

 **NSW SYLLABUS**  
for the Australian  
curriculum



**SCIENCE K–10**  
(incorporating Science  
and Technology K–6)  
**SYLLABUS**

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# INTRODUCTION

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## K–10 CURRICULUM

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

Board of Studies syllabuses include the agreed Australian curriculum content and content that clarifies the breadth and depth of learning and scope for Science. The Australian curriculum achievement standards underpin the syllabus outcomes and the stage statements for Early Stage 1 to Stage 5.

In accordance with the *K–10 Curriculum Framework* and the *Statement of Equity Principles*, the *Science K–10 (incorporating Science and Technology K–6) Syllabus* 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 offers 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 (incorporating Science and Technology K–6) Syllabus* will contribute to the curriculum and to students' achievement of the broad learning outcomes is outlined in the syllabus rationale.

## DIVERSITY OF LEARNERS

The *Science K–10 (incorporating Science and Technology K–6) Syllabus* is inclusive of the learning needs of all students. Particular advice about supporting students with special education needs, gifted and talented students, students learning English as an additional language and students learning Standard English as an additional dialect follows.

## STUDENTS WITH SPECIAL EDUCATION NEEDS

The rationale, aim, objectives, outcomes and content of the *Science K–10 (incorporating Science and Technology K–6) Syllabus* 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 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 or 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
- consideration of students' individual communication strategies, including verbal and non-verbal communication systems
- 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
- 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 these students, 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 the 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
- 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 adjustments to teaching, learning and assessment are not sufficient to access some or all of the Stage 4 and Stage 5 outcomes. 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 Stage 4 and Stage 5 objectives of the *Science K–10 (incorporating Science and Technology K–6) Syllabus*. Further

information about accessing and implementing the Science Years 7–10 Life Skills outcomes and content can be found in the Science support documents 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. *Life Skills Years 7–10: Advice on Planning, Programming and Assessment* provides further advice in relation to determining students for whom Life Skills outcomes and content are appropriate.

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

## GIFTED AND TALENTED STUDENTS

Gifted students have specific learning needs that may require adjustments to the pace, level and content of the curriculum. Differentiated educational opportunities will assist in meeting the needs of gifted students.

Generally, gifted students demonstrate the following characteristics:

- the capacity to learn at faster rates
- the capacity to find and solve problems
- the capacity to make connections and manipulate abstract ideas.

There are different kinds and levels of giftedness. Gifted and talented students may also possess learning disabilities that should be addressed when planning appropriate teaching, learning and assessment activities.

Curriculum strategies for gifted and talented students may include:

- differentiation: modifying the pace, level and content of teaching, learning and assessment activities
- acceleration: promoting a student to a level of study beyond their age group
- curriculum compacting: assessing a student's current level of learning and addressing aspects of the curriculum that have not yet been mastered.

School decisions about appropriate strategies are generally collaborative and involve teachers, parents and students with reference to documents and advice available from the Board of Studies and education sectors.

Gifted and talented students may also benefit from individual planning to determine curriculum options, as well as teaching, learning and assessment strategies, most suited to their needs and abilities.

## STUDENTS LEARNING ENGLISH AS AN ADDITIONAL LANGUAGE OR DIALECT (EAL/D)\*

Many students in Australian schools are learning English as an additional language or dialect (EAL/D). EAL/D learners are students whose first language is a language other than Standard Australian English and who require additional support to assist them to develop English language proficiency.

EAL/D students come from diverse backgrounds and may include:

- overseas- and Australian-born children whose first language is a language other than English
- Aboriginal and Torres Strait Islander students whose first language is an Indigenous language, including traditional languages
- Aboriginal and Torres Strait Islander students whose first language is Aboriginal English, including creoles and related varieties.

\* EAL/D is the term adopted by all Australian schools as part of the national education reform agenda of developing a K–12 Australian curriculum. The term English as an additional language or dialect (EAL/D)

may be used interchangeably with the following terms: English as a second language (ESL), English language learners (ELL), English as an additional language (EAL) or English as an additional dialect (EAD).

EAL/D learners enter Australian schools at different ages and stages of schooling and at different stages of English language learning. They have diverse talents and capabilities and a range of prior learning experiences and levels of literacy in their first language and in English. EAL/D students represent a significant and growing percentage of learners in NSW schools. For some, school is the only place they use English.

EAL/D learners are simultaneously learning a new language and the knowledge, understanding and skills of the *Science K–10 (incorporating Science and Technology K–6) Syllabus* through that new language. They require additional time and support, along with informed teaching that explicitly addresses their language needs, and assessments that take into account their developing language proficiency.

# SCIENCE AND TECHNOLOGY K–6 SYLLABUS



# SCIENCE AND TECHNOLOGY KEY

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The following codes and icons are used in the *Science and Technology K–6 Syllabus*.

## OUTCOME CODING

Syllabus outcomes have been coded in a consistent way. The code identifies the subject, stage, outcome number and the way content is organised.

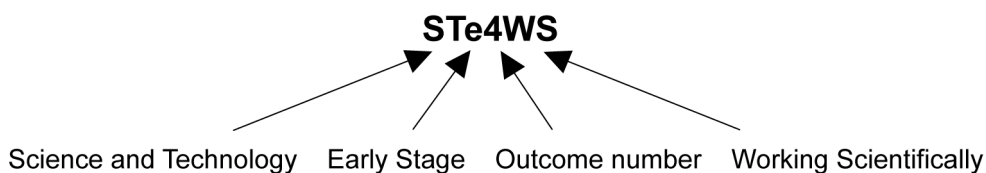
Early Stage 1 to Stage 3 are represented by the following codes:

Stages	Codes
Early Stage 1	e
Stage 1	1
Stage 2	2
Stage 3	3

In the *Science and Technology K–6 Syllabus*, the outcome codes indicate the subject, stage, outcome, strand or substrand. The values and attitudes outcomes are also coded:

Outcomes	Codes
Science and Technology (K–6)	ST
Values and Attitudes	VA
<b>Skills strands</b>	
Working Scientifically	WS
Working Technologically	WT
<b>Knowledge and Understanding strands</b>	
Natural Environment	NE
Made Environment	ME
<b>Knowledge and Understanding substrands</b>	
Physical World	PW
Earth and Space	ES
Living World	LW
Material World	MW
Built Environments	BE
Information	I
Products	P

For example:

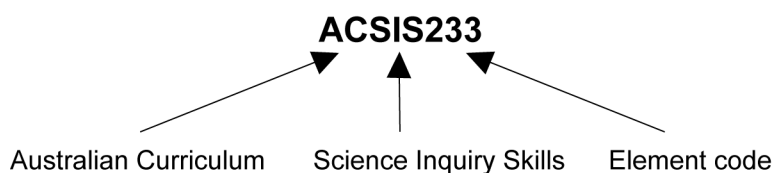


Outcome codes	Interpretations
STe-4WS	Science and Technology, Early Stage 1 - Outcome number 4, Working Scientifically
ST2-12MW	Science and Technology, Stage 2 - Outcome number 12, Material World

## CODING OF THE AUSTRALIAN CURRICULUM CONTENT

The syllabus includes all the Australian curriculum content descriptions for Science and Technology. The content descriptions are identified by an Australian curriculum code which appears in brackets at the end of each content description, for example:

Engage in discussions about observations and use methods such as drawing to represent ideas (AC SIS233).



Where a number of content descriptions are jointly represented, both description codes are included, for example (AC SIS212, AC SIS214).

The Australian curriculum Science codes are:


Codes	Interpretations
AC SIS	Australian Curriculum, Science Inquiry Skills
AC SHE	Australian Curriculum, Science as a Human Endeavour
AC SSU	Australian Curriculum, Science Understanding

## LEARNING ACROSS THE CURRICULUM ICONS

Learning across the curriculum content, including cross-curriculum priorities, general capabilities and other areas identified as important learning for all students, is incorporated and identified by icons in the *Science and Technology K–6 Syllabus*.

### Cross-curriculum priorities

---

 Aboriginal and Torres Strait Islander histories and cultures

---

 Asia and Australia's engagement with Asia


---

 Sustainability


---

### General capabilities


---

 Critical and creative thinking

---

 Ethical understanding

---

 Information and communication technology capability


---

 Intercultural understanding


---

 Literacy

---

 Numeracy


---

 Personal and social capability


---

### Other learning across the curriculum areas


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 Civics and citizenship

---

 Difference and diversity

---

 Work and enterprise

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# RATIONALE

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Science and technology are of increasing importance and integral to 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 and technology, and the significance of their contribution to and influence on society.

Scientific inquiry is a distinct way of finding answers to interesting questions and solutions to important problems about the natural world locally, nationally and globally, including shaping sustainable futures. Scientific 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 demonstrate honesty and fairness in using the skills of Working Scientifically.

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 of science and technology in their lives. They recognise that science advances through the contributions of many different people.

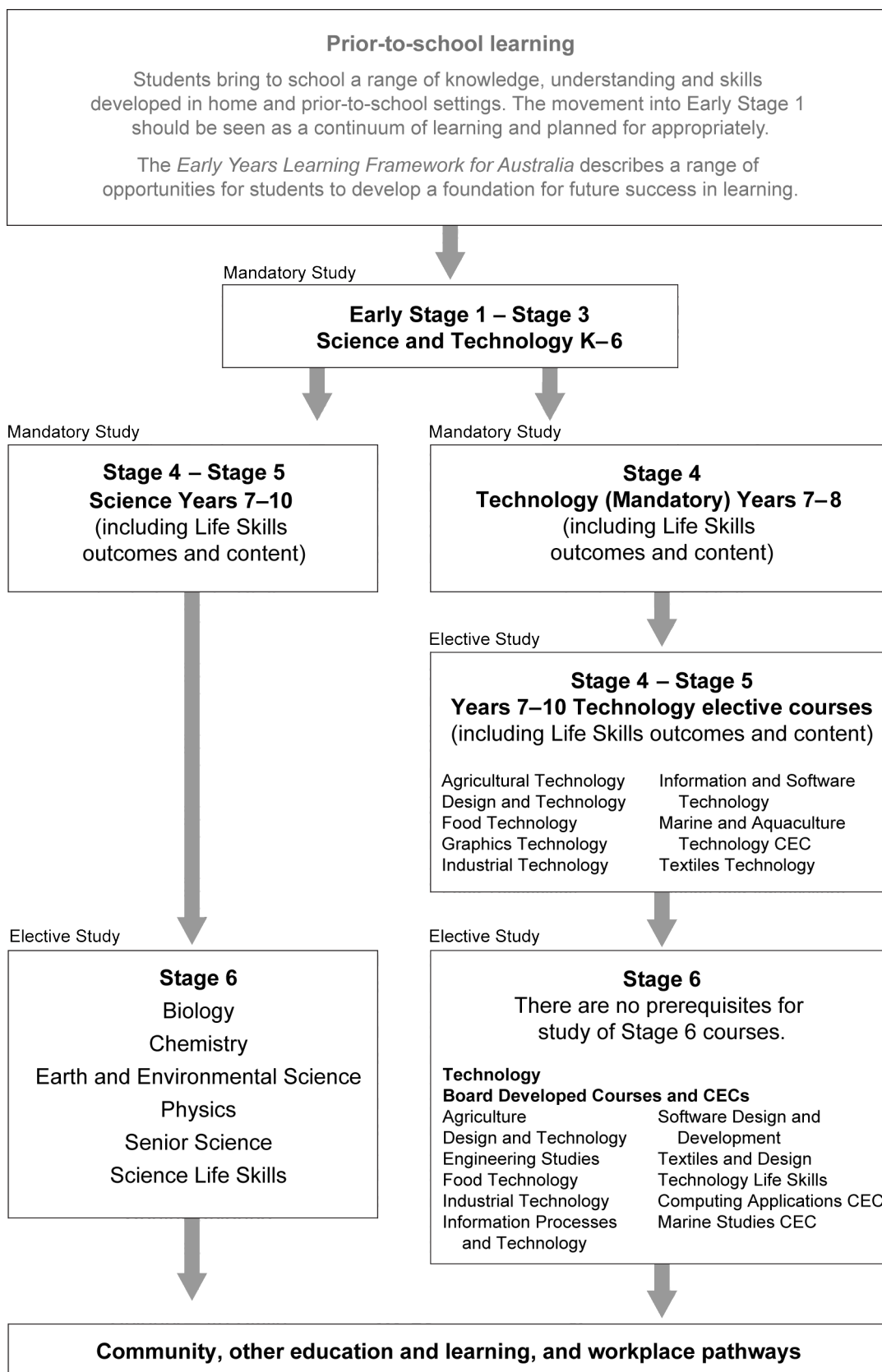
Technology and an understanding of design processes enable people to manage, interpret, shape and alter their environment to improve their quality of life at home, school, in workplaces and the broader community. The study of Technology involves solving real problems and creating ideas and solutions in response to needs and opportunities in a range of technological contexts. These contexts may include agriculture, engineering, food, graphics, industrial and digital technologies as well as product design that uses metals, textiles and timber.

When applying the processes of Working Technologically, students actively engage with real world situations and use technology skills, knowledge and understanding to create solutions for themselves and others. They creatively and competently use a range of materials, tools, equipment and techniques to produce solutions relevant to their world.

As disciplines, Science and Technology are linked through problem solving, by the skills and processes of scientific inquiry and technological design. Science often draws on tools and processes developed by technology. Technology in turn uses concepts, principles and processes developed by science. The study of Science and Technology provides opportunities for students to think and act critically and creatively, to develop informed attitudes based on evidence and reason, and to participate responsibly in developing innovative working solutions and ideas in response to opportunities and questions relevant to personal, social and environmental issues in their lives. Through engaging in Science and Technology learning, students begin to develop the capabilities needed to become more scientifically and technologically literate citizens.

The study of Science and Technology enables students to develop a positive self-concept as learners as well as 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.

# THE PLACE OF THE SCIENCE K–10 (INCORPORATING SCIENCE AND TECHNOLOGY K–6) SYLLABUS IN THE K–12 CURRICULUM



## AIM

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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 the 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.

# OBJECTIVES

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## 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 the future.

## SKILLS, KNOWLEDGE AND UNDERSTANDING

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 of the Natural Environment through understanding about the Physical World, Earth and Space, and Living World
- develop knowledge and understanding of the Natural Environment and the Made Environment through the Material World
- develop knowledge and understanding of the Made Environment through Built Environments, Information and Products.

# OUTCOMES

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## EARLY STAGE 1 – STAGE 3

### TABLE OF OBJECTIVES AND OUTCOMES

#### VALUES AND ATTITUDES

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

<b>Objectives</b>
Students:
<ul style="list-style-type: none"><li>• develop interest and positive, informed values and attitudes towards science and technology</li><li>• recognise the importance and relevance of science and technology in their lives now and for the future</li></ul>
<b>Early Stage 1 to Stage 3 outcomes</b>
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

<p><b>Objective</b> Students:</p> <ul style="list-style-type: none"> <li>develop knowledge, understanding of and skills in applying the processes of Working Scientifically</li> </ul>			
<p><b>Early Stage 1 outcome</b> A student:</p>	<p><b>Stage 1 outcome</b> A student:</p>	<p><b>Stage 2 outcome</b> A student:</p>	<p><b>Stage 3 outcome</b> A student:</p>
<p>STe-4WS explores their immediate surroundings by questioning, observing using their senses and communicating to share their observations and ideas</p>	<p>ST1-4WS investigates questions and predictions by collecting and recording data, sharing and reflecting on their experiences and comparing what they and others know</p>	<p>ST2-4WS investigates their questions and predictions by analysing collected data, suggesting explanations for their findings, and communicating and reflecting on the processes undertaken</p>	<p>ST3-4WS investigates by posing questions, including testable questions, making predictions and gathering data to draw evidence-based conclusions and develop explanations</p>
<p><b>Objective</b> Students:</p> <ul style="list-style-type: none"> <li>develop knowledge, understanding of and skills in applying the processes of Working Technologically</li> </ul>			
<p><b>Early Stage 1 outcome</b> A student:</p>	<p><b>Stage 1 outcome</b> A student:</p>	<p><b>Stage 2 outcome</b> A student:</p>	<p><b>Stage 3 outcome</b> A student:</p>
<p>STe-5WT uses a simple design process to produce solutions with identified purposes</p>	<p>ST1-5WT uses a structured design process, everyday tools, materials, equipment and techniques to produce solutions that respond to identified needs and wants</p>	<p>ST2-5WT applies a design process and uses a range of tools, equipment, materials and techniques to produce solutions that address specific design criteria</p>	<p>ST3-5WT plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints</p>

## KNOWLEDGE AND UNDERSTANDING

<b>Objective</b> Students: <ul style="list-style-type: none"> <li>develop knowledge of the Natural Environment through understanding about the Physical World, Earth and Space, and Living World</li> </ul>			
<b>Early Stage 1 outcomes</b> A student:	<b>Stage 1 outcomes</b> A student:	<b>Stage 2 outcomes</b> A student:	<b>Stage 3 outcomes</b> A student:
STe-6NE identifies that the way objects move depends on a variety of factors	ST1-6PW describes some sources of light and sound that they sense in their daily lives  ST1-7PW describes effects of pushes and pulls on objects they encounter	ST2-6PW identifies ways heat is produced and that heat moves from one object to another  ST2-7PW describes everyday interactions between objects that result from contact and non-contact forces	ST3-6PW describes how scientific understanding about the sources, transfer and transformation of electricity is related to making decisions about its use  ST3-7PW uses scientific knowledge about the transfer of light 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	ST1-8ES describes some observable changes that occur in the sky and landscape  ST1-9ES identifies ways that people use science in their daily lives to care for the environment and the Earth's resources	ST2-8ES describes some observable changes over time on the Earth's surface that result from natural processes and human activity  ST2-9ES describes how relationships between the sun and the Earth cause regular changes	ST3-8ES describes how discoveries by people from different cultures and times have contributed to advancing scientific understanding of the solar system  ST3-9ES explains rapid change at the Earth's surface caused by natural events, using evidence provided by advances in technology and scientific understanding

## KNOWLEDGE AND UNDERSTANDING (CONTINUED)

<p><b>Objective</b> Students:</p> <ul style="list-style-type: none"> <li>develop knowledge of the Natural Environment through understanding about the Physical World, Earth and Space, and Living World</li> </ul>			
<p><b>Early Stage 1 outcome</b> A student:</p>	<p><b>Stage 1 outcomes</b> A student:</p>	<p><b>Stage 2 outcomes</b> A student:</p>	<p><b>Stage 3 outcomes</b> A student:</p>
<p>STe-8NE identifies the basic needs of living things</p>	<p>ST1-10LW describes external features, changes in and growth of living things</p> <p>ST1-11LW describes ways that different places in the environment provide for the needs of living things</p>	<p>ST2-10LW describes that living things have life cycles, can be distinguished from non-living things and grouped, based on their observable features</p> <p>ST2-11LW describes ways that science knowledge helps people understand the effect of their actions on the environment and on the survival of living things</p>	<p>ST3-10LW describes how structural features and other adaptations of living things help them to survive in their environment</p> <p>ST3-11LW describes some physical conditions of the environment and how these affect the growth and survival of living things</p>
<p><b>Objective</b> Students:</p> <ul style="list-style-type: none"> <li>develop knowledge and understanding of the Natural Environment and the Made Environment through the Material World</li> </ul>			
<p><b>Early Stage 1 outcome</b> A student:</p>	<p><b>Stage 1 outcomes</b> A student:</p>	<p><b>Stage 2 outcomes</b> A student:</p>	<p><b>Stage 3 outcomes</b> A student:</p>
<p>STe-9ME identifies that objects are made of materials that have observable properties</p>	<p>ST1-12MW identifies ways that everyday materials can be physically changed and combined for a particular purpose</p> <p>ST1-13MW relates the properties of common materials to their use for particular purposes</p>	<p>ST2-12MW identifies that adding or removing heat causes a change of state between solids and liquids</p> <p>ST2-13MW identifies the physical properties of natural and processed materials, and how these properties influence their use</p>	<p>ST3-12MW identifies the observable properties of solids, liquids and gases, and that changes made to materials are reversible or irreversible</p> <p>ST3-13MW describes how the properties of materials determine their use for specific purposes</p>

## KNOWLEDGE AND UNDERSTANDING (CONTINUED)

<b>Objective</b> Students: <ul style="list-style-type: none"> <li>develop knowledge and understanding of the Made Environment through Built Environments, Information and Products</li> </ul>			
<b>Early Stage 1 outcome</b> A student:	<b>Stage 1 outcomes</b> A student:	<b>Stage 2 outcomes</b> A student:	<b>Stage 3 outcomes</b> A student:
STe-10ME recognises how familiar products, places and spaces are made to suit their purpose	ST1-14BE describes a range of places and spaces in the local environment and how their purposes influence their design  ST1-15I describes a range of familiar information sources and technologies and how their purposes influence their design  ST1-16P describes a range of manufactured products in the local environment and how their different purposes influence their design	ST2-14BE describes how people interact within built environments and the factors considered in their design and construction  ST2-15I describes ways that information solutions are designed and produced, and factors to consider when people use and interact with information sources and technologies  ST2-16P describes how products are designed and produced, and the ways people use them	ST3-14BE describes systems in built environments and how social and environmental factors influence their design  ST3-15I describes how social influences impact on the design and use of information and communication systems  ST3-16P describes systems used to produce or manufacture products, and the social and environmental influences on product design

## STAGE STATEMENTS

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Stage statements are summaries of the knowledge, understanding, skills, values and attitudes that have been developed by students as a result of achieving the outcomes for each stage of learning.

