BOARD OF STUDIES
NEW SOUTH WALES

Science K–10 (incorporating Science and Technology K–6)

Australian Curriculum

Draft syllabus

Version 2

Consultation period
13 February – 30 April 2012

Published by
Board of Studies NSW
GPO Box 5300
Sydney NSW 2001
Australia

Phone: (02) 9367 8111
Fax: (02) 9367 8484
Internet: www.boardofstudies.nsw.edu.au

February 2012

20111108

Contents

Background information

The *Science K–10 Syllabus (incorporating Science and Technology K–6)* is being developed to deliver the Australian Curriculum to NSW schools. The syllabus is being developed within the context of the NSW Board of Studies *K–10 Curriculum Framework*, using the Board's syllabus development process.

A draft syllabus was developed, and consultation occurred from June to September 2011. Based on this feedback, a second version of the draft has been prepared for a second round of consultation. The intention in 2012 is to deliver a final syllabus, together with initial support materials as part of the Board's syllabus handover processes.

The *Science K–10 Syllabus (incorporating Science and Technology K–6)* will challenge students to meet high, but realistic, expectations as they progress through the years of schooling. It clearly articulates standards that show what students are expected to know and be able to do at each stage from Kindergarten to Year 10. This provides the context for assessment for learning and meaningful reporting of student achievement.

The Board's syllabus development process

This project commenced at the draft syllabus development phase of the Board's syllabus development process. Broad consultation with teachers and other interest groups will precede the finalisation of the syllabus.

The process and timeline for the development of the syllabus follows.

Timeline for the development of the Science K–10 Syllabus (incorporating Science and Technology K–6)

Syllabus development	**Dates**
Draft syllabus version 2 released	Term 1, 2012
Consultation	Term 1, 2012
Publication of the syllabus	Term 3, 2012
Initial support materials released	Term 3, 2012
Additional support materials released	Term 4, 2012

How to respond

As you read the document you will notice the following icons:

ⓘ for your information	This icon indicates general information that assists in reading or understanding the information contained in the document. Text introduced by this icon will not appear in the final syllabus.
✍ consult	This icon indicates material on which responses and views are sought through consultation.

Consultation

The *Science K–10 Draft Syllabus Version 2 (incorporating Science and Technology K–6)* is accompanied by an online consultation survey on the Board of Studies website. The purpose of the survey is to obtain detailed comments from individuals and systems/organisations on the draft syllabus version 2. Please comment on both the strengths and weaknesses of the draft syllabus version 2. Feedback will be considered when the draft syllabus version 2 is modified.

The consultation period is from 13 February to 30 April 2012.

Written responses may be forwarded to:

Curriculum Officer, Science
GPO Box 5300
Sydney NSW 2001

Or emailed to: patricia.stockbridge@bos.nsw.edu.au

Or faxed to: (02) 9367 8476

The draft syllabus

1 Introduction

1.1 The K–10 curriculum

The Board of Studies syllabuses have been developed with respect to some overarching views about education. These include the *K–10 Curriculum Framework,* the Board's *Statement of Equity Principles* and the *Melbourne Declaration on Educational Goals for Young Australians (December 2008).*

In accordance with the *K–10 Curriculum Framework* and the Board's *Statement of Equity Principles*, the *Science K–10 Syllabus (incorporating Science and Technology K–6)* takes into account the diverse needs of all students. It identifies essential knowledge, understanding, skills, values and attitudes. It outlines clear standards of what students are expected to know and be able to do in K–10. It provides structures and processes by which teachers can provide continuity of study for all students.

The framework also provides a set of broad learning outcomes that summarise the knowledge, understanding, skills, values and attitudes essential for all students in all learning areas to succeed in and beyond their schooling.

The continued relevance of the *K–10 Curriculum Framework* is consistent with the intent of the *Melbourne Declaration on Educational Goals for Young Australians (December 2008),* which sets the direction for Australian schooling for the next 10 years. There are two broad goals:

> Goal 1: Australian schooling promotes equity and excellence
> Goal 2: All young Australians become successful learners, confident and creative individuals, and active and informed citizens.

The way in which learning in the *Science K–10 Syllabus (incorporating Science and Technology K–6)* will contribute to the curriculum and to students' achievement of the broad learning outcomes is outlined in the draft syllabus rationale.

1.2 Students with special education needs

The rationale, aim, objectives, outcomes and content of the *Science K–10 Syllabus (incorporating Science and Technology K–6)* have been designed to accommodate teaching approaches that support the learning needs of all students. The stage statements and the continuum of learning can help teachers identify the starting point for instruction for every student, including those with special education needs.

Collaborative curriculum planning will determine the most appropriate curriculum options for all students with special education needs in keeping with their learning needs, strengths, goals and interests.

Most students with special education needs will participate fully in learning experiences based on the regular syllabus outcomes and content. Students may require additional support, including adjustments to teaching, learning and assessment activities.

Adjustments are measures or actions taken in relation to teaching, learning and assessment that enable a student to access syllabus outcomes and content. These adjustments may involve:

- classroom organisation
- appropriate materials and resources to support teaching and learning activities
- the amount of content to be covered in a particular lesson or unit of work or the time allocated to complete work
- additional demonstration of key concepts and skills by the teacher, teacher's aide or a peer
- a range of appropriate learning activities with structured opportunities for guided and independent practice and effective feedback
- additional support through group work, peer or volunteer tutoring, and other individual assistance.

Kindergarten – Year 6

In Kindergarten to Year 6, it is important for all students to have the opportunity to participate fully in and progress through the curriculum. As they move through the developmental stages of learning, students demonstrate individual strengths and establish preferred ways of learning.

There are several curriculum options for students with special education needs in K–6. Students may:

- engage with selected outcomes and content appropriate to their learning needs
- engage with syllabus outcomes and content with adjustments
- engage with outcomes from an earlier stage, using age-appropriate content.

All decisions regarding curriculum options for students with special education needs should be made through the collaborative curriculum planning process, to ensure that syllabus outcomes and content reflect the learning needs and priorities of individual students.

In addition, the NSW K–6 curriculum provides for students with special education needs through:

- inclusive syllabus outcomes and content accessible by the full range of students
- additional advice and programming support for teachers on how to assist students to access the outcomes of the syllabus
- specific support documents for students with special education needs as part of the overall syllabus package.

Years 7–10

Students build on their achievement in Kindergarten to Year 6 as they undertake courses to meet requirements of the Years 7–10 curriculum. Students with special education needs can access the Years 7–10 syllabus outcomes and content in a range of ways including:

- under regular course arrangements
- through outcomes from a different stage (Early Stage 1 to Stage 5), using age-appropriate content
- with adjustments to teaching, learning and/or assessment experiences
- through Years 7–10 Life Skills outcomes and content.

For some students with special education needs, particularly those students with an intellectual disability, it may be determined that the Stage 4 and Stage 5 outcomes are not

appropriate to meet the needs of the student, even with adjustments to teaching, learning and assessment. For these students, the Years 7–10 Life Skills outcomes and content can provide the basis for developing a rigorous, relevant, accessible and meaningful age-appropriate program. A range of adjustments should be explored before a decision is made to access the Years 7–10 Life Skills outcomes and content.

The Years 7–10 Life Skills outcomes and content are developed from the Years 7–10 objectives of the *Science K–10 Syllabus (incorporating Science and Technology K–6)*. Further information about accessing and implementing Science Years 7–10 Life Skills outcomes and content can be found in the Science support document and *Life Skills Years 7–10: Advice on Planning, Programming and Assessment.*

School principals have the authority to approve student access to courses based on Years 7–10 Life Skills outcomes and content, and to determine the appropriateness of making adjustments to curriculum and assessment for individual students.

The Years 7–10 Life Skills outcomes and content are in section 8 of the syllabus. Assessment and reporting information for students with special education needs is in section 10.

Science and Technology K–6

2 Rationale

ⓘ for your information

The rationale describes the distinctive nature of the subject and outlines its relationship to the contemporary world and current practice. It explains the place and purpose of the subject in the curriculum and how *Science* contributes to the achievement of the broad learning outcomes of the *K–10 Curriculum Framework.*

✍ consult

Science and technology are integral to and are of increasing importance in our rapidly changing world. A student's sense of wonder and curiosity about the natural and made world is fostered through actively engaging in the processes of Working Scientifically and Working Technologically. Through questioning and seeking solutions to problems, students develop an understanding of the relationships between science, technology and the significance of its contribution to society.

Scientific inquiry is a distinct way of finding answers to interesting questions and important problems about the natural world locally, nationally and globally. Science knowledge provides explanations for a variety of phenomena and enables sense to be made of the Natural Environment and the Made Environment. As students engage in posing questions, testing ideas, developing and evaluating arguments based on evidence, they develop and apply their Working Scientifically skills. Through applying the processes of Working Scientifically, students use scientific inquiry to develop their understanding of science ideas and concepts, and the importance of scientific evidence in making informed decisions about the uses and influence of science and technology in relation to their lives. They demonstrate honesty and fairness in applying the processes of Working Scientifically and Working Technologically.

The study of technology encompasses a broad range of technological contexts that may include agriculture, engineering, food, graphics, industrial and digital technologies as well as product design that use metals, textiles and timber. It provides opportunities to solve real problems and create ideas and solutions in response to needs and opportunities in a range of technological contexts. Technology and an understanding of design processes enable people to manage, interpret, shape and alter their environment to improve their quality of life at home, school, in work places and the broader community. Students learn about technologies and creatively and competently use a range of materials, tools, equipment and techniques relevant to their world.

As disciplines, Science and Technology are linked through the skills and processes of scientific inquiry and technological problem-solving. Science often draws on tools and processes developed by technology that in turn uses concepts, principles and processes developed by science. The study of Science and Technology provides opportunities to think and act critically and creatively, and be innovative in developing working solutions and ideas in response to opportunities and questions. Through engaging in Science and Technology learning, students develop informed attitudes based on evidence and reason, to participate responsibly in personal, social and environmental issues relevant to their lives and to shape sustainable futures.

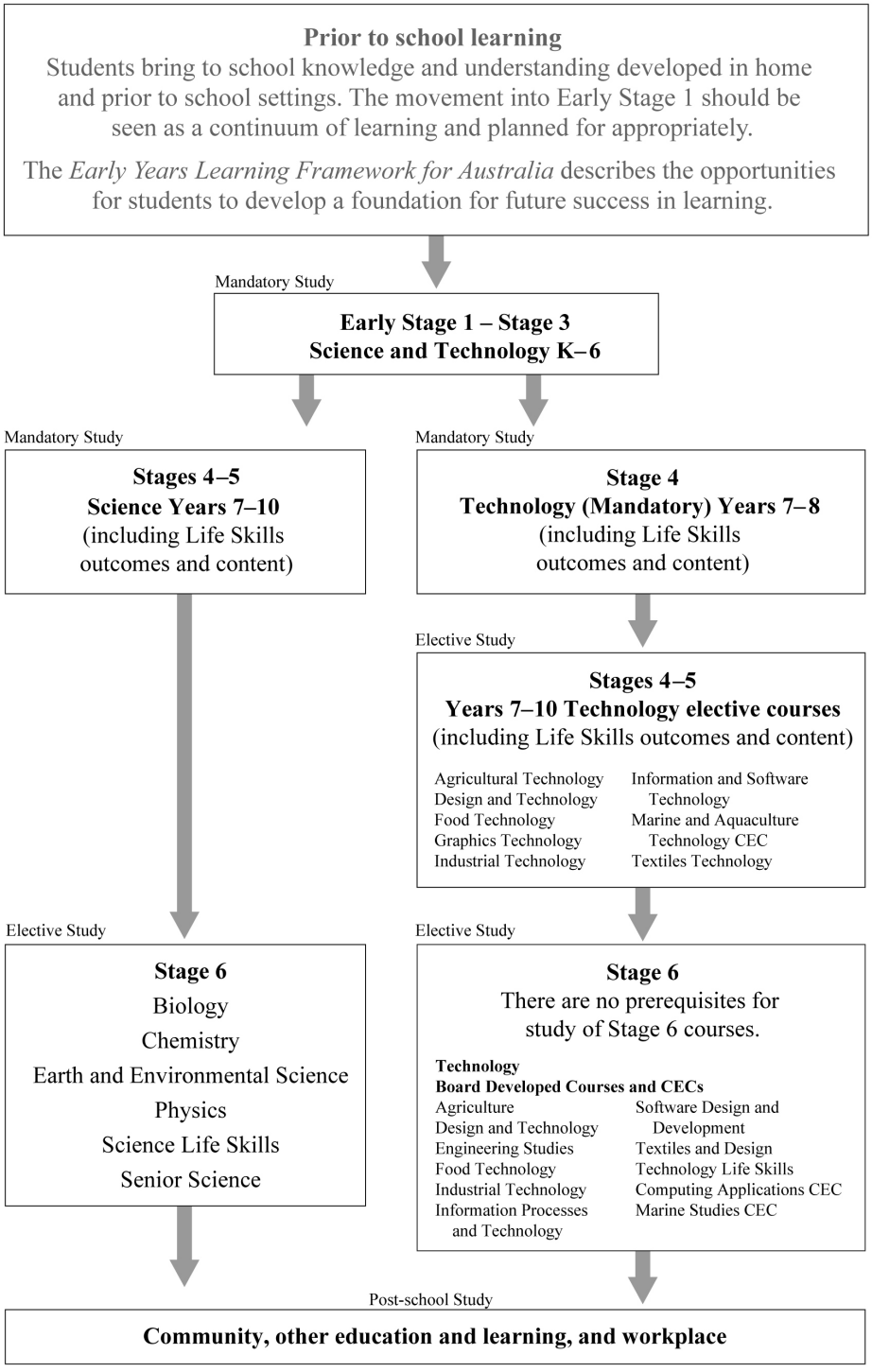
The study of science and technology enables students to develop a positive self-concept as learners, develop confidence in and gain enjoyment from their learning. They become self-motivated learners through active participation in challenging and engaging experiences in order to develop innovative solutions.

3 The place of the Science K–10 Syllabus (incorporating Science and Technology K–6) in the K–12 curriculum

ⓘ for your information

This section of the syllabus demonstrates the relationship between the K–10 syllabus and other associated courses. It shows the possible pathways of learning in the learning area.

✍ consult



4 Aim

ⓘ for your information

The aim provides a succinct statement of the overall purpose of the syllabus. It indicates the general educational benefits for students from programs based on the syllabus.

✍ consult

The aim of the *Science and Technology K–6 Syllabus* is to:

- foster students' sense of wonder and expand their natural curiosity about the world around them in order to develop their understanding of, interest in, and enthusiasm for science and technology
- develop students' competence and creativity in applying processes of Working Scientifically and Working Technologically to appreciate and understand the Natural Environment and Made Environment
- enhance students' confidence in making evidence-based decisions about the influences of science and technology in their lives
- enable students to confidently respond to needs and opportunities when designing solutions relevant to science and technology in their lives.

5 Objectives

ⓘ for your information

Objectives provide specific statements of the intention of a syllabus and amplify its aims. They act as organisers for the intended outcomes and define, in broad terms, the knowledge, understanding, skills, values and attitudes to be developed through study in the subject.

Objectives are organised under the areas of:

- values and attitudes
- knowledge, understanding and skills.

✍ consult

Values and attitudes

Students:

- develop interest and positive, informed values and attitudes towards science and technology
- recognise the importance and relevance of science and technology in their lives now and for their future.

Knowledge, understanding and skills

Students:

- develop knowledge, understanding of and skills in applying the processes of Working Scientifically
- develop knowledge, understanding of and skills in applying the processes of Working Technologically
- develop knowledge and understanding of and about the Natural Environment
- develop knowledge and understanding of and about the Natural Environment and the Made Environment through Material World
- develop knowledge and understanding of and about the Made Environment.

6 Outcomes

ⓘ for your information

Syllabus outcomes provide detail about what students are expected to achieve at the end of each stage in relation to the objectives. They indicate the knowledge, understanding and skills expected to be gained by most students as a result of effective teaching and learning, by the end of a stage. They are derived from the objectives of the syllabus.

Values and attitudes outcomes have been developed for the stages of learning.

✍ consult

Early Stage 1 – Stage 3

Table of objectives and outcomes

Values and attitudes

Objectives Students: • develop interest and positive, informed values and attitudes towards science and technology • recognise the importance and relevance of science and technology in their lives now and for their future
Early Stage 1 – Stage 3 outcomes A student:
STe-1VA, ST1-1VA, ST2-1VA, ST3-1VA shows interest in and enthusiasm for science and technology, responding to their curiosity, questions and perceived needs, wants and opportunities STe-2VA, ST1-2VA, ST2-2VA, ST3-2VA demonstrates a willingness to engage responsibly with local, national and global issues relevant to their lives and to shaping sustainable futures STe-3VA, ST1-3VA, ST2-3VA, ST3-3VA develops informed attitudes about the current and future use and influence of science and technology based on reason

Skills

<table>
<tr><td colspan="4">Objective
Students:
• develop knowledge, understanding of and skills in applying the processes of Working Scientifically</td></tr>
<tr><td>Early Stage 1 outcome
A student:</td><td>Stage 1 outcome
A student:</td><td>Stage 2 outcome
A student:</td><td>Stage 3 outcome
A student:</td></tr>
<tr><td>STe-4WS
explores their immediate surroundings by questioning, observing, using their senses and communicating to share their observations and ideas</td><td>ST1-4WS
investigates their questions and predictions by collecting and recording data, sharing and reflecting on their experiences and comparing what they and others know</td><td>ST2-4WS
investigates their questions and predictions by collecting and analysing data, suggesting explanations for their findings, and communicating and reflecting on the processes undertaken</td><td>ST3-4WS
investigates by posing questions, including testable questions, making predictions, and gathering data to draw evidence-based conclusions and develop explanations</td></tr>
<tr><td colspan="4">Objective
Students:
• develop knowledge, understanding of and skills in applying the processes Working Technologically</td></tr>
<tr><td>Early Stage 1 outcome
A student:</td><td>Stage 1 outcome
A student:</td><td>Stage 2 outcome
A student:</td><td>Stage 3 outcome
A student:</td></tr>
<tr><td>STe-5WT
uses a simple design process to produce solutions with identified purposes</td><td>ST1-5WT
uses a structured design process, everyday tools, materials, equipment and techniques to produce solutions that respond to identified needs and wants</td><td>ST2-5WT
applies a design process and uses a range of tools, equipment, materials and techniques to produce solutions that address specific design criteria</td><td>ST3-5WT
plans and implements a design process selecting a range of tools, equipment, materials and techniques to produce solutions that consider constraints</td></tr>
</table>

Knowledge and understanding

Objective Students: • develop knowledge and understanding of and about the Natural Environment			
Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:
STe-6NE identifies that the way objects move depends on a variety of factors	ST1-6NE describes some sources of light and sound that they sense in their daily lives ST1-7NE describes the effects of pushes and pulls on objects they encounter	ST2-6NE identifies ways heat is produced and that heat moves from one object to another ST2-7NE describes interactions between objects that result from contact and non-contact forces	ST3-6NE describes how people use scientific understanding about the sources, transfer and transformation of electricity in making decisions about its use ST3-7NE identifies that scientific knowledge about the transfer of light is used to solve problems that directly affect people's lives
STe-7NE observes using their senses how daily and seasonal changes in the environment affect them and other living things	ST1-8NE describes some observable changes that occur in the sky and landscape ST1-9NE identifies ways that people use science in their daily lives to care for the environment and Earth's resources	ST2-8NE describes some observable changes over time on the Earth's surface that result from natural processes and human activity ST2-9NE describes some relationships between the sun and the Earth that cause regular changes	ST3-8NE describes how discoveries by people from different cultures and times have contributed to advancing scientific understanding of the solar system ST3-9NE identifies that evidence provided by advances in technology and scientific understanding can be used to explain rapid change at the Earth's surface caused by natural events
STe-8NE identifies the basic needs of living things	ST1-10NE describes the growth, changes in and external features of living things ST1-11NE describes how different places in the environment provide for the needs of living things	ST2-10NE describes that living things have life cycles, can be distinguished from non-living things and grouped, based on their observable features ST2-11NE identifies that science knowledge helps people understand the effect of their actions on the survival of living things	ST3-10NE describes how structural features and other adaptations of living things help them to survive in their environment ST3-11NE describes the physical conditions of their environment that affect the growth and survival of living things

Objective Students: • develop knowledge and understanding of and about the Natural Environment and the Made Environment through Material World			
Early Stage 1 outcome A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:
STe-9ME identifies objects are made of materials that have observable properties	ST1-12NM identifies ways everyday materials can be physically changed and combined for a particular purpose	ST2-12NM identifies that adding or removing heat causes a change of state between solids and liquids	ST3-12NM identifies the observable properties of solids, liquids and gases, and that changes made to materials are reversible or irreversible
	ST1-13NM relates the properties of common materials to their use for their particular purposes	ST2-13NM identifies the physical properties of natural and processed materials and how these influence their use	ST3-13NM describes how the properties of materials determine their use for specific purposes

Objective Students: • develop knowledge and understanding of and about the Made Environment			
Early Stage 1 outcome A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:
STe-10ME recognises how familiar products, places and spaces are made to suit their purpose	ST1-14ME describes a range of places and spaces in the local environment and how their purposes influence their design	ST2-14ME describes how people interact within built environments and the factors considered in their design and construction	ST3-14ME describes systems in built environments and the social and environmental factors that influence their design
	ST1-15ME describes a range of familiar information sources and technologies and how their purposes influence their design	ST2-15ME describes ways information solutions are designed and produced, and the factors to consider when people use and interact with sources and technologies	ST3-15ME describes information and communication systems and how social influences impact on their design and use
	ST1-16ME describes a range of manufactured products in the local environment and how their different purposes influence their design	ST2-16ME describes how products are designed and produced, and the ways people use them	ST3-16ME describes systems used to produce or manufacture products, and the social and environmental influences on product design

7 Content

7.1 Organisation of content

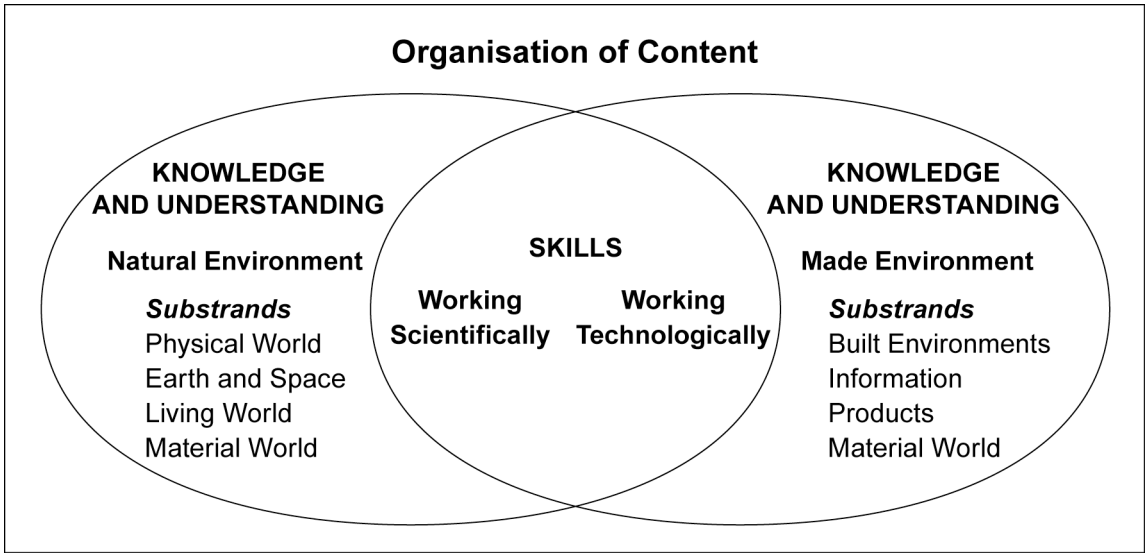
ⓘ for your information

Content specifies the expected learning for students as they work to achieve the outcomes, and describes the subject matter that is to be studied. Syllabus content reflects a balance between the acquisition of knowledge and the specific processes of learning in Science and Technology so that students are encouraged to engage in, take responsibility for, and continue their own learning.

The knowledge, understanding and skills described provide a sound basis for students to successfully move to the next stage of learning. Teachers will make decisions about the sequence of learning and the emphasis to be given to particular content, based on the needs of their students.

✍ consult

The *Science and Technology K–6 Syllabus* content is organised by strands in relation to the syllabus knowledge, understanding and skills objectives and outcomes.



The skills content strands are Working Scientifically and Working Technologically. Science and technology are linked through the skills and processes of scientific inquiry and technological problem-solving.

In Early Stage 1 the knowledge and understanding content strands are the Natural Environment and the Made Environment. In Stages 1 to 3 these strands are represented in more specific substrands.

The substrand Material World is common to both the Natural Environment and the Made Environment strands. It provides a foundation for the Chemical World in Science Years 7–10 and the study of materials in Technology (Mandatory) in Years 7–8.

Knowledge, understanding and skills content are interdependent. Learning about the Natural Environment and/or the Made Environment should be integrated through the processes of Working Scientifically and/or Working Technologically. Student learning will be enhanced through engaging in and applying the processes of Working Scientifically and/or Working Technologically in a range of contextualised hands-on scientific investigations and design projects.

Within each strand the content provides the basis for student achievement by the end of the stage at the expected level described in the outcomes. The content specifies the science and technology understanding and the expected scope and depth of learning as students engage with key skills, ideas and concepts. The content states the learning required for students to successfully transition to the next stage.

In order to support continuity of student learning in knowledge, understanding and skills together with other essential elements of the syllabus, programs should:

- integrate within each unit of work, content from across the knowledge and understanding strands with skills content
- include using and applying the processes of Working Scientifically and Working Technologically in a range of hands-on scientific investigations and design projects in each year K–6
- include appropriate content related to Working Scientifically, Working Technologically, the Natural Environment and the Made Environment in each year K–6
- incorporate within each of Stages 1–3 all knowledge and understanding substrands
- present units of work in contexts that are selected on the basis of their relevance to students' learning needs and experiences.

Content Strands

Skills

In the *Science and Technology K–6 Syllabus* content is organised by strands in relation to the skills, and knowledge and understanding objectives and outcomes.

Working Scientifically

- Students identify and ask questions about their world. They plan and conduct a range of first-hand investigations in which they use and apply the skills and processes of Working Scientifically. Through applying the processes of Working Scientifically, students use scientific inquiry to develop their knowledge and understanding of and about science. In their investigations students will often draw on processes and design ideas developed through Working Technologically.

Working Technologically

- Students recognise problems and respond to opportunities, needs and wants in their world for which possible solutions can be designed and produced. They explore and define design tasks, generate and develop ideas, produce solutions and evaluate their design processes and solutions. In developing design solutions, students will often use the findings from their investigations.

