipment list

EQUIPMENT ITEM	QUANTITIES	LESSON	1	2	3	4	5	6	6	6	7
		SESSION						1	2	3	
Equipment and materials											
balls, identical different sizes (eg, tennis ball and oversized tennis ball)	2 per team								●		
book	1 per class							●			
cardboard, A4 2 pieces	per class								●		
cardboard, stiff and small book	per team								●	●	
cardboard or paper strips labelled ‘bounce’, ‘slide’, ‘roll’ and ‘spin’ *optional*	sufficient quantity for cla										●
glue	sufficient quantity per te			●					●	●	
hoops or skipping ropes *optional*	2 per class					●					
objects that do not roll easily (eg, a block, shoe, lunch box)	1 collection per team							●			
objects that roll easily (eg, wheeled toy, marble, cardboard tube)	1 collection per team							●			
object that rolls easily (eg, toy car, marble)	1 per team									●	
old magazines *optional*	1 collection per class			●							
paper, A3	each team									●	
paper, A4	1 sheet per student										●
marbles, different sizes	2 per team								●		
ruler	1 per team									●	
self-adhesive tape	per team								●		
scissors	1 per team			●					●	●	
streamers	sufficient quantity per te								●	●	
surface, bumpy (eg, bubble wrap, corrugated cardboard)	1 per team									●	
surface, smooth (eg, laminated table, timber floor)	1 per team									●	
toys that move, various	collection for class					●					

EQUIPMENT ITEM	QUANTITIES	LESSON	1	2	3	4	5	6	6	6	7
		SESSION						1	2	3	
Resource sheets											
– 'Chance dance cube 1' (RS1)	1 per class						●				
– 'Chance dance cube 2' (RS2)	1 per class						●				
Teaching tools											
class science journal	1 per class		●	●	●	●	●	●	●	●	●
role wristbands or badges for Manager and Speaker	1 set per team							●	●	●	
student science journal	1 per student			●	●	●					
team roles chart	1 per class							●	●	●	
team skills chart	1 per class							●	●	●	
word wall	1 per class			●	●	●	●				●
Multimedia											
devices for playing music	1 per class		●				●				
music	1 per class		●				●				
digital camera *optional*	1 per class			●	●	●			●	●	
video camera *optional*	1 per class				●						

Appendix 6
On the move unit overview

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to represent their current understanding as they:	Students will be able to:	Students:	
ENGAGE	**Lesson 1** Movers and shakers	• identify and describe various voluntary and involuntary human movements • identify and describe some body parts that enable humans to move.	• use talk to report on observations and reflect on their experience of human movement • contribute ideas for the class science journal.	• experience movement by playing 'musical statues' • explore and discuss moving, involuntary movements and being still.	**Diagnostic assessment** • Represent ideas about movement through playing 'musical statues' and 'Simon says' • Through discussion, share ideas about movement

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page xi for Science, page xiii for English and xiv for Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
EXPLORE	**Lesson 2** On the hunt for things that move	• identify and describe some things that move and the ways they move • predict and observe things that move inside and outside the classroom.	• identify the broad purposes and features of a table • ask questions and make predictions • record ideas in a science journal • participate in discussion to recount observations and experience relating to the ways in which things move.	• look for things that move in the classroom, in the school grounds and outside the school grounds • describe their observations of how things move.	**Formative assessment** • Science journal entries • Through discussion, share ideas about what moves and how

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page xi for Science, page xiii for English and xiv for Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
EXPLORE	**Lesson 3** Playground play	• observe and describe movements made by humans • identify and describe some ways in which humans move • identify some body parts involved in human movement.	• use talk to report on observations and reflect on their experience • write and illustrate simple descriptions of humans moving • identify the broad features of a labelled diagram • use role-play to represent different ways humans can move • *optional:* recognise symbols and signs used to direct movement, for example, safety precautions.	• move on play equipment and observe a partner moving • make a record of their observations • discuss questions related to movement.	**Formative assessment** • Science journal entries • Shared observations • Labelled diagram