### PRIOR-TO-SCHOOL LEARNING

Students bring to school a range of knowledge, understanding and skills developed in home and prior-to-school settings. The movement into Early Stage 1 should be seen as a continuum of learning and planned for appropriately.

The *Early Years Learning Framework for Australia* describes a range of opportunities for students to learn and develop a foundation for future success in learning.

The *Early Years Learning Framework for Australia* has five Learning Outcomes that reflect contemporary theories and research evidence concerning children's learning. The outcomes are used to guide planning and to assist all children to make progress.

The outcomes are:

- 1 Children have a strong sense of identity
- 2 Children are connected with and contribute to their world
- 3 Children have a strong sense of wellbeing
- 4 Children are confident and involved learners
- 5 Children are effective communicators.

In addition, teachers need to acknowledge the learning that children bring to school, and plan appropriate learning experiences that make connections with existing language and literacy development, including language used at home.

### EARLY STAGE 1

By the end of Early Stage 1 students' sense of wonder and curiosity about the Natural Environment and the Made Environment is fostered through purposeful play, observing, questioning and exploring ideas. They learn about and use the processes of Working Scientifically and Working Technologically in a holistic way and 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. Students recognise that the way objects move depends on a variety of factors. They 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 knew, what they observed, what they did, how they felt about it and the usefulness of their final solutions.

## STAGE 1

By the end of Stage 1 students show an interest in science and technology by responding to questions, perceived needs and wants. They describe situations where they and other people 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 to 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 these 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

By the end of Stage 2 students 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 investigable 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 describe interactions between objects that result from contact and non-contact forces. Students 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, students 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

By the end of Stage 3 students 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.

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 them. 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. They describe key features of the solar system and the contribution of people from a range of cultures over time to the advancement of science. Students 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

By the end of Stage 4 students 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 science 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 the 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 the Earth's spheres.

## STAGE 5

By the end of Stage 5 students 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 science 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 science ideas for specific purposes and construct evidence-based arguments using appropriate scientific language, conventions and representations.

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 the 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.

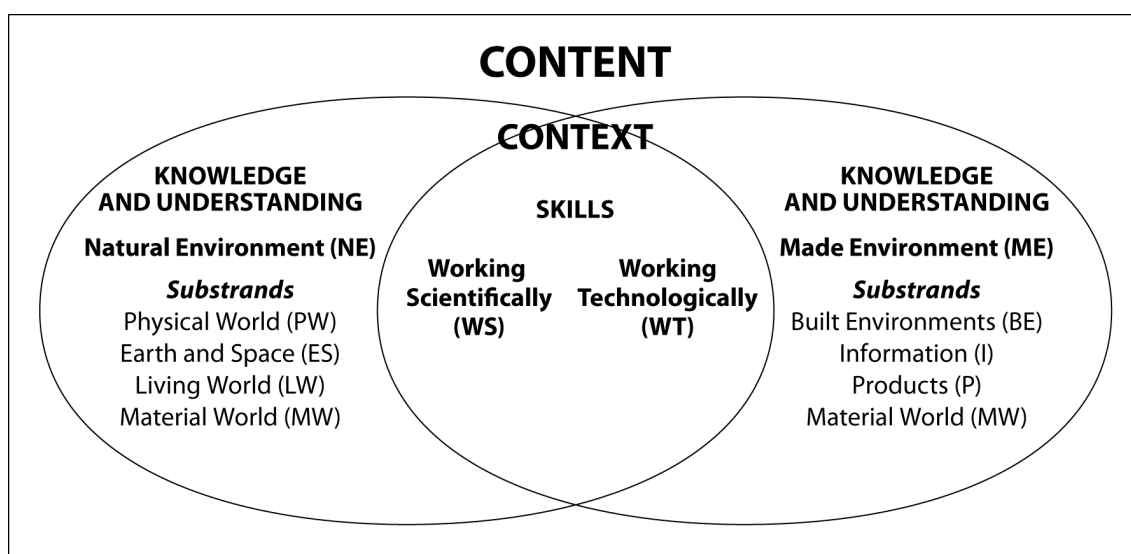
Students explain the organisation of the periodic table, chemical reactions and natural radioactivity in terms of atoms. They describe how different factors influence the rate of chemical reactions and the importance of a range of types of chemical reactions in the production of substances.

By the end of Stage 5 students 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 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.

# ORGANISATION OF CONTENT

For Kindergarten to Year 10, courses of study and educational programs are based on the outcomes of syllabuses. The content describes in more detail how the outcomes are to be interpreted and used, and the intended learning appropriate for the stage. In considering the intended learning, teachers will make decisions about the sequence, the emphasis to be given to particular areas of content, and any adjustments required based on the needs, interests and abilities of their students.

The knowledge, understanding and skills described in the outcomes and content provide a sound basis for students to successfully move to the next stage of learning.



The content of the *Science and Technology K–6 Syllabus* is organised by the strands:

- Skills:
  - Working Scientifically (WS)
  - Working Technologically (WT)
- Knowledge and Understanding:
  - Natural Environment (NE)
  - Made Environment (ME).

In Stages 1 to 3 the Knowledge and Understanding strands are represented in more specific substrands that form the continuum with the strands in Years 7–10. The substrand Material World is common to both the Natural Environment and the Made Environment strands. It provides a foundation for the Chemical World strand in the *Science Years 7–10 Syllabus* and the study of materials in the *Technology (Mandatory) Syllabus* in Years 7–8.

Within the Knowledge and Understanding strands/substrands:

- content statements summarise the overarching scientific and technological ideas. The related group of content describes the appropriate depth and scope of learning for each statement
- content incorporates understanding about the nature, development, use and influence of science and technology with relevant knowledge of the scientific and/or technological ideas, principles and concepts.

Continuity of learning in all aspects of the syllabus is provided when teaching programs:

- are based on contexts that:

- are relevant to students' learning needs, interests, experiences and cultural backgrounds
- relate to the nature, development, use and influence of science and technology
- draw on content from the Natural Environment and the Made Environment strands in each year
- incorporate the strands and substrands within each stage
- integrate the skills and processes of Working Scientifically and Working Technologically with content from the Knowledge and Understanding strands/substrands
- include a range of hands-on scientific investigations and design projects in each year from K–6 in which students apply the processes of Working Scientifically and Working Technologically
- address the objectives and outcomes for the values and attitudes through the relevant skills, knowledge and understanding content for each stage.

## CONTENT STRANDS

Science and Technology are linked through problem solving by the skills and processes of scientific inquiry and technological design.

### Skills

The strands Working Scientifically and Working Technologically describe the skills that students should be able to demonstrate by the end each stage. The content reflects the skills development continuum across Early Stage 1 to Stage 3.

The processes of Working Scientifically and Working Technologically are at the centre of teaching and learning. Students develop skills in using the processes of Working Scientifically and Working Technologically through active engagement in a range of contextualised hands-on scientific investigations and design projects.

#### *Working Scientifically (WS)*

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 of science and understanding about the Natural Environment and the Made Environment. They evaluate the processes and the quality of findings, evidence and conclusions. In their investigations students will often draw on processes and design ideas developed through Working Technologically.

#### *Working Technologically (WT)*

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 processes and solutions. In developing design solutions, students will often use the findings from their investigations.

### Knowledge and understanding

The skills and the knowledge and understanding outcomes and content are interdependent. Students develop their scientific and technological understanding about the Natural Environment and the Made Environment through applying the processes of Working Scientifically and Working Technologically.

#### *Natural Environment (NE)*

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.

#### *Made Environment (ME)*

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 enable 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 (PW)* – students develop their understanding of heat energy, electricity, light and sound. They learn that forces affect the movement of objects and they discover how people can use the knowledge about the transfer of heat energy and transformation of electricity in their everyday life.
- *Earth and Space (ES)* – students develop their understanding of the Earth's dynamic structure and its place in space. They learn that the 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 (LW)* – students develop their understanding of living things. They investigate the diversity of living things, including plants, animals and micro-organisms, as well as 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 (MW)* – students develop their understanding of the properties of materials, the way they behave and the changes they undergo as well as how these properties influence the way materials are used by people in objects, products, places and spaces.
- *Built Environments (BE)* – students develop their understanding about places and spaces, and their uses. 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 (I)* – 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 (P)* – 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 **Work 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.

Teachers should be aware that students may have food allergies that can result in anaphylaxis, a severe and sometimes sudden allergic reaction which is potentially life-threatening and always requires an emergency response. This is an important consideration in selecting the foods to be handled and consumed.

## LEARNING ACROSS THE CURRICULUM

Learning across the curriculum content, including the cross-curriculum priorities and general capabilities, assists students to achieve the broad learning outcomes defined in the Board of Studies *K–10 Curriculum Framework* and *Statement of Equity Principles*, and in the *Melbourne Declaration on Educational Goals for Young Australians (December 2008)*.

Cross-curriculum priorities enable students to develop understanding about and address the contemporary issues they face.

The cross-curriculum priorities are:

- Aboriginal and Torres Strait Islander histories and cultures 🖐️
- Asia and Australia's engagement with Asia <sup>a</sup>
- Sustainability. 🌱

General capabilities encompass the knowledge, skills, attitudes and behaviours to assist students to live and work successfully in the 21st century.

The general capabilities are:

- Critical and creative thinking ✨
- Ethical understanding ⚖️
- Information and communication technology capability 💻
- Intercultural understanding 🌐
- Literacy 📖
- Numeracy 📊
- Personal and social capability. 👥

The Board's syllabuses include other areas identified as important learning for all students:

- Civics and citizenship 🗳️
- Difference and diversity 🌈
- Work and enterprise. ⭐

Learning across the curriculum content is incorporated, and identified by icons, in the content of the *Science K–10 (incorporating Science and Technology K–6) Syllabus* in the following ways:

### **Aboriginal and Torres Strait Islander histories and cultures** 🖐️

Aboriginal and Torres Strait Islander communities have diverse cultures, social structures and a history of unique, complex knowledge systems. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to learn about how Aboriginal and Torres Strait Islander peoples have developed and refined knowledge about the world through observation, making predictions, testing (trial and error) and responding to environmental factors within specific contexts. Students will investigate examples of Aboriginal and Torres Strait Islander peoples' understanding of the environment and the ways that traditional knowledge and western scientific knowledge can be complementary.

### **Asia and Australia's engagement with Asia** <sup>a</sup>

Asia and Australia's engagement with Asia provides rich and engaging contexts for developing students' science and technology skills, knowledge and understanding. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to recognise that the Asian region includes diverse environments. Students appreciate how interactions within and between these environments and the impacts of human activity influence the region, including Australia, and have significance for the rest of the world.

The Asian region plays an important role in scientific and technological research and development in areas such as medicine, natural resource management and natural disaster prediction and management.

## **Sustainability**

Sustainability is concerned with the ongoing capacity of the Earth to maintain all life. It provides authentic contexts for exploring, investigating and understanding systems in the natural and made environments. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to investigate relationships between systems and system components, to consider how systems respond to change and to develop appreciation for the interconnectedness of the Earth's spheres.

Relationships, cycles and cause and effect are explored, and students develop observation and analytical skills to examine these relationships in the world around them to design solutions to identified sustainability problems.

## **Critical and creative thinking**

Critical and creative thinking are integral to activities where students learn to generate and evaluate knowledge, clarify concepts and ideas, seek possibilities, consider alternatives and solve problems. Critical and creative thinking are embedded in the skills and processes of Working Scientifically and Working Technologically. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to develop critical and creative thinking skills through asking and posing questions, making predictions, engaging in first-hand investigations and design projects, problem solving, making evidence-based decisions, and analysing and evaluating evidence.

## **Ethical understanding**

Students develop the capability to behave ethically as they identify and investigate the nature of ethical concepts, values and principles, and understand how reasoning can assist ethical judgement. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides opportunities for students to form and make ethical judgements in relation to scientific investigations, design, codes of practice, and the use of scientific and technological information and applications. Students explore what integrity and honesty mean in using the processes of Working Scientifically and Working Technologically. They apply ethical guidelines in their investigations and design projects, particularly in their implications for others and the environment.

## **Information and communication technology capability**

Information and communication technology (ICT) can be used effectively and appropriately to access, create and communicate information and ideas, solve problems and work collaboratively. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to develop ICT capability when they develop design ideas and solutions, research science concepts and applications, investigate science phenomena, and communicate their scientific and technological understandings. In particular they learn to access information, collect, analyse and represent data, model and interpret concepts and relationships, and communicate scientific and technological ideas, processes and information. Digital technologies and aids, such as animations and simulations, provide opportunities to view phenomena and test predictions that cannot be investigated through practical experiences in the classroom, and may enhance students' understanding and engagement with science and technology.

## **Intercultural understanding**

Students develop intercultural understanding as they learn to understand themselves in relation to others. This involves students valuing their own cultures and those of others, and engaging with people of diverse cultures in ways that recognise commonalities and differences, create connections and cultivate respect. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides opportunities for students to appreciate the contribution that diverse cultural perspectives have made to the development, breadth and diversity of scientific and technological knowledge and applications. Students learn about and engage with issues



requiring cultural sensitivity, and that scientists work in culturally diverse teams to address issues and solve problems of national and international importance.

## Literacy

Literacy is the ability to use a repertoire of knowledge and skills to communicate and comprehend effectively, using a variety of modes and media. Being 'literate' is more than the acquisition of technical skills – it includes the ability to identify, understand, interpret, create and communicate effectively using written, visual and digital forms of expression and communication for a number of purposes. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with the opportunities to understand that language varies according to the context. The language of science and technology is often technical and includes specific terms for concepts, processes and features of the world. Students learn that scientific and technological information can be presented in the form of diagrams, flowcharts, tables and graphs, and that specific text types are used to link information and ideas, give explanations, formulate questions, hypotheses, draw conclusions and construct evidence-based arguments.

## Numeracy

Numeracy involves students in recognising and understanding the role of mathematics in the world. Students become numerate as they develop the confidence, willingness and ability to apply mathematics in their lives in constructive and meaningful ways. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to develop numeracy skills through practical measurement and the collection, representation and interpretation of data from first-hand investigations and secondary sources. Initially students make measurements using informal units, then they apply the formal units of measurement. Students consider issues of uncertainty and reliability in measurement and learn data-analysis skills, identifying trends and patterns from numerical data and graphs.

## Personal and social capability

Students develop personal and social capability as they learn to understand and manage themselves, their relationships and their lives more effectively. This includes establishing positive relationships, making responsible decisions, working effectively individually and in teams and constructively handling challenging situations. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities, through applying processes of Working Scientifically and Working Technologically, to learn how scientific and technological knowledge informs and is applied in their daily lives. They develop skills in communication, initiative taking, goal setting, interacting with others, decision making, and the capacity to work independently and collaboratively. The study of Science and Technology enhances personal and social capability by expanding students' capacity to question, solve problems, explore and display curiosity. Students use their scientific and technological understanding to make informed choices about issues that impact on their lives and consider how the use and application of science and technology meet a range of personal and social needs.

## Civics and citizenship

Civics and citizenship content involves knowledge and understanding of how our Australian society operates. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to broaden their understanding of aspects of civics and citizenship in relation to the application of science ideas and technological advances, including ecological sustainability and the development of environmental and sustainable practices.

## Difference and diversity

Difference and diversity comprise gender, race and socio-economic circumstances. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides opportunities for students to understand and appreciate the difference and diversity they experience in their everyday lives. 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 also enables them to identify individual rights, challenge stereotypes and engage with opinions different to their own.

## **Work and enterprise** ★

Students develop work-related skills and an appreciation of the value of working individually and collaboratively when conducting investigations and design tasks. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides opportunities for students to prioritise safe practices and understand the potential risks and hazards present when conducting investigations and constructing design solutions. They safely use materials, electrical devices, classroom equipment and specialised tools.

## SKILLS

## WORKING SCIENTIFICALLY

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### OUTCOME

#### A student:


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

### CONTENT


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 environments
- exploring and making observations by using their senses to gather information about objects and events in their immediate surroundings (ACSIS011, 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 using drawings to represent ideas (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 (ACSIS012)  
- working in groups to reflect on what they found interesting, liked or disliked about what they did, what was or was not expected and what they would do differently  

### Background information

Progression:

The emphasis in Working Scientifically in Early Stage 1 is on fostering students' curiosity and wonder while developing their 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.

## SKILLS

## WORKING TECHNOLOGICALLY

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### OUTCOME

#### A student:

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

### CONTENT



Students explore and define a 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 suggesting the materials they could 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 
- reflecting on what they did and the usefulness of the final solution

### Background information

Progression:

In Early Stage 1 students learn about and participate in 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.