Knowledge and Understanding

The Natural Environment

- Students explore and learn about science as a unique way of answering questions and finding out about phenomena in the natural world and the importance of scientific evidence in decision-making and problem-solving. Students identify that many different people from different cultures make contributions to developments in scientific knowledge. They recognise the significance and influence of science and technology in their world.

The Made Environment

- Provides areas of focus for students to learn about technologies and their uses relevant to the personal, commercial and global areas of human activity. Students recognise that technology and understanding of design processes enables people to manage, interpret, shape and alter their environment to improve their quality of life.

In Stages 1 to 3, the Natural Environment and the Made Environment strands are divided into the following substrands:

- *Physical World* – students develop their understanding of heat energy, electricity, light and sound. They learn that forces affect the movement of objects and how knowledge about the transfer of heat energy and transformation of electricity can be used by people in their everyday life.
- *Earth and Space* – students develop their understanding of Earth's dynamic structure and its place in space. They learn that Earth is part of the solar system and is subject to change as a result of natural processes and human activity. They begin to appreciate that there is a growing need to develop an understanding of the Earth's characteristics and how people interact with their environment.

- *Living World* – students develop their understanding of living things. They investigate the diversity of living things, including plants, animals and microorganisms, their interdependence and interactions with each other and their environment. They explore their life cycles and structural features and how these aid survival.
- *Material World* – students develop their understanding of the properties of materials, the way they behave and the changes they undergo and how these properties influence the way materials are used by people in objects, products, places and spaces.
- *Built Environments* – students develop their understanding about space, places and their use. People create, construct and modify their surroundings for a wide range of purposes. The environments people build are an important part of our communities and culture.
- *Information* – students develop their understanding about the design and use of information for the purpose of conveying messages. Information and communication systems are fundamental to human activity. People create, communicate and access information using highly developed media and information technologies.
- *Products* – students develop their understanding of products that include objects, systems and artefacts, and the nature of materials and resources used to produce them. Products range from those that are individually crafted through to those that are produced commercially or in large quantities.

Note

In developing and delivering teaching programs teachers should be aware of, and adopt, relevant guidelines and directives of their education authorities and/or schools. Teaching programs should recognise and reflect relevant State and Commonwealth legislation, regulations and standards, including **Occupational Health and Safety Standards, Chemical Safety in Schools and Animal Welfare guidelines**. Teachers need to be aware of activities that may require notification, certification, permission, permits and licences.

Learning across the curriculum

ⓘ for your information

The Board of Studies has identified important learning for all students that can be delivered across the syllabuses. In K–10 syllabuses, the identified areas will be embedded in the descriptions of content. Content relating to learning across the curriculum addresses issues, perspectives and policies that will assist students to achieve the broad learning outcomes defined in the Board of Studies *K–10 Curriculum Framework*. These areas take account of the general capabilities and cross-curriculum priorities in the Australian curriculum.

This content will be included, where appropriate, while ensuring that subject integrity is maintained.

✍ consult

Aboriginal and Torres Strait Islander histories and cultures [AHC]

The syllabus provides opportunities in teaching and learning programs for the inclusion of Aboriginal and Torres Strait Islander contexts and perspectives relevant to Science and Technology such as:

- use of knowledge of change over time in the environment to develop seasonal calendars
- use of natural materials to make products and built environments
- use of story-telling to communicate information.

Asia and Australia's engagement with Asia [A]

The syllabus provides opportunities for students to understand the importance of Australia's relationship with Asia, including considering contemporary events which have resulted in shared experiences in response to a number of environmental issues such as:

- changes that have occurred in a local environment as a result of human activity
- how natural events cause rapid change to the Earth's surface
- how the design of built environments are influenced by a variety of social and environmental factors.

Civics and citizenship [CC]

The syllabus provides opportunities for students to broaden their understanding of aspects of civics and citizenship in relation to the application of scientific ideas and technological advances, including ecological sustainability and the development of environmental and sustainable practices, in areas such as:

- the ways people use science in their daily lives to care for the environment
- the inclusion of design criteria, which cause minimal impact on the environment
- the ways built environments might be designed and constructed in the future to incorporate sustainable environmental practices.

Critical and creative thinking [CCT]

The syllabus provides opportunities for students to develop skills in critical and creative thinking as they learn to generate and evaluate knowledge and ideas, employing these skills

when seeking new solutions to problems. Students may develop critical and creative thinking through activities such as:

- conducting appropriate and innovative investigations
- mind-mapping, brainstorming, sketching and modelling when generating design ideas
- evaluating possibilities and reflecting on the process of designing and producing.

Difference and diversity [DD]

The syllabus provides opportunities for students to understand and appreciate individual rights, challenge stereotypes and engage with opinions different to their own. Working Scientifically and Working Technologically provide opportunities for students to work collaboratively where they can develop an appreciation of the values and ideas of all group members. This may be facilitated by students:

- observing the different ways people interact with places and spaces in their environment
- considering how the design of information solutions influences their decisions and opinions.

Ethical understanding [EU]

The syllabus provides opportunities for students to engage with situations or circumstances which involve an ethical or moral decision-making process such as:

- the use of scientific knowledge in providing for the needs of humans and other living things
- appropriate etiquette when using the computer
- the incorporation of sustainable environmental practices when designing built environments.

Information and communication technology [ICT]

The syllabus provides opportunities for students to enhance and develop ICT skills and work effectively with ICT in representing data, information, observations and design ideas. This may be supported by the use of ICT to:

- record data and information electronically
- interact with information sources and digital technologies, including websites and digital games
- communicate ideas and display findings
- create information solutions for an identified need or opportunity.

Intercultural understanding [IU]

The syllabus provides opportunities for students to enhance their intercultural understanding through consideration of other cultures in relation to the development of scientific and techological knowledge such as:

- the contributions made by various cultures in the development of our knowledge of the solar system
- the production of different types of sound by instruments used by a variety of cultures
- how people interact with built environments for a range of social and cultural purposes.

Literacy [L]

The syllabus provides opportunities for students to develop broad literacy skills as well as more science and technology specific literacy by considering areas such as:

- communicating ideas and findings using reports, explanations and arguments
- extracting information from a variety of electronic and print sources
- presenting ideas and explanations about their investigations or design projects.

Numeracy [N]

The syllabus provides opportunities for students to develop numeracy skills in order to comprehend and interpret data and units of measurement, as well as accurately record observations and findings, which may be demonstrated by:

- the use of numerical data to record observations
- communicating data using graphs.

Personal and social competence [PSC]

The syllabus provides opportunities for students to develop an awareness of their individual, personal and social competence through activities such as:

- comparing their own ideas, understandings and conclusions respectfully with peers
- working cooperatively with others
- recognising the strengths of peers and conducting a self-assessment of their produced work.

Sustainability and environment [SE]

The syllabus provides opportunities for students to engage with scientific, technological or societal impacts on the Natural Environment and the Made Environment through activities such as:

- considering the importance of resource conservation
- describing how scientific and technological knowledge helps people understand the importance of recycling and the development of sustainable practices and technologies.

Work and enterprise [WE]

The syllabus provides opportunities for students to develop work-related skills and an appreciation of the value of working individually and collaboratively. This may be facilitated by students learning to:

- prioritise safe practices and understand the potential risks and hazards present when conducting investigations
- safely use electrical devices, classroom equipment and specialised tools
- work individually and cooperatively when conducting investigations and developing a design brief.

7.2 Content for Early Stage 1

✍ consult

Science and Technology • Early Stage 1

Skills – Working Scientifically

Outcome
A student:
- explores their immediate surroundings by questioning, observing using their senses and communicating to share their observations and ideas STe-4WS

Students question and predict by:
- responding to questions about familiar objects and events they are curious about in the natural and made environments (ACSIS014)
- making predictions resulting from their questions.

Students plan and conduct investigations by:
- sharing what they already know and how they could find out more about their questions relating to the natural and made environment
- exploring and making observations by using their senses to gather information about objects and events in their immediate surroundings (ASSIS011, ACSHE013)
- manipulating objects and materials through purposeful play.

Students process and analyse data and information by:
- organising objects or images of objects to display data and/or information
- engaging in discussions about observations and use drawings to represent ideas [CCT] (ACSIS233).

Students communicate by:
- using a range of methods to share observations and ideas such as drawing, informal and guided discussion, role-play, contributing to joint construction of short texts and/or using digital technologies [ICT] (ACSIS012)
- working in groups to reflect on what they liked or disliked about what they did, what was or was not expected or interesting and what they would do differently [CCT, PSC].

Background information

Progression:

The emphasis in Early Stage 1 is on fostering curiosity and wonder while developing skills in questioning, observing and exploring their world. In activities set by the teacher, students explore through purposeful play, manipulating, observing and describing what is accessible to their direct experience. They are encouraged to value and share their own questions and ideas about what happens, suggesting reasons for their observations.

Science and Technology • Early Stage 1

Skills – Working Technologically

Outcome

A student:

- uses a simple design process to produce solutions with identified purposes STe-5WT

Students explore and define the task by:

- identifying the purpose and use of existing products, places and spaces
- describing their likes and dislikes of existing products, places and spaces
- discussing the purpose and main features of what they need to produce and the materials they will use.

Students develop ideas and produce solutions by:

- using play and imagination to explore possibilities of products, places and spaces
- following a series of steps to draw or model ideas or construct solutions
- safely using common classroom equipment, resources and techniques to shape and join familiar materials.

Students evaluate by:

- recounting the steps taken to reach a final solution
- discussing their likes and dislikes in relation to what they have produced [PSC]
- reflecting on what they did and the usefulness of the final solution.

Background information

Progression:

In Early Stage 1 students use and learn about designing and producing as a structured series of activities. They observe the use of existing products, places and spaces. Students explore tasks set by the teacher with a particular emphasis on the purpose of their designs and how their designs relate to similar products and places in their immediate environment. In Early Stage 1, modelling is a common technique for developing design ideas. Drawing may be used to stimulate and communicate imagination and ideas. In Early Stage 1, little distinction need be made between developing ideas and producing solutions, and modelled ideas may often be regarded as a solution. Students reflect on their solutions in relation to perceived ‘usefulness’ in the wider world.

Science and Technology • Early Stage 1

Knowledge and Understanding – Natural Environment

Outcomes

A student:

- identifies that the way objects move depends on a variety of factors STe-6NE
- observes using their senses how daily and seasonal changes in our environment affect them and other living things STe-7NE
- identifies the basic needs of living things STe-8NE

The way objects move depends on a variety of factors, including their size and shape (ACSSU005).
Students:

- observe the way a variety of familiar objects move such as sliding, rolling, spinning and bouncing on the ground
- identify that the ways an object moves depends on its size and shape, such as tennis balls and blocks.

Daily and seasonal changes in our environment, including the weather, affect everyday life (ACSSU004).
Students:

- describe how people respond to familiar changes in their environment such as day and night and seasonal changes
- identify how plants and animals respond to changes in the environment such as trees losing their leaves and the thickness of animals' fur [CCT].

Living things have basic needs, including food and water (ACSSU002).
Students*:*

- describe what plants and animals, including humans, need to stay alive and healthy such as food, water and air
- identify the needs of a variety of living things in a range of situations such as pets at home, plants in the garden or plants and animals in bushland and/or on farms.

Science and Technology • Early Stage 1

Knowledge and Understanding – Made Environment

Outcomes

A student:

- identifies objects are made of materials that have observable properties STe-9ME
- recognises how familiar products, places and spaces are made to suit their purpose STe-10ME

Objects are made of materials that have observable properties (ACSSU003).

Students:

- observe using their senses a range of materials used to make specific objects, products, places and spaces
- group a range of materials on the basis of observable properties such as flexibility, texture, strength and colour
- relate the use of a range of materials to their properties.

Products, places and spaces in the immediate environment are made to suit their purpose.

Students:

- explore a range of existing products, places and spaces, and discuss their likes and dislikes [CCT]
- communicate their ideas about how familiar products, places and spaces work and have features that help them to be useful such as shoulder straps, zippers and different compartments in a school bag
- sketch or model ideas for a product, place or space and recount how their ideas suit their purpose [CCT, PSC].

7.3 Content for Stage 1

✍ consult

Science and Technology • Stage 1

Skills – Working Scientifically

Outcome
A student:
- investigates their questions and predictions by collecting and recording data, sharing and reflecting on their experiences and comparing what they and others know ST1-4WS

Students question and predict by:
- responding to and posing questions (ACSIS024, ACSIS037)
- making predictions about familiar objects and events and the outcomes of investigations (ACSIS024, ACSIS037, ACSHE021, ACSHE034).

Students plan investigations by:
- identifying the purpose of the investigation
- suggesting some types of activities that need to be undertaken during the processes of Working Scientifically
- suggesting observations that could be made to collect data and/or information about their questions and predictions
- recognising that the results of investigations can inform the processes of Working Technologically.

Students conduct investigations by:
- working cooperatively and individually when participating in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas and accessing information sources, surveys, and field work [PSC] (ACSIS025, ACSIS038)
- using a range of methods to gather data and/or information including using their senses to make observations and, safely and carefully using simple tools and equipment
- using informal measurements in the collection and recording of observations, with the assistance of digital technologies as appropriate [N] (ACSIS026, ACSIS039)
- making and recording observations and measurements honestly, using tally marks and informal units [N, EU].

Students process and analyse data and information by:
- using a range of methods to sort information, including drawings and provided tables, to match objects and events based on easily observable characteristics (ACSIS027, ACSIS040)
- describing changes in objects and events observed in investigations (ASSHE021, ASSHE034)
- comparing observations with those of others to identify similarities and differences in the findings of their investigations (ACSIS213, ACSIS041)
- comparing observations with predictions through discussion, such as whether observations were expected and related to their question and/or predictions [CCT] (ACSIS212, ACSIS214)
- sharing their ideas about the need for safety, care and honesty in observing, recording, displaying and interpreting data and/or information.

Students communicate by:
- representing and communicating observations and ideas using oral and written language, drawing and role-play [L] (ACSIS029, ACSIS042)
- displaying data and information in a variety of ways, including drawings, short text, provided tables and graphs using digital technologies as appropriate [ICT, N]
- sharing what they did and what they could do differently throughout the investigating process [CCT].

Science and Technology • Stage 1

Skills – Working Scientifically

Background information

Progression:

In Stage 1 students continue to use and learn about the processes of Working Scientifically through activities that have been structured by the teacher. They continue to observe and describe, as they did in Early Stage 1, but purposeful play becomes more focussed exploration. They ask different types of questions such as "What will happen if ...".

They recognise sequences of activities that are common to scientific investigations and begin to understand that Working Scientifically includes planning, conducting, processing and reflecting on their findings or experiences. Students begin to understand that scientific investigations are more likely to produce useful results if they are planned and conducted in particular ways. They are introduced to specific types of investigation including exploration, surveys, field work and accessing information sources, in which they manipulate materials and test ideas. Students employ strategies for recording, processing and communicating their observations, findings and ideas, consistent with stage-appropriate understandings in literacy and numeracy. Students begin to recognise findings from scientific investigations and information sources as the basis for accepting ideas.

In Stage 2, students begin to consider scientific information as well as their own prior knowledge in planning investigations. They offer reasons for selecting simple equipment to help make observations and measurements. They identify testable questions that can be investigated using safety and fairness. They begin to consider the relationship between the process undertaken and the evidence gathered in reflecting on their questions, investigations and ideas.

Science and Technology • Stage 1

Skills – Working Technologically

Outcome

A student:

- uses a structured design process, everyday tools, materials, equipment and techniques to produce solutions that respond to identified needs and wants ST1-5WT

Students explore and define the task by:

- identifying needs and wants of users/audiences such as using interviews, observations and surveys [CCT, PSC].

Students generate and develop ideas by:

- researching and exploring different sources of information, including searching the internet
- using techniques for documenting and communicating design ideas, including plans, drawings and making models using familiar materials
- exploring different materials by observing and manipulating them and using trial-and-error [CCT]
- describing the features of design ideas and the materials to be used
- using feedback from others to refine design ideas
- using the results of investigations to develop and refine design ideas.

Students produce solutions by:

- suggesting simple steps for production
- using a range of everyday tools, equipment, materials and techniques to produce solutions
- working cooperatively and safely [PSC].

Students evaluate by:

- explaining the strengths and limitations of what they did and what could have been done differently to improve the solution [CCT]
- identifying how their solution meets the needs of users/audiences [PSC].

Background information

Progression:

In Stage 1 students continue to use and learn about the processes of Working Technologically which have been structured by the teacher. They explore and define a teacher-determined task. In Early Stage 1 students explored the purpose of their designs whereas in Stage 1 'purpose' is more directly related to the needs of users/audiences. Students are introduced to ways of evaluating how well existing solutions meet the needs of users/audiences. They begin to use methods such as drawing and modelling to assist design development and they obtain user feedback to refine their ideas. Whereas in Early Stage 1 students used a process that made little distinction between developing ideas and producing solutions, in Stage 1 students begin to treat production as a discrete phase of the process and suggest steps for producing their solution. They begin to use an expanded range of everyday tools, equipment, materials and techniques for production. They start to systematically reflect on what they have produced and how design and production could be improved.

In Stage 2 students begin to use simple design criteria when developing and using processes of Working Technologically. They begin to develop and apply a sequence of production steps and continue to use a range of tools, equipment, materials and methods to produce their designed solution. Students begin to use methods to evaluate their ideas and solutions in relation to the specific design criteria, and suggest how their design could be adjusted.

Science and Technology • Stage 1

Knowledge and Understanding – Physical World

Outcomes

A student:

- describes some sources of light and sound that they sense in their daily lives ST1-6NE
- describes the effects of pushes and pulls on objects they encounter ST1-7NE

Light and sound are produced by a range of sources and can be sensed (ACSSU020).

Students:

- share their observations and ideas about different sources of light and sound encountered in their daily lives and their senses that detect them
- produce different sounds from familiar objects using actions such as striking, blowing, scraping and shaking
- use their sense of touch to feel vibrations from familiar objects and infer that sound is made when an object vibrates such as vocal chords, a stringed instrument and rubber bands
- explore how the loudness and range of types of sounds are related to the action used to produce them
- compare the range of types of sounds produced by musical instruments used by people from different cultures, such as didgeridoo and sitar [AHC, IU].

A push or a pull affects how an object moves or changes shape (ACSSU033).

Students:

- describe the effects of pushes and pulls on familiar objects, including moving, stopping, changing direction, changing shape or breaking
- explore how different strengths of pushes and pulls affect the movement of objects on land, through water and air
- identify ways that people use pushes and pulls in their everyday life such as sweeping with brooms and riding skateboards [CCT].

Science and Technology • Stage 1

Knowledge and Understanding – Earth and Space

Outcomes

A student:

- describes some observable changes that occur in the sky and landscape ST1-8NE
- identifies ways that people use science in their daily lives to care for the environment and Earth's resources ST1-9NE

Observable changes occur in the sky and landscape (ACSSU019).

Students:

- use a range of methods to describe observable, short term changes in the sky, such as clouds, the appearance of the stars at night and the position of the sun during the day
- observe and record environmental changes that occur over a longer time to identify patterns of events such as seasonal changes in temperature and the appearance of the moon [L]
- identify how the physical features of a landscape can be changed by processes such as weathering, erosion, floods or droughts.

Earth's resources, including water are used in a variety of ways (ACSSU032).

Students:

- identify the sources of some common resources obtained from the Earth such as soil, minerals and water [CCT]
- describe how some materials obtained from the Earth are used in a range of products at home or at school
- describe ways that water is used within the school or at home, identifying actions which could be taken to care for this resource such as turning off dripping taps or taking shorter showers [PSC, SE]
- describe ways in which people use science knowledge and skills in their daily lives to care for the environment and use resources sustainably [CC, CCT] (ACSHE022, ACSHE035).

Science and Technology • Stage 1

Knowledge and Understanding – Living World

Outcomes

A student:

- describes the growth, changes in and external features of living things ST1-10NE
- describes how different places in the environment provide for the needs of living things ST1-11NE

Living things have a variety of external features (ACSSU017).

Students:

- describe some external features of a variety of living things, including plants and animals
- use a range of methods, including fieldwork, to identify plants or animals in their local area
- devise simple classification systems based on the observable external features of plants or animals identified in the local area.

Living things grow, change and have offspring similar to themselves (ACSSU030).

Students*:*

- record the changes in growth of a common plant or animal using informal units, provided tables and digital technologies as appropriate [ICT, N]
- observe and record some of the changes a common plant or animal shows during its life, using appropriate digital technologies such as a camera [ICT, N]
- compare the appearance of adult living things with their offspring such as trees, dogs, cats, ducks, reptiles and humans.

Living things live in different places where their needs are met (ACSSU211).

Students:

- observe the different places in a local land or aquatic environment where living things can be found such as a school yard, pond, beach or bush
- describe how some different places in a local land or aquatic environment provide for the needs of the animals or plants that live there [CCT]
- explore the needs of a plant or an animal in its environment
- describe ways science knowledge and skills help people in their daily lives to care and provide for the needs of living things such as gardeners, farmers and pet carers [CC, EU] (ACSHE022, ACSHE035).

Science and Technology • Stage 1

Knowledge and Understanding – Material World

Outcomes

A student:

- identifies ways everyday materials can be physically changed and combined for a particular purpose ST1-12NM
- relates the properties of common materials to their use for their particular purposes ST1-13NM

Everyday materials can be physically changed in a variety of ways (ACSSU018).

Students:

- explore how some everyday materials can be physically changed by actions such as bending, twisting, stretching, squashing and heating.

Different materials can be combined, including by mixing, for a particular purpose (ACSSU031).

Students:

- predict the changes materials will undergo and compare their observations when the materials are combined such as sugar in water, sand in water; and mixed, such as cake ingredients and different colours of paints
- explore examples of how people at home and work change and combine different materials for a particular purpose such as food preparation and making concrete [CCT].

The different properties of materials enable them to be used for particular purposes.

Students:

- identify the similarities and differences in the properties of materials using their senses such as the textures of different fabrics, the difference in hardness of solid materials and the runniness of different liquids
- identify the properties of some common materials and why they are used for particular purposes, such as the waterproof property of plastic rainwear or insulating property of a woollen jumper [CCT]
- identify a range of natural materials used by Aboriginal and Torres Strait Islanders and share ideas about the ways they are used to suit a particular purpose, such as the use of wood, stone and fibres in the built environment [AHC].

Science and Technology • Stage 1

Knowledge and Understanding – Built Environments

Outcome

A student:

- describes a range of places and spaces in the local environment and how their purposes influence their design ST1-14ME

There is a range of places and spaces in the local environment.

Students:

- observe ways people use, and interact within, a range of places and spaces in their local environment such as areas within the schoolyard and the home [CCT, DD].

The purposes of places and spaces in the local environment influence their design.

Students:

- explore a range of places and spaces in the local environment and describe their different purposes, such as a hospital or playground
- describe how the different purposes of places and spaces in the local environment influence their design, such as storage and cooling areas in a supermarket and enclosures for pets and farm animals [CCT].

Science and Technology • Stage 1

Knowledge and Understanding – Information

Outcome

A student:

- describes a range of familiar information sources and technologies and how their purposes influence their design ST1-15ME

There is a range of information sources and technologies.

Students:

- use a range of information technologies to communicate with others [L, ICT]
- interact with an information source or technology to explore the ways that different forms of information are combined including text, image and sound, such as a website and digital game [ICT, PSC]
- explore the ways Aboriginal and Torres Strait Islanders communicate by story-telling [AHC].

The purposes of information sources and technologies influence their design.

Students:

- interact with a range of familiar information sources and technologies, and identify their purposes such as television programs, websites, digital games, newspapers and magazines [ICT, L]
- describe how the purpose of a specific information source or technology influences its design, such as a website or game [L, PSC].

Science and Technology • Stage 1

Knowledge and Understanding – Products

Outcome

A student:

- describes a range of manufactured products in the local environment and how their different purposes influence their design ST1-16ME

There is a range of manufactured products in the local environment.

Students:

- explore a variety of products in the local environment, such as food products and industrial products
- discuss the purpose and usefulness of familiar applications of science and technology products used in everyday life, such as the use of rechargeable batteries and recycled materials [SE]
- describe a variety of ways in which Aboriginal people have used or continue to use natural materials to make products that meet their needs, such as the use of natural fibres to make woven products [AHC].

The different purposes of products influence their design.

Students:

- identify the purpose of some familiar products and explore the features of their design that make the product work, such as the broad brim on a sun hat or a plastic raincoat
- explore ways in which products may be designed to conserve resources, such as using recyclable materials and reusable containers [SE]
- discuss the strengths and limitations of a specific product, considering the materials from which it is made [CCT].

7.4 Content for Stage 2

✍ consult

Science and Technology • Stage 2

Skills – Working Scientifically

Outcome
A student:
- investigates their questions and predictions by collecting and analysing data, suggesting explanations for their findings, and communicating and reflecting on the processes undertaken ST2-4WS

Students question and predict by:
- using curiosity, prior knowledge, experiences and scientific information with guidance, identifying questions in familiar contexts that can be investigated scientifically (ACSIS053, ACSIS064, ACSHE050, ACSHE061)
- predicting what might happen based on prior knowledge in an investigation (ACSIS053, ACSIS064, ACSHE050, ACSHE061).

Students plan investigations by:
- working collaboratively and individually, to suggest ways to plan and conduct investigations to find answers to questions [WE] (ACSIS054, ACSIS065)
- suggesting appropriate materials, tools and equipment they could use in conducting their investigations and recording their findings, identifying appropriate safety rules
- identifying where Working Scientifically might inform or test elements of Working Technologically in relation to established criteria [CCT].

Students conduct investigations by:
- following the planned method, adjusting procedures as necessary, including exploration, field work, surveys and researching secondary sources
- safely using appropriate materials, tools and equipment, to make and record observations using formal measurements and digital technologies as appropriate [ICT, PSC] (ACSIS055, ACSIS066)
- using a range of methods to record observations and measurements, including tables and formal units for length, time and mass.

Students process and analyse data and information by:
- using a range of methods including tables and simple column graphs to represent data and to identify patterns and trends, using digital technologies as appropriate [ICT] (ACSIS057, ACSIS068)
- sharing their findings and reflecting on the investigation; including whether a test was fair or not (ACSIS058, ACSIS069)
- describing patterns and relationships in data collected from investigations (ACSHE050, ACSHE061)
- comparing results with predictions, suggesting possible reasons for findings [PSC] (ACSIS215, ACSIS216)
- using their ideas and findings to identify what they could find out next through the processes of Working Scientifically and Working Technologically.

Students communicate by:
- representing and communicating ideas and findings in a variety of ways such as diagrams, physical representations and simple reports, tables, simple column graphs, written and oral factual texts, explanation and argument [L, N] (ACSIS060, ACSIS071)
- sharing what they did and found out, including identifying some strengths and limitations of the method they used and what could be done differently to improve their investigation, including fairness as appropriate [CCT].