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page xi for Science, page xiii for English and xiv for Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
EXPLORE	**Lesson 4** Toys that move	• observe moving toys • predict, identify and describe the ways in which toys move • identify specific features of toys that move • group toys in categories.	• use talk to predict, question, make distinctions and report observations • use appropriate language to describe different types of movement • *optional:* with support, create a Venn diagram to present information.	• observe and describe toys that move • predict and identify the ways in which toys can move • group toys according to specific features of movement.	**Formative assessment** • Through discussion, share observations of moving toys • Class science journal sharing • Classifying toys
EXPLAIN	**Lesson 5** Moving towards an explanation	• identify and describe pushing, pulling, bouncing, sliding, rolling and spinning.	• use language to make distinctions, speculate and question • participate in discussion to recount observations and experience relating to movement • follow instructions to play the 'chance dance' • physically represent their understanding of different types of movement.	• experience pushing, pulling, bouncing, sliding, rolling and spinning • discuss different ways to represent movement • play a 'chance dance'.	**Formative assessment** • Represent ideas about movement through participation in a 'chance dance' • 'Chance dance cube 1' (Resource sheet 1) • 'Chance dance cube 2' (Resource sheet 2)

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page xi for Science, page xiii for English and xiv for Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
ELABORATE	**Lesson 6** Rolling along ***Session 1*** Shape, rattle and roll ***Session 2*** Sizing it up ***Session 3*** Roll on	• with support, investigate how the shape of an object affects its ability to roll • with support, investigate how the size of an object affects its ability to roll • with support, investigate how far things roll on different surfaces.	• participate in discussion to generate explanations, compare ideas and relate evidence to explanations about rolling • physically represent their understanding of rolling.	***Session 1*** Shape, rattle and roll • investigate how they can move their bodies by rolling • investigate objects to determine the effect that shape has on rolling • record findings in the class science journal. ***Session 2*** Sizing it up • investigate how the size of an object affects its ability to roll • record findings in the class science journal. ***Session 3*** Roll on • investigate how far things roll on different surfaces • record findings in the class science journal.	**Summative assessment** of Science Inquiry Skills • Discussion about rolling and conducting an investigation • Contributions to 'how far things roll' graph

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page xi for Science, page xiii for English and xiv for Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
EVALUATE	**Lesson 7** Showing what we know	• identify and describe some things that move, the ways they move and the parts that enable them to move.	• use language to report on observations, clarify understanding and reflect on their experience of movement • represent their understanding about movement through drawing and writing.	• review the unit using the science journal, word wall and other resources developed during the unit • represent their ideas about movement • reflect on their learning during the unit.	**Summative assessment** of Science Understanding • represent ideas about movement through drawing, writing and discussion.

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page xi for Science, page xiii for English and xiv for Mathematics.

PrimaryConnections®
Linking science with literacy

PrimaryConnections Units

Year	Biological sciences	Chemical sciences	Earth and space sciences	Physical sciences
F	*Staying alive*	*That's my hat!*	*Weather in my world*	*On the move*
	Growing well	*What's it made of?*		
1	*Schoolyard safari*	*Spot the difference*	*Changes all around*	*Look! Listen!*
	Dinosaurs and more	*Bend it! Stretch it!*	*Up, down and all around*	
2	*Watch it grow!*	*All mixed up*	*Water works*	*Machine makers*
				Push-pull
3	*Feathers, fur or leaves?*	*Melting moments*	*Night and day*	*Heating up*
4	*Plants in action*	*Material world*	*Beneath our feet*	*Magnetic moves*
	Friends or foes?			
	Among the gum trees	*Package it better*		*Smooth moves*
5	*Desert survivors*	*What's the matter?*	*Earth's place in space*	*Light shows*
6	*Marvellous micro-organisms*	*Change detectives*	*Creators and destroyers*	*Circuits and switches*
	Rising salt		*Earthquake explorers*	*Essential energy*