## KNOWLEDGE AND UNDERSTANDING

## NATURAL ENVIRONMENT

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### 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 the environment affect them and other living things STe-7NE
- › identifies the basic needs of living things STe-8NE

### CONTENT

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, eg sliding, rolling, spinning and bouncing on the ground
- identify that the way an object moves depends on its size and shape, eg 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, eg day and night and seasonal changes
- identify how plants and animals respond to changes in the environment, eg trees losing their leaves and the thickness of animals' fur ❄️❄️

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

**Students:**

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

## KNOWLEDGE AND UNDERSTANDING

## MADE ENVIRONMENT

## OUTCOMES

## A student:

- › identifies that 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

## CONTENT





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, eg flexibility, texture, strength and colour

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 
- identify a variety of materials that are used in a range of existing familiar products, places and spaces
- communicate their ideas about how familiar products, places and spaces work and have features that help them to be useful, eg shoulder straps, zippers and compartments in a school bag 
- sketch or model ideas for a product, place or space and recount how their ideas suit their purpose  

## SKILLS

## WORKING SCIENTIFICALLY

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### OUTCOME

#### A student:



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

### CONTENT







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 fieldwork (ACSIS025, ACSIS038) 
- using a range of methods to gather data and/or information, including using their senses to make observations 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 (ACSIS026, ACSIS039)  
- making and recording observations and measurements honestly, using tally marks and informal units  

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, as to whether observations were expected and related to their questions and/or predictions (AC SIS212, AC SIS214) ⚙️
- 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 (AC SIS029, AC SIS042) 🎓
- displaying data and information in a variety of ways, including drawings, simple texts, provided tables and graphs, using digital technologies as appropriate 🖨️ 📄
- sharing what they did and what they could do differently throughout the investigating process ⚙️ 👤

## Background information

Progression:

In Stage 1 students build on their skills in using 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 focused exploration. They ask different types of questions, for example 'What will happen if ...'.

Students 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. They begin to understand that scientific investigations are more likely to produce useful results if they are planned and conducted in particular ways. Students are introduced to specific types of investigation, including exploration, surveys, fieldwork and accessing information sources, in which they manipulate materials and test ideas. They employ strategies for recording, processing and communicating their observations, findings and ideas, consistent with stage-appropriate understanding in literacy and numeracy. Students begin to recognise that findings from scientific investigations and information sources are 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. Students 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.



## SKILLS

## WORKING TECHNOLOGICALLY

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### 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

### CONTENT


Students explore and define a task by:

- identifying needs and wants of users/audiences, eg using interviews, observations and surveys  



Students generate and develop ideas by:

- researching and exploring different sources of information, including the internet
- exploring different materials by observing and manipulating them and using trial-and-error 
- using techniques for documenting and communicating design ideas, including simple plans, drawings and models, using familiar materials 
- describing the features of design ideas and the materials they select
- using feedback from others to refine design ideas 
- using the results of investigations to refine design ideas

Students produce solutions by:

- suggesting simple steps for production
- using a range of everyday tools, equipment, materials and techniques
- working cooperatively and safely 

Students evaluate by:

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

### Background information

Progression:

In Stage 1 students build on their skills in and knowledge about Working Technologically through activities that have been structured by the teacher. They explore and define teacher-determined tasks. 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, for example 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. Students 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.

## PHYSICAL WORLD

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### OUTCOMES

#### A student:

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

### CONTENT

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, eg striking, blowing, scraping or shaking
- use their sense of touch to feel vibrations from familiar objects and infer that sound is made when an object vibrates, eg vocal cords, a stringed instrument or a rubber band
- 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, eg didgeridoo or sitar 🌐👉🎵

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 and changing direction, changing shape or breaking
- explore how different strengths of pushes and pulls affect the movement of objects on land and through water and air 🏠
- demonstrate some ways that people use pushes and pulls in their everyday life, eg sweeping with brooms or riding skateboards 🛹

## EARTH AND SPACE

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### OUTCOMES

#### A student:

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

### CONTENT

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

Students:

- use a range of methods to describe observable, short-term changes in the sky, eg 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, eg seasonal changes in temperature and the appearance of the moon 🎓 📅
- describe some physical features of a landscape that have been changed by floods, droughts or processes, eg weathering and erosion 🌿

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

Students:

- identify that some common resources are obtained from the Earth, including soil, minerals and water ⚙️
- describe how some materials obtained from the Earth are used in a range of products at home or at school
- share their observations and ideas about the ways that water is used by people in their daily lives 🎓 👥
- identify some actions which could be taken to care for and use water sustainably, eg turning off dripping taps and/or taking shorter showers 🌿 ⚖️
- explore ways in which people use science knowledge and skills in their daily lives to care for the environment and use resources sustainably (ACSHE022, ACSHE035) 🌿 🌱 ⚙️ 🎓

## KNOWLEDGE AND UNDERSTANDING – NATURAL ENVIRONMENT

## LIVING WORLD

## OUTCOMES

## A student:

- › describes external features, changes in and growth of living things ST1-10LW
- › describes ways that different places in the environment provide for the needs of living things ST1-11LW

## CONTENT






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  
- observe and record some of the changes a common plant or animal shows during its life, using an appropriate digital technology, eg a camera   
- compare the appearance of adult living things with their offspring, eg trees, insects, birds, reptiles, cats or 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, eg a schoolyard, pond, beach or bush
- explore the needs of a plant or an animal in its environment
- describe how some different places in a local land or aquatic environment provide for the needs of the animals or plants that live there 
- observe and record ways people use science knowledge and skills in their daily lives to care for living things, such as gardeners, farmers or pet carers (ACSHE022, ACSHE035)   

## MATERIAL WORLD

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### OUTCOMES

#### A student:

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

### CONTENT




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

Students:

- explore how some everyday materials can be physically changed by actions, eg bending, twisting, stretching, squashing or heating



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

Students:

- predict the changes materials will undergo when they are combined, eg sugar in water or different colours of paint; and when they are mixed, eg sand and water or cake ingredients 
- compare their observations with their predictions when materials are combined and mixed
- explore examples of how people at home and work change and combine different materials for a particular purpose, eg food preparation and making concrete  

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

Students:

- use their senses to identify the similarities and differences in the properties of materials, eg 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, eg the waterproof property of plastic rainwear or insulating property of a woollen jumper 
- identify a range of natural materials used by Aboriginal and Torres Strait Islander peoples and share ideas about the ways they are used to suit a particular purpose, eg the use of wood, stone and fibres in the built environment 

## BUILT ENVIRONMENTS

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### OUTCOME

#### A student:

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

### CONTENT

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

Students:

- observe ways people use a range of places and spaces in their local environment, eg areas within the schoolyard and the home ⚙️ 🏠

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, eg a hospital or playground
- describe how the different purposes of places and spaces in the local environment influence their design, eg storage and cooling areas in a supermarket and enclosures for pets and farm animals ⚙️ 🎓
- examine some familiar places and spaces in the local environment and suggest modifications to their design

## KNOWLEDGE AND UNDERSTANDING – MADE ENVIRONMENT

## INFORMATION

## OUTCOME

## A student:

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

## CONTENT

There is a range of information sources and technologies.

Students:

- use a range of information technologies to communicate with others, eg letters, telephones, cameras and emails 📧 📺
- interact with an information source or technology to explore the ways that different forms of information are combined, including text, image and sound, eg a website or digital game 📺 👤
- explore communication methods used by Aboriginal and Torres Strait Islander peoples to share ideas and information, eg dance, stories, music and art 🙌 🌐

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, eg television programs, websites, digital games, newspapers and magazines 📺 📺
- describe how the purpose of a specific information source or technology influences its design, eg a website or game 📺 👤 📺



## KNOWLEDGE AND UNDERSTANDING – MADE ENVIRONMENT

## PRODUCTS

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### OUTCOME

#### A student:

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

### CONTENT

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

Students:

- explore a variety of products in the local environment, eg food products and industrial products
- discuss the purpose and usefulness of familiar applications of science and technology products used in everyday life, eg rechargeable batteries, recycled materials and single-use disposable food containers 🌿 📺
- describe a variety of ways in which Aboriginal and Torres Strait Islander peoples have used or continue to use natural materials to make products that meet their needs, eg the use of natural fibres to make woven products 🖐

The different purposes of products influence their design.

Students:

- identify the purpose of some familiar products and explore the features of their designs that make the products work, eg the broad brim on a sun hat or a plastic raincoat
- explore ways that products may be designed and made to conserve resources, eg recyclable materials and reusable containers 🌿
- discuss the strengths and limitations of a specific product, considering the materials from which it is made ⚙️

## SKILLS

## WORKING SCIENTIFICALLY

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### OUTCOME

#### A student:

- › investigates their questions and predictions by analysing collected data, suggesting explanations for their findings, and communicating and reflecting on the processes undertaken ST2-4WS

### CONTENT

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 (AC SIS053, ACSIS064) ⚙️
- predicting what might happen based on prior knowledge in an investigation (AC SIS053, ACSIS064) 🎓

Students plan investigations by:





- working collaboratively and individually, to suggest ways to plan and conduct investigations to find answers to questions (AC SIS054, 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 ⚙️

Students conduct investigations by:





- following the planned method, adjusting procedures as necessary, including exploration, fieldwork, surveys and researching secondary sources
- safely using appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate (AC SIS055, ACSIS066) 🖥️ ★ 📊
- using a range of methods to record observations and measurements with care and honesty, 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 (AC SIS057, ACSIS068) 🖥️ 📊 🎓
- sharing their findings and reflecting on the investigation, including whether a test was fair or not (AC SIS058, ACSIS069) 🧑🏫
- describing patterns and relationships in data collected from investigations (AC SHE050, ACSHE061)

- comparing results with predictions, suggesting possible reasons for findings (AC SIS215, 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 (AC SIS060, 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  

## Background information

Progression:

In Stage 2 students continue to develop their skills in using and applying the processes of Working Scientifically. The emphasis is on 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 develop their skills in using a range of investigation methods encountered in Stage 1 (exploration, surveys, accessing secondary sources and fieldwork). 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. They employ additional strategies for recording, processing and communicating their findings, consistent with stage-appropriate understanding in literacy and numeracy. Students 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, fieldwork and data from secondary sources. Students reflect on their evidence in relation to the process used.

## SKILLS

## WORKING TECHNOLOGICALLY

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### 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

### CONTENT

Students explore and define a 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 the proposed solution useful and attractive while having minimal impact on the environment 🌱🌿🌟👥

Students generate and develop ideas by:

- using creative thinking techniques, including brainstorming, mind-mapping, sketching and modelling ⚙️
- using a range of research techniques to access information relevant to the task 📖
- using techniques, including labelled drawings, modelling and storyboarding, for documenting and communicating design ideas 🎓
- using digital technologies and multimedia for communicating design ideas 📺
- refining ideas in responding to feedback from others 👥

Students produce solutions by:

- exploring a range of materials appropriate for the task
- developing and applying a plan and sequence for production that considers, where relevant, time and resources ⭐
- safely and correctly using a range of tools and equipment, materials and techniques, eg 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 the user/audience 👥
- using established design criteria to evaluate the process, product or solution, and suggesting how their design solution could be improved
- 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 identify 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 techniques 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 improved.

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.

## PHYSICAL WORLD

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### OUTCOMES

#### A student:

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

### CONTENT

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

Students:

- identify in their environment some different ways in which heat is produced, eg by electricity, burning (chemical) and friction (motion)
- observe the effects of heat moving from one object to another, eg 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, eg a pot holder, insulated bags or thermos ✨

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, eg dropping, bouncing or rolling objects ✨
- observe the way the force of gravity pulls objects towards the Earth, eg dropping objects from different heights
- observe everyday situations where the direct contact force (friction) affects the movement of objects on different surfaces, eg a bike or skateboard
- carry out tests to investigate the forces of attraction and repulsion between magnets

## EARTH AND SPACE

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### OUTCOMES








#### A student:

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

### CONTENT


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

Students:

- use appropriate tools and equipment to collect and record data about some changes in natural conditions, eg tides, daily temperature, rainfall and wind   
- investigate how change in the environment is used by Aboriginal and Torres Strait Islander peoples to develop seasonal calendars  
- describe some changes in the landscape that have occurred over time as a result of natural processes, eg erosion by wind and water
- research changes that have occurred in a local environment in Australia or an Asian region as a result of human activities, eg increasing erosion, construction of built environments and regeneration of an area  

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, eg by using models of the Earth and sun
- describe local seasonal changes that occur as a result of the Earth's movement around the 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, eg by using a shadow clock or sundial 

## KNOWLEDGE AND UNDERSTANDING – NATURAL ENVIRONMENT

## 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 ST2-10LW
- › describes ways that science knowledge helps people understand the effect of their actions on the environment and on the survival of living things ST2-11LW

## CONTENT

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, eg reproducing, growing and responding to stimuli
- identify and use patterns in the observable features of living things to group them, by using tables, diagrams or flowcharts 📊
- research ways that Aboriginal and Torres Strait Islander peoples classify some plants or animals 🤝 ⚙️

Living things have life cycles. (ACSSU072)

Students:

- observe first-hand one animal or plant as it grows and develops, and sequence the stages in its life cycle 📖
- identify ways that the environment can affect the life cycle of plants and animals

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

Students:

- identify some factors in the local environment that are needed by plants and animals for survival
- outline the relationship between plants and animals, including that plants are able to use light to make food, while animals must eat plants or other animals to obtain food 📖
- investigate the role of living things in a habitat, eg plants as producers and microbes (micro-organisms) as decomposers ⚙️
- gather information about some relationships between living things, eg predator-prey, competitors and mutually beneficial relationships 🌱 📖



- predict the effect of natural changes in the environment on some relationships between plants and animals, eg drought and fire
- describe some examples of how science knowledge helps people to understand the effect of their actions on the environment and the survival of living things (ACSHE051, ACSHE062)



## MATERIAL WORLD

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### OUTCOMES

#### A student:

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

### CONTENT

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, eg butter, chocolate and water ❄️❄️
- describe how scientific knowledge about the effects of heating and cooling is used by people in their everyday life, eg the types of clothes worn, the packaging and preparation of food and everyday devices, eg freezers, irons or cooktops

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, eg grains in bread, particles in chipboard or cork, threads within a fabric or fibres in paper 🔍
- identify the properties of some natural and processed materials
- describe how a range of common natural and processed materials are used in everyday life
- generate ideas about how the physical properties of some natural and processed materials influence their use ❄️❄️

## BUILT ENVIRONMENTS

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### OUTCOME

#### A student:

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

### CONTENT

People interact in varying ways within built environments.

Students:

- observe how people interact within a built environment and describe how its design meets the needs of the users, eg the ways people use and interact in a local shopping centre or playground ⚙️ 🛠️
- 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, eg use of the local hall for a school play or use of local playing fields for sport 🏟️ 🌐

A range of factors needs to be considered when designing and constructing built environments.

Students:

- examine some built environments, eg a local playground or shopping centre, and identify some factors that have been considered in the design, such as purpose, access, aesthetic and environmental considerations, and movement within the space 🧑🏫 ⚙️ 🛠️
- describe how the design and construction of a built environment may be modified to better suit the needs of users

## KNOWLEDGE AND UNDERSTANDING – MADE ENVIRONMENT

## INFORMATION

## OUTCOME





## A student:

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

## CONTENT




There are processes and considerations involved in designing and producing information solutions.

Students:

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





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, eg the design of advertisements  
- explore how people use current and emerging technologies to communicate, access and record information, eg email, mobile phones, blogs and wikis 

A range of factors need to be considered when using information sources and technologies.

Students:

- demonstrate appropriate safety and etiquette in relation to computer usage, eg general computer care, file security, maintaining confidentiality of passwords, printing and sharing resources   
- acknowledge ownership of information when selecting and using information, eg citing sources 

## PRODUCTS

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### OUTCOME




#### A student:

- › describes how products are designed and produced, and the ways people use them  
ST2-16P

### CONTENT



There are various processes involved in 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, eg pedals, cogs and chains work together 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  

People use products in a variety of ways.

Students:

- explore the ways existing products can be reused and recycled to incorporate environmental considerations, eg products designed from recycled PET bottles  
- examine how people use applications of science and technology in their work, eg builders, farmers and graphic designers

## SKILLS

## WORKING SCIENTIFICALLY

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### OUTCOME

#### A student:

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

### CONTENT

Students question and predict by:

- with guidance, posing questions to clarify practical problems or inform a scientific investigation (AC SIS231, AC SIS232)
- predicting what the findings of an investigation might be (AC SIS231, AC SIS232) 🎓
- 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, fieldwork, research and fair tests (AC SIS086, AC SIS103, AC SHE081, AC SHE098)
- deciding which variable should be changed and measured in fair tests while keeping everything else the same (AC SIS087, AC SIS104) ⚙️
- collaboratively and individually selecting suitable methods for gathering data and information first-hand and from reliable secondary sources 🎓 👥 ⭐

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 (AC SIS088, AC SIS105) 👥
- accurately observing, measuring and recording data, using digital technologies as appropriate (AC SIS087, AC SIS104) 🖥️ 🎓
- using formal units and abbreviations for measuring and recording data 📊
- suggesting improvements to the methods used to investigate a question or solve a problem (AC SIS091, AC SIS108) ⚙️

Students process and analyse data and information by:

- constructing and using a range of representations, including tables, graphs (column, picture, line and 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 📊

- drawing conclusions and providing explanations based on data and information gathered first-hand or from secondary sources ❄️
- comparing gathered data with predictions, and using 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

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 (ACSIS090, ACSIS107) 📊💻📱❄️
- using a variety of ways to honestly and accurately communicate ideas, explanations and processes, including multi-modal texts, labelled diagrams, as well as written and oral factual texts as appropriate (ACSIS093, ACSIS110) 🗣️⚖️📊💻

## Background information

Progression:

In Stage 3 students develop their skills in applying the processes of Working Scientifically through planning and conducting a range of types of investigations. They increase their understanding of 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 at an introductory level, the language of science 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.

## SKILLS

## WORKING TECHNOLOGICALLY

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### OUTCOME

#### A student:

- › plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints ST3-5WT

### CONTENT

Students explore and define a task by:

- exploring needs for, or opportunities to undertake, the task
- identifying the users' needs and wants using techniques, eg observations, surveys, interviews and market research ★
- developing a design brief individually and in collaboration with others 👤
- developing design criteria that considers, where relevant, function, aesthetics, social and environmental considerations ⚙️ 🌿
- planning the process considering constraints where relevant, eg time, finance, resources and expertise ★

Students generate and develop ideas by:

- selecting and using creative thinking techniques, including mind-mapping, brainstorming, sketching and modelling ⚙️
- selecting and using research techniques appropriate to the task 👤
- selecting and using techniques for documenting and communicating design ideas to others, eg drawings, plans, flow charts, storyboarding, modelling and presentations, using digital technologies 🖥️ 📱 ★ 👤
- identifying a range of appropriate materials for the task
- selecting and using techniques to investigate the suitability of materials ⚙️
- applying established criteria to evaluate and modify ideas


Students produce solutions by:

- testing the suitability of materials, considering whether the test was fair or not
- developing a plan and specifications to guide production ⚙️
- using their plans and production sequence
- 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 ⚙️



- self or peer assessing the final product by using the established design criteria 

## Background information

Progression:

In Stage 3 students continue to implement and record a process of design. They 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 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.