Science and Technology • Stage 2

Skills – Working Scientifically

Background information

Progression:

In Stage 2 the emphasis on Working Scientifically is producing evidence that can be shared with peers, requiring honesty and accuracy in recording and communicating, as well as evaluation of the process undertaken. Students begin to reflect on the relationship between the process undertaken and their evidence, pondering on such questions as "How sure am I?"

Students continue to use the range of investigation methods encountered in Stage 1 (exploration, surveys, accessing secondary sources and field work). They are introduced to the notion of fairness in investigations. They use data and/or information from secondary sources where necessary, to extend the scope of their investigations. Students make suggestions about the selection of simple tools and equipment to help make observations and measurements more accurately. Students employ additional strategies for recording, processing and communicating their findings, consistent with stage-appropriate understandings in literacy and numeracy. They draw on appropriate digital technologies where relevant, to locate and access data and/or information, to record and process data, and to share and communicate their ideas and understandings.

In Stage 3 students take greater responsibility for planning, including posing testable questions and using fair tests. They refine their use of exploration, field work and data from secondary sources. Students reflect on their evidence in relation to the process used.

Science and Technology • Stage 2

Skills – Working Technologically

Outcome

A student:

- applies a design process and uses a range of tools, equipment, materials and techniques to produce solutions that address specific design criteria ST2-5WT

Students explore and define the task by:

- exploring design situations and/or existing solutions relevant to the needs and wants of themselves and others
- working individually and collaboratively to develop a design brief that identifies simple design criteria relating to requirements that make it useful, attractive and cause minimal impact on the environment [CC, SE].

Students generate and develop ideas by:

- using creative thinking techniques including brainstorming, sketching and modelling [CCT]
- using a range of research techniques to access information relevant to the task
- using techniques for documenting and communicating design ideas, including labelled drawings, modelling, storyboarding and using digital technologies and multimedia for presentations [ICT]
- testing the suitability of materials, considering whether the test was fair or not
- refining ideas in responding to feedback from others [PSC].

Students produce solutions by:

- developing and applying a plan and sequence for production that considers, where relevant, time and resources
- safely and correctly using a range of tools, equipment, materials and techniques, such as cutting, combining, joining, shaping, assembling and finishing materials.

Students evaluate by:

- reflecting on the process followed and what could be done differently to ensure that the solution meets the needs of themselves and others [PSC]
- using established design criteria to evaluate the process and suggesting how their design solution could be adjusted
- reflecting on findings to identify what they could find out next through the processes of Working Technologically and Working Scientifically.

Background information

Progression:

In Stage 2 students begin to develop and use the processes of Working Technologically that identifies simple design criteria. They continue to generate design ideas using creative thinking methods and begin to refine their ideas using established design criteria and feedback provided by others. Students begin to develop and apply a sequence of production steps and identify, select and correctly use a range of tools, equipment, materials and methods to produce their designed solution. They begin to use methods including investigating scientifically to evaluate their ideas and solutions in relation to the specific design criteria and suggest how their design could be adjusted.

In Stage 3 students begin to plan a process of design considering constraints of time, finance, resources and expertise. They use appropriate methods to generate design ideas and begin to apply established criteria to evaluate and modify their design ideas. When producing solutions students follow their own plans and identify, select and correctly use a range of tools, equipment, materials and techniques appropriate for the task.

Science and Technology • Stage 2

Knowledge and Understanding – Physical World

Outcomes

A student:

- identifies ways heat is produced and that heat moves from one object to another ST2-6NE
- describes interactions between objects that result from contact and non-contact forces ST2-7NE

Heat can be produced in many ways and can move from one object to another (ACSSU049).

Students:

- observe some different ways in which heat is produced in the environment such as by friction (motion), electricity and burning (chemical)
- describe the effects of heat moving from one object to another such as the feeling when hands are placed in warm or cold water
- describe how people use scientific knowledge in their work and everyday life to control the movement of heat from one object to another, such as a pot holder, insulated bags or thermos [CCT].

Forces can be exerted by one object on another through direct contact or from a distance (ACSSU076).

Students:

- investigate the effect of forces on the behaviour of objects such as by dropping, bouncing or rolling objects [CCT]
- observe the way gravity pulls objects towards the Earth such as dropping objects from different heights
- observe everyday situations where the direct contact force (friction) affects the movement of objects such as a toy car moving on different surfaces
- carry out tests to investigate the forces of attraction and repulsion between magnets.

Science and Technology • Stage 2

Knowledge and Understanding – Earth and Space

Outcomes

A student:

- describes some observable changes over time on the Earth's surface that result from natural processes and human activity ST2-8NE
- describes some relationships between the sun and the Earth that cause regular changes ST2-9NE

Earth's surface changes over time as a result of natural processes and human activity (ACSSU075).

Students:

- observe and use appropriate tools and equipment to collect and record data, using tables, about some changes in natural conditions such as tides, daily temperature, rainfall and wind [N, L, ICT]
- describe changes in the landscape that have occurred over time as a result of natural processes, such as erosion by wind and water
- research the changes that have occurred in a local land or aquatic environment as a result of human activities such as regeneration of an area, constructing built environments and erosion in Australia or Asian regions [A]
- describe local seasonal changes that occur as a result of the Earth's movement around the Sun
- investigate how Aboriginal and Torres Strait Islander knowledge of change over time in their environment is used to develop seasonal calendars [AHC].

Earth's rotation on its axis causes regular changes, including night and day (ACSSU048).

Students:

- demonstrate that the rotation of the Earth on its axis is the cause of night and day, such as by using models of the Earth and sun
- observe and record changes in the length and direction of a shadow during the day to show how the movement of the Earth around the sun can be used to measure time, such as using a shadow clock or sundial.

Science and Technology • Stage 2

Knowledge and Understanding – Living World

Outcomes

A student:

- describes that living things have life cycles, can be distinguished from non-living things and grouped, based on their observable features ST2-10NE
- identifies that science knowledge helps people understand the effect of their actions on the survival of living things ST2-11NE

Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044).

Students:

- sort objects according to whether they are living or non-living
- identify some features of living things that distinguish them from non-living things, such as reproducing, growing and responding to stimuli
- identify and use patterns in the observable features of living things to group them, such as using tables, diagrams and flowcharts [L, N]
- research ways that Aboriginal or Torres Strait Islanders classify some plants or animals [AHC].

Living things have life cycles (ACSSU072).

Students:

- observe first-hand one animal or plant as they grow and develop, and sequence the stages in their life cycles [L].

Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073).

Students*:*

- identify different habitats within a local environment and how these are used by plants and animals
- outline the relationship between plants and animals noting that plants are able to use light to make food, while to obtain food animals must eat plants or other animals [L]
- gather information about some relationships between living things, such as feeding and the role of insects and birds in plant reproduction [SE, L]
- predict the effect of natural changes in the environment on some relationships between plants and animals, such as drought and fire
- describe how scientific knowledge helps people to understand that the survival of living things and the environment is affected by their everyday actions such as human activity and loss of habitat, pollution by plastics and oil spills [PSC, SE] (ACSHE051, ACSHE062).

Science and Technology • Stage 2

Knowledge and Understanding – Material World

Outcomes

A student:

- identifies that adding or removing heat causes a change of state between solids and liquids ST2-12NM
- identifies the physical properties of natural and processed materials and how these influence their use ST2-13NM

A change of state between solid and liquid can be caused by adding or removing heat (ACSSU046).

Students:

- describe some everyday situations where solids and liquids change state by adding heat (heating) or removing heat (cooling)
- predict and observe the effects of adding heat or removing heat on a variety of everyday solids and/or liquids such as butter, chocolate and water
- describe how science knowledge about the effects of heating and cooling is used by people in their everyday life such as the types of clothes worn, the packaging and preparation of food and everyday devices such as freezers, irons and cook tops.

Natural and processed materials have a range of physical properties which influence their use (ACSSU074).

Students:

- observe the changes that occur in the physical properties of everyday materials when they are heated, cooled, bent, stretched, folded and twisted
- observe and describe the structure of materials that can be seen with the naked eye and a magnifying glass such as grains in bread, particles in chip board or cork, threads within a fabric or fibres in paper
- describe how a range of common natural and processed materials are used in everyday life
- identify the physical properties of some natural and processed materials, and suggest how these properties influence their use [CCT].

Science and Technology • Stage 2

Knowledge and Understanding – Built Environments

Outcome

A student:

- describes how people interact within built environments and the factors considered in their design and construction ST2-14ME

How people interact within built environments.

Students:

- observe how people interact within a place or space and describe how its design meets the needs of the users, such as the ways people use and interact within the schoolyard or local playground [CCT]
- survey a range of places and spaces in local built environments and identify how people interact within them for a range of purposes for social and cultural reasons, such as use of the local hall for a school play or use of local playing fields for sport [DD, IU].

Factors considered when designing and constructing built environments.

Students:

- examine some built environments, such as a local playground, and identify some factors that have been considered in the design such as purpose, access, environmental considerations and movement within the space [PSC, CCT].

Science and Technology • Stage 2

Knowledge and Understanding – Information

Outcome

A student:

- describes ways information solutions are designed and produced, and the factors to consider when people use and interact with sources and technologies ST2-15ME

Designing and producing information solutions.

Students:

- use common digital technologies and applications to organise and communicate information for a specific task, such as word processing and digital presentation software [ICT]
- investigate the effectiveness of an information solution for its intended use, such as a game or animated story book
- demonstrate how a variety of media can be combined to address the needs of a specific audience such as combining visual images, sound and text in a digital presentation [ICT, L, WE].

People interact with information sources and technologies in a variety of ways.

Students:

- interview the users of an information solution and find out how the design has influenced their decisions and opinions such as the design of advertisements [CCT, PSC]
- explore how people use current and emerging technologies to communicate, access and record information such as email, mobile phones, blogs and wikis [ICT].

Factors to consider when using information sources and technologies.

Students:

- demonstrate appropriate etiquette in relation to computer usage such as general computer care, file security, maintaining confidentiality of passwords, printing and sharing resources [PSC, ICT, EU]
- acknowledge ownership of information when selecting and using information such as citing sources [ICT].

Science and Technology • Stage 2

Knowledge and Understanding – Products

Outcome
A student:
- describes how products are designed and produced, and the ways people use them ST2-16ME

The ways products are designed and produced.
Students:
- identify the component parts of a product and explain how the parts are designed to work together such as pedals, cogs and chains work to make bicycle wheels move
- examine the process used to produce an existing product by creating a flowchart from design to producing the finished product [CCT].

The ways people use products.
Students:
- explore the ways existing products can be reused and recycled to incorporate environmental considerations, such as products designed from recycled PET bottles [SE, CCT]
- examine how people use applications of science and technology in their work such as builders, farmers and graphic designers.

7.5 Content for Stage 3

✍ consult

Science and Technology • Stage 3

Skills – Working Scientifically

Outcome
A student:
- investigates by posing questions, including testable questions, making predictions, and gathering data to draw evidence-based conclusions and to develop explanations ST3-4WS

Students question and predict by:
- with guidance, posing questions to clarify practical problems or inform a scientific investigation (ACSIS231, ACSIS232)
- predicting what the findings of an investigation might be (ACSIS231, ACSIS232)
- applying experience from similar situations in the past to predict what might happen in a new situation.

Students plan investigations by:
- with guidance, planning appropriate investigation methods to test predictions, answer questions or solve problems including surveys, field work, research and fair tests (ACSIS086, ACSIS103, ACSHE081, ACSHE098)
- deciding which variable should be changed and measured in fair tests while keeping everything else the same (ACSIS087, ACSIS104)
- collaboratively and individually selecting suitable methods for gathering data and information first-hand and from reliable secondary sources [L].

Students conduct investigations by:
- working individually and collaboratively in conducting a range of appropriate investigation methods including fair tests to answer questions or solve problems
- using suitable equipment and materials, checking observations and measurements by repeating them where appropriate
- using equipment and materials safely, identifying potential risks (ACSIS088, ACSIS105)
- accurately observing, measuring and recording data using digital technologies as appropriate [ICT] (ACSIS087, ACSIS104)
- using formal units and abbreviations for measuring and recording data [N]
- suggesting improvements to the methods used to investigate a question or solve a problem (ACSIS091, ACSIS108).

Students process and analyse data and information by:
- constructing and using a range of representations including tables and graphs, (column, picture graphs, line graphs, divided bar graphs) and labelled diagrams
- using numerical techniques to analyse data and information, including calculating the means and percentages of small sets of data [N]
- drawing conclusions and explanations based on data and information gathered first-hand or from secondary sources
- comparing gathered data with predictions and use as evidence in developing explanations of events and phenomena (ACSIS218, ACSIS221, ACSHE081, ACSHE098)
- reflecting on their gathered evidence in relation to:
  - the process used to gather, process and analyse their data and information
  - their own prior knowledge as well as accepted scientific explanations
  - their own and others' conclusions [CCT].

Science and Technology • Stage 3

Skills – Working Scientifically

Students communicate by:

- constructing and using a range of representations, including tables and graphs to represent and describe observations, patterns or relationships in data including using digital technologies as appropriate [N, ICT, L] (ACSIS090, ACSIS107)
- using a variety of ways to communicate ideas, explanations and processes, including multimodal texts, labelled diagrams, as well as written and oral factual texts as appropriate [L, N] (ACSIS093, ACSIS110).

Background information

Progression:

In Stage 3 students understand the importance of undertaking scientific investigations honestly and accurately to develop shared evidence-based understandings. They further develop their understanding of the relationship between evidence and the process undertaken, reflecting on their evidence in relation to the process used. Students are more self-reliant in asking questions and in planning and conducting their investigations. They pose testable questions relating to simple cause-and-effect relationships and consider fairness and ways to check observations and measurements. They bring a greater understanding of scientific explanations to their work. Students select and refine their application of the investigation methods encountered in previous stages, by considering data and information from secondary sources, comparing field observations made at different sites or times and using systematic approaches to exploration. Students employ additional methods for recording, processing and communicating their findings, consistent with their stage-appropriate progression in literacy and numeracy including using introductory scientific language and graphical representations. They select and use digital technologies where relevant to gather, organise, process and communicate information and/or data from a variety of sources for identified purposes and audiences.

In Stage 4 there is an emphasis on planning and conducting investigations in which variables are controlled (fair tests). The terms independent and dependent variables are introduced. Students move into specialised school laboratory environments and learn to use laboratory equipment safely and effectively. They refine their skills in planning and conducting investigations, processing data and/or information and communicating findings. They further develop skills in critical thinking, problem-solving and the use of creativity and imagination in investigating scientifically.

Science and Technology • Stage 3

Skills – Working Technologically

Outcome

A student:

- plans and implements a design process selecting a range of tools, equipment, materials and techniques to produce solutions that consider constraints ST3-5WT

Students explore and define the task by:

- exploring needs or opportunities for the task
- identifying the users' needs and wants using techniques such as observations, surveys, interviews and market research
- developing a design brief in collaboration with others
- developing design criteria that considers, where relevant, function, aesthetics, social and environmental considerations [CCT, SE]
- planning the process considering constraints where relevant, such as time, finance, resources and expertise.

Students generate and develop ideas by:

- selecting and using creative thinking techniques including mind-mapping, brainstorming, sketching and modelling [CCT]
- selecting and using research techniques appropriate to the task
- selecting and using techniques for documenting and communicating design ideas to others such as drawings, plans, storyboarding, modelling and presentations using digital technologies [ICT, L]
- selecting and using techniques to investigate the suitability of materials [CCT]
- applying established criteria to evaluate and modify ideas.

Students produce solutions by:

- developing a plan and specifications to guide production
- using their plans and production sequence to produce solutions
- for a design project, selecting and safely using a range of tools, equipment and related techniques to cut, edit, join, manipulate and shape materials and/or information.

Students evaluate by:

- identifying the strengths and limitations of the process used [CCT]
- self or peer assessing the final product by using the established design criteria.

Background information

Progression:

In Stage 3 students continue to implement a process of design and begin to plan this process considering constraints of time, finance, resources and expertise. They select appropriate methods to generate ideas and apply established criteria to evaluate and modify their ideas. Students continue to use communication techniques to present ideas to others and begin to prepare documentation using plans and specifications. They produce their solutions following their own plans and select and use a range of tools, equipment, materials and techniques appropriate for the task. Students continue to evaluate, throughout the process of designing and producing, using their established criteria and constraints.

In Stage 4 students are able to apply design processes that reflect an understanding of needs and opportunities. They continue to research and extract information from a variety of sources and begin to use experiments and tests to enhance the development of a design project. They move into specialised school technology workshops/environments and learn to safely and responsibly apply a broad range of contemporary and appropriate tools, materials and techniques in the development of design projects. They further develop their skills in managing their own time by sequencing processes of designing, producing and evaluating.

Science and Technology • Stage 3

Knowledge and Understanding – Physical World

Outcomes

A student:

- describes how people use scientific understanding about the sources, transfer and transformation of electricity in making decisions about its use ST3-6NE
- identifies that scientific knowledge about the transfer of light is used to solve problems that directly affect people's lives ST3-7NE

Electrical circuits provide a means of transferring and transforming electricity (ACSSU097).
Students:

- identify potential risks and demonstrate safe use when using electrical circuits and devices
- demonstrate the need for a circuit to be complete to allow the transfer (flow) of electricity
- construct simple circuits incorporating devices such as switches and light globes
- observe and describe how some devices transform (change) electricity to heat energy, light, sound or movement such as hair dryers, light bulbs, bells and fans [L].

Energy from a variety of sources can be used to generate electricity and this knowledge can inform personal and community-based decisions (ACSSU219).
Students:

- research and present ideas about the different ways electricity can be generated such as solar, hydroelectricity, geothermal and wave-generated electricity [L]
- discuss how scientific knowledge about sources of energy can be used to inform personal and community decisions about the use and conservation of sustainable sources of energy [SE, PSC] (ACSHE217, ACSHE220).

Light from a source forms shadows and can be absorbed, reflected and refracted (ACSSU080).
Students:

- classify materials as transparent, opaque or translucent, based on whether light passes through them, is absorbed, scattered or reflected
- gather evidence to support their predictions about how light travels and is reflected
- observe and describe how the absorption of light by materials and objects forms shadows, such as a puppet show
- research using secondary sources to gather information about discoveries and inventions that depend on the refraction of light and how these solve problems that directly affect people's lives, such as magnifiers, spectacles, mirrors, prisms [CCT] (ACSHE083, ACSHE100).

Science and Technology • Stage 3

Knowledge and Understanding – Earth and Space

Outcomes

A student:

- describes how discoveries by people from different cultures and times have contributed to advancing scientific understanding of the solar system ST3-8NE
- identifies that evidence provided by advances in technology and scientific understanding can be used to explain rapid change at the Earth's surface caused by natural events ST3-9NE

The Earth is part of a system of planets orbiting around a star (the sun) (ACSSU078).

Students:

- research the key features of the planets of the solar system and compare how long each takes to orbit the sun
- demonstrate using models that the Earth revolves around the sun and the moon revolves around the Earth
- research the important contributions made by people from a range of cultures and organisations, using technologies of the time, to advancing scientific understanding of the solar system such as Aryabhata, Copernicus, Galileo, CSIRO and NASA [CC, CCT, IU] (ACSHE082, ACSHE099)
- describe how Aboriginal and Torres Strait Islander people use observations of the night sky to inform decisions about some everyday activities, such as food gathering and ceremonies [AHC].

Sudden geological changes or extreme weather conditions can affect Earth's surface (ACSSU096).

Students:

- describe using examples how natural events cause rapid changes to the Earth's surface such as earthquakes, volcanic eruptions or tsunamis in Asia and cyclones, droughts**,** bushfires or floods in Australia [A]
- research how some discoveries and inventions have increased scientific knowledge and provided evidence about natural events that cause rapid changes at the Earth's surface such as seismographs [L]
- identify ways that advances in science and technology have assisted people to plan for and manage natural disasters, such as detection systems for tsunamis, floods and bushfires [SE].

Science and Technology • Stage 3

Knowledge and Understanding – Living World

Outcomes

A student:

- describes how structural features and other adaptations of living things help them to survive in their environment ST3-10NE
- describes the physical conditions of their environment that affect the growth and survival of living things ST3-11NE

The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094).

Students:

- identify some physical conditions of a local environment such as temperature, slope, wind speed, amount of light and water
- make predictions about how changing the physical conditions of their environment impacts on the growth and survival of living things, such as temperature or amount of water on a plant, yeast or bread mould [CCT, PSC]
- use gathered data to develop explanations about how changing the physical conditions of their environment affects the growth of living things [L, N]
- research the physical conditions needed for a particular plant to grow in a certain area, such as a plant for a garden or bananas in the tropics [L].

Living things have structural features and adaptations that help them to survive in their environment (ACSSU043).

Students:

- observe and describe the structural features of some native Australian animals and plants [SE]
- present ideas and explanations about how the structural features and behaviour of some living things help them to survive in their environment, such as shiny surfaces of leaves on sand dune plants and nocturnal behaviour in some animals [L, CCT].

Science and Technology • Stage 3

Knowledge and Understanding – Material World

Outcomes

A student:

- identifies the observable properties of solids, liquids and gases, and that changes made to materials are reversible or irreversible ST3-12NM
- describes how the properties of materials determine their use for specific purposes ST3-13NM

Solids, liquids and gases have different observable properties and behave in different ways (ACSSU077).

Students:

- observe and compare the differences in the properties and behaviour of solids and liquids, such as a definite shape and the ability to flow
- demonstrate that air has mass and takes up space such as in an inflated basketball, bubbles, balloons and beaten egg white
- research the benefits of using solid, liquid and gaseous fuels for heating [CCT, SE].

Changes to materials can be reversible, such as melting, freezing and evaporating or irreversible, such as burning and rusting (ACSSU095).

Students:

- observe and describe some readily observable reversible changes that materials can undergo such as melting and then solidifying chocolate in moulds, dissolving and retrieving salt from water
- make and test predictions about the effect of temperature on the state of some substances such as adding and removing heat from water
- observe some irreversible changes that common materials undergo and identify that the changes may result in new materials or products such as rusting iron, burning paper, cooking a cake and making toffee.

The properties of materials determine their use for specific purposes.

Students:

- relate the properties of materials used in a familiar product to its use
- explore how materials are used in innovative ways for specific purposes such as the use of soft fall materials in playgrounds and geotextiles to retain water in landscaping
- discuss how scientific and technological knowledge about the properties of materials can be used to inform decisions about use for their specific purposes [CCT].

Science and Technology • Stage 3

Knowledge and Understanding – Built Environments

Outcome

A student:

- describes systems in built environments and the social and environmental factors that influence their design ST3-14ME

Systems in built environments are designed to meet the needs of people.

Students:

- identify elements that work together as a system to serve and support built environments and how they are designed to meet the needs of people, such as transport systems that provide access for people to get to work or systems that provide electricity to people [CCT]
- draw a plan of, or model a built environment that includes a range of systems to meet the needs and wants of a specific group of users.

Social and environmental factors influence the design of built environments.

Students:

- consider changes in the design or use of places and spaces over time and the factors that have influenced these changes, such as changes in the design and use of a library due to technological developments or the design of buildings after an earthquake [CCT, EU, CC]
- brainstorm ideas about how built environments might be designed and constructed in the future to incorporate sustainable environmental practices, such as the use of recycled materials, natural lighting and solar energy [CCT, EU, PSC].

Science and Technology • Stage 3

Knowledge and Understanding – Information

Outcome
A student:
- describes information and communication systems and how social influences impact on their design and use ST3-15ME

Systems can be used to transfer information and support communication.
Students:
- explore how information and communication systems can be used to exchange ideas, collaborate with others, organise and present data such as a database, spreadsheet, communication systems and multimedia designs [ICT]
- communicate with others in different social and/or cultural contexts when designing an information solution, such as being a member of a collaborative online learning community [L].

Social influences can impact on the design of information.
Students:
- demonstrate appropriate and responsible use of information sources and technologies considering, where relevant, different points of view and/or stereotyping [WE, EU]
- explore a range of emerging information technologies and the ways communicating with others have changed, such as the use of video-conferencing, blogs and wikis [ICT]
- discuss issues of safety and privacy of personal information when communicating, selecting and using information sources and technologies [L].

Science and Technology • Stage 3

Knowledge and Understanding – Products

Outcome

A student:

- describes systems used to produce or manufacture products, and the social and environmental influences on product design ST3-16ME

Systems are used to produce or manufacture products.

Students:

- investigate a system to produce or manufacture a product, such as using an assembly line to produce a food product for sale in the school canteen, or the use of robotics in manufacturing a product [CCT]
- compare the production process in a domestic setting to mass production, such as baking bread in the home to making it in a bakery.

Social and environmental factors can influence the design of products.

Students:

- research the environmental impact of an everyday product from its production through its use and disposal, such as a PET bottle, a car or newspaper [L, EU, SE]
- redesign a product to respond to a specific social or environmental consequence, such as redesign the packaging of a food product to reduce garbage [CCT, SE].

10 Assessment

10.1 Standards

The Board of Studies *K–10 Curriculum Framework* is a standards-referenced framework that describes, through syllabuses and other documents, the expected learning outcomes for students.

Standards in the framework consist of two interrelated elements:

- outcomes and content in syllabuses showing what is to be learned
- descriptions of levels of achievement of that learning.

Exemplar tasks and student work samples help to elaborate standards.

Syllabus outcomes in Science and Technology contribute to a developmental sequence in which students are challenged to acquire new knowledge, understanding and skills.

The standards are typically written for two years of schooling and set high, but realistic, expectations of the quality of learning to be achieved by the end of Years 2, 4, 6, 8 and 10.

Using standards to improve learning

Teachers use standards in Science and Technology as a reference point for planning teaching and learning programs, as well as for assessing and reporting student progress. Standards in Science and Technology help teachers and students to set targets, monitor achievement, and as a result, make changes to programs and strategies to support and improve each student's progress.

10.2 Assessment for learning

Assessment for learning is designed to enhance teaching and improve student learning. It gives students opportunities to produce work that leads to development of their knowledge, understanding and skills. Teachers decide how and when to assess student achievement, as they plan the work students will do, using a range of appropriate assessment strategies including self-assessment and peer assessment.

Teachers of Science and Technology provide students with opportunities in the context of everyday classroom activities, as well as planned assessment events, to demonstrate their learning.

In summary, *assessment for learning*:

- is an essential and integrated part of teaching and learning
- reflects a belief that all students can improve
- involves setting learning goals with students to encourage growth and development
- involves students in self-assessment and peer assessment
- provides feedback that helps students understand the next steps in learning and plan how to achieve them
- involves teachers, students and parents reflecting on assessment data.

Quality assessment practices

Effective assessment for learning informs teachers and students about past, present and future learning. The quality of assessment practices and materials can be judged using the following *assessment for learning* principles. The following *assessment for learning* principles provide the criteria for judging the quality of assessment materials and practices.

Assessment for learning principles

Assessment for learning:

- promotes learning by emphasising the interactions between learning and manageable assessment strategies
  - teachers reflect on the purposes of assessment and on their assessment strategies
  - assessment activities allow for demonstration of learning outcomes
  - assessment is embedded in learning activities and informs the planning of future learning activities
  - teachers use assessment to identify what a student can already do
- clearly expresses the goals of the learning activity
  - students know and understand the learning goals and the criteria that will be applied to judge the quality of their achievement
  - students receive feedback that helps them make further progress
- helps students learn better, rather than just achieve a better mark
  - assessment is an integral component of the teaching–learning process rather than a separate activity
  - teachers design and select tasks that assess, and therefore encourage, deeper learning
  - feedback motivates the learner and helps students to understand that engagement with feedback can lead to improvement
- provides meaningful and constructive feedback
  - feedback is directed to the achievement of standards and away from comparisons with peers
  - feedback is clear about strengths and areas for further development
  - feedback is individualised and provides strategies for improvement
- encourages students to take responsibility for their own learning
  - assessment includes strategies for self-assessment and peer assessment, emphasising the next steps needed for further learning
- is inclusive of all learners
  - assessment against standards provides opportunities for the diverse range of learners to achieve their best
  - assessment activities are accessible and free of bias.

10.3 Assessment for students with special education needs

Some students with special education needs will require adjustments to assessment practices in order to demonstrate what they know and can do in relation to syllabus outcomes and content. These may be:

- adjustments to the assessment process, for example additional time, rest breaks, quieter conditions, or the use of a reader and/or scribe or specific technology
- adjustments to assessment tasks, for example rephrasing questions, using simplified language, fewer questions or alternative formats for questions
- alternative formats for responses, for example written point form instead of essays, scaffolded structured responses, short objective questions, multimedia presentations.

Further examples of adjustments to assessment for students with special education needs can be found in the Science and Technology support material.

10.4 Reporting

Reporting is the process of providing feedback to students, parents and other teachers about student progress.

Teachers use assessment evidence to extend the process of *assessment for learning* into their *assessment of learning*. In a standards-referenced framework teachers make professional judgements about student achievement at key points in the learning cycle. These points may be at the end of a year or stage, when schools may wish to report differentially on the levels of knowledge, understanding and skills demonstrated by students.

Descriptions of student achievement in Science and Technology provide schools with a useful tool to report consistent information about student achievement to students and parents, and to the next teacher to help plan the next steps in the learning process.

The A–E grade scale or equivalent provides a common language for reporting by describing observable and measurable features of student achievement at the end of a stage, within the indicative hours of study. Teachers use the descriptions of the standards to make a professional, on-balance judgement, based on available assessment information, to match each student's achievement to a description. The Common Grade Scale (A–E) or equivalent is used by teachers to report student levels of achievement from Stages 1 to 5.

The values and attitudes objectives and outcomes are an integral part of learning and an important element of any course. Schools may decide to report on them separately to students and parents such as using some form of descriptive statement. Measures of objectives and outcomes that address values and attitudes are not used in determining a student's grade.

For students with special education needs, teachers may need to consider, in consultation with their school and sector, the most appropriate method of reporting student achievement. It may be deemed more appropriate for students with special education needs to be reported against outcomes or goals identified through the collaborative curriculum planning process.

10.5 Choosing assessment strategies

The range of assessment strategies should gather information about the depth of students' understanding, the development of skills, as well as the extent of content knowledge. Assessment strategies should allow for flexibility in the design of tasks.

A collaborative approach to assessment develops a shared understanding of syllabus standards and helps teachers make consistent judgements of evidence of student achievement.

When choosing assessment strategies, teachers should consider whether the tasks:

- ensure a variety of types of task that cater for the full range of students
- show a clear relationship between the outcomes, what has been taught and the content being assessed
- inform students about the nature of the task and marking guidelines
- demonstrate validity and reliability, and are free from prejudice, discrimination and stereotyping
- provide constructive feedback about what students are able to do and what they need to do in order to improve their level of performance
- allow opportunities for self-assessment and peer assessment.

Further advice about choosing assessment strategies will be provided in support materials.

Science
7–10

2 Rationale

ⓘ for your information

The rationale describes the distinctive nature of the subject and outlines its relationship to the contemporary world and current practice. It explains the place and purpose of the subject in the curriculum and how Science contributes to the achievement of the broad learning outcomes of the *K–10 Curriculum Framework.*

✍ consult

Science provides an empirical way of answering interesting and important questions about the biological, physical and technological world. Scientific knowledge is contestable and is revised, refined and extended as new evidence arises or existing evidence is re-conceptualised. The study of science is a collaborative, creative endeavour and has led to a dynamic body of knowledge organised as an interrelated set of models, theories, laws, systems, structures and interactions. It is through this body of knowledge that science provides explanations for a variety of phenomena and enables sense to be made of the natural world.

As students actively engage in the processes of Working Scientifically, they gain an increased appreciation and understanding of the importance of science in their own lives and society, locally and globally. Through questioning and seeking solutions to problems, students develop an understanding of the relationships between science and technology and its importance in the current and future practice of science.

Through applying the processes of Working Scientifically, students use scientific inquiry to develop their understanding of science ideas and concepts, as well as the importance of scientific evidence. They demonstrate honesty, ethical principles and respect for differing viewpoints on scientific issues. By engaging in scientific inquiry, students develop a deeper appreciation of the unique nature and development of science as an evolving body of knowledge, of the provisional nature of scientific explanations and of the complex relationship between evidence and ideas.

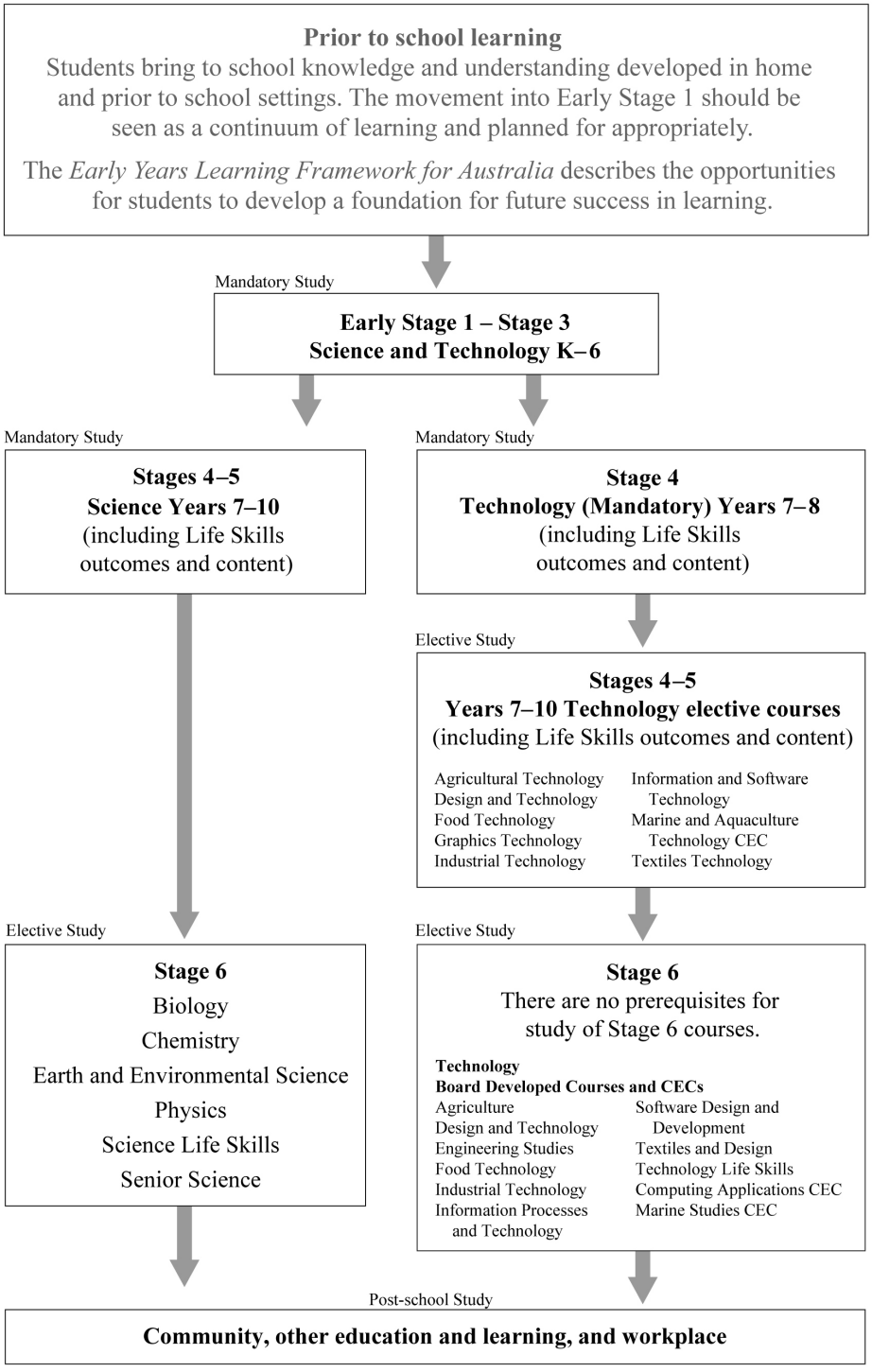
The study of science enables students to develop a positive self-concept as learners, and gain confidence in and enjoyment from their learning. Through active participation in challenging and engaging experiences they become self-motivated, independent learners. Their understanding of science and its social and cultural contexts provides a basis for students to make reasoned evidence-based future choices and ethical decisions and to engage in finding innovative solutions to science-related personal, social and global issues, including sustainable futures.

3 The place of the Science K–10 Syllabus (incorporating Science and Technology K–6) in the K–12 curriculum

ⓘ for your information

This section of the syllabus demonstrates the relationship between the K–10 syllabus and other associated courses. It shows the possible pathways of learning in the learning area.

✍ consult



4 Aim

ⓘ for your information

The aim provides a succinct statement of the overall purpose of the syllabus. It indicates the general educational benefits for students from programs based on the syllabus.

✍ consult

The aim of the *Science Years 7–10 Syllabus* is to develop students':

- interest in and enthusiasm for science, as well as an appreciation of its role in finding solutions to science-related problems and issues relevant to their lives
- knowledge and understanding of the nature and practice of scientific inquiry, and skills in applying the processes of Working Scientifically
- scientific knowledge of and about phenomena within the natural world and the application of their understanding to new situations and events
- appreciation of the development and dynamic nature of scientific knowledge, its influence in improving understanding of the natural world and the contribution of evidence-based decisions in informing societies' use of science and technology.

5 Objectives

ⓘ for your information

Objectives provide specific statements of the intention of a syllabus and amplify its aims. They act as organisers for the intended outcomes and define, in broad terms, the knowledge, understanding, skills, values and attitudes to be developed through study in the subject.

Objectives are organised under the areas of:

- values and attitudes
- knowledge, understanding and skills.

✍ consult

Values and attitudes

Students:

- develop an appreciation of the contribution of science to finding solutions to personal, social and global issues relevant to their lives
- develop a willingness to use evidence and reason to engage with and respond to scientific and technological ideas as informed, reflective citizens.

Knowledge, understanding and skills

Students:

- develop knowledge, understanding of and skills in applying the processes of Working Scientifically
- develop knowledge and understanding of and about Physical World, Earth and Space, Living World and Chemical World.

6 Outcomes

ⓘ for your information

Syllabus outcomes provide detail about what students are expected to achieve at the end of each stage in relation to the objectives. They indicate the knowledge, understanding and skills, expected to be gained by most students as a result of effective teaching and learning by the end of a stage. They are derived from the objectives of the syllabus.

Values and attitudes outcomes have been developed for the stages of learning.

✍ consult

Stages 4 and 5

Table of objectives and outcomes

Values and Attitudes

<table>
<tr><td colspan="2">Objectives
Students:
• develop an appreciation of the contribution of science to finding solutions to personal, social and global issues relevant to their lives
• develop a willingness to use evidence and reason to engage with and respond to scientific and technological ideas as informed, reflective citizens</td></tr>
<tr><td>Stage 4 outcomes
A student:</td><td>Stage 5 outcomes
A student:</td></tr>
<tr><td colspan="2">SC4-1VA, SC5-1VA
appreciates the importance of science in their lives and the role of scientific inquiry in increasing understanding of the world around them

SC4-2VA, SC5-2VA
shows a willingness to engage in finding solutions to science-related personal, social and global issues, including shaping sustainable futures

SC4-3VA, SC5-3VA
demonstrates confidence in making reasoned, evidence-based decisions about the current and future use and influence of science and technology, including ethical considerations</td></tr>
</table>

Skills

Objective Students: • develop knowledge, understanding of and skills in applying the processes of Working Scientifically	
Stage 4 outcomes A student:	**Stage 5 outcomes** A student:
SC4-4WS identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge	SC5-4WS develops questions or hypotheses to be investigated scientifically
SC4-5WS collaboratively and individually produces a plan to investigate questions and problems	SC5-5WS produces a plan to investigate an identified question, hypothesis or problem
SC4-6WS follows a sequence of instructions to safely undertake a range of types of investigations, individually and collaboratively	SC5-6WS undertakes a first-hand investigation to collect valid and reliable data and information individually and collaboratively
SC4-7WS processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns, relationships and draw conclusions	SC5-7WS processes, analyses and evaluates data from a first-hand investigation or secondary sources
SC4-8WS selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to an identified problem	SC5-8WS applies scientific understanding and critical thinking skills to suggest possible solutions to an identified problem
SC4-9WS presents ideas, findings and information to a given audience using appropriate scientific language, representations and text types	SC5-9WS presents ideas and evidence for a specific purpose and audience, using appropriate scientific language, conventions and representations

Knowledge and understanding

Objective Students: • develop knowledge and understanding of and about Physical World, Earth and Space, Living World and Chemical World	
Stage 4 outcomes A student:	**Stage 5 outcomes** A student:
SC4-10KU describes the action of forces in everyday situations SC4-11KU discusses how scientific knowledge and technological developments have contributed to finding solutions to problems involving energy transfers and transformations	SC5-10KU applies models, theories and laws to explain situations involving energy, force and motion SC5-11KU explains how science understanding about energy conservation, transfers and transformations is applied in systems
SC4-12KU describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system SC4-13KU explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource management practices	SC5-12KU describes changing ideas about the structure of the Earth and the universe to illustrate how models, theories and laws are refined over time by the scientific community SC5-13KU explains how scientific knowledge about global patterns of geological activity and interactions involving global systems can be used to inform decisions related to contemporary issues
SC4-14KU relates the structure and function of living things to their classification, survival and reproduction SC4-15KU explains the contribution of scientific understanding and technological advances in finding solutions to contemporary issues	SC5-14KU analyses interactions between components and processes within biological systems SC5-15KU explains how scientific understanding has advanced through scientific discoveries, technological developments and needs of society
SC4-16KU describes the observed properties and behaviour of matter using scientific models and theories about the motion and arrangement of particles SC4-17KU explains how scientific understanding of, and discoveries about the properties of elements, compounds and mixtures relate to their uses in everyday life	SC5-16KU explains how models, theories and laws about matter have been refined as new scientific evidence becomes available SC5-17KU discusses the importance of chemical reactions in the production of a range of substances, and the influence of society on the development of new materials

Years 7–10 Life Skills outcomes

For some students with special education needs, particularly those students with an intellectual disability, it may be determined that the Stage 4 and 5 outcomes and content are not appropriate. For these students, Life Skills outcomes and content can provide a relevant and meaningful program. Refer to section 1 for further information about curriculum options for students with special education needs. Years 7–10 Life Skills outcomes and content are in section 8.

7 Content

7.1 Organisation of content

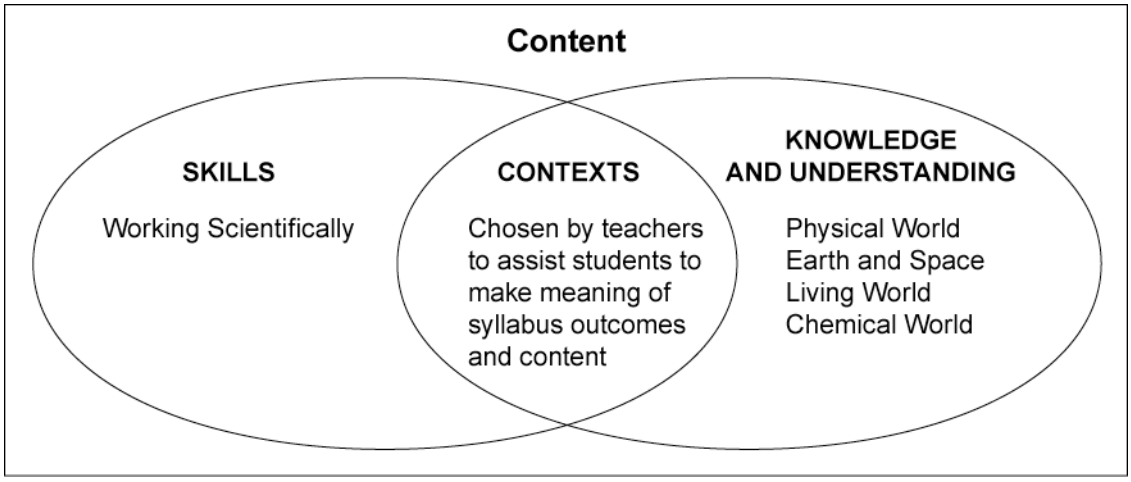
ⓘ for your information

Content specifies the expected learning for students as they work to achieve the outcomes, and describes the subject matter that is to be studied. Syllabus content reflects a balance between the acquisition of knowledge and the specific processes of learning in Science so that students are encouraged to engage in, take responsibility for, and continue their own learning.

The knowledge, understanding and skills described provide a sound basis for students to successfully move to the next stage of learning. Teachers will make decisions about the sequence of learning and the emphasis to be given to particular content, based on the needs of their students.

✍ consult

The *Science Years 7–10 Syllabus* content is organised by strands in relation to the syllabus knowledge, understanding and skills objectives and outcomes.



The content specifies key scientific understanding and clarifies the scope and depth of the essential knowledge, understanding and skills students are expected to demonstrate by the end of a stage. It provides a basis for students to reach the standards described in the outcomes by the end of the stage and as such to allow them to successfully transition to the next stage of learning.

The Working Scientifically strand specifies the skills content. Students develop their scientific understanding about the natural world and the unique nature of the discipline through using and applying the processes of Working Scientifically. Students develop skills in applying the processes of Working Scientifically through regular, active participation in a range of collaborative and individual hands-on practical experiences.

The knowledge and understanding content strands are Physical World, Earth and Space, Living World, and Chemical World. These strands build on the Natural Environment substrands of the K–6 Science and Technology syllabus. The Material World substrand in K–6 Science and Technology provides the foundation for Chemical World.

Each knowledge and understanding strand specifies essential content about scientific concepts, principles, models, theories and laws relevant to each discipline that is integrated with content that increases students' understanding of the nature, development, use and influence of science.

In order to provide for continuity of student learning and coverage of essential elements of the syllabus, programs should:

- incorporate all stage content over the two years of the stage
- integrate into each unit of work, content from across the knowledge and understanding strands with skills content
- include using and applying the processes of Working Scientifically in a range of types of hands-on practical experiences in each year
- ensure that at least 50% of the allocated course time includes hands-on practical experiences
- include at least one substantial student research project in each of Stage 4 and Stage 5
- present units of work in contexts that are selected on the basis of their relevance to students' learning needs and experiences. In selecting the contexts, consideration is to be given to factors such as local issues, resources and students' interests, learning history and cultural backgrounds.

Content strands

In the *Science Years 7–10 Syllabus* content is organised by strands in relation to the skills, and knowledge and understanding objectives and outcomes.

Skills

Students further develop their skills by actively engaging in using and applying the processes of Working Scientifically when undertaking a range of types of practical experiences, including a Student Research Project in each stage.

Through applying the processes of Working Scientifically, students use scientific inquiry to develop their understanding of science ideas and concepts, the unique nature of science as a discipline and the importance of scientific evidence in making informed decisions about the use of science and technology. In each unit of work the processes of Working Scientifically are at the centre of teaching and learning.

The Working Scientifically strand involves students in the processes of:

Questioning and predicting

- identifying and constructing questions
- proposing hypotheses
- making predictions about possible outcomes.

Planning investigations

- working individually and collaboratively to plan and organise activities
- using time and resources effectively
- establishing priorities between tasks
- selecting appropriate methods, materials, specimens and equipment to complete activities
- identifying ways of reducing risks and addressing ethical guidelines in the laboratory and in the field.

Conducting investigations

- working individually and collaboratively to locate and gather information from a variety of sources for a planned investigation
- increasing students' skills in performing first-hand investigations
- gathering first-hand data and information
- assessing risks and addressing ethical issues in using equipment, materials and chemicals safely
- accessing and collecting information from secondary sources using appropriately a variety of digital technologies.

Processing and analysing data and information

- organising data and information to explain trends, patterns and relationships
- using critical thinking skills to analyse data and information, make predictions and evaluate evidence
- representing data and information in meaningful ways
- evaluating the quality of data, information, processes and evidence
- using evidence to draw and justify conclusions.

Problem-solving

- identifying issues and problems
- framing possible problem-solving processes
- using creative thinking to develop ideas and possibilities that are new and applying them in different and new situations
- devising appropriate strategies to deal with issues and working through them in a logical and coherent way.

Communicating

- conveying information, ideas and findings of investigations to others through appropriate representations and digital technologies
- representing data and information in multimodal text
- presenting information and ideas using appropriate scientific language and text types.

Practical experiences

The practical experiences including the Student Research Project provides opportunities for students to engage in scientific inquiry during the course of their learning. Through applying the processes of Working Scientifically students use scientific inquiry to develop their understanding of science ideas and concepts and the importance of scientific evidence-based conclusions.

Practical experiences should emphasise hands-on activities and include:

- undertaking laboratory investigations, including fair tests and controlled experiments
- undertaking fieldwork and surveys
- researching by using a variety of print and multimedia, internet and electronic sources of data and information
- using a range of strategies and technologies to collect and record data, including appropriate use of digital technologies such as data loggers
- using and constructing models
- using or reorganising second-hand data, including those in spreadsheets and databases
- extracting information and reorganising information in the form of flow charts, tables, graphs, diagrams, prose, keys, spreadsheets and databases
- using digital technologies such as computer animations and simulations to capture and analyse data and information
- presenting data and information in multimodal text.

Student research project

Class time should be allocated to assist students in clarifying their question or problem to be investigated, developing hypotheses, identifying variables to be controlled, measured or changed in fair tests, planning their investigations, carrying out research, evaluating evidence and conclusions, and communicating results, findings and explanations to others.

All students are required to undertake **at least one** substantial research project during each of Stage 4 and Stage 5.

- At least one project will involve hands-on practical investigation.
- At least one Stage 5 project will be an individual task.

Students should choose investigations related to one of the topics they have studied or to an area of interest. They should be encouraged to address problems relevant to their immediate

environment and use readily available materials to undertake their investigation. Apart from the mandatory Stage 5 individual project, projects may involve collaboration with peers.

The Student Research Project can be used as an assessment of learning strategy to inform future teaching. It may also form part of the assessment for learning in the school-based assessment program.

Note

In developing and delivering teaching programs teachers should be aware of, and adopt, relevant guidelines and directives of their education authorities and/or schools. Teaching programs should recognise and reflect relevant State and Commonwealth legislation, regulations and standards including **Occupational Health and Safety Standards, Chemical Safety in Schools and Animal Welfare guidelines**. Teachers need to be aware of activities that may require notification, certification, permission, permits and licences.

Knowledge and understanding

In the knowledge and understanding strands, content about scientific concepts, principles, models, theories and laws relevant to each discipline is integrated with content related to the nature, development, use and influence of science. The integrated units of work developed in each stage should draw on content from the processes of Working Scientifically and knowledge and understanding content from across the knowledge and understanding strands.

The knowledge and understanding content is organised into four strands:

Physical World

Throughout the Physical World the strand is concerned with understanding the nature of forces and motion, and matter and energy. The two key concepts developed within this strand are that forces affect the motion and behaviour of objects and that energy can be transferred and transformed from one form to another. Through this strand students gain an understanding of how the concepts of force, motion, matter and energy apply to systems ranging in scale from atoms to the universe itself.

Earth and Space

The Earth and Space strand is concerned with Earth's dynamic structure and its place in the cosmos. The key concepts developed within this strand are that Earth is part of a solar system that is part of a larger universe and Earth is subject to change within and on its surface, over a range of timescales, as a result of natural processes. Students explore the ways in which humans use resources from the Earth and appreciate the influence of human activity on the surface of the Earth and the atmosphere.

Living World

The Living World strand is concerned with understanding living things. The key concepts developed within this strand are that the cell is the basic unit of life and that there is a diverse range of living things which have evolved on Earth. Students will gain an appreciation of the interdependence of living things and how they interact with each other and the environment. Through this strand students gain an understanding of how the structure of living things relates to the functions that their body systems perform and how these features aid their survival.

Chemical World

The Chemical World strand is concerned with understanding the composition and behaviour of matter. The key concepts developed within this strand are that the chemical and physical properties of substances are determined by their structure on an atomic scale and that substances change and new substances are produced in chemical reactions by rearranging atoms through atomic interactions and energy transfer.

Essential and additional content

The distinction between essential and additional content recognises that some students will need all of the available allocated time to focus on the essential content, while others will extend their learning by engaging with content beyond the syllabus.

The additional knowledge and understanding content presented in the syllabus provides suggestions only and should not be considered an exhaustive list. Additional content selected for the school learning program must be based on scientific understanding that is evidence-based and has been refined over time through review processes by the scientific community. All scientific ideas are theories and must be testable and measurable using the procedures of scientific inquiry.

Teachers should develop units of work to address all of the essential content of the syllabus and may use any remaining allocated time in each stage to:

- incorporate additional content into units of study throughout their teaching program or develop extension units in their teaching program. In this way, students' learning can be extended into areas of specific interest
- choose other contexts to reinforce the essential content of the syllabus. In this way, students can be given more time to acquire the essential knowledge, understanding and skills
- undertake remediation of knowledge, understanding and/or skills in addressing the outcomes and essential content of the syllabus.

Life Skills

For some students with special education needs, particularly those students with an intellectual disability, it may be determined that the Stage 4 and 5 outcomes and content are not appropriate. For these students, Life Skills outcomes and content can provide a relevant and meaningful program. Refer to section 1 for further information about curriculum options for students with special education needs. Years 7–10 Life Skills outcomes and content are in section 8.