## PHYSICAL WORLD

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### OUTCOMES

#### A student:

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

### CONTENT

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, eg switches and light globes
- observe and describe how some devices transform (change) electricity to heat energy, light, sound or movement, eg hair dryers, light globes, bells and fans 🎓 ⚙️

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




Students:

- research and present ideas about the different ways electricity can be generated, eg burning coal or natural gas; solar, hydroelectric, geothermal, wind and wave-generated electricity 🎓
- describe how scientific knowledge can be used to inform personal and community decisions about the use and conservation of sustainable sources of energy (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, reflected or scattered
- observe and describe how the absorption of light by materials and objects forms shadows, eg building shading
- gather evidence to support their predictions about how light travels and is reflected ⚙️

- research, using secondary sources to gather information about science understandings, discoveries and/or inventions that depend on the reflection and refraction of light and how these are used to solve problems that directly affect people's lives, eg mirrors, magnifiers, spectacles and prisms (ACSHE083, ACSHE100)   

## EARTH AND SPACE

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### OUTCOMES

#### A student:

- › describes how discoveries by people from different cultures and times have contributed to advancing scientific understanding of the solar system ST3-8ES
- › explains rapid change at the Earth's surface caused by natural events, using evidence provided by advances in technology and scientific understanding ST3-9ES

### CONTENT

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 (ACSHE082, ACSHE099) 🌍 ⚙️ 🌐 ⭐
- describe how Aboriginal and Torres Strait Islander peoples use observations of the night sky to inform decisions about some everyday activities, eg food gathering and ceremonies 🙌

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

Students:

- describe using examples how natural geological events cause rapid changes to the Earth's surface, eg earthquakes, volcanic eruptions or tsunamis in the Asian region or throughout the world 🌐
- research how some discoveries or inventions have increased scientific knowledge and provided evidence about natural events that cause rapid changes at the Earth's surface 🎓
- investigate a recent Australian example of the effect on the Earth's surface of extreme weather conditions, eg cyclones, droughts or floods
- identify ways that advances in science and technology have assisted people to plan for and manage natural disasters to minimise their effects, eg detection systems for tsunamis, floods and bush fires 🌿

## KNOWLEDGE AND UNDERSTANDING – NATURAL ENVIRONMENT

## LIVING WORLD

## OUTCOMES





## A student:

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

## CONTENT







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 
- present ideas and explanations about how the structural features and behaviour of some plants and animals help them to survive in their environment, eg shiny surfaces of leaves on sand dune plants and nocturnal behaviour in some animals  
- research the conditions needed for a particular plant to grow and survive in its environment, eg an indoor plant, plants in deserts, drought-resistant wheat or salt-tolerant plants 

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, eg temperature, slope, wind speed, amount of light and water
- make predictions about how changing the physical conditions of the environment impacts on the growth and survival of living things, eg different amounts of light or water on plant growth or the effect of different temperatures on the growth of yeast or bread mould   
- use gathered data to develop explanations about how changing the physical conditions of the environment affects the growth and survival of living things   

## MATERIAL WORLD

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### OUTCOMES

#### A student:

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

### CONTENT



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, eg shape and ability to flow
- demonstrate that air has mass and takes up space, eg in an inflated basketball, bubbles, balloons and beaten egg white




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

Students:

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

The properties of materials determine their use for specific purposes.

Students:

- identify the properties of materials used in a familiar product and relate them to its use
- explore how materials are used in innovative ways for specific purposes, eg the use of soft-fall materials in playgrounds and geotextiles to retain water in landscaping
- describe how scientific and technological knowledge about the properties of materials can be used to inform decisions about use for their specific purposes 
- research the reasons for and the benefits of using solid, liquid and gaseous fuels for heating  

## KNOWLEDGE AND UNDERSTANDING – MADE ENVIRONMENT

## BUILT ENVIRONMENTS

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### OUTCOME

#### A student:

- › describes systems in built environments and how social and environmental factors influence their design ST3-14BE

### CONTENT

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, eg transport systems that provide access for people to get to work or systems that provide electricity to sites ⚙️⚙️
- 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, eg shade for a playground

Social and environmental factors influence the design of built environments.

Students:

- consider ways that the design or use of places and spaces have changed over time and the social and/or environmental factors that have influenced these changes, eg changes in the design and use of a library due to technological developments or the design of buildings after an earthquake ⚙️⚙️🏠🌍
- generate and develop ideas about how built environments might be designed and constructed in the future to incorporate sustainable environmental practices, eg the use of recycled materials, natural lighting and solar energy ⚙️⚙️🏠👤👤
- develop designs and solutions to meet specific social or environmental needs of users, eg an energy-efficient building or high-traffic airport terminal/train station

## KNOWLEDGE AND UNDERSTANDING – MADE ENVIRONMENT

## INFORMATION

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### OUTCOME



#### A student:

- › describes how social influences impact on the design and use of information and communication systems ST3-15I

### CONTENT







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, eg a database, spreadsheet and multimedia designs 
- communicate with others in different social and/or cultural contexts when designing an information solution, eg being a member of a collaborative online learning community 

Social influences can impact on the design of information sources and technologies.

Students:

- demonstrate appropriate and responsible use of information sources and technologies considering, where relevant, different points of view and/or stereotyping   
- explore a range of emerging information technologies and the ways that communicating with others has changed, eg the use of video-conferencing, blogs and wikis 
- discuss issues of safety and privacy of personal information when communicating, selecting and using information sources and technologies  



## KNOWLEDGE AND UNDERSTANDING – MADE ENVIRONMENT

## PRODUCTS

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### OUTCOME

#### A student:

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

### CONTENT

Systems are used to produce or manufacture products.

Students:

- investigate a system to produce or manufacture a product, eg using an assembly line to produce a food product for sale in the school canteen, or the use of robotics in manufacturing a product ⚙️
- compare the production process in a domestic setting to mass production, eg 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 to its use and disposal, eg a PET bottle, a car or newspaper 🎓 ⚖️ 🌱
- redesign a product to respond to a specific social or environmental consequence, eg redesign the packaging of a food product to reduce garbage ⚙️ 🌱

# SCIENCE YEARS 7–10 SYLLABUS

## SCIENCE KEY

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The following codes and icons are used in the *Science Years 7–10 Syllabus*.

### OUTCOME CODING

Syllabus outcomes have been coded in a consistent way. The code identifies the subject, stage, outcome number and the way content is organised.

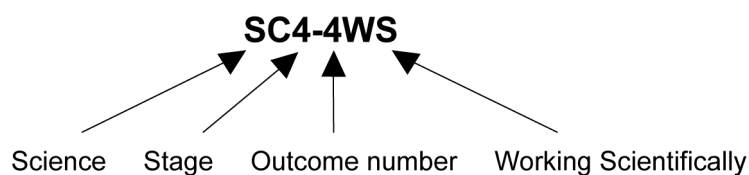
Stage 4 and Stage 5 are represented by the following codes:

Stages	Codes
Stage 4	4
Stage 5	5

In the *Science Years 7–10 Syllabus*, the outcome codes indicate the subject, stage, outcome and strand. The values and attitudes outcomes are also coded:

Outcomes	Codes
Science (Years 7–10)	SC
Science Life Skills	SCLS
Values and Attitudes	VA
<b>Skills strand</b>	
Working Scientifically	WS
<b>Knowledge and Understanding strands</b>	
Physical World	PW
Earth and Space	ES
Living World	LW
Chemical World	CW

For example:

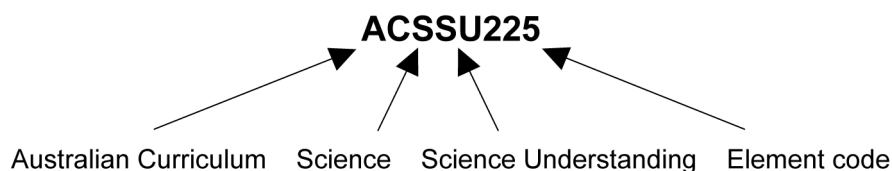


Outcome codes	Interpretations
SC4-4WS	Science, Stage 4 - Outcome number 4, Working Scientifically
SC5-16CW	Science, Stage 5 - Outcome number 16, Chemical World
SCLS-9WS	Science, Life Skills - Outcome number 9, Working Scientifically

## CODING OF THE AUSTRALIAN CURRICULUM CONTENT

The syllabus includes all the Australian curriculum content descriptions for Science. The content descriptions are identified by an Australian curriculum code which appears in brackets at the end of each content description, for example:

Chemical change involves substances reacting to form new substances (ACSSU225).



Where a number of content descriptions are jointly represented, both description codes are included, for example (AC SIS125, AC SIS140).




The Australian curriculum Science codes are:

Codes	Interpretations
AC SIS	Australian Curriculum, Science Inquiry Skills
AC SHE	Australian Curriculum, Science as a Human Endeavour
AC SSU	Australian Curriculum, Science Understanding








## LEARNING ACROSS THE CURRICULUM ICONS

Learning across the curriculum content, including cross-curriculum priorities, general capabilities and other areas identified as important learning for all students, is incorporated and identified by icons in the *Science Years 7–10 Syllabus*.




### Cross-curriculum priorities

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

### General capabilities

	Critical and creative thinking
	Ethical understanding
	Information and communication technology capability
	Intercultural understanding
	Literacy
	Numeracy
	Personal and social capability

### Other learning across the curriculum areas

	Civics and citizenship
	Difference and diversity
	Work and enterprise

## RATIONALE

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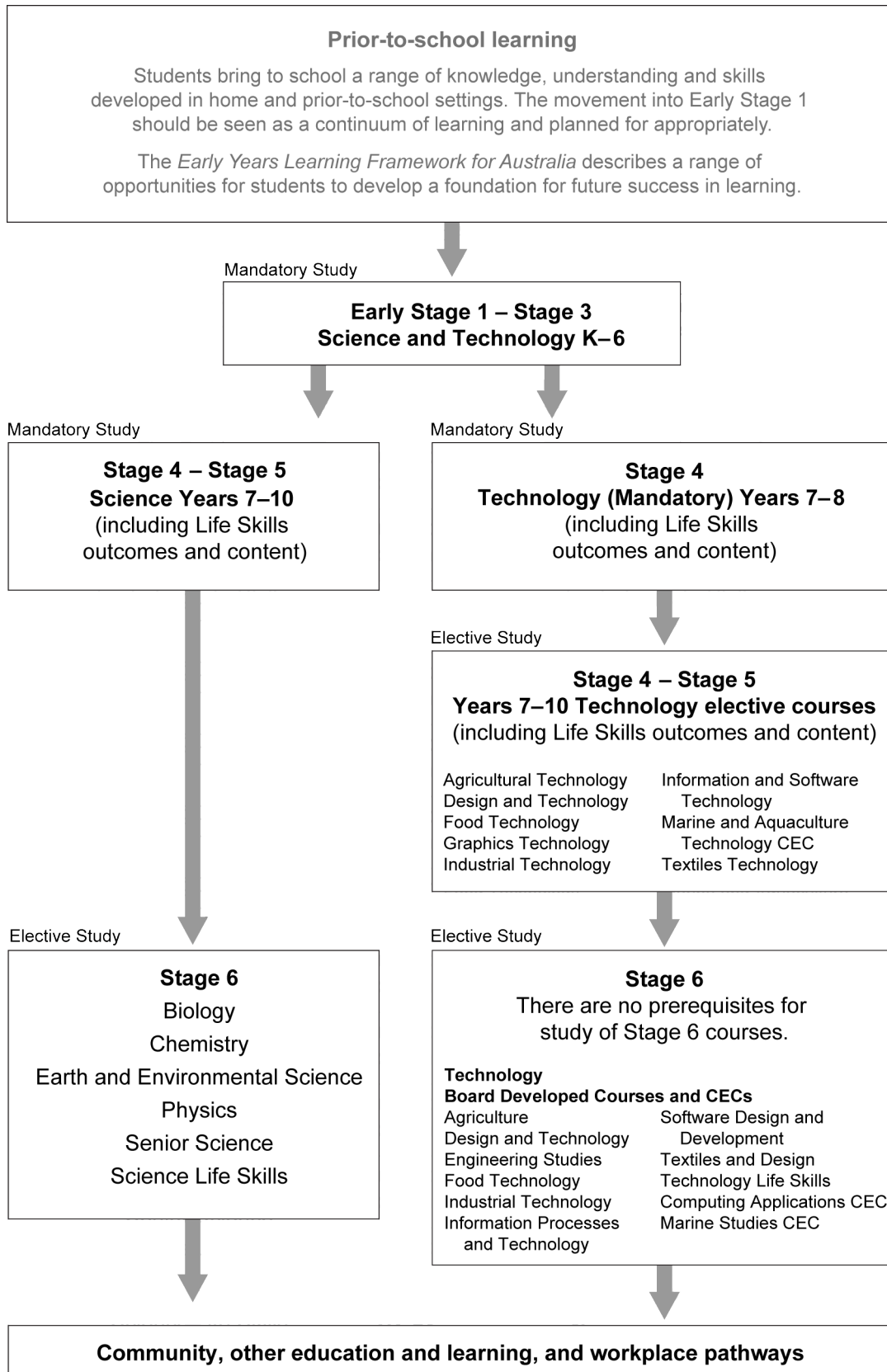
Science provides an empirical way of answering interesting and important questions about the biological, physical and technological world. Scientific knowledge is contestable and is revised, refined and extended as new evidence arises or existing evidence is re-conceptualised. The study of Science is 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. Providing opportunities for students to continue to strengthen these scientific capabilities, helps them further develop as scientifically literate citizens.

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.

# THE PLACE OF THE SCIENCE K–10 (INCORPORATING SCIENCE AND TECHNOLOGY K–6) SYLLABUS IN THE K–12 CURRICULUM



## AIM

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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 contemporary science-related problems and issues
- 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.

# OBJECTIVES

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## 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 now and in the future
- develop a willingness to use evidence and reason to engage with and respond to scientific and technological ideas as informed, reflective citizens.

## SKILLS, KNOWLEDGE AND UNDERSTANDING

Students:

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



# OUTCOMES

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## STAGE 4 AND STAGE 5

### TABLE OF OBJECTIVES AND OUTCOMES

#### VALUES AND ATTITUDES

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

<b>Objectives</b>
Students:
<ul style="list-style-type: none"><li>• develop an appreciation of the contribution of science to finding solutions to personal, social and global issues relevant to their lives now and in the future</li><li>• develop a willingness to use evidence and reason to engage with and respond to scientific and technological ideas as informed, reflective citizens</li></ul>
<b>Stage 4 to Stage 5 outcomes</b>
A student:
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

## SKILLS

<p><b>Objective</b> Students:</p> <ul style="list-style-type: none"> <li>develop knowledge, understanding of and skills in applying the processes of Working Scientifically</li> </ul>	
<p><b>Stage 4 outcomes</b> A student:</p>	<p><b>Stage 5 outcomes</b> A student:</p>
<p>SC4-4WS identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge</p> <p>SC4-5WS collaboratively and individually produces a plan to investigate questions and problems</p> <p>SC4-6WS follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually</p> <p>SC4-7WS processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions</p> <p>SC4-8WS selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems</p> <p>SC4-9WS presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations</p>	<p>SC5-4WS develops questions or hypotheses to be investigated scientifically</p> <p>SC5-5WS produces a plan to investigate identified questions, hypotheses or problems, individually and collaboratively</p> <p>SC5-6WS undertakes first-hand investigations to collect valid and reliable data and information, individually and collaboratively</p> <p>SC5-7WS processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions</p> <p>SC5-8WS applies scientific understanding and critical thinking skills to suggest possible solutions to identified problems</p> <p>SC5-9WS presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations</p>

## KNOWLEDGE AND UNDERSTANDING

<b>Objective</b> Students: <ul style="list-style-type: none"> <li>develop knowledge of the Physical World, Earth and Space, Living World and Chemical World, and understanding about the nature, development, use and influence of science</li> </ul>	
<b>Stage 4 outcomes</b> A student:	<b>Stage 5 outcomes</b> A student:
SC4-10PW describes the action of unbalanced forces in everyday situations  SC4-11PW discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformations	SC5-10PW applies models, theories and laws to explain situations involving energy, force and motion  SC5-11PW explains how scientific understanding about energy conservation, transfers and transformations is applied in systems
SC4-12ES describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system  SC4-13ES explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource use and management	SC5-12ES 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  SC5-13ES 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
SC4-14LW relates the structure and function of living things to their classification, survival and reproduction  SC4-15LW explains how new biological evidence changes people's understanding of the world	SC5-14LW analyses interactions between components and processes within biological systems  SC5-15LW explains how biological understanding has advanced through scientific discoveries, technological developments and the needs of society
SC4-16CW describes the observed properties and behaviour of matter, using scientific models and theories about the motion and arrangement of particles  SC4-17CW explains how scientific understanding of, and discoveries about the properties of elements, compounds and mixtures relate to their uses in everyday life	SC5-16CW explains how models, theories and laws about matter have been refined as new scientific evidence becomes available  SC5-17CW 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 Stage 5 outcomes and content are not appropriate. For these students, Life Skills outcomes and content can provide a relevant and meaningful program. Refer to the Introduction for further information about curriculum options for students with special education needs. Years 7–10 Life Skills outcomes and content are in the Life Skills section of the syllabus.

## STAGE STATEMENTS

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Stage statements are summaries of the knowledge, understanding, skills, values and attitudes that have been developed by students as a result of achieving the outcomes for each stage of learning.

### PRIOR-TO-SCHOOL LEARNING

Students bring to school a range of knowledge, understanding and skills developed in home and prior-to-school settings. The movement into Early Stage 1 should be seen as a continuum of learning and planned for appropriately.

The *Early Years Learning Framework for Australia* describes a range of opportunities for students to learn and develop a foundation for future success in learning.

The *Early Years Learning Framework for Australia* has five Learning Outcomes that reflect contemporary theories and research evidence concerning children's learning. The outcomes are used to guide planning and to assist all children to make progress.

The outcomes are:

- 1 Children have a strong sense of identity
- 2 Children are connected with and contribute to their world
- 3 Children have a strong sense of wellbeing
- 4 Children are confident and involved learners
- 5 Children are effective communicators.

In addition, teachers need to acknowledge the learning that children bring to school, and plan appropriate learning experiences that make connections with existing language and literacy development, including language used at home.

### EARLY STAGE 1

By the end of Early Stage 1 students' sense of wonder and curiosity about the Natural Environment and the Made Environment is fostered through purposeful play, observing, questioning and exploring ideas. They learn about and use the processes of Working Scientifically and Working Technologically in a holistic way and 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. Students recognise that the way objects move depends on a variety of factors. They 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 knew, what they observed, what they did, how they felt about it and the usefulness of their final solutions.