Learning across the curriculum

ⓘ for your information

The Board of Studies has identified important learning for all students that can be delivered across the syllabuses. In K–10 syllabuses, the identified areas will be embedded in the descriptions of content. Content relating to learning across the curriculum addresses issues, perspectives and policies that will assist students to achieve the broad learning outcomes defined in the Board of Studies *K–10 Curriculum Framework*. These areas take account of the general capabilities and cross-curriculum priorities in the Australian curriculum.

This content will be included, where appropriate, while ensuring that subject integrity is maintained.

✍ consult

Aboriginal and Torres Strait Islander histories and cultures [AHC]

The syllabus provides opportunities in teaching and learning programs for the inclusion of Aboriginal and Torres Strait Islander contexts and perspectives relevant to science such as:

- terrestrial and aquatic resource management
- conservation and management of local ecosystems.

Asia and Australia's engagement with Asia [A]

The syllabus provides opportunities for students to understand the importance of Australia's relationship with Asia and the significance of Asia's role in the development of scientific ideas and technological advances. This may be facilitated by considering:

- global patterns in geological activity including the Asia-Pacific region
- the role of plate tectonics in describing continental movement over time.

Civics and citizenship [CC]

The syllabus provides opportunities for students to broaden their understanding of aspects of civics and citizenship in relation to the application and development of scientific ideas and technological advances. This may be facilitated by students considering:

- the importance of commitment to ecological sustainability
- the role of science in the development of appropriate resource management processes.

Critical and creative thinking [CCT]

The syllabus provides opportunities for students to develop skills in critical and creative thinking through conducting appropriate and innovative investigations and problem-solving such as:

- applying critical thinking in considering proposals, solutions and conclusions
- considering how the values and needs of contemporary society can influence the focus of scientific research.

Difference and diversity [DD]

The syllabus provides opportunities for students to understand and appreciate individual rights, challenge stereotypes and engage with opinions different to their own, by participating in activities such as:

- considering the issues associated with organ transplantation and the prevention of diseases
- investigating strategies used to conserve and manage non-renewable resources.

Ethical understanding [EU]

The syllabus provides opportunities for students to engage with situations or circumstances which involve an ethical or moral decision-making process. This may be facilitated by students considering:

- the importance of honesty in conducting scientific investigations
- ethical considerations in relation to the uses and advances of scientific knowledge and technology.

Information and communication technology [ICT]

The syllabus provides opportunities for students to enhance and develop ICT skills and work effectively with ICT in representation of data, information and observations. This may be facilitated by students:

- applying appropriate use of digital technologies, research on the internet and engaging with emerging technologies
- using appropriate digital technologies to measure, record and communicate their findings and data from a range of scientific investigations.

Intercultural understanding [IU]

The syllabus provides opportunities for students to enhance their intercultural understanding through consideration of other cultures in relation to the development of scientific knowledge. This may be facilitated by students considering:

- contribution of ideas by people from different cultures to understanding of the solar system
- the application of knowledge about the properties of elements and compounds to their use in everyday life by people of different cultures in the past.

Literacy [L]

The syllabus provides opportunities for students to develop broad literacy skills as well as more science-specific literacy. Students may develop literacy skills by:

- making judgements based on scientific knowledge and accurately reporting upon findings
- researching and extracting information from a variety of electronic and print sources.

Numeracy [N]

The syllabus provides opportunities for students to develop numeracy skills in order to comprehend and interpret data and units of measurement, as well as accurately record observations and findings. Students may develop numeracy skills by:

- representing data in various formats, identifying trends and patterns in findings
- interpreting data and findings, including considering reliability and integrity of numerical data.

Personal and social competence [PSC]

The syllabus provides opportunities for students to develop an awareness of their individual, personal and social competence through a consideration of the following:

- comparing their own understandings and conclusions respectfully with peers
- working cooperatively and recognising the strengths of peers, and conducting self-assessment of their produced work.

Sustainability and environment [SE]

The syllabus provides opportunities for students to engage with scientific, technological or societal impacts on the environment such as:

- understanding of the importance of resource conservation, recycling and the development of sustainable practices and technologies
- an appreciation of the impact that human activity has upon the environment and the positive and negative effects of technological advances.

Work and enterprise [WE]

The syllabus provides opportunities for students to develop work-related skills and an appreciation of the value of working individually and collaboratively. The syllabus may facilitate this by:

- students individually and collaboratively planning and conducting appropriate methods in working scientifically
- students learning to prioritise safe practices and understand the potential risks and hazards present when conducting investigations.

7.6 Content for Stage 4

✍ consult

Science • Stage 4

Skills – Working Scientifically

Questioning and predicting

Outcome
A student:
- identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge SC4-4WS

Related Life Skills outcome: *SCLS-4WS*

Students:
- identify questions and problems that can be investigated scientifically (ACSIS124, ACSIS139)
- make predictions based on scientific knowledge and their own observations (ACSIS124, ACSIS139).

Planning investigations

Outcome
A student:
- collaboratively and individually produces a plan to investigate questions and problems SC4-5WS

Related Life Skills outcome: *SCLS-5WS*

Students:
Identify data to be collected
- identify the purpose of an investigation
- propose the type of information and data that needs to be collected in a range of investigation types, including first-hand and secondary sources [N, CCT].

Plan first-hand investigations
- collaboratively and individually plan a range of investigation types including fieldwork, experiments, surveys and research (ACSIS125, ACSIS140)
- identify in fair tests, variables to be controlled, measured and changed
- outline a logical procedure for undertaking a range of types of investigations to collect valid first-hand data, including fair tests.

Choose equipment or resources
- identify suitable equipment or resources to perform the task, including safety equipment and digital technologies [ICT]
- locate possible sources of data and information, including secondary sources, relevant to the investigation [CCT, L]
- describe safety and ethical guidelines to be addressed [EU, PSC].

Conducting investigations

Outcome
A student:
- follows a sequence of instructions to safely undertake a range of types of investigations, individually and collaboratively SC4-6WS

Related Life Skills outcome: *SCLS-6WS*

Science • Stage 4

Skills – Working Scientifically

Students:

- collaboratively and individually conduct a range of investigation types including fieldwork and experiments ensuring safety and ethical guidelines are followed (ACSIS125, ACSIS140)
- assemble and use appropriate equipment and resources to perform the investigation, including safety equipment
- select equipment to collect data with accuracy appropriate to the task [ICT, N] (ACSIS126, ACSIS141)
- follow the planned procedure when conducting an investigation, including in fair tests, measuring and controlling variables [EU, PSC] (ACSIS126, ACSIS141)
- record observations and measurements accurately using appropriate units for physical quantities
- perform specific roles safely and responsibly when working collaboratively to complete the task within the timeline [PSC]
- assess the method used and identify improvements to the method [CCT, WE] (ACSIS131, ACSIS146).

Processing and analysing data and information

Outcome

A student:

- processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns, relationships and draw conclusions SC4-7WS

Related Life Skills outcome: *SCLS-7WS*

Students:

Processing information

- summarise data, from students' own investigations and secondary sources [N] (ACSIS130, ACSIS145)
- construct and use a range of representations, to organise data including graphs, keys, models, diagrams, tables and spreadsheets [CCT, N]
- access information from a range of sources including using digital technologies [ICT, L, N]
- extract information from diagrams, flowcharts, tables, databases, other texts, multimedia resources and graphs including column graphs, histograms, sector graphs, line graphs [N, L]
- apply simple numerical procedures such as calculating means when processing data and information as appropriate [N].

Analysing information

- check the reliability of gathered data and information by comparing them with observations or information from other sources [CCT]
- construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate [ICT, N, L] (ACSIS129, ACSIS144)
- use scientific understanding to identify relationships and draw conclusions based on students' data or secondary sources (ACSIS130, ACSIS145)
- identify data which supports or discounts a question being investigated or a proposed solution to a problem [CCT, N]
- produce inferences based on presented information and observations [CCT]
- use cause and effect relationships to explain ideas and findings [CCT]
- reflect on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected [CCT] (ACSIS131, ACSIS146).

Science • Stage 4

Skills – Working Scientifically

Problem-solving

Outcome
A student:
- selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to an identified problem SC4-8WS

Related Life Skills outcome: *SCLS-8WS*

Students:
- use identified strategies to suggest possible solutions to a familiar problem [CCT]
- describe different strategies that could be employed to solve an identified problem with a scientific component [CCT]
- use scientific knowledge and findings from investigations to evaluate claims [CCT] (ACSIS132, ACSIS234)
- evaluate the appropriateness of different strategies for solving an identified problem [EU, CCT].

Communicating

Outcome
A student:
- presents ideas, findings and information to a given audience using appropriate scientific language, representations and text types SC4-9WS
- **Related Life Skills outcome:** *SCLS-9WS*

Students:
- communicate ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate [L] (ACSIS133, ACSIS148)
- use appropriate text types including a discussion, explanation, exposition, procedure or recount in presentation [L]
- use a recognised method to acknowledge sources of data and information [L]
- use a range of representations to clearly and/or succinctly present data and information including diagrams, keys, models, tables, drawings, images, flowcharts, spreadsheets and databases [L, ICT]
- select and construct the appropriate type of graph (from column graph, histogram, sector or line graph) to express relationships clearly and succinctly, using digital technologies as appropriate [N, ICT].

Science • Stage 4

Knowledge and Understanding – Physical World

Outcomes

A student:

- describes the action of forces in everyday situations SC4-10KU
- discusses how scientific knowledge and technological developments have contributed to finding solutions to problems involving energy transfers and transformations SC4-11KU

Related Life Skills outcomes: *SCLS-10KU, SCLS-11KU, SCLS-12KU*

Change to an object's motion is caused by unbalanced forces acting on the object (ACSSU117).

Students:

- identify changes that take place when particular forces are acting
- predict the effect of unbalanced forces acting in everyday situations
- describe some examples of technological developments that have contributed to finding solutions to reduce the impact of forces in everyday life such as car safety equipment and footwear design
- recall friction as a contact force which opposes motion and produces heat
- analyse everyday common situations where friction operates
- investigate factors which influence the size and effect of frictional forces.

The action of forces which act at a distance may be observed and related to everyday situations.

Students:

- use the term 'field' in describing forces acting at a distance [L]
- describe ways in which objects acquire electrostatic charge
- describe the behaviour of charges when they are brought close to each other
- investigate everyday situations where the effects of electrostatic forces can be observed such as lightning strikes during severe weather and dust storms [CCT]
- identify that Earth's gravity pulls objects towards the centre of the Earth (ACSSU118)
- describe everyday situations where gravity acts as an unbalanced force
- distinguish between the terms 'mass' and 'weight'
- describe the behaviour of magnetic poles when they are brought close together
- investigate how magnets and electromagnets are used in some everyday devices or technologies used in everyday life.

Scientific understanding about energy transfers and transformations causing change in systems can be used in everyday life.

Students:

- identify situations or phenomena in which energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems (ACSSU155)
- describe heat transfer by conduction, convection and radiation including situations in which each occurs
- investigate some energy transformations that cause change within everyday systems involving heat energy, electricity, sound and light
- associate electricity with energy transfer in a simple circuit
- construct and draw circuits containing a number of components to show a transfer of electricity.

Science • Stage 4

Knowledge and Understanding – Physical World

Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations (ACSHE120, ACSHE135).

Students:

- identify that most energy conversions are inefficient and lead to the production of heat energy such as in light bulbs [CCT]
- discuss the implications for society and the environment of the production of heat energy due to inefficient conversions in a range of devices people use in everyday life, such as in electric motors [CCT]
- research ways in which science understanding and technological developments have led to improvements in devices that increase the efficiency of energy transfers or conversions [CCT].

Additional content

Students:

- describe characteristics of specific forces in terms of size and direction
- identify some advantages of levers, pulleys, gears and inclined planes
- analyse various simple machines in terms of energy input and output, and work done
- distinguish between everyday and scientific meanings of work
- trace the history of the development of particular devices or technologies, such as circuitry through to microcircuitry
- describe the scientific principles used in some traditional technologies used and developed by Aboriginal and Torres Strait Islanders [AHC]
- trace the history of pendulum motion studies and its connection with timekeeping and setting standards of length
- investigate the production of lightning during volcanic eruptions and dust storms
- debate intergenerational aspects of using non-renewable resources [CCT, PSC, SE]
- investigate a simple machine, such as lever or pulley system
- investigate the Earth's magnetic field.

Science • Stage 4

Knowledge and Understanding – Earth and Space

Outcomes

A student:

- describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system SC4-12KU
- explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource management practices SC4-13KU

Related Life Skills outcomes: *SCLS-13KU, SCLS-14KU, SCLS-15KU, SCLS-16KU*

Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales (ACSSU153).

Students:

- describe the inner structure of the Earth in terms of core, mantle, crust and lithosphere
- relate the formation of a range of common landforms to weathering, erosion and deposition
- outline the origins of and relationships between sedimentary, igneous and metamorphic rocks
- describe the conditions under which fossils form
- outline how geological history can be interpreted in a sequence of horizontal sedimentary layers, in which the oldest are at the base and the youngest at the top
- identify that sedimentary, igneous and metamorphic rocks contain minerals
- classify a variety of common rocks and minerals into groups according to their observable properties [L]
- explain the breaking down of rocks in terms of chemical and physical changes
- describe examples to show how people use understanding and skills from across the disciplines of science in occupations related to the exploration, mining or processing of minerals in Australia [WE] (ACSHE224, ACSHE227).

Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the solar system.

Students:

- explain that predictable phenomena on Earth, including day and night, seasons and eclipses, are caused by the relative positions of the sun, Earth and the moon (ACSSU115)
- compare current and historical models of the solar system to show how models are modified or rejected as a result of new evidence [CCT]
- describe some examples of how technological advances have led to discoveries and increased scientific understanding of the solar system
- demonstrate using examples, that ideas by people from different cultures have contributed to our current understanding of the solar system [IU].

Scientific understanding influences the choices people make in regard to the use and management of Earth's resources.

Students:

- describe uses of a variety of natural and made resources obtained from living things, the atmosphere, lithosphere and hydrosphere
- classify a range of Earth's resources as renewable or non-renewable, including those obtained from living things and extracted from the atmosphere, lithosphere and hydrosphere (Earth's spheres) (ACSSU116)
- investigate some strategies people use to conserve and manage non-renewable resources, such as recycling and use of alternative natural and made resources [DD]
- select a major non-renewable resource found in Australia and discuss different viewpoints that people may use to weight criteria in making decisions about the use of this resource [PSC, SE]

Science • Stage 4

Knowledge and Understanding – Earth and Space

- outline the choices that need to be made when considering whether to use scientific and technological advances to obtain a resource from Earth's spheres [EU, SE, PSC].

Science understanding has influenced the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE121, ACSHE136).
Students:

- identify that water is an important resource that cycles through the environment (ACSSU222)
- explain the water cycle in terms of the physical processes involved
- explain how scientific understanding of the water cycle has influenced the development of household, industry and agricultural water management practices [CCT, SE]
- research how Aboriginal and Torres Strait Islander knowledge is being used in decisions to care for country and place, such as terrestrial and aquatic resource management [AHC, SE, IU].

Additional content
Students:

- describe the effect of the forces of the sun and moon on the hydrosphere
- debate the economic and environmental impacts of mining and resource exploration [CCT, PSC]
- evaluate costs and benefits of various sources of energy, including those available to remote communities
- describe some methods used by scientists to determine the relative age of rock layers
- describe ways in which technology has increased the variety of made resources [L]
- investigate the role of forces and energy in the formation of different types of rocks and minerals
- investigate examples of how scientific knowledge has developed through collaboration of experts from across the disciplines of science, such as space exploration and resource management [CCT, L].

Science • Stage 4

Knowledge and Understanding – Living World

Outcomes

A student:

- relates the structure and function of living things to their classification, survival and reproduction SC4-14KU
- explains the contribution of scientific understanding and technological advances in finding solutions to contemporary issues SC4-15KU

Related Life Skills outcomes: *SCLS-17KU, SCLS-18KU, SCLS-19KU, SCLS-20KU, SCLS-21KU*

Cells are the basic units of living things and have specialised structures and functions (ACSSU149).

Students:

- identify that living things are made of cells
- identify structures within cells and describe their functions including the nucleus, cytoplasm, cell membrane, cell wall and chloroplast
- outline the role of respiration in providing energy for the activities of cells
- identify that cell division produces new cells from other living cells.

There are differences within and between groups of organisms; classification helps organise this diversity (ACSSU111).

Students:

- identify reasons for classifying living things
- classify a variety of living things on the basis of similarities and differences in structural features
- use simple keys to identify a range of plants and animals
- outline the structural features used to group living things including plants, animals, fungi and bacteria
- explain how the features of some Australian plants and animals are adaptations for survival and reproduction in their environment
- describe, using an example of an organism or group of organisms, where the classification has changed as a result of new evidence from technological developments, scientific discoveries and/or advances in scientific understanding.

Multi-cellular organisms contain systems of organs that carry out specialised functions that enable them to survive and reproduce (ACSSU150).

Students:

- distinguish between unicellular and multi-cellular organisms
- identify that there are different types of cells in the tissues, organs and organ systems of multi-cellular organisms
- explain that the systems in multi-cellular organisms work together to serve the needs of cells in providing oxygen, nutrients, water and removing wastes
- outline the role of cell division in growth, repair and reproduction in multi-cellular organisms
- identify the materials required by multi-cellular organisms for the processes of respiration and photosynthesis
- describe the role of the flower in reproduction and the root, stem and leaf in maintaining flowering plants as functioning organisms.

Science • Stage 4

Knowledge and Understanding – Living World

Scientific knowledge changes as new evidence becomes available and some scientific discoveries have significantly changed people's understanding of the world (ACSHE119, ACSHE134).
Students:

- recall some examples of groups of microorganisms
- describe examples of beneficial and harmful effects that microorganisms can have on living things and the environment
- recount how evidence from a past or present scientific discovery has changed people's understanding of microorganisms and contributed to solving a real world problem such as health, hygiene, food preservation, sewage treatment or biotechnology.

Advances in scientific knowledge and technological developments contribute to finding solutions to a range of contemporary issues related to human health.
Students:

- describe the role of the digestive, circulatory, excretory, skeletomuscular and respiratory systems in maintaining humans as a functioning multi-cellular organism
- outline the role of the reproductive system in humans
- describe using examples how developments in technology have contributed to finding solutions to issues related to the functioning of the human body such as organ transplantation, artificial joints/limbs, treatment for diabetes, asthma, kidney or heart disease
- research an example of how changes in scientific knowledge have contributed to finding a solution to a human health issue, including ethical considerations
- give examples to show that groups of people in society may use or weight criteria differently in making decisions about the application of a solution to a human health issue such as organ transplantation, control and prevention of diseases and dietary deficiencies [CCT, DD, PSC].

Science and technology contribute to finding solutions to conserving and managing sustainable ecosystems.
Students:

- construct and interpret food chains and food webs, including examples from Australian ecosystems
- describe interactions between organisms in food chains and food webs, including producers, consumers and decomposers (ACSSU112)
- predict how human activities can affect interactions in food chains and food webs, including examples from Australian land or marine ecosystems (ACSSU112)
- explain using examples to show how scientific evidence and/or technological developments contribute to developing solutions to manage the impact of natural events on Australian ecosystems such as bushfires, drought, cyclones or floods
- describe how scientific understanding has influenced the development of practices in agriculture such as animal husbandry or crop cultivation to improve yields and sustainability and impact of plant cloning techniques in horticulture.

Additional content
Students:

- identify how people in occupations that involve the biological sciences use understanding and skills from across the disciplines of science [WE]
- propose reasons why society should support biological research [CCT, PSC]
- research the function of mitochondria in respiration
- design simple keys to identify a range of living things
- classify, using a hierarchial system, a range of selected plants and animals to species level [L]
- identify the contributions of Australian scientists to the study of human impact on environments and to local environmental management projects.

Science • Stage 4

Knowledge and Understanding – Chemical World

Outcomes

A student:

- describes the observed properties and behaviour of matter using scientific models and theories about the motion and arrangement of particles SC4-16KU
- explains how scientific understanding of, and discoveries about the properties of elements, compounds and mixtures relate to their uses in everyday life SC4-17KU

Related Life Skills outcomes: *SCLS-22KU, SCLS-23KU, SCLS-24KU*

The properties of the different states of matter can be explained in terms of the motion and arrangement of particles (ACSSU151).

Students:

- describe the behaviour of matter in terms of particles that are continuously moving and interacting
- relate an increase or decrease in the amount of energy possessed by particles to changes in particle movement
- use a simple particle model to predict the effect of adding or removing heat on different states of matter
- relate changes in the physical properties of matter to heat energy and particle movement that occurs during observations of evaporation, condensation, boiling, melting and freezing
- explain density in terms of a simple particle model
- identify the benefits and limitations of using models to explain the properties of solids, liquids and gases [CCT].

Scientific knowledge and developments in technology have changed our understanding of the structure and properties of matter.

Students:

- describe at a particle level the differences between elements, compounds and mixtures, including the type and arrangement of particles (ACSSU152)
- identify some examples of common compounds
- explain why internationally recognised symbols are used for common elements
- describe the properties and uses of some common elements, including metals and non-metals
- identify technologies that have changed our understanding about the structure and properties of elements, such as electron microscopy used to examine metal crystals [CCT]
- investigate how people in different cultures in the past have applied their knowledge of the properties of elements and compounds to their use in everyday life, such as utensils, weapons and tools [L, IU].

Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques (ACSSU113).

Students:

- describe the importance of water as a solvent in daily life, industries and the environment
- describe aqueous mixtures in terms of solute, solvent and solution
- relate a range of techniques used to separate the components of some common mixtures to the physical principles involved in each process, including filtration, decantation, evaporation, crystallisation, chromatography and distillation [CCT]
- investigate the application of a physical separation technique used in everyday situations or industrial processes, such as water filtering, sorting waste materials, extracting pigments or oils from plants, separating blood products or cleaning up oil spills
- research how people in different occupations use understanding and skills from across the disciplines of science in carrying out separation techniques [CCT].

Science • Stage 4

Knowledge and Understanding – Chemical World

In a chemical change, new substances are formed, which may have specific properties related to their uses in everyday life.
Students:

- compare physical and chemical changes in terms of the arrangement of particles and reversibility of the process
- demonstrate that a chemical change involves substances reacting to form new substances (ACSSU225)
- identify when a chemical change is taking place by observing a change in temperature, the appearance of new substances, or the disappearance of an original substance
- investigate some examples of chemical change that occur in everyday life such as digestion, photosynthesis, respiration and chemical weathering
- propose reasons why society should support scientific research into the development of new substances obtained from living things, the atmosphere, lithosphere or hydrosphere (Earth's spheres) [EU, CCT, PSC]
- describe using examples, how collaboration and connecting ideas across the disciplines of science has increased knowledge about making or obtaining new substances from Earth's spheres, such as pharmaceuticals and polymers (ACSHE223, ACSHE226).

Additional content
Students:

- research how a knowledge of physical properties of natural materials is used by Aboriginal and Torres Strait Islanders in everyday life such as utensils, shelter, housing and bush medicine [AHC]
- identify some common colloids
- investigate the nature of mineral crystals
- outline how some historical developments have contributed to evidence which has advanced our understanding of the particle model of matter
- investigate how the chemical properties of a substance, for example, its flammability and ability to corrode, will affect its use
- explain the changes in pressure in gases in terms of increases or decreases in the frequency of particle collisions.

7.7 Content for Stage 5

✍ consult

Science • Stage 5

Skills – Working Scientifically

Questioning and predicting

Outcome
A student:
- develops questions or hypotheses to be investigated scientifically SC5-4WS

Related Life Skills outcome: *SCLS-4WS*

Students:
- formulate questions or hypotheses that can be investigated scientifically (ACSIS164, ACSIS198)
- predict outcomes based on observations and scientific knowledge.

Planning investigations

Outcome
A student:
- produces a plan to investigate an identified question, hypothesis or problem SC5-5WS

Related Life Skills outcome: *SCLS-5WS*

Students:
Identify data sources:
- describe the purpose of an investigation
- explain why certain types of information needs to be collected in a range of investigation types.

Plan first-hand investigations
- plan and select appropriate investigation methods, including field work and laboratory experimentation to collect reliable data [CCT, PSC, WE] (ACSIS165, ACSIS199)
- describe a logical procedure for undertaking a range of types of investigations
- design controlled experiments to collect valid first-hand data
- specify the dependent and independent variables when planning controlled experiments
- account for the use of an experimental control as appropriate
- identify the appropriate units to be used in collecting data [N].

Choose equipment or resources
- select appropriate methods to collect and record reliable data or information, using digital technologies as appropriate such as data loggers [ICT, N]
- select possible sources of data, including secondary sources, relevant to the investigation
- assess risks and address ethical issues associated with these methods [PSC, EU] (ACSIS165, ACSIS199).

Conducting investigations

Outcome
A student:
- undertakes a first-hand investigation to collect valid and reliable data and information individually and collaboratively SC5-6WS

Related Life Skills outcome: *SCLS-6WS*

Science • Stage 5

Skills – Working Scientifically

Students:

- collaboratively and individually use appropriate investigation methods, including field work and laboratory experimentation to collect reliable data (ACSIS165, ACSIS199)
- safely construct, assemble and manipulate identified equipment
- select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data [WE] (ACSIS166, ACSIS200)
- select and safely assemble identified equipment, either individually or collaboratively [WE]
- select and use appropriate units for measuring physical quantities
- justify why variables need to be kept constant if reliable first-hand data is to be collected in controlled experiments
- evaluate the effectiveness of the planned procedure, considering risk factors and ethical issues, and suggest improvements as appropriate [CCT].

Processing and analysing data

Outcome

A student:

- processes, analyses and evaluates data from a first-hand investigation or secondary sources SC5-7WS

Related Life Skills outcome: *SCLS-7WS*

Students:

Processing information

- select and use a variety of methods to organise data and information including diagrams, tables, models, spreadsheets and databases [N, ICT, L]
- select and extract information from tables, flow diagrams, graphs (column graphs, histograms, sector graphs, line graphs), other texts and audiovisual resources [N]
- use a range of appropriate digital technologies to access data and information [ICT]
- apply numerical procedures and mathematical concepts as appropriate when processing data and information.

Analysing information

- analyse patterns and trends, including identify inconsistencies in data and information [N, CCT] (ACSIS169, ACSIS203)
- describe relationships between variables [CCT] (ACSIS169, ACSIS203)
- identify data which supports or discounts a question or hypothesis being investigated or a proposed solution to a problem [CCT]
- assess the validity and reliability of first-hand data [CCT]
- apply mathematical concepts and use digital technologies where appropriate to assist analysis of data and information [N, CCT, ICT]
- use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS170, ACSIS204)
- use models to explain phenomena and make predictions [N, CCT]
- evaluate conclusions and evidence, including identifying sources of uncertainty and possible alternative explanations (ACSIS171, ACSIS205)
- describe specific ways to improve the quality of the data (ACSIS171, ACSIS205)
- critically analyse the validity of information from secondary sources (ACSIS172, ACSIS206).