## STAGE 1

By the end of Stage 1 students show an interest in science and technology by responding to questions, perceived needs and wants. They describe situations where they and other people 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 to 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 these 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

By the end of Stage 2 students 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 investigable 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 describe interactions between objects that result from contact and non-contact forces. Students 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, students 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

By the end of Stage 3 students 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.

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 them. 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. They describe key features of the solar system and the contribution of people from a range of cultures over time to the advancement of science. Students 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

By the end of Stage 4 students 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 science 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 the 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 the Earth's spheres.



## STAGE 5

By the end of Stage 5 students 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 science 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 science ideas for specific purposes and construct evidence-based arguments using appropriate scientific language, conventions and representations.

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 the 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.

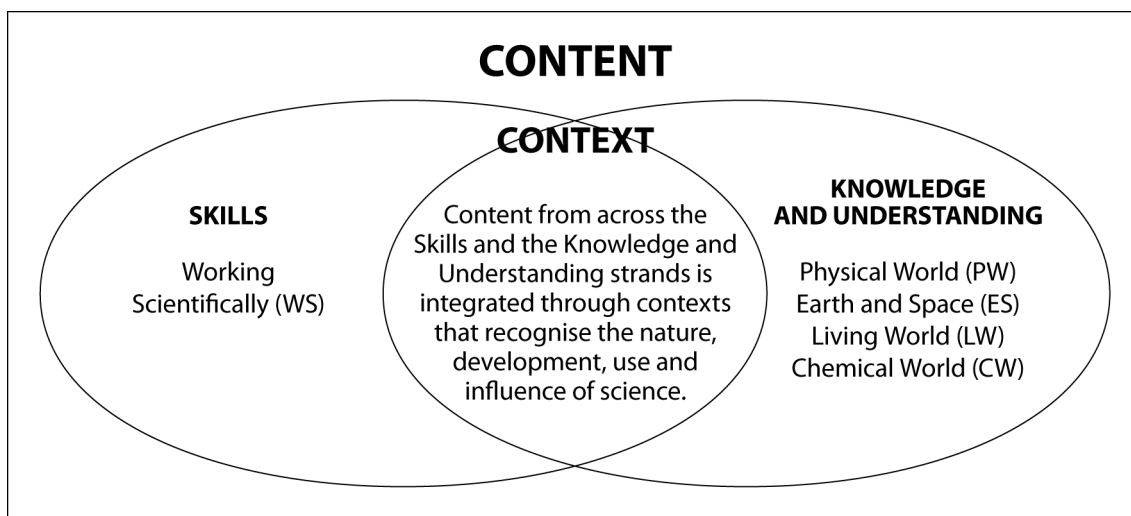
By the end of Stage 5 students describe how the values and needs of contemporary society can influence the focus of scientific research and technological development in a variety of areas, including efficiency of use of electricity and non-renewable energy sources, the development of new materials, biotechnology, and plant, animal and human health. They 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.

# ORGANISATION OF CONTENT

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For Kindergarten to Year 10, courses of study and educational programs are based on the outcomes of syllabuses. The content describes in more detail how the outcomes are to be interpreted and used, and the intended learning appropriate for the stage. In considering the intended learning, teachers will make decisions about the sequence, the emphasis to be given to particular areas of content, and any adjustments required based on the needs, interests and abilities of their students.

The knowledge, understanding and skills described in the outcomes and content provide a sound basis for students to successfully move to the next stage of learning.



The content of the *Science Years 7–10 Syllabus* is organised by the strands:

- Skills:
  - Working Scientifically (WS)
- Knowledge and Understanding:
  - Physical World (PW)
  - Earth and Space (ES)
  - Living World (LW)
  - Chemical World (CW).

These strands form a continuum with the Working Scientifically strand and the Natural Environment substrands of the *Science and Technology K–6 Syllabus*. The Material World substrand in the *Science and Technology K–6 Syllabus* provides the foundation for the Chemical World strand.

Within the Knowledge and Understanding strands:

- content statements summarise the overarching scientific concepts/ideas and understanding about science. The related group of content describes the appropriate depth and scope of learning for each statement
- content incorporates understanding about the nature, development, use and influence of science with relevant knowledge of scientific concepts, principles, models, theories and laws.

Continuity of learning in all aspects of the syllabus is provided when teaching programs:

- are based on contexts that:

- are relevant to students' learning needs, interests, experiences and cultural backgrounds
- relate to the nature, development, use and influence of science
- incorporate all content across each stage
- integrate content selected from across the Knowledge and Understanding strands through the skills and processes of Working Scientifically
- develop understanding of science through a range of hands-on practical experiences that use the skills and processes of Working Scientifically
- engage students in scientific inquiry through applying the processes of Working Scientifically
- allocate at least 50% of the course time to students' active engagement in hands-on practical experiences
- include at least one substantial student research project in each of Stage 4 and Stage 5
- address the objectives and outcomes for the values and attitudes through the relevant skills, knowledge and understanding content for each stage.

## CONTENT STRANDS

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

### Skills

The skills strand is organised by the processes of Working Scientifically and specifies the development of the skills that students should be able to demonstrate by the end of Stage 4 and Stage 5. The content reflects the continuum with the Working Scientifically strand in K–6.

The processes of Working Scientifically are at the centre of teaching and learning. 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, including at least one substantial 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.

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
- 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 skills in performing first-hand investigations
- gathering first-hand data and information
- using time and resources effectively
- 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 novel 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 multi-modal texts
- presenting information and ideas using appropriate scientific language and text types.

### **Practical experiences**

The practical experiences, including the student research project, provide 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 a range of types of 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, as well as 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, eg data loggers
- using and constructing models
- using or reorganising second-hand data, including those in spreadsheets and databases
- extracting and reorganising information in the form of flow charts, tables, graphs, diagrams, prose, keys, spreadsheets and databases
- using digital technologies, eg computer animations and simulations, to capture and analyse data and information
- presenting data and information in multi-modal texts.

### **Student research project**

Class time should be allocated to assist students in clarifying their question or problem to be investigated, developing hypotheses and identifying variables to be controlled, measured or changed in fair tests. Students should also be supported in 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 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 for learning strategy to inform future teaching. It may also form part of the assessment of 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 **Work 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.

Teachers should be aware that students may have food allergies that can result in anaphylaxis, a severe and sometimes sudden allergic reaction which is potentially life-threatening and always requires an emergency response. This is an important consideration in selecting the foods to be handled and consumed.

### **Knowledge and understanding**

The Knowledge and Understanding strands specify the content for each stage and integrate content related to the understanding about the nature, development, use and influence of science with knowledge of scientific concepts, principles, models, theories and laws. Students develop their scientific understanding about the natural world and the unique nature of Science as a discipline through using and applying the processes of Working Scientifically.

Teachers choose contexts to assist students make meaning of and integrate the content. The choice of appropriate contexts for scientific learning should encourage students to further develop their understanding of science as a distinct view and way of thinking about the natural world.

The knowledge and understanding content is organised into four strands:

#### *Physical World (PW)*

The Physical World 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 (ES)*

The Earth and Space strand is concerned with the Earth's dynamic structure and its place in the cosmos. The key concepts developed within this strand are that the Earth is part of a solar system that, in turn, is part of a larger universe and that the 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 that humans use resources from the Earth and appreciate the influence of human activity on the surface of the Earth and the atmosphere.

#### *Living World (LW)*

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 that 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 (CW)*

The Chemical World strand is concerned with understanding the composition and behaviour of matter. The key concepts developed in 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.

## **Additional content**

The syllabus content is designed so that the typical student can realistically address it in the indicative course time. Additional knowledge and understanding content is provided in recognition that some students will need to extend their learning by engaging with content beyond the syllabus. To broaden and deepen students' scientific understanding, teachers may develop extension units or incorporate additional content into units of study throughout their teaching program.

The additional knowledge and understanding content presented in the syllabus provides suggestions only, should not be considered an exhaustive list and is not required as prerequisite knowledge for any Stage 6 Science course. 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 science ideas are theories and must be testable and measurable using the procedures of scientific inquiry.

Teachers may:

- 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 content of the syllabus. In this way, students can be given more time to acquire the skills, knowledge and understanding
- undertake remediation of knowledge, understanding and/or skills in addressing the outcomes and 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 Stage 5 outcomes and content are not appropriate. For these students, Life Skills outcomes and content can provide a relevant and meaningful program. Refer to the Introduction for further information about curriculum options for students with special education needs. Years 7–10 Life Skills outcomes and content are in the Life Skills section of the syllabus.



## LEARNING ACROSS THE CURRICULUM

Learning across the curriculum content, including the cross-curriculum priorities and general capabilities, assists students to achieve the broad learning outcomes defined in the Board of Studies *K–10 Curriculum Framework* and *Statement of Equity Principles*, and in the *Melbourne Declaration on Educational Goals for Young Australians (December 2008)*.

Cross-curriculum priorities enable students to develop understanding about and address the contemporary issues they face.

The cross-curriculum priorities are:

- Aboriginal and Torres Strait Islander histories and cultures 🖐️
- Asia and Australia's engagement with Asia <sup>a</sup>
- Sustainability. 🌱

General capabilities encompass the knowledge, skills, attitudes and behaviours to assist students to live and work successfully in the 21st century.

The general capabilities are:

- Critical and creative thinking 🧠
- Ethical understanding ⚖️
- Information and communication technology capability 💻
- Intercultural understanding 🌐
- Literacy 📖
- Numeracy 📊
- Personal and social capability. 👤

The Board's syllabuses include other areas identified as important learning for all students:

- Civics and citizenship 🗳️
- Difference and diversity 🌈
- Work and enterprise. ⭐

Learning across the curriculum content is incorporated, and identified by icons, in the content of the *Science K–10 (incorporating Science and Technology K–6) Syllabus* in the following ways:

### **Aboriginal and Torres Strait Islander histories and cultures** 🖐️

Aboriginal and Torres Strait Islander communities have diverse cultures, social structures and a history of unique, complex knowledge systems. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to learn about how Aboriginal and Torres Strait Islander peoples have developed and refined knowledge about the world through observation, making predictions, testing (trial and error) and responding to environmental factors within specific contexts. Students will investigate examples of Aboriginal and Torres Strait Islander peoples' understanding of the environment and the ways that traditional knowledge and western scientific knowledge can be complementary.

### **Asia and Australia's engagement with Asia** <sup>a</sup>

Asia and Australia's engagement with Asia provides rich and engaging contexts for developing students' science and technology skills, knowledge and understanding. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to recognise that the Asian region includes diverse environments. Students appreciate how interactions within and between these environments and the impacts of human activity influence the region, including Australia, and have significance for the rest of the world.

The Asian region plays an important role in scientific and technological research and development in areas such as medicine, natural resource management and natural disaster prediction and management.

### **Sustainability**

Sustainability is concerned with the ongoing capacity of the Earth to maintain all life. It provides authentic contexts for exploring, investigating and understanding systems in the natural and made environments. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to investigate relationships between systems and system components, to consider how systems respond to change and to develop appreciation for the interconnectedness of the Earth's spheres.

Relationships, cycles and cause and effect are explored, and students develop observation and analytical skills to examine these relationships in the world around them to design solutions to identified sustainability problems.

### **Critical and creative thinking**

Critical and creative thinking are integral to activities where students learn to generate and evaluate knowledge, clarify concepts and ideas, seek possibilities, consider alternatives and solve problems. Critical and creative thinking are embedded in the skills and processes of Working Scientifically and Working Technologically. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to develop critical and creative thinking skills through asking and posing questions, making predictions, engaging in first-hand investigations and design projects, problem solving, making evidence-based decisions, and analysing and evaluating evidence.

### **Ethical understanding**

Students develop the capability to behave ethically as they identify and investigate the nature of ethical concepts, values and principles, and understand how reasoning can assist ethical judgement. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides opportunities for students to form and make ethical judgements in relation to scientific investigations, design, codes of practice, and the use of scientific and technological information and applications. Students explore what integrity and honesty mean in using the processes of Working Scientifically and Working Technologically. They apply ethical guidelines in their investigations and design projects, particularly in their implications for others and the environment.

### **Information and communication technology capability**

Information and communication technology (ICT) can be used effectively and appropriately to access, create and communicate information and ideas, solve problems and work collaboratively. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to develop ICT capability when they develop design ideas and solutions, research science concepts and applications, investigate science phenomena, and communicate their scientific and technological understandings. In particular they learn to access information, collect, analyse and represent data, model and interpret concepts and relationships, and communicate scientific and technological ideas, processes and information. Digital technologies and aids, such as animations and simulations, provide opportunities to view phenomena and test predictions that cannot be investigated through practical experiences in the classroom, and may enhance students' understanding and engagement with science and technology.

### **Intercultural understanding**

Students develop intercultural understanding as they learn to understand themselves in relation to others. This involves students valuing their own cultures and those of others, and engaging with people of diverse cultures in ways that recognise commonalities and differences, create connections and cultivate respect. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides opportunities for students to appreciate the contribution that diverse cultural perspectives have made to the development, breadth and diversity of scientific and technological knowledge and applications. Students learn about and engage with issues requiring cultural sensitivity, and learn that scientists work in culturally diverse teams to address issues and solve problems of national and international importance.

## Literacy

Literacy is the ability to use a repertoire of knowledge and skills to communicate and comprehend effectively, using a variety of modes and media. Being 'literate' is more than the acquisition of technical skills – it includes the ability to identify, understand, interpret, create and communicate effectively using written, visual and digital forms of expression and communication for a number of purposes. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with the opportunities to understand that language varies according to the context. The language of science and technology is often technical and includes specific terms for concepts, processes and features of the world. Students learn that scientific and technological information can be presented in the form of diagrams, flowcharts, tables and graphs, and that specific text types are used to link information and ideas, give explanations, formulate questions, hypotheses, draw conclusions and construct evidence-based arguments.

## Numeracy

Numeracy involves students in recognising and understanding the role of mathematics in the world. Students become numerate as they develop the confidence, willingness and ability to apply mathematics in their lives in constructive and meaningful ways. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to develop numeracy skills through practical measurement and the collection, representation and interpretation of data from first-hand investigations and secondary sources. Initially students make measurements using informal units, then they apply the formal units of measurement. Students consider issues of uncertainty and reliability in measurement and learn data-analysis skills, identifying trends and patterns from numerical data and graphs.

## Personal and social capability

Students develop personal and social capability as they learn to understand and manage themselves, their relationships and their lives more effectively. This includes establishing positive relationships, making responsible decisions, working effectively individually and in teams and constructively handling challenging situations. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities, through applying processes of Working Scientifically and Working Technologically, to learn how scientific and technological knowledge informs and is applied in their daily lives. They develop skills in communication, initiative taking, goal setting, interacting with others, decision making, and the capacity to work independently and collaboratively. The study of Science and Technology enhances personal and social capability by expanding students' capacity to question, solve problems, explore and display curiosity. Students use their scientific and technological understanding to make informed choices about issues that impact on their lives and consider how the use and application of science and technology meet a range of personal and social needs.

## Civics and citizenship

Civics and citizenship content involves knowledge and understanding of how our Australian society operates. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides students with opportunities to broaden their understanding of aspects of civics and citizenship in relation to the application of science ideas and technological advances, including ecological sustainability and the development of environmental and sustainable practices.

## Difference and diversity

Difference and diversity comprise gender, race and socio-economic circumstances. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides opportunities for students to understand and appreciate the difference and diversity they experience in their everyday lives. 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 also enables them to identify individual rights, challenge stereotypes and engage with opinions different to their own.

## **Work and enterprise** ★

Students develop work-related skills and an appreciation of the value of working individually and collaboratively when conducting investigations and design tasks. The *Science K–10 (incorporating Science and Technology K–6) Syllabus* provides opportunities for students to prioritise safe practices and understand the potential risks and hazards present when conducting investigations and constructing design solutions. They safely use materials, electrical devices, classroom equipment and specialised tools.

## QUESTIONING AND PREDICTING

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### 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*

### CONTENT

WS4 Students question and predict by:

- a. identifying questions and problems that can be investigated scientifically (ACSIS124, ACSIS139)
- b. making predictions based on scientific knowledge and their own observations (ACSIS124, ACSIS139)

## PLANNING INVESTIGATIONS

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### OUTCOME





#### A student:

- › collaboratively and individually produces a plan to investigate questions and problems  
SC4-5WS



**Related Life Skills outcome:** *SCLS-5WS*

### CONTENT



WS5.1 Students identify data to be collected in an investigation by:

- a. identifying the purpose of an investigation
- b. proposing the type of information and data that needs to be collected in a range of investigation types, including first-hand and secondary sources  
- c. locating possible sources of data and information, including secondary sources, relevant to the investigation  

WS5.2 Students plan first-hand investigations by:

- a. collaboratively and individually planning a range of investigation types, including fieldwork, experiments, surveys and research (AC SIS125, AC SIS140)
- b. outlining a logical procedure for undertaking a range of investigations to collect valid first-hand data, including fair tests
- c. identifying in fair tests, variables to be controlled (held constant), measured and changed
- d. describing safety and ethical guidelines to be addressed  

WS5.3 Students choose equipment or resources for an investigation by:

- a. identifying suitable equipment or resources to perform the task, including safety equipment and digital technologies 
- b. selecting equipment to collect data with accuracy appropriate to the task (AC SIS126, AC SIS141) 

## CONDUCTING INVESTIGATIONS

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### OUTCOME







#### A student:

- › follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually SC4-6WS

**Related Life Skills outcome:** SCLS-6WS

### CONTENT

WS6 Students conduct investigations by:

- a. collaboratively and individually conducting a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (AC SIS125, AC SIS140) 
- b. assembling and using appropriate equipment and resources to perform the investigation, including safety equipment
- c. selecting equipment to collect data with accuracy appropriate to the task (AC SIS126, AC SIS141) 
- d. following the planned procedure, including in fair tests, measuring and controlling variables (AC SIS126, AC SIS141) 
- e. recording observations and measurements accurately, using appropriate units for physical quantities 
- f. performing specific roles safely and responsibly when working collaboratively to complete a task within the timeline 
- g. assessing the method used and identifying improvements to the method (AC SIS131, AC SIS146) 

## PROCESSING AND ANALYSING DATA AND INFORMATION

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### OUTCOME









#### A student:

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












**Related Life Skills outcome:** SCLS-7WS

### CONTENT

WS7.1 Students process data and information by:

- a. summarising data from students' own investigations and secondary sources (AC SIS130, AC SIS145)  
- b. using a range of representations to organise data, including graphs, keys, models, diagrams, tables and spreadsheets 
- c. extracting information from diagrams, flowcharts, tables, databases, other texts, multimedia resources and graphs including histograms and column, sector and line graphs  
- d. accessing information from a range of sources, including using digital technologies  
- e. applying simple numerical procedures, eg calculating means when processing data and information, as appropriate 

WS7.2 Students analyse data and information by:

- a. checking the reliability of gathered data and information by comparing with observations or information from other sources  
- b. constructing and using a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate (AC SIS129, AC SIS144)   
- c. identifying data which supports or discounts a question being investigated or a proposed solution to a problem  
- d. using scientific understanding to identify relationships and draw conclusions based on students' data or secondary sources (AC SIS130, AC SIS145)
- e. proposing inferences based on presented information and observations  
- f. reflecting on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected (AC SIS131, AC SIS146)  



## SKILLS – WORKING SCIENTIFICALLY

## PROBLEM SOLVING

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### OUTCOME

**A student:**

- › selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems SC4-8WS

**Related Life Skills outcome:** SCLS-8WS

### CONTENT

WS8 Students solve problems by:

- a. using identified strategies to suggest possible solutions to a familiar problem ⚙️
- b. describing different strategies that could be employed to solve an identified problem with a scientific component ⚙️
- c. using scientific knowledge and findings from investigations to evaluate claims (ACSIS132, ACSIS234) ⚙️
- d. using cause and effect relationships to explain ideas and findings ⚙️
- e. evaluating the appropriateness of different strategies for solving an identified problem ⚖️ ⚙️

## COMMUNICATING

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### OUTCOME

#### A student:

- › presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations SC4-9WS

**Related Life Skills outcome:** *SCLS-9WS*

### CONTENT

WS9 Students communicate by:

- a. presenting ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (AC SIS133, AC SIS148) 🎓 💻
- b. using appropriate text types in presentations, including a discussion, explanation, exposition, procedure and recount 🎓
- c. using a recognised method to acknowledge sources of data and information 🎓
- d. constructing and using a range of representations to honestly, clearly and/or succinctly present data and information including diagrams, keys, models, tables, drawings, images, flowcharts, spreadsheets and databases 🎓 💻 📊
- e. constructing and using the appropriate type of graph (histogram, column, sector or line graph) to express relationships clearly and succinctly, employing digital technologies as appropriate 📊 💻

## KNOWLEDGE AND UNDERSTANDING

## PHYSICAL WORLD

## OUTCOMES

## A student:




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

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

## CONTENT




PW1 Change to an object's motion is caused by unbalanced forces acting on the object. (ACSSU117)

Students:

- a. identify changes that take place when particular forces are acting
- b. predict the effect of unbalanced forces acting in everyday situations
- c. describe some examples of technological developments that have contributed to finding solutions to reduce the impact of forces in everyday life, eg car safety equipment and footwear design  
- d. analyse some everyday common situations where friction operates to oppose motion and produce heat 
- e. investigate factors that influence the size and effect of frictional forces

PW2 The action of forces that act at a distance may be observed and related to everyday situations.