Science • Stage 5

Skills – Working Scientifically

Problem-solving

Outcome

A student:

- applies scientific understanding and critical thinking skills to suggest possible solutions to an identified problem SC5-8WS

Related Life Skills outcome: *SCLS-8WS*

Students:

- describe strategies to develop a range of possible solutions to an identified problem
- assess strategies that have been identified as possible solutions to an identified problem
- apply critical thinking in considering suggested proposals, solutions and conclusions, including a consideration of risk [CCT]
- use cause-and-effect relationships to explain ideas
- apply the processes of working scientifically in developing creative solutions to problems [CCT, EU, PSC]
- evaluate approaches used to solve problems (ACSIS172, ACSIS206).

Communicating

Outcome

A student:

- presents ideas and evidence for a specific purpose and audience, using appropriate scientific language, conventions and representations SC5-9WS

Related Life Skills outcome: *SCLS-9WS*

Students:

- select and use appropriate text types including a discussion, explanation, exposition, procedure, recount or report for different purposes and contexts, in presentations [L]
- construct an appropriate table, type of diagram, table or graph (from column graph, histogram, sector or line graph) to present information and show relationships clearly and succinctly using digital technologies as appropriate [N, L, ICT]
- use appropriate units for physical quantities and symbols to express relationships, including mathematical ones [N]
- propose ideas that demonstrate coherence and logical progression [CCT]
- communicate scientific ideas and information for a particular purpose including using appropriate scientific language, conventions, representations to specific audiences (ACSIS174, ACSIS208)
- communicate scientific ideas and information for a particular purpose including constructing evidence-based arguments [CCT] (ACSIS174, ACSIS208).

Science • Stage 5

Knowledge and Understanding – Physical World

Outcomes

A student:

- applies models, theories and laws to explain situations involving energy, force and motion SC5-10KU
- explains how science understanding about energy conservation, transfers and transformations is applied in systems SC5-11KU

Related Life Skills outcomes: *SCLS-10KU, SCLS-11KU, SCLS-12KU*

Energy transfer through different mediums can be explained using wave and particle models (ACSSU182).

Students:

- explain, in terms of the particle model, the processes underlying convection and conduction of heat energy
- identify situations where waves transfer energy
- describe qualitatively, using the wave model, the features of waves including wavelength, frequency and speed
- explain the transmission of sound in different mediums
- name and describe the properties of different types of electromagnetic radiation that make up the electromagnetic spectrum
- relate the properties of different types of radiation in the electromagnetic spectrum to their uses in everyday life, including communications technology [CCT]
- distinguish between the absorption, reflection and refraction of light and identify everyday situations where each occurs [CCT].

The motion of objects can be described and predicted using the laws of physics (ACSSU229).

Students:

- describe qualitatively the relationship between force, mass and acceleration
- explain qualitatively the relationship between distance, speed and time
- relate acceleration qualitatively to a change in speed and/or direction as a result of a net force
- analyse qualitatively everyday situations involving motion in terms of Newton's Laws [CCT].

Scientific understanding of current electricity has resulted in technological developments designed to improve the efficiency in generation and use of electricity.

Students:

- describe voltage, resistance and current using analogies
- describe qualitatively the relationship between voltage, resistance and current
- compare the characteristics and applications of series and parallel electrical circuits
- outline recent examples where scientific or technological developments in areas such as low-emissions electricity generation and reduction in atmospheric pollution have involved specialist teams from different branches of science, engineering and technology [CCT, PSC, L].

Energy conservation in a system can be explained by describing energy transfers and transformations (ACSSU190).

Students:

- apply the law of conservation of energy to account for the total energy involved in energy transfers and transformations
- describe how, in energy transfers and transformations, a variety of processes can occur so that usable energy is reduced and the system is not 100% efficient
- discuss using examples how the values and needs of contemporary society can influence the focus

Science • Stage 5

Knowledge and Understanding – Physical World

of scientific research in the area of increasing efficiency of the use of electricity by individuals and society [CCT, SE] (ACSHE228, ACSHE230)

- discuss viewpoints and choices that need to be considered in making decisions about the use of non-renewable energy resources [SE, EU, CC, CCT].

Additional content

Students:

- describe how engineers and architects employ scientific concepts and principles in designing energy efficient devices and buildings [CCT]
- describe quantitatively features of waves including frequency, wavelength and speed using $v = f\lambda$ [N]
- relate scattering and dispersion of light to everyday occurrences
- explain the difference between speed and velocity
- describe the relationships between displacement, time, velocity and acceleration, both qualitatively and quantitatively, using equations of motion [N]
- describe and use quantitatively the relationship between force, mass and acceleration [N]
- apply Newton's laws to space travel
- explain the relationship between voltage, resistance and current using Ohm's Law
- compare energy changes in interactions such as car crashes, pendulums, lifting and dropping.

Science • Stage 5

Knowledge and Understanding – Earth and Space

Outcomes
A student:

- describes changing ideas about the structure of the Earth and the universe to illustrate how models, theories and laws are refined over time by the scientific community SC5-12KU
- explains how scientific knowledge about global patterns of geological activity and interactions involving global systems can be used to inform decisions related to contemporary issues SC5-13KU

Related Life Skills outcomes: *SCLS-13KU, SCLS-14KU, SCLS-15KU, SCLS-16KU*

Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community (ACSHE157, ACSHE191).
Students:

- outline some of the major features contained in the universe, including galaxies, stars, solar systems and nebulae (ACSSU188)
- describe using examples some technological developments that have advanced scientific understanding about the solar system [CCT, L]
- use appropriate scales in describing differences in sizes of and distances between structures making up the universe [N]
- identify that all objects exert a force of gravity on all other objects in the universe
- use scientific evidence to outline how the Big Bang theory can be used to explain the origin of the universe and its age [CCT, L] (ACSSU188)
- outline how scientific thinking about the origins of the universe continues to be refined over time through a process of review by the scientific community [CCT].

The theory of plate tectonics explains global patterns of geological activity and continental movement (ACSSU180).
Students:

- outline how the theory of plate tectonics changed ideas about the structure of the Earth and continental movement over geological time
- relate movements of Earth's plates to mantle convection currents and gravitational forces
- outline how the theory of plate tectonics explains global patterns of geological activity including earthquakes, volcanic activity and formation of new landforms [A]
- describe how some technological developments such as echo sounders and magnetometers have increased scientific understanding of global patterns in geological activity, including in the Asia-Pacific region [A, CCT].

People use scientific knowledge to evaluate claims, explanations or predictions in relation to interactions involving the biosphere, lithosphere, hydrosphere and atmosphere (Earth's spheres) (ACSHE160, ACSHE194).
Students:

- outline how global systems rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere including the carbon cycle (ACSSU189)
- describe some impacts of natural events including cyclones, volcanic eruptions or earthquakes on the Earth's spheres [CCT, L]
- evaluate scientific evidence for current issues impacting on society that are the result of human activity on global systems such as the greenhouse effect, ozone layer depletion, effect of climate change on sea levels, long-term effects of loss of biodiversity and waste management [CCT, EU, PSC]
- discuss the reasons different groups in society may use or weight criteria differently to evaluate

Science • Stage 5

Knowledge and Understanding – Earth and Space

claims, explanations or predictions in making decisions about contemporary issues involving interactions of the Earth's spheres [CCT, EU, PSC].

Additional content

Students:

- outline examples where advances in science and emerging science and technologies significantly affect people's lives including generating new career opportunities in areas such as astrophysics, geophysics, space science, vulcanology
- relate colours of stars to their age, distance from Earth and size
- describe some recent contributions made by female and male scientists, including Australian examples, in the exploration and study of the universe
- describe evidence used to support estimates of time in the universe
- discuss evidence relating global warming to changes in weather patterns including El Niño and La Niña [CCT, IU]
- discuss technological developments that have extended the ability of scientists to collect information about and monitor events in the natural world [CCT]
- discuss the development and implications of international agreements relating to biodiversity and climate change, such as the original 1987 Montreal Protocol, 1992 United Nations Conference on Environment and Development, 1997 Kyoto Protocol and the 2009 United Nations Climate Change Conference [EU]
- examine the factors that drive the deep ocean currents, their role in regulating climate and their effects on marine life
- research how computer modelling has improved knowledge and predictability of phenomena such as climate change and atmospheric pollution
- outline recent examples where scientific or technological developments in areas such as sustainable transport, low-emissions electricity generation and reduction in atmospheric pollution have involved specialist teams from different branches of science, engineering and technology [CCT, WE].

Science • Stage 5

Knowledge and Understanding – Living World

Outcomes

A student:

- analyses interactions between components and processes within biological systems SC5-14KU
- explains how scientific understanding has advanced through scientific discoveries, technological developments and needs of society SC5-15KU

Related Life Skills outcomes: *SCLS-17KU, SCLS-18KU, SCLS-19KU, SCLS-20KU, SCLS-21KU*

Multi-cellular organisms rely on coordinated and interdependent internal systems to respond to changes in their environment (ACSSU175).

Students:

- describe some examples to show ways in which multi-cellular organisms respond to changes in their environment [CCT]
- outline how the coordinated function of body systems provides cells with requirements for life including oxygen, nutrients, water and removal of wastes [CCT]
- outline some responses of the human body to infectious and non-infectious diseases
- describe the role of and interaction between, the coordination systems in maintaining humans as functioning organisms
- discuss using examples related to plant, animal or human health how the values and needs of contemporary society can influence the focus of scientific research such as the occurrence of an epidemic or pandemic disease, lifestyle related non-infectious diseases in humans, effects of natural disasters or human activities [PSC, CCT].

Conserving and maintaining the quality and sustainability of the environment requires scientific understanding of interactions in and of the flow of matter and energy through ecosystems.

Students:

- recall that ecosystems consist of communities of interdependent organisms and abiotic components of their environment (ACSSU176)
- distinguish between biotic and abiotic components of an ecosystem
- outline using examples how matter is cycled (flows) through ecosystems such as nitrogen (ACSSU176)
- describe how energy flows through ecosystems, including input and output through food webs (ACSSU176)
- analyse how changes in biotic and abiotic components of an ecosystem affect populations of organisms [CCT]
- research how Aboriginal and Torres Strait Islanders recognise relationships in local ecosystems and use their knowledge to conserve and manage their environment [AHC]
- evaluate some examples of strategies used to balance human activities and needs in ecosystems with conserving, protecting and maintaining the quality and sustainability of the environment [CCT, PSC, EU].

Advances in scientific understanding often rely on developments in technology, and technological advances are often linked to scientific discoveries (ACSHE158, ACSHE192).

Students:

- relate the organs involved in human reproductive systems to their function and to the role of reproduction
- identify that during reproduction the transmission of heritable characteristics from one generation to the next involves DNA and genes (ACSSU184)
- identify that genetic information is transferred in the DNA of chromosomes and that genes are part of DNA

Science • Stage 5

Knowledge and Understanding – Living World

- outline how the Watson-Crick model of DNA explains:
  - the exact replication of DNA
  - changes in genes (mutation)
- describe, using examples, how developments in technology have advanced scientific understanding of biotechnology such as stem cell research, in vitro fertilisation, cloning [CCT, EU]
- describe some benefits and problems of the use and applications of biotechnology, including social and ethical considerations [PSC]
- outline using examples how the needs of contemporary society have influenced the focus of scientific research in biotechnology [CCT, PSC].

The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence (ACSSU185).
Students:

- describe scientific evidence that present-day organisms have evolved from organisms in the past
- relate the fossil record to the age of the Earth and the time over which life has been evolving
- explain, using examples, how natural selection relates to the theory of evolution, such as in the development of resistance of bacteria to antibiotics and insects to pesticides [L]
- outline the roles of genes and environmental factors in the survival of organisms in a population [CCT].

Additional content
Students:

- outline why the same genetic information is not equally expressed in all cells
- discuss ethical issues that may arise in relation to the use of organ transplantation, gene technology or stem cell research [CCT, EU]
- discuss how/why any investigations relating to biological research and involving or impacting on animals must be justified, humane and considerate of each animal's needs [CCT, EU]
- describe the range of functions carried out by some endocrine (hormonal) glands in humans [L]
- discuss the role of the endocrine system in the control of reproduction
- investigate how models can be used to predict the changes in populations due to environmental changes such as the impact of fire or flooding, introduction of a disease or predator [CCT, L]
- discuss the strengths and limitations of using models to make predictions about changes in biological systems [CCT]
- outline examples where advances in science and/or emerging science and technologies significantly affect people's lives including generating new career opportunities in a variety of biological science careers such as dentistry, environment, medical technology, biomedical engineering, physiology, pharmaceuticals, nanotechnology [CCT, L]
- research the role of the development of fast computers in the analysis of DNA sequences [ICT]
- demonstrate how information technology is be applied in bioinformatics [ICT].

Science • Stage 5

Knowledge and Understanding – Chemical World

Outcomes

A student:

- explains how models, theories and laws about matter have been refined as new scientific evidence becomes available SC5-16KU
- discusses the importance of chemical reactions in the production of a range of substances, and the influence of society on the development of new materials SC5-17KU

Related Life Skills outcomes: *SCLS-22KU, SCLS-23KU, SCLS-24KU*

Scientific understanding changes and is refined over time through a process of review by the scientific community.

Students:

- identify that all matter is made up of atoms which are composed of protons, neutrons and electrons (ACSSU177)
- describe the structure of atoms in terms of the nucleus, protons, neutrons and electrons
- outline historical developments of the atomic theory to demonstrate how models and theories have been contested and refined over time through a process of review by the scientific community [L]
- identify that natural radioactivity arises from the decay of the nuclei in atoms, releasing particles and energy (ACSSU177)
- evaluate the benefits and problems associated with medical and industrial uses of nuclear energy [EU, SE, CCT].

The atomic structure and properties of elements are used to organise them in the Periodic Table (ACSSU186).

Students:

- identify the atom as the smallest unit of an element and can be represented by a symbol
- distinguish between some common elements, by comparing information about the numbers of protons, neutrons and electrons
- relate the properties of some common elements to their position in the Periodic Table
- describe the organisation of elements in the Periodic Table using their atomic number
- predict, using the Periodic Table, the properties of some common elements
- outline how creativity, logical reasoning and the scientific evidence available at the time, contributed to the development of the modern Periodic Table [L, CCT].

Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction, mass is not created or destroyed (ACSSU178).

Students:

- recall that all matter is composed of atoms and has mass
- identify a range of compounds using their common names and chemical formulae
- classify compounds into groups based on common chemical characteristics
- investigate a range of types of important chemical reactions that occur in non-living systems and involve energy transfer including:
  - combustion (ACSSU179)
  - the reaction of acids with metals and acids with carbonates (ACSSU179)
  - corrosion
  - precipitation
  - neutralisation
  - decomposition
- identify some examples of important chemical reactions that occur in living systems and involve energy transfer including respiration and reactions of acids such as digestion (ACSSU179)

Science • Stage 5

Knowledge and Understanding – Chemical World

- construct word equations from observations and written descriptions of a range of chemical reactions [L]
- deduce that new substances are formed during chemical reactions by rearranging atoms rather than by creating or destroying them.

Different types of chemical reactions are used to produce a range of products and can occur at different rates and involve energy transfer (ACSSU187).
Students:

- identify that chemical reactions involve energy transfer and can be exothermic or endothermic
- compare combustion and respiration as types of chemical reactions which release energy but occur at different rates
- describe the effects of factors such as temperature and catalysts on the rate of some common chemical reactions
- examine how social, ethical and environmental considerations can influence decisions about scientific research related to the development and production of new materials [CCT, EU, L, SE]
- outline examples where advances in science and emerging science and technologies significantly affect people's lives including generating new career opportunities in a variety of chemical science careers such as biochemistry, industrial chemistry, pharmaceuticals and polymer chemistry [CCT, L] (ACSHE161, ACSHE195).

Additional content
Students:

- use models to describe the arrangement of electrons in the principal energy levels of common elements
- sort metals into their order of activity
- identify the characteristics that classify substances as either ionic or covalent compounds
- balance a range of common chemical equations
- identify properties of different substances that can be explained in terms of their subatomic structure
- research the development of ideas about the nature of radioactivity [L]
- investigate the processes involved in the production of new materials from synthetic fibres [L]
- evaluate using scientific evidence the claims, explanations or predictions made in the media or advertising in relation to a substance, material or product.

8 Years 7–10 Life Skills outcomes and content

A small percentage of students with special education needs particularly those with an intellectual disability, may best fulfil curriculum requirements for Science Years 7–10 by undertaking Life Skills outcomes and content.

In order to provide a relevant and meaningful program of study that reflects the needs, interests and abilities of each student, schools may integrate Science Years 7–10 Life Skills outcomes and content across a variety of school and community contexts.

The following points need to be taken into consideration:

- specific Life Skills outcomes will be selected on the basis that they meet the particular needs, goals and priorities of each student
- students are not required to complete all outcomes
- outcomes may be demonstrated independently or with support.

A range of adjustments to teaching, learing and assessment experiences should be explored before a decision is made to access Years 7–10 Life Skills outcomes and content. Information about adjustments can be found in *Life Skills Years 7–10: Advice on Planning, Programming and Assessment*.

The Years 7–10 Life Skills outcomes and content are developed from the Years 7–10 objectives of the *Science K–10 Syllabus (incorporating Science and Technology K–6)*. They indicate the knowledge, understanding and skills expected to be gained by most students as a result of effective teaching and learning, by the end of a stage.

Values and attitudes outcomes have also been developed for the stages of learning.

8.1 Years 7–10 Life Skills outcomes

✍ consult

Table of objectives and outcomes

Objectives Students: • develop an appreciation of the contribution of science to finding solutions to personal, social and global issues relevant to their lives • develop a willingness to use evidence and reason to engage with and respond to scientific and technological ideas as informed, reflective citizens
Life Skills outcomes A student:
SCLS-1VA recognises the role of science in personal, social and global issues relating to everyday life SCLS-2VA recognises that using the processes of Working Scientifically increases their understanding of the world SCLS-3VA demonstrates a willingness to engage with science-related issues relevant to their lives

SCLS-1VA, SCLS-2VA and SCLS-3VA refer to values and attitudes developed through the study of Science. These outcomes are integrated throughout the Years 7–10 Science Life Skills content.

Objective Students: • develop knowledge, understanding of and skills in applying the processes of Working Scientifically
Life Skills outcomes A student:
SCLS-4WS asks questions that can be tested and makes predictions SCLS-5WS participates in the development of a plan to investigate questions or problems SCLS-6WS follows a sequence of instructions to participate in an investigation SCLS-7WS collects, records and interprets data and information SCLS-8WS recognises strategies to solve identified problems SCLS-9WS uses a variety of strategies to communicate information about an investigation

Objective
Students:
- develop knowledge and understanding of and about Physical World, Earth and Space, Living World and Chemical World

Life Skills outcomes
A student:

SCLS-10KU
explores a range of forces in everyday situations

SCLS-11KU
investigates various forms and sources of energy and their uses

SCLS-12KU
investigates ways to use energy responsibly

SCLS-13KU
identifies features of the Earth

SCLS-14KU
explores features of the solar system including the Earth's position and movement

SCLS-15KU
identifies that the Earth is the source of resources used in everyday life

SCLS-16KU
investigates some practices used in the effective management of the Earth's resources

SCLS-17KU
recognises features of living and non-living things

SCLS-18KU
identifies structures of living things and their functions

SCLS-19KU
explores the interactions of living things with each other and the environment

SCLS-20KU
explores ways in which science and technology have improved human health

SCLS-21KU
investigates the impact of science and technology on the environment

SCLS-22KU
recognises the properties of common substances

SCLS-23KU
explores how common chemicals affect everyday life

SCLS-24KU
investigates a variety of chemical changes

Years 7–10 Life Skills and related syllabus outcomes

Objectives
Students:

- develop an appreciation of the contribution of science to finding solutions to personal, social and global issues relevant to their lives
- develop a willingness to use evidence and reason to engage with and respond to scientific and technological ideas as informed, reflective citizens

Life Skills outcomes A student:	**Related Stage 4/5 outcomes** A student:
SCLS-1VA recognises the role of science in personal, social and global issues relating to everyday life	SC4-1VA, SC5-1VA appreciates the importance of science in their lives and the role of scientific inquiry in increasing understanding of the world around them
SCLS-2VA recognises that using the processes of Working Scientifically increases their understanding of the world	SC4-2VA, SC5-2VA shows a willingness to engage in finding solutions to science-related personal, social and global issues, including shaping sustainable futures
SCLS-3VA demonstrates a willingness to engage with science-related issues relevant to their lives	SC4-3VA, SC5-3VA demonstrates confidence in making reasoned, evidence-based decisions about the current and future use and influence of science and technology, including ethical considerations

Objective Students: • develop knowledge, understanding of and skills in applying the processes of Working Scientifically	
Life Skills outcomes A student:	**Related Stage 4/5 outcomes** A student:
SCLS-4WS asks questions that can be tested and makes predictions	SC4-4WS identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge SC5-4WS develops questions or hypotheses to be investigated scientifically
SCLS-5WS participates in the development of a plan to investigate questions or problems	SC4-5WS collaboratively and individually produces a plan to investigate questions and problems SC5-5WS produces a plan to investigate an identified question, hypothesis or problem
SCLS-6WS follows a sequence of instructions to participate in an investigation	SC4-6WS follows a sequence of instructions to safely undertake a range of types of investigations, individually and collaboratively SC5-6WS undertakes a first-hand investigation to collect valid and reliable data and information individually and collaboratively
SCLS-7WS collects, records and interprets data and information	SC4-7WS processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns, relationships and draw conclusions SC5-7WS processes, analyses and evaluates data from a first-hand investigation or secondary sources
SCLS-8WS recognises strategies to solve identified problems	SC4-8WS selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to an identified problem SC5-8WS applies scientific understanding and critical thinking skills to suggest possible solutions to an identified problem
SCLS-9WS uses a variety of strategies to communicate information about an investigation	SC4-9WS presents ideas, findings and information to a given audience using appropriate scientific language, representations and text types SC5-9WS presents ideas and evidence for a specific purpose and audience, using appropriate scientific language, conventions and representations

Objective Students: • develop knowledge and understanding of and about Physical World, Earth and Space, Living World and Chemical World	
Life Skills outcomes A student:	**Related Stage 4/5 outcomes** A student:
SCLS-10KU explores a range of forces in everyday situations	SC4-10KU describes the action of forces in everyday situations SC5-10KU applies models, theories and laws to explain situations involving energy, force and motion
SCLS-11KU investigates various forms and sources of energy and their uses SCLS-12KU investigates ways to use energy responsibly	SC4-11KU discusses how scientific knowledge and technological developments have contributed to finding solutions to problems involving energy transfers and transformations SC5-11KU explains how science understanding about energy conservation, transfers and transformations is applied in systems
SCLS-13KU identifies features of the Earth SCLS-14KU explores features of the solar system including the Earth's position and movement	SC4-12KU describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system SC5-12KU describes changing ideas about the structure of the Earth and the universe to illustrate how models, theories and laws are refined over time by the scientific community
SCLS-15KU identifies that the Earth is the source of resources used in everyday life SCLS-16KU investigates some practices used in the effective management of the Earth's resources	SC4-13KU explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource management practices SC5-13KU explains how scientific knowledge about global patterns of geological activity and interactions involving global systems can be used to inform decisions related to contemporary issues
SCLS-17KU recognises features of living and non-living things SCLS-18KU identifies structures of living things and their functions	SC4-14KU relates the structure and function of living things to their classification, survival and reproduction
SCLS-19KU explores the interactions of living things with each other and the environment	SC5-14KU analyses interactions between components and processes within biological systems

SCLS-20KU explores ways in which science and technology have improved human health SCLS-21KU investigates the impact of science and technology on the environment	SC4-15KU explains the contribution of scientific understanding and technological advances in finding solutions to contemporary issues SC5-15KU explains how scientific understanding has advanced through scientific discoveries, technological developments and needs of society
SCLS-22KU recognises the properties of common substances	SC4-16KU describes the observed properties and behaviour of matter using scientific models and theories about the motion and arrangement of particles SC5-16KU explains how models, theories and laws about matter have been refined as new scientific evidence becomes available
SCLS-23KU explores how common chemicals affect everyday life SCLS-24KU investigates a variety of chemical changes	SC4-17KU explains how scientific understanding of, and discoveries about the properties of elements, compounds and mixtures relate to their uses in everyday life SC5-17KU discusses the importance of chemical reactions in the production of a range of substances, and the influence of society on the development of new materials

8.2 Years 7–10 Life Skills content

The Years 7–10 Life Skills content forms the basis for learning opportunities. Students will not be required to complete all of the content to demonstrate achievement of an outcome.

✍ Consult

Content within the *Science Years 7–10 Syllabus* has been organised by strands. Refer to section 7.1 for further information relating to the organisation of content.

Science • Life Skills

Skills – Working Scientifically

Questioning and predicting

Outcome
A student:
- asks questions that can be tested and makes predictions SCLS-4WS

Students:
- ask questions about familiar objects and events
- identify questions that can be investigated scientifically
- predict the outcomes of an investigation, using background knowledge, experience and/or scientific understanding [CCT].

Planning investigations

Outcome
A student:
- participates in the development of a plan to investigate questions or problems SCLS-5WS

Students:
- suggest suitable methods for gathering data, including practical investigations and research using secondary sources [N]
- identify scientific equipment and materials and their purposes
- identify safety rules when using scientific equipment and materials in an investigation [WE]
- work individually and/or collaboratively to record aspects of their plan [PSC, WE]
- recognise variables to be changed, kept the same and measured in an investigation.

Conducting investigations

Outcome
A student:
- follows a sequence of instructions to participate in an investigation SCLS-6WS

Students:
- use a range of techniques, including practical experiences, surveys, field work and research, to gather data and information, using digital technologies as appropriate [ICT, N]
- select and use appropriate equipment, measuring tools and methods to make accurate observations and measurements [N]
- work individually and/or collaboratively to participate in an investigation [PSC, WE]
- make adjustments when necessary to a planned method for an investigation
- follow safety rules when using equipment and tools in an investigation [WE]
- record observations and measurements using appropriate units and abbreviations [L, N].

Science • Life Skills

Skills – Working Scientifically

Processing and analysing data and information

Outcome
A student:
- collects, records and interprets data and information SCLS-7WS

Students:
- select the most appropriate method to organise and display data and information [N, CCT]
- interpret data and information gathered [N]
- relate data and information gathered to questions and predictions [CCT]
- draw conclusions from data and information gathered in an investigation [CCT]
- reflect on the strengths and limitations of their investigation [PSC]
- use their conclusions to identify further questions that may be investigated scientifically.