Students:

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

PW3 Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems. (ACSSU155)

Students:

- a. identify objects that possess energy because of their motion (kinetic) or because of other properties (potential)
- b. describe the transfer of heat energy by conduction, convection and radiation, including situations in which each occurs
- c. relate electricity with energy transfer in a simple circuit
- d. construct and draw circuits containing a number of components to show a transfer of electricity
- e. investigate some everyday energy transformations that cause change within systems, including motion, electricity, heat, sound and light

PW4 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:

- a. identify that most energy conversions are inefficient and lead to the production of heat energy, eg in light bulbs ✨
- b. research ways in which scientific knowledge and technological developments have led to finding a solution to a contemporary issue, eg improvements in devices to increase the efficiency of energy transfers or conversions ✨🌱
- c. discuss the implications for society and the environment of some solutions to increase the efficiency of energy conversions by reducing the production of heat energy ✨⚖️

#### **Additional content**

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 4.

Students:

- investigate characteristics of specific forces in terms of size and direction
- investigate some simple machines, eg levers, pulleys, gears or inclined planes
- trace the history of the development of particular devices or technologies, eg circuitry through to microcircuitry
- describe the scientific principles used in some traditional technologies used and developed by Aboriginal and Torres Strait Islander peoples 🖐️
- trace the history of pendulum-motion studies and its connection with timekeeping and setting standards of length
- debate intergenerational implications of the use of non-renewable energy resources ✨👥🌱
- research current ideas about the Earth's magnetic field and its effects

## 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 SC4-12ES
- › explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource use and management SC4-13ES

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

## CONTENT

ES1 Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales. (ACSSU153)

Students:

- a. describe the structure of the Earth in terms of core, mantle, crust and lithosphere
- b. relate the formation of a range of landforms to physical and chemical weathering, erosion and deposition
- c. outline the origins of and relationships between sedimentary, igneous and metamorphic rocks
- d. identify that sedimentary, igneous and metamorphic rocks contain minerals
- e. classify a variety of common rocks and minerals into groups according to their observable properties 🎓
- f. describe the conditions under which fossils form
- g. 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 ⚙️
- h. 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 (ACSHE224, ACSHE227) ★ 🌏

ES2 Scientific knowledge changes as new evidence becomes available. Some technological developments and scientific discoveries have significantly changed people's understanding of the solar system.

Students:

- a. explain that predictable phenomena on the Earth, including day and night, seasons and eclipses are caused by the relative positions of the sun, the Earth and the moon (ACSSU115)
- b. demonstrate, using examples, how ideas by people from different cultures have contributed to the current understanding of the solar system 🌐 ⚙️
- c. compare historical and current models of the solar system to show how models are modified or rejected as a result of new scientific evidence ⚙️

- d. describe some examples of how technological advances have led to discoveries and increased scientific understanding of the solar system 🖥️

ES3 Scientific knowledge influences the choices people make in regard to the use and management of the Earth's resources.

Students:

- a. classify a range of the Earth's resources as renewable or non-renewable (ACSSU116) 🌱
- b. outline features of some non-renewable resources, including metal ores and fossil fuels
- c. describe uses of a variety of natural and made resources extracted from the biosphere, atmosphere, lithosphere and hydrosphere
- d. investigate some strategies used by people to conserve and manage non-renewable resources, eg recycling and the alternative use of natural and made resources 🌱
- e. discuss different viewpoints people may use to weight criteria in making decisions about the use of a major non-renewable resource found in Australia 🧑🏻🧑🏻🚫
- f. 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 ⚖️ 🌱 🧑🏻🧑🏻

ES4 Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management. (ACSHE121, ACSHE136)

Students:

- a. identify that water is an important resource that cycles through the environment (ACSSU222)
- b. explain the water cycle in terms of the physical processes involved
- c. demonstrate how scientific knowledge of the water cycle has influenced the development of household, industrial and agricultural water management practices ⚙️ 🌱
- d. research how Aboriginal and Torres Strait Islander peoples' knowledge is being used in decisions to care for country and place, eg terrestrial and aquatic resource management 🌱 🌐 🙌

### Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 4.

Students:

- investigate examples of how scientific knowledge has developed through collaboration of experts from across the disciplines of Science, eg space exploration and resource management ⚙️ 🎓
- describe the effect of the forces of the sun and moon on the hydrosphere
- investigate the role of forces and energy in the formation of different types of rocks and minerals
- describe some methods used by scientists to determine the relative age of rock layers
- debate the economic and environmental impacts of mining and resource exploration ⚙️ 🧑🏻🧑🏻 🌱
- describe ways in which technology has increased the variety of made resources 🎓

## KNOWLEDGE AND UNDERSTANDING

## LIVING WORLD

## OUTCOMES

## A student:



- › relates the structure and function of living things to their classification, survival and reproduction SC4-14LW
- › explains how new biological evidence changes people's understanding of the world SC4-15LW

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

## CONTENT

LW1 There are differences within and between groups of organisms; classification helps organise this diversity. (ACSSU111)

Students:

- a. identify reasons for classifying living things
- b. classify a variety of living things based on similarities and differences in structural features
- c. use simple keys to identify a range of plants and animals 
- d. identify some examples of groups of micro-organisms
- e. outline the structural features used to group living things, including plants, animals, fungi and bacteria
- f. explain how the features of some Australian plants and animals are adaptations for survival and reproduction in their environment 

LW2 Cells are the basic units of living things and have specialised structures and functions. (ACSSU149)

Students:

- a. identify that living things are made of cells
- b. identify structures within cells, including the nucleus, cytoplasm, cell membrane, cell wall and chloroplast, and describe their functions
- c. outline the role of respiration in providing energy for the activities of cells
- d. identify that new cells are produced by cell division
- e. distinguish between unicellular and multicellular organisms
- f. identify that different types of cells make up the tissues, organs and organ systems of multicellular organisms

LW3 Multicellular organisms contain systems of organs that carry out specialised functions that enable them to survive and reproduce. (ACSSU150)

Students:

- a. identify the materials required by multicellular organisms for the processes of respiration and photosynthesis
- b. explain that the systems in multicellular organisms work together to provide cell requirements, including gases, nutrients and water, and to remove cell wastes 🎓
- c. outline the role of cell division in growth, repair and reproduction in multicellular organisms
- d. describe the role of the flower, root, stem and leaf in maintaining flowering plants as functioning organisms 🎓 ⚙️
- e. describe the role of the digestive, circulatory, excretory, skeletal/muscular and respiratory systems in maintaining a human as a functioning multicellular organism 🎓
- f. outline the role of the reproductive system in humans

LW4 Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world. (ACSHE119, ACSHE134)

Students:

- a. research an example of how changes in scientific knowledge have contributed to finding a solution to a human health issue ⚙️ ⚖️
- b. recount how evidence from a scientific discovery has changed understanding and contributed to solving a real world problem, eg animal or plant disease, hygiene, food preservation, sewage treatment or biotechnology 🎓 👤
- c. describe, using examples, how developments in technology have contributed to finding solutions to a contemporary issue, eg organ transplantation, artificial joints/limbs, treatment for diabetes, asthma, kidney or heart disease 🖥️ 🎓
- d. 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 contemporary issue, eg organ transplantation, control and prevention of diseases and dietary deficiencies ⚙️ ⚖️ 👤 ⚖️

LW5 Science and technology contribute to finding solutions to conserving and managing sustainable ecosystems.

Students:

- a. construct and interpret food chains and food webs, including examples from Australian ecosystems
- b. describe interactions between organisms in food chains and food webs, including producers, consumers and decomposers (ACSSU112)
- c. describe examples of beneficial and harmful effects that micro-organisms can have on living things and the environment
- d. predict how human activities can affect interactions in food chains and food webs, including examples from Australian land or marine ecosystems (ACSSU112) ⚙️
- e. explain, using examples, how scientific evidence and/or technological developments contribute to developing solutions to manage the impact of natural events on Australian ecosystems 🎓 🌍
- f. describe how scientific knowledge has influenced the development of practices in agriculture, eg animal husbandry or crop cultivation to improve yields and sustainability, or the effect of plant-cloning techniques in horticulture 🌱 🎓



## Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 4.

Students:

- describe how people in occupations that involve the biological sciences use understanding and skills from across the disciplines of Science ★
- debate why society should support biological research ⚙️ 👤 ⚖️
- design and construct simple keys to identify a range of living things ⚙️
- classify, using a hierarchical system, a range of selected plants and animals to species level 🎓
- identify, 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
- research the contributions of Australian scientists to the study of human impact on environments and to local environmental management projects 🌿 ★
- discuss how the observations and understanding of the structure, function and life cycles of native plants are used by Aboriginal and Torres Strait Islander peoples 🖐️

## 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 SC4-16CW
- › explains how scientific understanding of, and discoveries about, the properties of elements, compounds and mixtures relate to their uses in everyday life SC4-17CW

**Related Life Skills outcomes:** SCLS-22CW, SCLS-23CW

## CONTENT

CW1 The properties of the different states of matter can be explained in terms of the motion and arrangement of particles. (ACSSU151)

Students:

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

CW2 Scientific knowledge and developments in technology have changed our understanding of the structure and properties of matter.

Students:

- a. describe the properties and uses of some common elements, including metals and non-metals
- b. identify how our understanding of the structure and properties of elements has changed as a result of some technological devices
- c. identify some examples of common compounds
- d. explain why internationally recognised symbols are used for common elements
- e. describe at a particle level the difference between elements, compounds and mixtures, including the type and arrangement of particles (ACSSU152)
- f. 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, eg utensils, weapons and tools 🎓 🌐 📱

CW3 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 ✨
- investigate the application of a physical separation technique used in everyday situations or industrial processes, eg 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 ✨ ✨ ✨

CW4 In a chemical change, new substances are formed, which may have specific properties related to their uses in everyday life.

Students:

- 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
- demonstrate that a chemical change involves substances reacting to form new substances (ACSSU225)
- investigate some examples of chemical change that occur in everyday life, eg photosynthesis, respiration and chemical weathering
- compare physical and chemical changes in terms of the arrangement of particles and reversibility of the process
- propose reasons why society should support scientific research, eg in the development of new pharmaceuticals and polymers ⚖️ ✨ 👤 🌿
- describe, using examples, how science knowledge can develop through collaboration and connecting ideas across the disciplines of science, eg making or obtaining new substances from Earth's spheres (ACSHE223, ACSHE226) ✨

### Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 4.

Students:

- research how a knowledge of physical properties of natural materials is used by Aboriginal and Torres Strait Islander peoples in everyday life, eg tools, weapons, utensils, shelter, housing or bush medicine 🖐️
- discuss the cost and benefits to society of the development of new materials
- investigate the nature of mineral crystals
- outline how some historical developments have contributed to evidence that has advanced our understanding of the particle model of matter
- investigate how the chemical properties of a substance will affect its use, eg flammability and ability to corrode
- explain the changes in pressure of gases in terms of increases or decreases in the frequency of particle collisions

## SKILLS – WORKING SCIENTIFICALLY

## QUESTIONING AND PREDICTING

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### OUTCOME

**A student:**

- › develops questions or hypotheses to be investigated scientifically SC5-4WS

**Related Life Skills outcome:** *SCLS-4WS*

### CONTENT

WS4 Students question and predict by:

- a. formulating questions or hypotheses that can be investigated scientifically (AC SIS164, AC SIS198) ⚙️
- b. predicting outcomes based on observations and scientific knowledge

## SKILLS – WORKING SCIENTIFICALLY

## PLANNING INVESTIGATIONS

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### OUTCOME



#### A student:

- › produces a plan to investigate identified questions, hypotheses or problems, individually and collaboratively SC5-5WS




**Related Life Skills outcome:** SCLS-5WS

### CONTENT






WS5.1 Students identify data to be collected for an investigation by:

- a. describing the purpose of an investigation
- b. explaining why certain types of information need to be collected in a range of investigation types  
- c. selecting possible sources of data, including secondary sources, relevant to the investigation
- d. justifying why variables need to be kept constant if reliable first-hand data is to be collected in controlled experiments

WS5.2 Students plan first-hand investigations by:

- a. planning and selecting appropriate investigation methods, including fieldwork and laboratory experimentation, to collect reliable data (AC SIS165, AC SIS199)   
- b. describing a logical procedure for undertaking a range of investigation types
- c. designing controlled experiments to collect valid first-hand data
- d. specifying the dependent and independent variables for controlled experiments
- e. accounting for the use of an experimental control as appropriate

WS5.3 Students choose equipment or resources for an investigation by:

- a. identifying appropriate equipment and materials
- b. identifying the appropriate units to be used in collecting data 
- c. selecting equipment to collect and record reliable data or information, using digital technologies as appropriate, eg data loggers  
- d. assessing risks and addressing ethical issues associated with these methods (AC SIS165, AC SIS199)  

## CONDUCTING INVESTIGATIONS

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### OUTCOME











#### A student:

- › undertakes first-hand investigations to collect valid and reliable data and information, individually and collaboratively SC5-6WS

**Related Life Skills outcome:** SCLS-6WS

### CONTENT

WS6 Students conduct investigations by:

- a. individually and collaboratively using appropriate investigation methods, including fieldwork and laboratory experimentation, to collect reliable data (ACSIS165, ACSIS199) 
- b. safely constructing, assembling and manipulating identified equipment 
- c. selecting and using appropriate equipment, including digital technologies, to systematically and accurately collect and record data (ACSIS166, ACSIS200)  
- d. using appropriate units for measuring physical quantities 
- e. reporting data and information, evidence and findings, with accuracy and honesty 
- f. evaluating the effectiveness of the planned procedure, considering risk factors and ethical issues, and suggesting improvements as appropriate    

## PROCESSING AND ANALYSING DATA AND INFORMATION

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### OUTCOME










#### A student:

- › processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions SC5-7WS










**Related Life Skills outcome:** SCLS-7WS

### CONTENT

WS7.1 Students process data and information by:

- a. selecting and using a variety of methods to organise data and information including diagrams, tables, models, spreadsheets and databases   
- b. selecting and extracting information from tables, flow diagrams, other texts, audiovisual resources and graphs, including histograms and column, sector or line graphs 
- c. accessing data and information by using a range of appropriate digital technologies 
- d. applying numerical procedures and mathematical concepts and using digital technologies, where appropriate   
- e. identifying data which supports or discounts a question or hypothesis being investigated or a proposed solution to a problem 
- f. describing specific ways to improve the quality of the data (AC SIS171, AC SIS205)

WS7.2 Students analyse data and information by:

- a. analysing patterns and trends, including identifying inconsistencies in data and information (AC SIS169, AC SIS203)  
- b. describing relationships between variables (AC SIS169, AC SIS203)  
- c. assessing the validity and reliability of first-hand data 
- d. using knowledge of scientific concepts to draw conclusions that are consistent with evidence (AC SIS170, AC SIS204)
- e. synthesising data and information to develop evidence-based arguments
- f. evaluating conclusions and evidence, including identifying sources of uncertainty and possible alternative explanations (AC SIS171, AC SIS205)  
- g. critically analysing the validity of information from secondary sources (AC SIS172, AC SIS206)  

## PROBLEM SOLVING

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### OUTCOME







#### A student:

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

**Related Life Skills outcome:** SCLS-8WS

### CONTENT

WS8 Students solve problems by:

- describing strategies to develop a range of possible solutions to an identified problem
- assessing strategies that have been identified as possible solutions to an identified problem
- applying the processes of Working Scientifically in developing creative solutions to problems   
- using cause-and-effect relationships to explain ideas
- using models to explain phenomena and make predictions  
- applying critical thinking in considering suggested proposals, solutions and conclusions, including a consideration of risk 
- evaluating different approaches used to solve problems (AC SIS172, AC SIS206)



## COMMUNICATING

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### OUTCOME

#### A student:

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

**Related Life Skills outcome:** *SCLS-9WS*

### CONTENT

WS9 Students communicate by:

- a. selecting and using in presentations, for different purposes and contexts, appropriate text types including discussions, explanations, expositions, procedures, recounts or reports 🎓
- b. selecting and constructing an appropriate table, type of diagram, table or graph (histogram or sector, column or line graph) to present information and show relationships clearly and succinctly using digital technologies as appropriate 📊 🎓 🖥️
- c. using appropriate units for physical quantities and symbols to express relationships, including mathematical ones 📊
- d. proposing ideas that demonstrate coherence and logical progression ⚙️ 🎓
- e. presenting scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations for specific audiences (AC SIS174, AC SIS208) 🎓

## KNOWLEDGE AND UNDERSTANDING

PHYSICAL WORLD

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## OUTCOMES

## A student:

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

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

## CONTENT

PW1 Energy transfer through different mediums can be explained using wave and particle models. (ACSSU182)

Students:

- a. explain, in terms of the particle model, the processes underlying convection and conduction of heat energy
- b. identify situations where waves transfer energy
- c. describe qualitatively, using the wave model, the features of waves including wavelength, frequency and speed
- d. explain, using the particle model, the transmission of sound in different mediums
- e. relate the properties of different types of radiation in the electromagnetic spectrum to their uses in everyday life, including communications technology \*\*
- f. describe the occurrence and some applications of absorption, reflection and refraction in everyday situations \*\*

PW2 The motion of objects can be described and predicted using the laws of physics. (ACSSU229)

Students:

- a. describe qualitatively the relationship between force, mass and acceleration
- b. explain qualitatively the relationship between distance, speed and time
- c. relate acceleration qualitatively to a change in speed and/or direction as a result of a net force
- d. analyse qualitatively everyday situations involving motion in terms of Newton's laws \*\*

PW3 Scientific understanding of current electricity has resulted in technological developments designed to improve the efficiency in generation and use of electricity.

Students:

- a. describe voltage, current and resistance in terms of energy applied, carried and dissipated
- b. describe qualitatively the relationship between voltage, resistance and current

- c. compare the characteristics and applications of series and parallel electrical circuits
- d. outline recent examples where scientific or technological developments have involved specialist teams from different branches of science, engineering and technology, eg low-emissions electricity generation and reduction in atmospheric pollution 🚰👥🎓

PW4 Energy conservation in a system can be explained by describing energy transfers and transformations. (ACSSU190)

Students:

- a. apply the law of conservation of energy to account for the total energy involved in energy transfers and transformations
- b. 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
- c. discuss, using examples, how the values and needs of contemporary society can influence the focus of scientific research in the area of increasing efficiency of the use of electricity by individuals and society (ACSHE228, ACSHE230) 🚰👥⚖️
- d. discuss viewpoints and choices that need to be considered in making decisions about the use of non-renewable energy resources 🌿⚖️🇺🇸🚰

### Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 5.

Students:

- investigate quantitatively, features of waves including frequency, wavelength and speed using  $v = f\lambda$  and relate this to musical instruments 🎵
- 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, using the equations of motion 📊
- relate quantitatively, force, mass and acceleration, and apply to everyday situations 📊
- apply Newton's laws of motion to space travel 🚀
- compare energy changes in interactions in sport activities 🏃
- explain the relationship between resistance, voltage and current, using Ohm's Law 📊
- investigate the energy efficiency of appliances and relate this to a household energy account
- research how engineers and architects employ scientific concepts and principles in designing energy-efficient devices and buildings 🚰👥🎓

## 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 SC5-12ES
- › 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 SC5-13ES

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

## CONTENT




ES1 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:

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

ES2 The theory of plate tectonics explains global patterns of geological activity and continental movement. (ACSSU180)

Students:

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

ES3 People use scientific knowledge to evaluate claims, explanations or predictions in relation to interactions involving the atmosphere, biosphere, hydrosphere and lithosphere. (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 ✨🎓
- evaluate scientific evidence of some current issues affecting society that are the result of human activity on global systems, eg the greenhouse effect, ozone layer depletion, effect of climate change on sea levels, long-term effects of waste management and loss of biodiversity ✨⚖️👥🌱
- discuss the reasons different groups in society may use or weight criteria differently to evaluate claims, explanations or predictions in making decisions about contemporary issues involving interactions of the Earth's spheres ✨⚖️👥

### Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 5.

Students:

- relate colours of stars to their age, size and distance from the Earth
- describe evidence used to support estimates of time in the universe ✨
- describe some recent contributions made by Australian scientists in the exploration and study of the universe ✨
- discuss technological developments that have extended the ability of scientists to collect information about, and monitor events in, the natural world ✨
- research evidence relating global warming to changes in weather patterns, including El Niño and La Niña ✨🌱
- examine the factors that drive 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, eg atmospheric pollution, ocean salinity and climate change 🖥️
- discuss the development and implications of international agreements relating to biodiversity and climate change, eg the original 1987 Montreal Protocol, 1992 United Nations Conference on Environment and Development, 1997 Kyoto Protocol and the 2009 United Nations Climate Change Conference ⚖️🌱
- 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 and vulcanology ✨

## KNOWLEDGE AND UNDERSTANDING

## LIVING WORLD

## OUTCOMES

## A student:


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

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

## CONTENT


LW1 Multicellular organisms rely on coordinated and interdependent internal systems to respond to changes in their environment. (ACSSU175)

Students:

- a. describe some examples of how multicellular organisms respond to changes in their environment
- b. describe how the coordinated function of internal systems in multicellular organisms provides cells with requirements for life, including gases, nutrients and water, and removes cell wastes
- c. outline some responses of the human body to infectious and non-infectious diseases
- d. describe the role of, and interaction between, the coordination systems in maintaining humans as functioning organisms
- e. discuss, using examples, how the values and needs of contemporary society can influence the focus of scientific research, eg the occurrence of diseases affecting animals and plants, an epidemic or pandemic disease in humans or lifestyle related non-infectious diseases in humans 

LW2 Conserving and maintaining the quality and sustainability of the environment requires scientific understanding of interactions within, the cycling of matter and the flow of energy through ecosystems.

Students:

- a. recall that ecosystems consist of communities of interdependent organisms and abiotic components of the environment (ACSSU176)
- b. outline using examples how matter is cycled through ecosystems such as nitrogen (ACSSU176)
- c. describe how energy flows through ecosystems, including input and output through food webs (ACSSU176)
- d. analyse how changes in some biotic and abiotic components of an ecosystem affect populations and/or communities 

- e. assess ways that Aboriginal and Torres Strait Islander peoples' cultural practices and knowledge of the environment contribute to the conservation and management of sustainable ecosystems 🖐️🌿
- f. evaluate some examples in ecosystems, of strategies used to balance conserving, protecting and maintaining the quality and sustainability of the environment with human activities and needs ⚙️👥⚖️🌿

LW3 Advances in scientific understanding often rely on developments in technology, and technological advances are often linked to scientific discoveries. (ACSHE158, ACSHE192)

Students:

- a. relate the organs involved in human reproductive systems to their function
- b. identify that during reproduction the transmission of heritable characteristics from one generation to the next involves DNA and genes (ACSSU184)
- c. identify that genetic information is transferred as genes in the DNA of chromosomes
- d. outline how the Watson-Crick model of DNA explains:
  - the exact replication of DNA
  - changes in genes (mutation)
- e. describe, using examples, how developments in technology have advanced biological understanding, eg vaccines, biotechnology, stem-cell research and in-vitro fertilisation ⚙️👥🧬
- f. discuss some advantages and disadvantages of the use and applications of biotechnology, including social and ethical considerations 👥⚖️

LW4 The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence. (ACSSU185)

Students:

- a. describe scientific evidence that present-day organisms have evolved from organisms in the past
- b. relate the fossil record to the age of the Earth and the time over which life has been evolving
- c. explain, using examples, how natural selection relates to changes in a population, eg in the development of resistance of bacteria to antibiotics and insects to pesticides 🎓
- d. outline the roles of genes and environmental factors in the survival of organisms in a population ⚙️

### Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 5.

Students:

- debate why any investigation relating to biological research and involving or affecting animals, must be humane, justified and ethical ⚙️⚖️
- describe the range of functions carried out by some endocrine (hormonal) glands in humans 🎓
- investigate how models can be used to predict the changes in populations due to environmental changes, eg the impact of fire or flooding, introduction of a disease or predator ⚙️🎓
- discuss the strengths and limitations of using models to make predictions about changes in biological systems ⚙️

- describe examples of advances in science and/or emerging science and technologies, in areas that involve biological science such as dentistry, environmental science, biomedical engineering, physiology, pharmaceuticals or nanotechnology 🛠️🎓★
- assess the role of the development of fast computers in the analysis of DNA sequences 🖥️
- research how information technology is applied in bioinformatics 🖥️



## 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 SC5-16CW
- › 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 SC5-17CW

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

## CONTENT

CW1 Scientific understanding changes and is refined over time through a process of review by the scientific community.

Students:

- a. identify that all matter is made of atoms which are composed of protons, neutrons and electrons (ACSSU177)
- b. describe the structure of atoms in terms of the nucleus, protons, neutrons and electrons
- c. 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 🎓
- d. identify that natural radioactivity arises from the decay of nuclei in atoms, releasing particles and energy (ACSSU177)
- e. evaluate the benefits and problems associated with medical and industrial uses of nuclear energy ⚖️🌱⚙️

CW2 The atomic structure and properties of elements are used to organise them in the Periodic Table. (ACSSU186)

Students:

- a. identify the atom as the smallest unit of an element and that it can be represented by a symbol
- b. distinguish between the atoms of some common elements by comparing information about the numbers of protons, neutrons and electrons
- c. describe the organisation of elements in the Periodic Table using their atomic number
- d. relate the properties of some common elements to their position in the Periodic Table
- e. predict, using the Periodic Table, the properties of some common elements
- f. outline some examples to show how creativity, logical reasoning and the scientific evidence available at the time, contributed to the development of the modern Periodic Table 🎓⚙️📊

CW3 Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed. (ACSSU178)

Students:

- a. recall that all matter is composed of atoms and has mass
- b. identify a range of compounds using their common names and chemical formulae
- c. classify compounds into groups based on common chemical characteristics
- d. 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 including metals and carbonates (ACSSU179)
  - corrosion
  - precipitation
  - neutralisation
  - decomposition
- e. identify some examples of important chemical reactions that occur in living systems and involve energy transfer, including respiration and reactions involving acids such as occur during digestion (ACSSU179)
- f. construct word equations from observations and written descriptions of a range of chemical reactions 🎓
- g. deduce that new substances are formed during chemical reactions by rearranging atoms rather than creating or destroying them

CW4 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:



- a. identify that chemical reactions involve energy transfer and can be exothermic or endothermic
- b. compare combustion and respiration as types of chemical reactions that release energy but occur at different rates
- c. describe the effects of factors, eg temperature and catalysts, on the rate of some common chemical reactions
- d. analyse how social, ethical and environmental considerations can influence decisions about scientific research related to the development and production of new materials ⚙️ ⚖️ 🎓 🌱
- e. describe examples to show where advances in science and/or emerging science and technologies significantly affect people's lives, including generating new career opportunities in areas of chemical science such as biochemistry and industrial chemistry (ACSHE161, ACSHE195) ⚙️ 🎓 ⭐

### Additional content

Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students' skills, knowledge and understanding in Stage 5.

Students:

- use models to describe the arrangement of electrons in the energy levels of common elements
- research the development of ideas about the nature of radioactivity 🎓
- investigate the order of activity of a range of metals
- balance a range of common chemical equations
- conduct flame tests and explain the colours in terms of subatomic structure
- research ways that are used to restore and prevent corrosion of submerged objects

- investigate the processes involved in the production of new materials from synthetic fibres 
- evaluate, using scientific evidence, the claims, explanations or predictions made in the media or advertising in relation to a substance, material or product
- construct simple electrochemical cells using fruit and describe energy transfer
- research the structure of small portable electrochemical cells, eg mercury cells and rechargeable batteries 

## YEARS 7–10 LIFE SKILLS OUTCOMES AND CONTENT

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For a small percentage of students with special education needs, particularly those with an intellectual disability, adjustments to teaching, learning and assessment may not be sufficient to access some or all of the Stage 4 and Stage 5 outcomes. These students may best fulfil the 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, learning and assessment experiences should be explored before a decision is made to access Years 7–10 Life Skills outcomes and content. Decisions about curriculum options for students with special education needs should be made through the collaborative curriculum planning process.

The Years 7–10 Life Skills outcomes and content are developed from the Stage 4 and Stage 5 objectives of the *Science K–10 (incorporating Science and Technology K–6) Syllabus*. They indicate the skills, knowledge and understanding expected to be gained by most students as a result of effective teaching and learning by the end of a stage.

Further information in relation to planning, implementing and assessing Life Skills outcomes and content can be found in *Life Skills Years 7–10: Advice on Planning, Programming and Assessment*.

## YEARS 7–10 LIFE SKILLS OUTCOMES

### TABLE OF OBJECTIVES AND OUTCOMES

#### VALUES AND ATTITUDES

<b>Objectives</b> Students: <ul style="list-style-type: none"><li>develop an appreciation of the contribution of science to finding solutions to personal, social and global issues relevant to their lives now and in the future</li><li>develop a willingness to use evidence and reason to engage with and respond to scientific and technological ideas as informed, reflective citizens</li></ul>
<b>Life Skills outcomes</b> 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 Science Years 7–10 Life Skills content.

#### SKILLS

<b>Objective</b> Students: <ul style="list-style-type: none"><li>develop knowledge, understanding of and skills in applying the processes of Working Scientifically</li></ul>
<b>Life Skills outcomes</b> A student:
SCLS-4WS asks questions that can be tested and makes predictions
SCLS-5WS participates in planning to investigate questions or problems
SCLS-6WS participates in an investigation by following a sequence
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

## KNOWLEDGE AND UNDERSTANDING

<b>Objective</b> Students: <ul style="list-style-type: none"><li>develop knowledge of the Physical World, Earth and Space, Living World and Chemical World, and understanding about the nature, development, use and influence of science</li></ul>
<b>Life Skills outcomes</b> A student:
SCLS-10PW explores a range of forces in everyday situations  SCLS-11PW identifies various forms and sources of energy and their uses  SCLS-12PW investigates ways to use energy responsibly
SCLS-13ES identifies features of the Earth  SCLS-14ES explores features of the solar system, including the Earth's position and movement  SCLS-15ES identifies that the Earth is the source of resources used in everyday life  SCLS-16ES investigates some practices used in the effective management of the Earth's resources
SCLS-17LW recognises features of living and non-living things  SCLS-18LW identifies structures of living things and their functions  SCLS-19LW explores ways in which science and technology have improved human health  SCLS-20LW explores the interactions of living things with each other and the environment  SCLS-21LW investigates the effect of science and technology on the environment
SCLS-22CW recognises the properties of common substances  SCLS-23CW explores how common chemicals affect everyday life  SCLS-24CW investigates a variety of chemical changes

## YEARS 7–10 LIFE SKILLS AND RELATED SYLLABUS OUTCOMES

<p><b>Objectives</b> Students:</p> <ul style="list-style-type: none"> <li>• develop an appreciation of the contribution of science to finding solutions to personal, social and global issues relevant to their lives now and in the future</li> <li>• develop a willingness to use evidence and reason to engage with and respond to scientific and technological ideas as informed, reflective citizens</li> </ul>	
<p><b>Life Skills outcomes</b> A student:</p>	<p><b>Related Stage 4/5 outcomes</b> A student:</p>
<p>SCLS-1VA recognises the role of science in personal, social and global issues relating to everyday life</p> <p>SCLS-2VA recognises that using the processes of Working Scientifically increases their understanding of the world</p> <p>SCLS-3VA demonstrates a willingness to engage with science-related issues relevant to their lives</p>	<p>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</p> <p>SC4-2VA, SC5-2VA shows a willingness to engage in finding solutions to science-related personal, social and global issues, including shaping sustainable futures</p> <p>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</p>

## YEARS 7–10 LIFE SKILLS AND RELATED SYLLABUS OUTCOMES (CONTINUED)

<b>Objective</b> Students: <ul style="list-style-type: none"> <li>develop knowledge, understanding of and skills in applying the processes of Working Scientifically</li> </ul>	
<b>Life Skills outcomes</b> A student:	<b>Related Stage 4/5 outcomes</b> 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 planning 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 identified questions, hypotheses or problems, individually and collaboratively
SCLS-6WS participates in an investigation by following a sequence	SC4-6WS follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually  SC5-6WS undertakes first-hand investigations 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 and relationships, and draw conclusions  SC5-7WS processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions
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 identified problems  SC5-8WS applies scientific understanding and critical thinking skills to suggest possible solutions to identified problems
SCLS-9WS uses a variety of strategies to communicate information about an investigation	SC4-9WS presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations  SC5-9WS presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations



## YEARS 7–10 LIFE SKILLS AND RELATED SYLLABUS OUTCOMES (CONTINUED)

<p><b>Objective</b> Students:</p> <ul style="list-style-type: none"> <li>develop knowledge of the Physical World, Earth and Space, Living World and Chemical World, and understanding about the nature, development, use and influence of science</li> </ul>	
<p><b>Life Skills outcomes</b> A student:</p>	<p><b>Related Stage 4/5 outcomes</b> A student:</p>
<p>SCLS-10PW explores a range of forces in everyday situations</p>	<p>SC4-10PW describes the action of unbalanced forces in everyday situations</p> <p>SC5-10PW applies models, theories and laws to explain situations involving energy, force and motion</p>
<p>SCLS-11PW identifies various forms and sources of energy and their uses</p> <p>SCLS-12PW investigates ways to use energy responsibly</p>	<p>SC4-11PW discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformations</p> <p>SC5-11PW explains how scientific understanding about energy conservation, transfers and transformations is applied in systems</p>
<p>SCLS-13ES identifies features of the Earth</p> <p>SCLS-14ES explores features of the solar system, including the Earth's position and movement</p>	<p>SC4-12ES describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system</p> <p>SC5-12ES 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</p>
<p>SCLS-15ES identifies that the Earth is the source of resources used in everyday life</p> <p>SCLS-16ES investigates some practices used in the effective management of the Earth's resources</p>	<p>SC4-13ES explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource use and management</p> <p>SC5-13ES 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</p>
<p>SCLS-17LW recognises features of living and non-living things</p> <p>SCLS-18LW identifies structures of living things and their functions</p> <p>SCLS-19LW explores ways in which science and technology have improved human health</p>	<p>SC4-14LW relates the structure and function of living things to their classification, survival and reproduction</p> <p>SC5-14LW analyses interactions between components and processes within biological systems</p>

## YEARS 7–10 LIFE SKILLS AND RELATED SYLLABUS OUTCOMES (*CONTINUED*)

<b>Life Skills outcomes</b> A student:	<b>Related Stage 4/5 outcomes</b> A student:
SCLS-20LW explores the interactions of living things with each other and the environment  SCLS-21LW investigates the effect of science and technology on the environment	SC4-15LW explains how new biological evidence changes people's understanding of the world  SC5-15LW explains how biological understanding has advanced through scientific discoveries, technological developments and the needs of society
SCLS-22CW recognises the properties of common substances          SCLS-23CW explores how common chemicals affect everyday life	SC4-16CW describes the observed properties and behaviour of matter, using scientific models and theories about the motion and arrangement of particles  SC5-16CW explains how models, theories and laws about matter have been refined as new scientific evidence becomes available  SC4-17CW explains how scientific understanding of, and discoveries about the properties of elements, compounds and mixtures relate to their uses in everyday life
SCLS-24CW investigates a variety of chemical changes	SC5-17CW 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 CONTENT**

The Years 7–10 Life Skills content forms the basis for learning opportunities. Content should be selected based on the abilities, needs and interests of students. Students will not be required to complete all the content to demonstrate achievement of an outcome.