Problem-solving

Outcome
A student:
- recognises strategies to solve identified problems SCLS-8WS

Students:
- identify problems that can be investigated scientifically
- identify different strategies that could be used to solve a problem [CCT].

Communicating

Outcome
A student:
- uses a variety of strategies to communicate information about an investigation SCLS-9WS

Students:
- use a variety of strategies, including tables, graphs and diagrams, to present data and information, using digital technologies as appropriate [ICT, N]
- communicate ideas and information gathered through a scientific investigation in a variety of forms, using digital technologies as appropriate [L, ICT].

Practical experiences

Where appropriate, students should have the opportunity to develop their skills in Working Scientifically by participating in a range of practical experiences to develop their understanding and demonstrate achievement of Science Years 7–10 Life Skills outcomes. The Working Scientifically processes may be integrated into any additional Life Skills content undertaken and can provide students with meaningful opportunities to engage with scientific concepts.

Science • Life Skills

Knowledge and Understanding – Physical World

Outcome
A student:
- explores a range of forces in everyday situations SCLS-10KU

There are different types of forces which can be experienced in daily life.
Students:

Forces
- identify a force as a push or pull
- communicate what happens when a force is applied to an object such as squeezing/stretching, accelerating/decelerating
- observe the change in motion that occurs when a force is applied to an object such as a car starting/stopping, a surfer changing direction or an elevator moving up and down
- investigate how technological developments have reduced the harmful impact of forces in everyday life such as safety helmets, seatbelts and airbags [CCT, ICT].

Frictional force
- recognise that heat is generated when surfaces rub together such as rubbing hands together or tyres moving on the surface of the road
- identify some of the effects of friction such as wear and tear on shoes and tyres
- participate in an investigation of the friction caused by a variety of surfaces such as rolling a ball on a smooth or bumpy surface
- explore ways of reducing friction such as greasing or smoothing surfaces.

Electrostatic forces
- identify an electrical discharge such as lightning, sparks from taking off an acrylic jumper, 'zaps' from rubbing shoes on carpet
- investigate the effects of rubbing insulators to gain a static electric charge such as plastic and nylon
- investigate the properties of electrical charges including attraction and repulsion.

Gravitational force
- investigate the effects of gravity as a downward-acting force on a variety of objects.

Magnetic forces
- recognise a common magnet
- recognise the effects of a magnet by observing the responses of a variety of materials to a magnet, including iron and steel
- investigate attraction and repulsion by the poles of a magnet
- identify uses of magnets such as fridge magnets, toys, motors or compasses.

Outcomes
A student:
- investigates various forms and sources of energy and their uses SCLS-11KU
- investigates ways to use energy responsibly SCLS-12KU

There are different forms of energy, which may be transferred and transformed for different purposes.
Students:
- observe and/or experience forms of energy such as feeling heat from a fire, seeing light from a lamp or feeling the vibrations when a musical instrument is played
- recognise forms of energy we use in our home/school such as heat, light, sound
- identify the sources of energy we use in the home/school such as electricity, gas and solar

Science • Life Skills

Knowledge and Understanding – Physical World

- recognise that the form of energy can change such as electrical to heat (stove), electrical to sound and light (television) or electrical to light and heat (light globe)
- recognise that electrical devices source electrical power from power points and batteries
- explore potential risks and the safe use of electrical devices such as turning off the power point before unplugging a device and not using electrical devices near water [PSC]
- construct or draw simple circuits [N]
- recognise that electricity cannot flow if the circuit is incomplete, such as when a fuse breaks.

Responsible use of energy is important for individuals and society.
Students:

- identify why we should reduce our use of energy [SE]
- explore ways in which individuals can reduce their use of energy such as walking instead of using transport, limiting the length of a shower or turning electrical appliances off instead of leaving them on standby [SE, PSC]
- investigate new technologies and innovations to help reduce the amount of energy used around the home, such as energy-saving light globes, energy ratings on appliances or home insulation [SE, ICT].

Science • Life Skills

Knowledge and Understanding – Earth and Space

Outcomes

A student:

- identifies features of the Earth SCLS-13KU
- explores features of the solar system including the Earth's position and movement SCLS-14KU

The Earth has a variety of features that can be observed.

Students:

- classify features of their local area according to whether they are natural or man made such as buildings, trees and parks
- interact with and/or investigate some natural features of their local area to recognise their purpose, such as rivers used for fishing and swimming [CC]
- identify, using maps, pictures, interactive media or videos, some examples of Australian landforms, such as mountains, deserts, oceans, rivers, lakes, swamps, beaches and sand dunes [ICT, N]
- investigate some changes in the local landscape that have occurred over time, such as erosion by wind and water
- research natural processes such as volcanic activity, tsunamis, earthquakes using digital technologies or simulation models [ICT]
- investigate how plate tectonics, volcanoes, tsunamis or earthquakes may change or create a landform [CCT]
- recognise that the Earth is a sphere and is surrounded by air [N].

Features of the Earth are influenced by its position and movement in the solar system.

Students:

- identify some components of the solar system such as planets, moons, stars, meteors and comets
- explore some of the features of our solar system using interactive media, videos, models, visual and graphic resources [ICT]
- compare some features of different planets in the solar system [CCT]
- recognise the importance of the sun as a star which provides heat and light to Earth
- identify some stars and constellations including the Southern Cross
- compare the sizes of the Earth, sun and moon [N]
- recognise that the Earth moves around the sun
- identify the time it takes the Earth to travel around the sun (one year) [N]
- identify that night and day are caused by the rotation of the Earth once every 24 hours, such as by comparing the lengths of shadows produced at different times of the day [N]
- identify and sequence the seasons [N]
- compare the timing of the seasons in the Southern and Northern hemispheres [N]
- explore a seasonal calendar used by Aboriginal and Torres Strait Islanders [AHC]
- recognise that phases of the moon follow a cycle [N].

Outcomes

A student:

- identifies that the Earth is the source of resources used in everyday life SCLS-15KU
- investigates some practices used in the effective management of the Earth's resources SCLS-16KU

The Earth is the source of all the resources needed in everyday life.

Students:

- recognise the needs of living things for survival such as food, water, clean air and shelter

Science • Life Skills

Knowledge and Understanding – Earth and Space

- recognise that the needs of living things are provided by the Earth
- identify natural resources in the environment that are essential to human needs
- identify the structure of the Earth in terms of core, mantle and crust
- recognise that the Earth's crust is made of different types of rocks
- identify some of the Earth's natural resources such as rocks, minerals, water, fossil fuels
- identify the uses of some natural resources including providing fuel for cars
- distinguish between some natural resources that are non-renewable, such as fossil fuels, coal, minerals, and those that are renewable, such as water and solar energy [SE].

Human activity impacts on the effective management of Earth's resources.
Students:

- identify items of waste that can be recycled
- participate in the recycling of items of waste such as using a recycling bin appropriately [CC, PSC]
- identify ways to reduce the quantity of resources used, such as turning taps off properly, only running the dishwasher when full or choosing for bills to be sent electronically
- explore human activities that negatively affect resources such as logging, overfishing and destroying habitats [SE, PSC]
- identify ways to conserve and protect the use of resources in everyday life such as land care and water management [PSC, SE]
- explore and/or participate in ways in which to improve the environment such as composting, recycling, cleaning up the local area and planting trees [PSC, SE]
- investigate strategies to prevent landform erosion or repair landforms after erosion [SE]
- identify how human activity has impacted on the Earth's atmosphere at a global level, such as climate change and ozone depletion [SE]
- identify ways that individuals may change their lifestyle to reduce the negative effects of their actions on the atmosphere, such as car pooling or using electric/hybrid cars [SE, EU, PSC]
- recognise ways Aboriginal or Torres Strait Islander people sustain the value of the land, such as through the selective use of resources [AHC].

Science • Life Skills

Knowledge and Understanding – Living World

Outcomes
A student:
- recognises features of living and non-living things SCLS-17KU
- identifies structures of living things and their functions SCLS-18KU

There are differences within and between living things.
Students:
- group things according to whether they are living or non-living
- recognise living things and non-living things at home, at school and in the community
- recognise the two main groups of living things (animals and plants)
- identify a variety of plants and animals in the local environment
- describe characteristics of living things such as living things grow and change; use food, water and air; react to changes; reproduce
- compare the similarities and differences in the needs of living things such as plants need sunlight and water, animals need food and water [CCT]
- identify some external features of animals and/or plants
- classify a variety of living things according to their observable features such as vertebrates, invertebrates, mammals, reptiles, fish and birds [CCT]
- represent classifications of living things in a variety of ways such as diagrams and tables [N, L]
- observe changes that occur in a plant and/or animal over time
- recognise that living things have life cycles
- represent the life cycle of a common animal and/or plant in a variety of ways [N, L]
- observe the stages in the life cycle of a common animal and/or plant
- identify some microorganisms in the environment such as bacteria and viruses [SE]
- outline some beneficial and harmful effects that microorganisms can have on living things such as contribution to health, production of useful products and disease [SE]
- participate in and/or investigate ways to care for an identified living thing [PSC].

Living things have structures that carry out specialised functions.
Students:
- recognise some structures of animals such as fur, feathers, hard shells, skin and limbs
- communicate the function of some basic structures of animals such as limbs are used for moving
- observe some structures in plants such as root, stem and leaf
- appreciate that the structures in a plant serve a specific function, such as the hardness of a stem provides support and transport of water and nutrients; leaves absorb light and make food
- identify some major organs of the body such as the organs of the skeletal/muscular, circulatory, digestive, respiratory, excretory, reproductive and/or nervous systems
- describe the functions of some major organs of the body
- explore the consequences of damage to an organ or system [CCT]
- identify factors that are important in maintaining a healthy body such as exercise and diet [PSC].

Outcome
A student:
- explores the interactions of living things with each other and the environment SCLS-19KU

Living things depend on each other and on the environment.
Students:
- recognise that living things need food
- recognise that food is a source of energy for animals

Science • Life Skills

Knowledge and Understanding – Living World

- recognise that sunlight is a source of energy for plants
- explore the ways in which plants use sunlight to make their own food
- experience the needs of living things as they grow, such as the effect of light and water on plants
- describe a simple food chain such as caterpillar eats plant; magpie eats caterpillar
- represent simple food chains in a variety of ways, such as a pictorial representation or flowchart [N]
- recognise an ecosystem in the local environment
- identify the relationships between plants and animals within an ecosystem [SE]
- participate in an investigation of an ecosystem through constructing and observing their own ecosystem or exploring an existing ecosystem
- identify the features of a variety of living things that make them suited to their environment
- explore how some features of a common plant and/or animal help it to survive in its environment [CCT]
- identify the roles of producers (plants), consumers (animals) and decomposers (fungi) in an identified ecosystem (rock pool, garden)
- observe the decomposition process through building and maintaining a compost heap or worm farm
- communicate the purpose of decomposition such as natural recycling of materials
- identify materials that are cycled within an ecosystem, including water and carbon dioxide.

Outcomes

A student:

- explores ways in which science and technology have improved human health SCLS-20KU
- investigates the impact of science and technology on the environment SCLS-21KU

Scientific and technological developments have affected the functioning of the human body.
Students:

- recognise that humans need clean air, water, food and shelter
- identify an issue that could affect the functioning of the human body such as eating food that has not been prepared or stored appropriately; eating a balanced diet; maintaining oral hygiene; protecting the skin from sun damage [PSC]
- investigate ways to maintain a healthy body [PSC]
- investigate how scientific developments have changed or influenced the way people look after their bodies such as the use of sunscreen to prevent sunburn; gym equipment to exercise different parts of the body; refrigeration to store food; immunisation to prevent disease; safety helmets and seatbelts [CCT, PSC, ICT]
- identify some responses of the body to infectious and non-infectious diseases
- communicate how advances in science and technology have improved our understanding of the causes and control of some infectious diseases.

Human activity can impact on how an ecosystem functions.
Students:

- recognise waste, including personal and school waste or waste in the local community
- engage with an ecosystem to recognise the effects of particular waste, such as rubbish in the school environment or dumping oil and grease into rivers and streams [SE, CC]
- respond to ways to reduce the impact of waste on an ecosystem such as putting rubbish in the bin, exploring alternatives to pouring bleaches down the drain [SE, PSC]
- explore positive and negative changes to the environment as a result of human activity such as building cities, farms and roads; fishing; pollution [SE, CC, EU]
- recognise the difference between native and introduced species of plants and animals

Science • Life Skills

Knowledge and Understanding – Living World

- explore ways that the introduction of plant or animal species such as rabbits and boneseed, has affected a local ecosystem [SE]
- participate in an investigation to reduce the impact of human activity on an environment, such as rubbish in the school environment [SE, CC]
- participate in and/or investigate caring for an ecosystem such as planting trees, constructing fences to protect the habitat [SE, PSC].

Science • Life Skills

Knowledge and Understanding – Chemical World

Outcomes
A student:

- recognises the properties of common substances SCLS-22KU
- explores how common chemicals affect everyday life SCLS-23KU

Solids, liquids and gases have different properties.
Students:

- identify matter as existing as either a solid (ice, desk), a liquid (milk, soft drink, water) or a gas (wind from a fan, air in balloons, bubbles in water)
- recognise that matter can change its state such as ice cream becomes liquid when it melts; boiled water becomes gas (steam) when it is heated; breath turns to liquid (condensation) in cold temperatures
- investigate the effect of heat on the states of matter such as through evaporation, melting, boiling, condensation and freezing
- recognise as matter common materials in their surroundings such as cup, water, table, air
- recognise some properties of materials such as strength, flexibility, elasticity, hardness
- recognise things made from metal such as coins, taps, saucepans, pipes, window frames
- describe some of the properties of metals such as shiny appearance; silver or gold in colour; heats quickly; changes shape without breaking; most are solids; good for conducting electricity
- identify and categorise familiar objects according to whether they are metals or non-metals.

Mixtures can be separated using a range of techniques.
Students:

- recognise common mixtures that are naturally occurring and those that can be made such as sea water, muddy water, cordial, tea containing milk and sugar, rice cooking in water
- recognise some substances that can be dissolved such as sugar, liquid dishwashing detergent, oil in petrol for motor fuel, carbon dioxide gas in water for soft drinks
- observe the effects of dissolving a substance into another substance such as sugar in water
- participate in an investigation to identify substances that can be dissolved and substances that cannot be dissolved
- identify different ways of separating mixtures such as draining rice with a sieve, filtering coffee or evaporating water from salt water
- explore reasons for separating mixtures such as water purification
- separate the components of some common mixtures through techniques including filtration, decantation, evaporation, crystallisation (dissolve sugar in water and leave in the sun to evaporate into sugar crystals), chromatography (place different coloured lollies on filter paper, add water and observe the food colouring separate) [WE].

Common chemicals have different uses.
Students:

- recognise common foods that contain acids, such as lemons and oranges, yoghurt and vinegar
- recognise the uses of a variety of natural materials in different cultures, such as the use of common plants as dyes for clothing and shelter by Aboriginal and Torres Strait Islander peoples [AHC]
- recognise uses of metals in familiar contexts such as cutlery, cooking utensils, cars, furniture, window frames, door handles
- describe the properties of materials in relation to a useful function such as elastic bands are flexible so that they fit a variety of objects
- describe the properties of metals in relation to a useful function such as metal as a good conductor to make simple circuits; metal as a poor insulator to keep drinks warm
- describe common uses for a variety of substances such as Styrofoam cups, coolers

Science • Life Skills

Knowledge and Understanding – Chemical World

- investigate the best substance to use for a particular purpose such as the best material to insulate a coffee cup [CCT]
- identify common chemicals in the home such as vinegar, baking soda, salt, sugar, soap, nail polish remover, bleach, motor oil, paint [WE]
- identify and associate common household chemicals with their uses such as detergents for removing grease; bleach for sanitising
- identify common chemical safety/hazard symbols [WE]
- recognise and attend to language used to describe how hazardous a product is such as 'danger', 'warning', 'caution' [WE, PSC]
- describe the need for safe use and storage of household chemicals including strategies to minimise harm
- explore the effects of an identified household chemical that is not used or stored safely
- explore and/or participate in the safe use and storage of household chemicals [PSC].

Outcome
A student:
- investigates a variety of chemical changes SCLS-24KU

When a chemical change occurs, new substances may be formed.
Students:
- observe some types of chemical changes such as baking a cake, making bread, lighting a sparkler, gas bubbles forming in water
- recognise that some chemicals change when heated such as burning magnesium
- recognise that some chemicals are changed, created or disappear when combined
- recognise that a chemical change has occurred when rust forms on iron materials in the school grounds or at home
- investigate the requirements for rusting including oxygen and water from the air
- identify ways to prevent rusting such as painting or plating
- describe some ways to remove rust from metals including using sandpaper, soaking in lemon juice.

There are different types of chemical reactions that can be used in our everyday life.
Students:
Combustion
- identify common things that burn such as paper, cardboard, wood and leaves
- recognise highly combustible materials such as petrol, spray cans, nail polish
- identify the types of energy that are produced by burning things such as heat and light
- recognise that things change when they burn such as paper turns to ash
- investigate the requirements for combustion such as fuel, high temperature, oxygen from the air
- identify safety issues relating to combustion such as prevention, storage procedures [PSC].

Reactions of acids
- distinguish between acids and alkalis by observing the colour change when adding red cabbage juice to a variety of household chemicals such as vinegar, floor or window cleaner, soap, lemon juice, milk, shampoo, lemonade or soda water
- investigate the reaction of acids such as by adding vinegar to baking soda and observing the effects.

9 Continuum of learning in Science K–10 and Technology K–8

ⓘ for your information

Stage outcomes and stage statements illustrate the continuum of learning in the *Science K–10 Syllabus (incorporating Science and Technology K–6).*

9.1 Stage outcomes

✍ consult

Continuum of learning in Science K–10

Values and attitudes

Early Stage 1 to Stage 3 outcomes A student:	**Stage 4 – 5 outcomes** A student:
STe-1VA, ST1-1VA, ST2-1VA, ST3-1VA shows interest in and enthusiasm for science and technology, responding to their curiosity, questions and perceived needs, wants and opportunities	SC4-1VA, SC5-1VA appreciates the importance of science in their lives and the role of scientific inquiry in increasing understanding of the world around them
STe-2VA, ST1-2VA, ST2-2VA, ST3-2VA demonstrates a willingness to engage responsibly with local, national and global issues relevant to their lives and to shaping sustainable futures	SC4-2VA, SC5-2VA shows a willingness to engage in finding solutions to science-related personal, social and global issues, including shaping sustainable futures
STe-3VA, ST1-3VA, ST2-3VA, ST3-3VA develops informed attitudes about the current and future use and influence of science and technology based on reason	SC4-3VA, SC5-3VA demonstrates confidence in making reasoned, evidence-based decisions about the current and future use and influence of science and technology, including ethical considerations

Skills

Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:	**Stage 4 outcomes** A student:	**Stage 5 outcomes** A student:
STe-4WS explores their immediate surroundings by questioning, observing using their senses and communicating to share their observations and ideas	ST1-4WS investigates their questions and predictions by collecting and recording data, sharing and reflecting on their experiences and comparing what they and others know	ST2-4WS investigates their questions and predictions by collecting and analysing data, suggesting explanations for their findings, and communicating and reflecting on the processes undertaken	ST3-4WS investigates by posing questions, including testable questions, making predictions, and gathering data to draw evidence-based conclusions and develop explanations	SC4-4WS identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge	SC5-4WS develops questions or hypotheses to be investigated scientifically
				SC4-5WS collaboratively and individually produces a plan to investigate questions and problems	SC5-5WS produces a plan to investigate an identified question, hypothesis or problem
				SC4-6WS follows a sequence of instructions to safely undertake a range of types of investigations, individually and collaboratively	SC5-6WS undertakes a first-hand investigation to collect valid and reliable data and information individually and collaboratively
				SC4-7WS processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns, relationships and draw conclusions	SC5-7WS processes, analyses and evaluates data from a first-hand investigation or secondary sources
				SC4-8WS selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to an identified problem	SC5-8WS applies scientific understanding and critical thinking skills to suggest possible solutions to an identified problem
				SC4-9WS presents ideas, findings and information to a given audience using appropriate scientific language, representations and text types	SC5-9WS presents ideas and evidence for a specific purpose and audience, using appropriate scientific language, conventions and representations

Knowledge and understanding

Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:	**Stage 4 outcomes** A student:	**Stage 5 outcomes** A student:
STe-6NE identifies that the way objects move depends on a variety of factors	ST1-6NE describes some sources of light and sound that they sense in their daily lives	ST2-6NE identifies ways heat is produced and that heat moves from one object to another	ST3-6NE describes how people use scientific understanding about the sources, transfer and transformation of electricity in making decisions about its use	SC4-10KU describes the action of forces in everyday situations	SC5-10KU applies models, theories and laws to explain situations involving energy, force and motion
	ST1-7NE describes the effects of pushes and pulls on objects they encounter	ST2-7NE describes interactions between objects that result from contact and non-contact forces	ST3-7NE identifies that scientific knowledge about the transfer of light is used to solve problems that directly affect peoples' lives	SC4-11KU discusses how scientific knowledge and technological developments have contributed to finding solutions to problems involving energy transfers and transformations	SC5-11KU explains how science understanding about energy conservation, transfers and transformations is applied in systems
STe-7NE observes using their senses how daily and seasonal changes in the environment affect them and other living things	ST1-8NE describes some observable changes that occur in the sky and landscape	ST2-8NE describes some observable changes over time on the Earth's surface that result from natural processes and human activity	ST3-8NE describes how discoveries by people from different cultures and times have contributed to advancing scientific understanding of the solar system	SC4-12KU describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system	SC5-12KU describes changing ideas about the structure of the Earth and the universe to illustrate how models, theories and laws are refined over time by the scientific community
	ST1-9NE identifies ways that people use science in their daily lives to care for the environment and Earth's resources	ST2-9NE describes some relationships between the sun and the Earth that cause regular changes	ST3-9NE identifies that evidence provided by advances in technology and scientific understanding can be used to explain rapid change at the Earth's surface caused by natural events	SC4-13KU explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource management practices	SC5-13KU explains how scientific knowledge about global patterns of geological activity and interactions involving global systems can be used to inform decisions related to contemporary issues
STe-8NE identifies the basic needs of living things	ST1-10NE describes the growth, changes in and external features of living things	ST2-10NE describes that living things have life cycles, can be distinguished from non-living things and grouped, based on their observable features	ST3-10NE describes how structural features and other adaptations of living things help them to survive in their environment	SC4-14KU relates the structure and function of living things to their classification, survival and reproduction	SC5-14KU analyses interactions between components and processes within biological systems
	ST1-11NE describes how different places in the environment provide for the needs of living things	ST2-11NE identifies that science knowledge helps people understand the effect of their actions on the survival of living things	ST3-11NE describes the physical conditions of their environment that affect the growth and survival of living things	SC4-15KU explains the contribution of scientific understanding and technological advances in finding solutions to contemporary issues	SC5-15KU explains how scientific understanding has advanced through scientific discoveries, technological developments and needs of society

Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:	**Stage 4 outcomes** A student:	**Stage 5 outcomes** A student:
STe-9ME identifies that objects are made of materials that have observable properties	ST1-12NM identifies ways that everyday materials can be physically changed and combined for a particular purpose	ST2-12NM identifies that adding or removing heat causes a change of state between solids and liquids	ST3-12NM identifies the observable properties of solids, liquids and gases, and that changes made to materials are reversible or irreversible	SC4-16KU describes the observed properties and behaviour of matter using scientific models and theories about the motion and arrangement of particles	SC5-16KU explains how models, theories and laws about matter have been refined as new scientific evidence becomes available
	ST1-13NM relates the properties of common materials to their use for their particular purposes	ST2-13NM identifies the physical properties of natural and processed materials and how these influence their use	ST3-13NM describes how the properties of materials determine their use for specific purposes	SC4-17KU explains how scientific understanding of, and discoveries about the properties of elements, compounds and mixtures relate to their uses in everyday life	SC5-17KU discusses the importance of chemical reactions in the production of a range of substances, and the influence of society on the development of new materials

Continuum of Learning in Technology K–8

Values and attitudes

Early Stage 1 to Stage 3 outcomes A student:	**Stage 4 Outcomes** A student:
STe-1VA, ST1-1VA, ST2-1VA, ST3-1VA shows interest in and enthusiasm for science and technology, responding to their curiosity, questions and perceived needs, wants and opportunities	4.1.1 applies design processes that respond to needs and opportunities in each design project
STe-2VA, ST1-2VA, ST2-2VA, ST3-2VA demonstrates a willingness to engage responsibly with local, national and global issues relevant to their lives and to shaping sustainable futures	4.1.2 describes factors influencing design in the areas of study of Built Environments, Products and Information and Communications 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project
STe-3VA, ST1-3VA, ST2-3VA, ST3-3VA develops informed attitudes about the current and future use and influence of science and technology based on reason	4.4.1 explains the impact of innovation and emerging technologies on society and the environment 4.6.2 identifies and explains ethical, social, environmental and sustainability considerations related to design projects

Skills

Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:	**Stage 4 outcomes** A student:
STe-4WS explores their immediate surroundings by questioning, observing using their senses and communicating to share their observations and ideas	ST1-4WS investigates their questions and predictions by collecting and recording data, sharing and reflecting on their experiences and comparing what they and others know	ST2-4WS investigates their questions and predictions by collecting and analysing data, suggesting explanations for their findings, and communicating and reflecting on the processes undertaken	ST3-4WS investigates by posing questions, including testable questions, making predictions, and gathering data to draw evidence-based conclusions and develop explanations	4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources
STe-5WT uses a simple design process to produce solutions with identified purposes	ST1-5WT uses a structured design process, everyday tools, materials, equipment and techniques to produce solutions that respond to identified needs and wants	ST2-5WT applies a design process and uses a range of tools, equipment, materials and techniques to produce solutions that address specific design criteria	ST3-5WT plans and implements a design process selecting a range of tools, equipment, materials and techniques to produce solutions that consider constraints	4.1.1 applies design processes that respond to needs and opportunities in each design project 4.2.1 generates and communicates creative design ideas and solutions 4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources 4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project 4.5.1 applies management processes to successfully complete design projects 4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project 4.6.1 applies appropriate evaluation techniques throughout each design project

Knowledge and Understanding

Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:	**Stage 4 outcomes** A student:
STe-6NE identifies that the way objects move depends on a variety of factors	ST1-6NE describes some sources of light and sound that they sense in their daily lives	ST2-6NE identifies ways heat is produced and that heat moves from one object to another	ST3-6NE describes how people use scientific understanding about the sources, transfer and transformation of electricity in making decisions about its use	Not specifically addressed in outcomes. Energy can be addressed optionally within suitable design projects
	ST1-7NE describes the effects of pushes and pulls on objects they encounter	ST2-7NE describes interactions between objects that result from contact and non-contact forces	ST3-7NE identifies that scientific knowledge about the transfer of light is used to solve problems that directly affect peoples' lives	
STe-7NE observes using their senses how daily and seasonal changes in the environment affect them and other living things	ST1-8NE describes some observable changes that occur in the sky and landscape	ST2-8NE describes some observable changes over time on the Earth's surface that result from natural processes and human activity	ST3-8NE describes how discoveries by people from different cultures and times have contributed to advancing scientific understanding of the solar system	4.6.2 identifies and explains ethical, social, environmental and sustainability considerations related to design projects
	ST1-9NE identifies ways that people use science in their daily lives to care for the environment and Earth's resources	ST2-9NE describes some relationships between the sun and the Earth that cause regular changes	ST3-9NE identifies that evidence provided by advances in technology and scientific understanding can be used to explain rapid change at the Earth's surface caused by natural events	
STe-8NE identifies the basic needs of living things	ST1-10NE describes the growth, changes in and external features of living things	ST2-10NE describes that living things have life cycles, can be distinguished from non-living things and grouped, based on their observable features	ST3-10NE describes how structural features and other adaptations of living things help them to survive in their environment	
	ST1-11NE describes how different places in the environment provide for the needs of living things	ST2-11NE identifies that science knowledge helps people understand the effect of their actions on the survival of living things	ST3-11NE describes the physical conditions of their environment that affect the growth and survival of living things	

Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:	**Stage 4 outcomes** A student:
STe-9ME identifies objects are made of materials that have observable properties	ST1-12NM identifies ways everyday materials can be physically changed and combined for a particular purpose ST1-13NM relates the properties of common materials to their use for their particular purposes	ST2-12NM identifies that adding or removing heat causes a change of state between solids and liquids ST3-13NM identifies the physical properties of natural and processed materials and how these influence their use	ST3-12NM identifies the observable properties of solids, liquids and gases and that changes made to materials are reversible or irreversible ST3-13NM describes how the properties of materials determine their use for specific purposes	4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project 4.4.1 explains the impact of innovation and emerging technologies on society and the environment
STe-10ME recognises how familiar products, places and spaces are made to suit their purpose	ST1-14ME describes a range of places and spaces in the local environment and how their purposes influence their design ST1-15ME describes a range of familiar information sources and technologies and how their purposes influence their design ST1-16ME describes a range of manufactured products in the local environment and how their different purposes influence their design	ST2-14ME describes how people interact within built environments and the factors considered in their design and construction ST2-15ME describes ways information solutions are designed and produced, and the factors to consider when people use and interact with sources and technologies ST2-16ME describes how products are designed and produced, and the ways people use them	ST3-14ME describes systems in built environments and the social and environmental factors that influence their design ST3-15ME describes information and communication systems and how social influences impact on their design and use ST3-16ME describes systems used to produce or manufacture products, and the social and environmental influences on product design	4.1.2 describes factors influencing design in the areas of study of Built Environments, Products and Information and Communications 4.1.3 identifies the roles of designers and their contribution to the improvement of the quality of life 4.4.1 explains the impact of innovation and emerging technologies on society and the environment 4.6.2 identifies and explains ethical, social, environmental and sustainability considerations related to design projects

9.2 Stage statements

ⓘ for your information

The stage statements include the Australian curriculum achievement standards and summarise the knowledge, understanding, skills, values and attitudes developed by students as a result of achieving the outcomes for each stage of learning.

✍ consult

Early Stage 1

In Early Stage 1 students' sense of wonder and curiosity about the Natural Environmental and the Made Environment is fostered through purposeful play, observing, questioning and exploring ideas. They use and learn about the processes of Working Scientifically and Working Technologically in a holistic way and are unlikely to perceive the different processes as they often work in situations where these aspects occur at the same time.

Students recognise that science involves them exploring their immediate surroundings using their senses. They identify that living things have basic needs and suggest how daily and seasonal changes in the environment affect them and other living things. They recognise that the way objects move depends on a variety of factors. Students identify that objects are made of materials that have observable properties and that familiar products, places and spaces are made to suit their purpose.

Through active participation in the processes of Working Scientifically and Working Technologically, students show a growing awareness of the appropriate use of a range of classroom equipment and work safely when using resources and materials. They communicate their observations and ideas about familiar objects, events, places, spaces and products. Students share their findings and ideas about what they already know, what they observe, what they did, how they feel about it and the usefulness of their final solutions.

Stage 1

In Stage 1 students show an interest in science and technology by responding to questions, perceived needs and wants. They describe situations were other people and themselves use science and technology in their daily lives. They investigate the variety of ways in which the Earth's resources are used and suggest ways that science and technology can help people care for the environment and shape sustainable futures.

Through activities structured by the teacher, students continue to learn about and engage in applying the processes of Working Scientifically and Working Technologically. Students show curiosity about the Natural Environment and the Made Environment, while purposeful play becomes more focused on exploring and making observations using their senses.

When engaging in the processes of Working Scientifically and Working Technologically students safely and carefully manipulate available tools, materials and equipment. They use a range of methods to represent information and communicate their observations and ideas to others with the assistance of digital technologies where appropriate.

When Working Scientifically students identify questions, make predictions and investigate everyday phenomena to explore and answer their questions. They participate in a range of types of investigations including surveys, testing ideas and accessing information sources. Students follow instructions to collect, record and compare their observations using informal measurements as appropriate.

When Working Technologically students use a structured design process to produce solutions in response to identified needs and wants of users/audiences. They generate and develop design ideas using research and communicate their ideas using plans, drawings and models. Students use a sequence of simple steps to produce solutions for built environments, information and products. They give simple explanations about what they did to design and produce the solution and how it meets the needs of the user/audience.

Students describe the features of and ways in which living things grow and change, and how living things depend on places in their environment to meet their needs. They describe some sources of light and sound that they sense in their daily lives. They also describe changes in the sky and landscape, as well as the effects of pushes and pulls on objects.

Students identify ways in which materials can be physically changed and combined, and that properties of everyday materials can be related to their uses for particular purposes. They use their understanding of the Made Environment to describe a range of manufactured products, built environments and information sources and technologies, and how their different purposes influence their design.

Stage 2

Students in Stage 2 are responsive to ideas and show interest in and enthusiasm for science and technology. They appreciate the importance of science and technology in their lives and show a willingness to improve the quality of their local environment.

Students begin to initiate their own investigations and develop ideas for design tasks based on their prior science and technology knowledge and experiences. When using the processes of Working Scientifically and Working Technologically they begin to develop and apply a sequence of steps.

When engaging in the processes of Working Scientifically and Working Technologically students safely and carefully manipulate available tools, materials and equipment. They identify ways of improving techniques and methods used in their investigations and design tasks. Students suggest ways that findings from the processes of Working Scientifically and Working Technologically can inform further investigations and design tasks. They use a range of representations to document and communicate methods, techniques, findings, ideas and information including digital technologies as appropriate.

Students identify when science is used to ask investigatable questions and predict outcomes. They follow instructions to plan and conduct a range of first-hand investigations, including fieldwork. Students make and record observations, using formal measurements as appropriate and suggesting reasons why methods were fair or not. They organise and identify patterns in data using provided tables and simple column graphs. Students suggest reasons for observations and compare findings with predictions.

Students explore a design task and develop a design brief that identifies simple design criteria. They continue to generate and develop ideas and begin to use creative thinking techniques including brainstorming and sketching. They begin to develop and apply a structured plan to produce their solutions for built environments, information and products. Students use design criteria and feedback to explain how their design solution could be adjusted and improved to meet their needs and those of others.

Students use their understanding of the Natural Environment to describe observable changes on the Earth's surface that result from natural and human processes. They relate movements of the Earth to regular observable changes and explain interactions between objects that result from contact and non-contact forces. They sequence key stages in the life cycle of a plant or animal, distinguish between living and non-living things and group them based on observable features. They identify relationships between living things and describe situations where science knowledge can influence their own and others' actions.

Students relate the behaviour of heat to observable changes in state that occur between solids and liquids. In suggesting explanations for everyday observations, they identify how the observable properties of materials influence their use. Using their understanding of the Made Environment, they describe how products are designed, produced and used in different ways by people. They describe how people interact within a place and space, and explain how these are designed to meet the needs of users.

Stage 3

Students in Stage 3 show informed attitudes to issues related to the current and future use and influence of science and technology. They are interested and willing to engage in local, national and global issues that are relevant to their lives and the maintenance of a sustainable future. They are able to discuss how science and technology directly affect people's lives and are used to solve problems.

Students initiate, use and apply the processes of Working Scientifically and Working Technologically with a greater level of independence. They are more self-reliant in undertaking a range of scientific investigations and design projects, and in collaboratively completing the tasks. Students select and safely use a variety of equipment, materials and resources identifying potential risks. They identify where improvements to their methods, techniques or research could enhance the quality of the information gathered. Students use a range of representations to present, document and communicate methods, findings and ideas including tables, graphs, diagrams and multi-modal texts using digital technologies where relevant. Students evaluate their design solutions and identify the strengths and limitations of the process used.

When Working Scientifically, students follow instructions, pose questions for investigations, predict likely outcomes and demonstrate honesty and accuracy in collecting, recording and analysing data and information. In planning and conducting fair tests they are able to identify variables to be changed and measured, and check results by repeating observations and measurements. They construct tables and graphs to organise data and identify patterns. They use evidence to draw conclusions and develop explanations.

When Working Technologically, students plan and implement a design process to meet the needs and wants of users/audiences. They explore and define the design task, establishing design criteria and considering constraints when planning the process. Students select and apply appropriate methods to develop and generate ideas and apply established criteria to evaluate and modify these. They develop plans, specifications and production sequences to produce solutions for built environments, information and products. They evaluate their solutions using self and peer assessment and identify the strengths and limitations of the process used.

As students continue to observe and investigate aspects of the Natural Environment, they explain how natural events cause rapid changes to the Earth's surface, describe key features of the solar system and the contribution of people from a range of cultures over time to the advancement of science. They explain everyday phenomena associated with the transfer of light and requirements for the transfer and transformation of electricity. They identify how energy from a variety of sources can be used to generate electricity and how science knowledge is used to inform personal and community decisions. Students describe how features of living things help them to survive in their environment and how the growth and survival of living things is affected by changes in the physical conditions of their environment.

Students identify the observable properties of solids, liquids and gases. They compare and classify different types of observable changes to materials, considering how their properties determine their use.

Within the Made Environment students explain how production systems are used to manufacture products. They explore changes that have occurred in the design of products over time and the social and environmental factors that influence the design of products.

Students investigate how systems in built environments are designed to meet the needs of people, in response to social and environmental influences. They explain how systems can be used to transfer information and support communication, and how social influences impact on the design of a range of emerging information products.

Stage 4

Students in Stage 4 use scientific inquiry by actively engaging in using and applying the processes of Working Scientifically. They identify questions and problems that they can test or research scientifically. They select and use appropriate strategies, understanding and skills to generate creative plausible solutions to identified problems. Individually and collaboratively they plan and conduct a range of types of first-hand investigations, including fieldwork and controlled experimental methods ensuring that fairness, safety and ethical guidelines are followed.

Students process and analyse data and information from first-hand investigations and secondary sources to identify trends, patterns and relationships, drawing relevant, evidence-based conclusions. They reflect on how the methods, strategies used and the quality of data obtained could be improved. Their ideas, methods and findings are communicated to a given audience using appropriate scientific language, representations and text types, with information sources acknowledged using a recognised method.

By engaging in scientific inquiry students develop their knowledge of and about scientific ideas and concepts, as well as the nature, development and importance of scientific evidence. They explain how scientific knowledge changes as new discoveries and technological developments are made available, appreciating that new evidence leads to an improved understanding of the world.

Students describe the action of unbalanced forces on the motion of objects in everyday situations, including Earth's gravity. They discuss how developments in scientific knowledge and technology have contributed to finding solutions to problems involving the use of energy transfers and transformations in simple systems and how the solutions may impact on other areas of society.

Students relate the structure and function of living things to their classification, survival and reproduction. They predict the effects of environmental changes on ecosystems and how scientific understanding influences the development of some management practices. They explain the contribution and influence of scientific knowledge and technological advances in finding solutions to contemporary issues and that these solutions may involve ethical considerations.

Students describe the dynamic nature of models, theories and laws in developing scientific understanding of the Earth, solar system and observed properties and behaviour of matter. They describe processes occurring in and on the Earth and the time scales involved, as well as situations where understanding and skills from across the disciplines of science are used in exploration for resources and, obtaining and processing of materials. They explain how advances in scientific understanding influence the choices people make about resource use and management practices in shaping sustainable futures.

Students relate the physical and chemical properties of matter to how materials are processed and used by society in everyday life. They describe situations where scientific knowledge and collaboration between scientists generates solutions to obtaining and making new substances from Earth's spheres.

Stage 5

Students in Stage 5 use scientific inquiry by actively engaging in using and applying the processes of Working Scientifically to increase their understanding of and about the world around them. By engaging in scientific inquiry, students develop their understanding of scientific ideas and concepts, how scientific knowledge is refined over time and the significance of scientific evidence in evaluating claims, explanations and predictions.

Students formulate questions or hypotheses to be investigated scientifically. They apply scientific understanding and critical thinking skills to suggest possible solutions to identified problems. Individually and collaboratively they plan and undertake a range of types of first-hand investigations to accurately collect data using appropriate units, assessing risk and considering ethical issues associated with the method. They design and conduct controlled experiments to collect valid and reliable first-hand data.

In Stage 5 students process, analyse and evaluate data and information from first-hand investigations to draw conclusions consistent with the evidence, identifying sources of uncertainty and possible alternative explanations for findings. They assess the validity and reliability of claims made in secondary sources. They evaluate the methods and strategies they and others use and ways in which the quality of data could be improved, including the appropriate use of digital technologies. They communicate scientific ideas for specific purposes and construct evidence-based arguments using appropriate scientific language, representations and text types.

Students apply models, theories and laws to explain phenomena and situations involving energy, force and motion. They explain the concept of energy conservation, by describing energy transfers and transformations within systems.

Students describe changing ideas about the structure of the Earth, origins of the universe and the diversity of life on Earth to illustrate how models, theories and laws are refined over time by the scientific community as new evidence becomes available. They describe situations where advances in scientific understanding may depend on developments in technology, and that technological advances are frequently linked to scientific discoveries.

Students explain how scientific understanding has contributed to knowledge about global patterns of geological activity and interactions between global systems. They analyse interactions between components and processes within biological systems and their responses to external changes. They use scientific evidence to assess whether claims, explanations and predictions are supported and can be used to evaluate predictions and inform decisions related to contemporary issues.

Students explain the organisation of the periodic table, chemical reactions and natural radioactivity in terms of atoms. They describe how different factors influence the rate of chemical reactions and the importance of a range of types of chemical reactions in the production of substances.

By the end of Stage 5 students can describe how the values and needs of contemporary society can influence the focus of scientific research and technological development in a variety of areas, including efficiency of use of electricity and non-renewable energy sources, the development of new materials, biotechnology, and plant, animal and human health. They can outline examples of where the applications of the advances of science, emerging sciences and technologies significantly affect people's lives, including generating new career opportunities.

10 Assessment

10.1 Standards

The Board of Studies *K–10 Curriculum Framework* is a standards-referenced framework that describes, through syllabuses and other documents, the expected learning outcomes for students.

Standards in the framework consist of two interrelated elements:

- outcomes and content in syllabuses showing what is to be learned
- descriptions of levels of achievement of that learning.

Exemplar tasks and student work samples help to elaborate standards.

Syllabus outcomes in Science contribute to a developmental sequence in which students are challenged to acquire new knowledge, understanding and skills.

The standards are typically written for two years of schooling and set high, but realistic, expectations of the quality of learning to be achieved by the end of Years 2, 4, 6, 8 and 10.

Using standards to improve learning

Teachers use standards in Science as a reference point for planning teaching and learning programs, as well as for assessing and reporting student progress. Standards in Science help teachers and students to set targets, monitor achievement, and as a result, make changes to programs and strategies to support and improve each student's progress.

10.2 Assessment for learning

Assessment for learning is designed to enhance teaching and improve student learning. It gives students opportunities to produce work that leads to development of their knowledge, understanding and skills. Teachers decide how and when to assess student achievement, as they plan the work students will do, using a range of appropriate assessment strategies including self-assessment and peer assessment.

Teachers of Science provide students with opportunities in the context of everyday classroom activities, as well as planned assessment events, to demonstrate their learning.

In summary, *assessment for learning*:

- is an essential and integrated part of teaching and learning
- reflects a belief that all students can improve
- involves setting learning goals with students to encourage growth and development
- involves students in self-assessment and peer assessment
- provides feedback that helps students understand the next steps in learning and plan how to achieve them
- involves teachers, students and parents reflecting on assessment data.

Quality assessment practices

Effective assessment for learning informs teachers and students about past, present and future learning. The quality of assessment practices and materials can be judged using the following *assessment for learning* principles. The following assessment for learning principles provide the criteria for judging the quality of assessment materials and practices.

Assessment for learning principles

Assessment for learning:

- promotes learning by emphasising the interactions between learning and manageable assessment strategies
  - teachers reflect on the purposes of assessment and on their assessment strategies
  - assessment activities allow for demonstration of learning outcomes
  - assessment is embedded in learning activities and informs the planning of future learning activities
  - teachers use assessment to identify what a student can already do
- clearly expresses the goals of the learning activity
  - students know and understand the learning goals and the criteria that will be applied to judge the quality of their achievement
  - students receive feedback that helps them make further progress
- helps students learn better, rather than just achieve a better mark
  - assessment is an integral component of the teaching–learning process rather than a separate activity
  - teachers design and select tasks that assess, and therefore encourage, deeper learning
  - feedback motivates the learner and helps students to understand that engagement with feedback can lead to improvement
- provides meaningful and constructive feedback
  - feedback is directed to the achievement of standards and away from comparisons with peers
  - feedback is clear about strengths and areas for further development
  - feedback is individualised and provides strategies for improvement
- encourages students to take responsibility for their own learning
  - assessment includes strategies for self-assessment and peer assessment, emphasising the next steps needed for further learning
- is inclusive of all learners
  - assessment against standards provides opportunities for the diverse range of learners to achieve their best
  - assessment activities are accessible and free of bias.

10.3 Assessment for students with special education needs

Some students with special education needs will require adjustments to assessment practices in order to demonstrate what they know and can do in relation to syllabus outcomes and content. These may be:

- adjustments to the assessment process, for example additional time, rest breaks, quieter conditions, or the use of a reader and/or scribe or specific technology
- adjustments to assessment tasks, for example rephrasing questions, using simplified language, fewer questions or alternative formats for questions
- alternative formats for responses, for example written point form instead of essays, scaffolded structured responses, short objective questions or multimedia presentations.

Further examples of adjustments to assessment for students with special education needs can be found in the Science support material.

Life Skills assessment

Each student undertaking the Science Years 7–10 Life Skills course will study selected outcomes and content. The syllabus outcomes and content form the basis of learning opportunities for students.

Assessment should provide opportunities for students to demonstrate achievement in relation to the outcomes and to apply their knowledge, understanding and skills to a range of situations or environments, including the school and the wider community.

Students may demonstrate achievement in relation to Science Years 7–10 Life Skills outcomes independently, with adjustments, or with support. The type of adjustments and support will vary according to the particular needs of the student and the requirements of the activity.

Further information about the assessment of students undertaking Life Skills outcomes and content can be found in *Life Skills Years 7–10: Advice on Planning, Programming and Assessment.*

10.4 Reporting

Reporting is the process of providing feedback to students, parents and other teachers about student progress.

Teachers use assessment evidence to extend the process of *assessment for learning* into their *assessment of learning*. In a standards-referenced framework teachers make professional judgements about student achievement at key points in the learning cycle. These points may be at the end of a year or stage, when schools may wish to report differentially on the levels of knowledge, understanding and skills demonstrated by students.

Descriptions of student achievement in Science provide schools with a useful tool to report consistent information about student achievement to students and parents, and to the next teacher to help plan the next steps in the learning process.

The A–E grade scale or equivalent provides a common language for reporting by describing observable and measurable features of student achievement at the end of a stage, within the indicative hours of study. Teachers use the descriptions of the standards to make a professional, on-balance judgement, based on available assessment information, to match each student's achievement to a description. The Common Grade Scale (A–E) or equivalent is used by teachers to report student levels of achievement from Stages 1 to 5.

The values and attitudes objectives and outcomes are an integral part of learning and an important element of any course. Schools may decide to report on them separately to students and parents such as using some form of descriptive statement. Measures of objectives and outcomes that address values and attitudes are not used in determining a student's grade.

For students with special education needs, teachers may need to consider, in consultation with their school and sector, the most appropriate method of reporting student achievement. It may be deemed more appropriate for students with special education needs to be reported against outcomes or goals identified through the collaborative curriculum planning process.

10.5 Choosing assessment strategies

The range of assessment strategies should gather information about the depth of students' understanding, the development of skills, as well as the extent of content knowledge. Assessment strategies should allow for flexibility in the design of tasks.

A collaborative approach to assessment develops a shared understanding of syllabus standards and helps teachers make consistent judgements of evidence of student achievement.

When choosing assessment strategies, teachers should consider whether the tasks:

- ensure a variety of types of task that cater for the full range of students
- show a clear relationship between the outcomes, what has been taught and the content being assessed
- inform students about the nature of the task and marking guidelines
- demonstrate validity and reliability, and are free from prejudice, discrimination and stereotyping
- provide constructive feedback about what students are able to do and what they need to do in order to improve their level of performance
- allow opportunities for self-assessment and peer assessment.

Further advice about choosing assessment strategies will be provided in support materials.

11 Glossary

The terms defined in this glossary have specific relevance for teaching or the interpretation of the *Science K–10 Syllabus (incorporating Science and Technology K–6)*.

A Glossary of Key Words, provided on the Board of Studies website at www.boardofstudies.nsw.edu.au/syllabus_hsc/glossary_keywords.html, provides key verbs frequently used to introduce the outcomes and essential content in the syllabus.

biotechnology	The use of living things to make or change products. Gene technology sits within the broader area of biotechnology and includes the discovery of genes, understanding of how genes function and interact, and genetic modification or engineering.
content	The substance or subject matter to be studied by students. This is expressed in the syllabus in terms of the knowledge, understanding and skills.
context	Contexts are devised by teachers and are the framework within which the learning experiences take place. The syllabus does not specify contexts, as these will be selected by the teacher. The knowledge, understanding and skills content is developed in contexts relevant to the needs, interests and experiences of students.
control (the control in an experiment)	The sample in an experiment to which all the other samples are compared.
conclusions	An opinion or judgement based on evidence.
data	Facts or figures that can be used to draw conclusions.
dependent variable	The factor in an experiment that changes as a result of changes to the independent variable; conventionally plotted on the vertical (y) axis of a graph.
Earth's spheres	The division of four interacting spheres into atmosphere, biosphere, lithosphere and hydrosphere.
evidence	In science, evidence is valid/reliable data that can be used to support a particular theory, hypothesis, idea or conclusion.
fair test	An investigation where one variable (the independent variable) is changed and all other conditions (controlled variables) are kept the same; what is measured or observed is referred to as the dependent variable.
field work	An investigation that is undertaken in the normal environment of the subject of the study.
first-hand investigation	Inquiry based on the direct use of observation or measurement.
formal measurement	Measurement that is based on an agreed standard unit, such as metre, second and gram.
hypothesis	A predictive statement which can be tested using a range of methods, most often associated with experimental procedure; can be supported or refuted by experiment.
independent variable	The variable that is deliberately changed, often through a series of preset values. Conventionally plotted on the horizontal (x) axis of a graph.
informal measurement	Measurement that is not based on any agreed standard unit. Informal measurements may include hand spans and paces.

interactions	Involves the identification of interactions between components within and between systems that leads to a greater understanding of how our world works. An understanding of natural complex systems or the development of successful technologies requires the integration and application of concepts from more than one science discipline.
investigation	A range of types of first-hand activities that can be used to answer a question, explore an idea or solve a problem. Scientific investigations usually involve using and applying, such as the processes of planning a course of action, collecting and interpreting data, drawing evidence-based conclusions and communicating findings.
law	A simple and precise statement that has been shown, based on available evidence, to be universally reliable. It describes phenomena that occur with unvarying regularity under the same conditions. No scientific law is ever conclusively verified.
model	A mathematical, conceptual or physical representation that describes, simplifies, clarifies or provides an explanation of the structure, workings or relationships within an object, system or idea. Models can provide a means of testing and predicting behaviour within limited conditions.
multi-modal text	Text that combines two or more modes of communication. This can include print text as well as image and spoken word as in film or computer presentations.
observe(able)	That which can be sensed either directly by an individual or indirectly by measuring devices.
plausible accuracy	Accuracy estimated taking into consideration the evident sources of error and the limitations of the instruments used in making the measurements.
qualitatively account for	To use descriptive explanations involving features, characteristics or properties to identify important components.
qualitative data	Information that is not numerical in nature.
quantitative	Involving data or components that can be expressed or measured numerically, including chemical formulae or numbers.
relate	To identify connections or associations between ideas and/or relationships between components of systems and structures.
reliability of first-hand data	The degree to which repeated observation and/or measurements taken under identical circumstances will yield the same results.
research	A type of investigation through the literature or by practical investigations of relevant information.
scientific investigation	A systematic inquiry carried out using scientific processes to inquire into the knowledge and understanding of and about science.
secondary sources	A range of forms of information and data that have resulted from the investigations of other people, including graphs, diagrams and images.
senses	Perceptions that a living organism uses to take in information about its surroundings. The five main senses are hearing, sight, touch, taste and smell.
structure	Entities in which the parts are linked together to form a whole.
sustainability	The patterns of activities that meet the needs of the present generation without prejudicing the ability of future generations to meet their needs.

survey	A type of investigation to obtain data and information that involves asking respondents a range of questions.
system	A set of components within the natural and made environments that interact.
technologies	The knowledge and creative processes that assist people to use tools, resources and systems to solve problems and meet human needs and wants.
theory	An explanation of a body of experimental evidence that has been accepted through the processes of review by the scientific community. A theory provides predictions that can be tested against observations and can be supported or refuted.
validity of first-hand data	The extent to which the processes and resultant data measure what was intended.
variable	A factor that can be changed, kept the same or measured in an investigation.
variable held constant	Factors that may vary, but for the purposes of an experiment are deliberately held constant so that a valid conclusion is possible.
visual literacy	The ability to decode, interpret, create, question, challenge and evaluate texts that communicate with visual images as well as, or rather than, words.