## **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.

## SKILLS – WORKING SCIENTIFICALLY

## QUESTIONING AND PREDICTING

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### OUTCOME

**A student:**

- › asks questions that can be tested and makes predictions SCLS-4WS

**Related Stage 4/5 outcomes:** SC4-4WS, SC5-4WS

### CONTENT

Students question and predict by:

- asking questions about familiar objects and events
- identifying questions that can be investigated scientifically
- predicting the outcomes of an investigation using background knowledge, experience and/or scientific understanding \*\*

## SKILLS – WORKING SCIENTIFICALLY

## PLANNING INVESTIGATIONS

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### OUTCOME





**A student:**

- › participates in planning to investigate questions or problems SCLS-5WS

**Related Stage 4/5 outcomes:** SC4-5WS, SC5-5WS

### CONTENT

Students plan investigations by:

- suggesting suitable methods for gathering data, including practical investigations and research, using secondary sources 
- identifying scientific equipment and materials, and their purposes
- identifying safety rules when using scientific equipment and materials in an investigation 
- working individually and/or collaboratively to record aspects of their plan  
- recognising variables to be changed, kept the same and measured in an investigation

## SKILLS – WORKING SCIENTIFICALLY

## CONDUCTING INVESTIGATIONS

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### OUTCOME







**A student:**

- › participates in an investigation by following a sequence SCLS-6WS

**Related Stage 4/5 outcomes:** SC4-6WS, SC5-6WS

### CONTENT

Students conduct investigations by:

- using a range of techniques including practical experiences, surveys, fieldwork and research to gather data and information, using digital technologies as appropriate  
- selecting and using appropriate equipment, measuring tools and methods to make accurate observations and measurements 
- working individually and/or collaboratively to participate in an investigation  ★
- making adjustments when necessary to a planned method for an investigation
- following safety rules when using equipment and tools in an investigation ★
- recording observations and measurements, using appropriate units and abbreviations  

## SKILLS – WORKING SCIENTIFICALLY

## PROCESSING AND ANALYSING DATA AND INFORMATION

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### OUTCOME

**A student:**

- › collects, records and interprets data and information SCLS-7WS

**Related Stage 4/5 outcomes:** SC4-7WS, SC5-7WS

### CONTENT

Students process and analyse data and information by:

- selecting the most appropriate method to organise and display data and information 📊 ⚙️
- interpreting data and information gathered 📊
- relating data and information gathered, to questions and predictions ⚙️
- drawing conclusions from data and information gathered in an investigation ⚙️
- reflecting on the strengths and limitations of their investigation 👥
- using their conclusions to identify further questions that may be investigated scientifically

## SKILLS – WORKING SCIENTIFICALLY

## PROBLEM SOLVING

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### OUTCOME

**A student:**

- › recognises strategies to solve identified problems SCLS-8WS

**Related Stage 4/5 outcomes:** SC4-8WS, SC5-8WS

### CONTENT

Students solve problems by:

- identifying problems that can be investigated scientifically
- identifying different strategies that could be used to solve a problem ⚙️



## SKILLS – WORKING SCIENTIFICALLY

## COMMUNICATING

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### OUTCOME





**A student:**

- › uses a variety of strategies to communicate information about an investigation SCLS-9WS

**Related Stage 4/5 outcomes:** SC4-9WS, SC5-9WS

### CONTENT

Students communicate by:

- using a variety of strategies including tables, graphs and diagrams to present data and information, using digital technologies as appropriate  
- presenting ideas and information gathered through a scientific investigation in a variety of forms, using digital technologies as appropriate  

## KNOWLEDGE AND UNDERSTANDING

## PHYSICAL WORLD: FORCES

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### OUTCOME

#### A student:

- › explores a range of forces in everyday situations SCLS-10PW



**Related Stage 4/5 outcomes:** SC4-10PW, SC5-10PW

### CONTENT

There are different types of forces that can be experienced in daily life.

#### *Forces*

Students:

- identify a force as a push or pull
- recognise the ways people use pushes and pulls in everyday life, eg opening and closing a door
- communicate what happens when a force is applied to an object, eg squeezing/stretching
- observe the change in motion that occurs when a force is applied to an object, eg 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, eg safety helmets, seatbelts and airbags  

#### *Frictional force*

Students:

- recognise that heat is generated when surfaces rub together, eg rubbing hands together or tyres moving on the surface of a road
- identify some of the effects of friction, eg wear and tear on shoes and tyres
- participate in an investigation of the friction caused by a variety of surfaces, eg rolling a ball on a smooth or bumpy surface
- explore ways of reducing friction, eg by smoothing or greasing a surface
- recognise factors that influence the size of frictional forces

#### *Electrostatic forces*

Students:

- identify an electrical discharge, eg 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, eg plastic and nylon
- investigate attraction or repulsion of electrical charges

### *Gravitational force*

Students:

- observe the way the force of gravity pulls objects towards the Earth
- investigate the effects of gravity as a downward-acting force on a variety of objects

### *Magnetic forces*

Students:

- 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, eg fridge magnets, toys, motors or compasses

## KNOWLEDGE AND UNDERSTANDING

## PHYSICAL WORLD: ENERGY

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### OUTCOMES

#### A student:



- › identifies various forms and sources of energy and their uses SCLS-11PW
- › investigates ways to use energy responsibly SCLS-12PW

**Related Stage 4/5 outcomes:** SC4-11PW, SC5-11PW

### CONTENT






There are different forms of energy, which may be transferred and transformed for different purposes.

Students:

- observe and/or experience forms of energy, eg 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, eg heat, light or sound
- identify the sources of energy we use in the home/school, eg electricity, gas or solar
- recognise that the form of energy can change, eg electrical to heat (stove), electrical to sound and light (television) or electrical to light and heat (light globe)
- recognise that electrical devices source electricity from power points and batteries
- explore potential risks and the safe use of electrical devices, eg turning off the power point before unplugging a device and not using electrical devices near water 
- construct or draw simple circuits 
- recognise that electricity cannot flow if the circuit is incomplete, eg when a fuse breaks

Responsible use of energy is important for individuals and society.

Students:

- identify why we should reduce our use of energy 
- explore ways in which individuals can reduce their use of energy, eg walking or cycling instead of driving, limiting the length of a shower or turning electrical appliances off instead of leaving them on standby  
- investigate new technologies and innovations to help reduce the amount of energy used around the home, eg energy-saving light globes, energy ratings on appliances or home insulation  

## KNOWLEDGE AND UNDERSTANDING

## EARTH AND SPACE: EARTH AND SOLAR SYSTEM

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### OUTCOMES

#### A student:

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

**Related Stage 4/5 outcomes:** SC4-12ES, SC5-12ES

### CONTENT

The Earth has a variety of features that can be observed and that change over time.

#### *Features of the Earth*

Students:

- classify features of their local area according to whether they are natural or man-made, eg buildings, trees and parks
- interact with and/or investigate some natural features of their local area to recognise their purpose, eg rivers used for fishing and swimming 🇦🇺
- identify using maps, pictures, interactive media or videos some examples of Australian landforms, eg mountains, deserts, oceans, rivers, lakes, swamps, beaches and sand dunes 🖨️ 📊
- recognise that the Earth is a sphere and is surrounded by air

#### *Changes to the features of the Earth*

Students:

- describe the effects of droughts and floods on the local landscape
- investigate some changes to features in the local landscape that have occurred by natural processes, eg weathering and erosion by water
- research natural processes in Asia and Australia, eg volcanic activity, tsunamis and earthquakes, using digital technologies or simulation models 🖨️ 🗣️
- investigate how volcanoes, tsunamis or earthquakes may change or create a landform 🚀

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

#### *Solar system*

Students:

- identify some components of the solar system, eg planets, moons, stars, meteors and comets
- explore some of the features of our solar system using interactive media, videos, models, visual and graphic resources 🖨️
- compare some features of different planets in the solar system 🚀

- recognise the importance of the sun as a star, which provides heat and light to the Earth
- identify some stars and constellations including the Southern Cross
- explore how Aboriginal and Torres Strait Islander peoples use the night sky to make decisions about everyday activities, eg food gathering and ceremonies 🖐️
- compare the sizes of the Earth, sun and moon 📊

### *The Earth's movement in space*

Students:

- recognise that the Earth moves around the sun
- identify the time it takes the Earth to travel around the sun (one year) 📊
- identify that night and day are caused by the rotation of the Earth once every 24 hours
- compare the lengths of shadows produced at different times of the day 📊
- identify and sequence the seasons 📊
- compare the timing of the seasons in the Southern and Northern hemispheres 📊
- explore a seasonal calendar used by Aboriginal and Torres Strait Islander peoples 🖐️
- recognise that the phases of the moon follow a cycle 📊

## KNOWLEDGE AND UNDERSTANDING

## EARTH AND SPACE: EARTH'S RESOURCES

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### OUTCOMES

#### A student:

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

**Related Stage 4/5 outcomes:** SC4-13ES, SC5-13ES

### CONTENT

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

Students:

- recognise that living things need food, water, clean air and shelter for survival
- recognise that the needs of all living things are provided by the Earth
- recognise some natural resources in the environment
- identify the uses of a variety of natural resources, including fuel for cars
- recognise ways that water is used in the school or at home
- 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, eg rocks, minerals, water and fossil fuels
- distinguish between some natural resources that are non-renewable, eg fossil fuels, minerals and those that are renewable, eg water and solar energy 🌿

Human activity has an impact on the effective management of the Earth's resources.

Students:

- identify items of waste that can be recycled
- participate in the recycling of items of waste, eg using a recycling bin appropriately ♻️ 👤
- identify ways to reduce the quantity of resources used, eg turning off taps properly, running the dishwasher only when full or requesting that bills be sent electronically
- explore human activities that negatively affect resources, eg logging, overfishing and destroying habitats 🌿 👤
- identify ways to conserve and protect the use of resources in everyday life, eg land care and water management 👤 🌿
- explore and/or participate in ways to improve the environment, eg composting, recycling, cleaning up the local area and planting trees 👤 🌿
- investigate strategies to prevent landform erosion or repair landforms after erosion 🌿

- identify how human activity has affected the Earth's atmosphere at a global level, eg climate change and ozone depletion 🌿
- identify ways that individuals may change their lifestyle to reduce the negative effects of their actions on the atmosphere, eg cycling, car pooling or using electric/hybrid cars 🌿 ⚖️ 👤
- recognise ways that Aboriginal and Torres Strait Islander peoples sustain the value of the land, eg through the selective use of resources 🖐️



## KNOWLEDGE AND UNDERSTANDING

## LIVING WORLD: STRUCTURE AND FUNCTION

## OUTCOMES

## A student:

- > recognises features of living and non-living things SCLS-17LW
- > identifies structures of living things and their functions SCLS-18LW

**Related Stage 4/5 outcomes:** SC4-14LW, SC5-14LW

## CONTENT

There are differences within and between living things.

*Living and non-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 ways that living and non-living things are different, eg growing and reproducing

*Features of living things*

Students:

- 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, eg living things grow and change, use food, use water and air, respond to changes and reproduce
- compare the similarities and differences in the needs of living things, eg plants need sunlight and water, animals need food and water ✨
- identify some external features of animals and/or plants
- classify a variety of living things according to their observable features, eg vertebrates (mammals, reptiles, fish, birds) and invertebrates (insects, spiders, snails) ✨
- represent the classification of living things in a variety of ways, eg diagrams and tables 📊📖
- participate in and/or investigate ways to care for an identified living thing 👥
- identify some micro-organisms in the environment, eg bacteria and viruses 🌱
- outline some beneficial and harmful effects that micro-organisms can have on living things, eg contribution to health, production of useful products and disease 🌱
- explore ways that Aboriginal and Torres Strait Islander peoples classify plants or animals 🙌

### *Changes in living things*

Students:

- recognise that living things have life cycles
- observe changes that occur in a plant and/or animal over time, eg by comparing a living adult with its offspring
- observe the stages in the life cycle of a common animal and/or plant
- represent stages in the life cycle of a common animal and/or plant in a variety of ways 🎨

Living things have structures that carry out specialised functions.

#### *Plants*

Students:

- observe some structures in plants, eg root, stem and leaf
- appreciate that the structures in a plant serve a specific function, eg the hardness of a stem provides support and transport of water and nutrients, and leaves absorb light and make food

#### *Animals*

Students:

- recognise some external structures of animals, eg fur, feathers, hard shells, skin and limbs
- communicate the function of some basic external structures of animals, eg limbs are used for moving
- identify some major organs of the body, eg 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 ⚙️
- identify factors that are important in maintaining a healthy body, eg exercise and diet 🧑🏿🧑🏻

## KNOWLEDGE AND UNDERSTANDING

## LIVING WORLD: HUMAN BODY

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### OUTCOME

#### A student:







- › explores ways in which science and technology have improved human health SCLS-19LW

**Related Stage 4/5 outcomes:** SC4-14LW, SC5-14LW

### CONTENT

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, eg eating food that has not been prepared or stored appropriately, eating a balanced diet, maintaining oral hygiene or protecting the skin from sun damage 
- investigate ways to maintain a healthy body 
- investigate how scientific developments have changed or influenced the way people look after their bodies, eg the use of sunscreen to prevent sunburn, gym equipment to exercise different parts of the body, refrigeration to store food, immunisation to prevent disease, or safety helmets and seatbelts   
- 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 

## KNOWLEDGE AND UNDERSTANDING

## LIVING WORLD: ENVIRONMENT

## OUTCOMES

## A student:





- › explores the interactions of living things with each other and the environment SCLS-20LW
- › investigates the effect of science and technology on the environment SCLS-21LW

**Related Stage 4/5 outcomes:** SC4-15LW, SC5-15LW

## CONTENT

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

Human activity can affect 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, eg plastic bags and bottles in the school environment, fishing lines and hair ties in rivers and streams, and oil and grease in drains 🌿🗑️
- respond to ways to reduce the effect of waste on an ecosystem, eg putting rubbish in the bin, using biodegradable detergents and plastics, and exploring alternatives to dumping oil and grease into drains that feed rivers and streams 🌿👥
- explore positive and negative changes to the environment as a result of human activity, eg building cities, farms and roads, fishing or pollution 🌿🗑️⚖️
- recognise the difference between native and introduced species of plants and animals
- explore ways that the introduction of plant or animal species, eg rabbits and boneseed, has affected a local ecosystem 🌿
- participate in an investigation to reduce the effect of human activity on an environment, eg tree planting in the school or local environment 🌿🗑️
- participate in and/or investigate caring for an ecosystem, eg planting trees or constructing fences to protect the habitat 🌿👥

## KNOWLEDGE AND UNDERSTANDING

## CHEMICAL WORLD: PROPERTIES OF SUBSTANCES

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### OUTCOMES

**A student:**


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

**Related Stage 4/5 outcomes:** SC4-16CW, SC5-16CW, SC4-17CW

### CONTENT

Solids, liquids and gases have different properties.

Students:

- recognise common materials in their surroundings, eg cup, water, table or air
- identify matter existing as either a solid (ice, desk), a liquid (milk, soft drink, water) or a gas (air from a fan, air in balloons, bubbles in water)
- recognise that matter can change its state, eg ice cream melts to become a liquid, boiled water becomes gas (steam) when it is heated and breath turns to liquid (condensation) in cold temperatures
- investigate the effect of heat on the states of matter, eg evaporation, melting, boiling, condensation and freezing 
- recognise some properties of materials, eg strength, flexibility, elasticity or hardness
- recognise things made from metal, eg coins, taps, saucepans, pipes or window frames
- describe some of the properties of metals, eg shiny appearance, silver or gold in colour, heats quickly, changes shape without breaking, most are solids and 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, eg sea water, muddy water, cordial, tea containing milk and sugar or rice cooking in water
- recognise some substances that can be dissolved, eg sugar, liquid dishwashing detergent, oil in petrol for motor fuel or carbon dioxide gas in water for soft drinks
- observe the effects of dissolving a substance into another substance, eg 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, eg draining rice with a sieve, filtering coffee or evaporating water from salt water
- explore reasons for separating mixtures, eg 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) and chromatography (place coloured lollies in water and observe the food colouring separate using filter paper) ★

Common chemicals have different uses.

Students:

- recognise common foods that contain acids, eg lemons and oranges, yoghurt and vinegar
- recognise the uses of a variety of natural materials in different cultures, eg the use of common plants as dyes for clothing and shelter by Aboriginal and Torres Strait Islander peoples 🖐️
- recognise uses of metals in familiar contexts, eg cutlery, cooking utensils, cars, furniture, window frames or door handles
- describe the properties of materials in relation to a useful function, eg elastic bands are flexible so that they fit a variety of objects
- describe the properties of metals in relation to a useful function, eg metal as a good conductor to make simple circuits or metal as a poor insulator to keep drinks warm
- describe common uses for a variety of substances, eg styrofoam cups or coolers
- investigate the best substance to use for a particular purpose, eg the best material to insulate a coffee cup ⚙️
- identify common chemicals in the home, eg vinegar, baking soda, salt, sugar, soap, nail polish remover, bleach, motor oil or paint ★
- identify and associate common household chemicals with their uses, eg detergents for removing grease or bleach for sanitising
- identify common chemical safety/hazard symbols ★
- recognise and note the language used to describe how hazardous a product is, eg 'danger', 'warning' or 'caution' ★ 🧑🏻🧑🏻
- describe the need for safe use and storage of household chemicals, including strategies to minimise harm 🌿
- describe 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 🧑🏻🧑🏻

## KNOWLEDGE AND UNDERSTANDING

## CHEMICAL WORLD: CHEMICAL CHANGE

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### OUTCOME

**A student:**

- › investigates a variety of chemical changes SCLS-24CW

**Related Stage 4/5 outcome:** SC5-17CW

### CONTENT

When a chemical change occurs, new substances may be formed.


Students:

- observe some types of chemical changes, eg baking a cake, making bread, lighting a sparkler or gas bubbles forming in water
- recognise that some substances change when heated, eg burning magnesium
- recognise that in a chemical change there may be the appearance of a new substance, eg rust forms on iron materials or the disappearance of an original substance, eg acid is added to a piece of chalk
- investigate the requirements for rusting, including oxygen and water from the air
- identify ways to prevent rusting, eg painting or plating
- describe some ways to remove rust from metals, including using sandpaper or soaking in lemon juice

There are different types of chemical reactions that can be used in our everyday life.

#### *Combustion*

Students:

- identify common things that burn, eg paper, cardboard, wood and leaves
- recognise that materials change when they burn, eg paper turns to ash
- identify that burning things produce heat and light
- investigate the requirements for combustion, eg fuel, heat and oxygen (air)
- identify safety issues relating to combustion, eg prevention and storage procedures 
- recognise highly combustible materials, eg petrol, paint in spray cans or nail polish

#### *Reactions of acids*

Students:

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



# CONTINUUM OF LEARNING IN SCIENCE K–10 AND TECHNOLOGY K–8

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## STAGE OUTCOMES

### CONTINUUM OF LEARNING IN SCIENCE K–10

#### VALUES AND ATTITUDES

<b>Early Stage 1 to Stage 3 outcomes</b> A student:	<b>Stage 4 to Stage 5 outcomes</b> 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

<b>Early Stage 1 outcomes</b> A student:	<b>Stage 1 outcomes</b> A student:	<b>Stage 2 outcomes</b> A student:	<b>Stage 3 outcomes</b> A student:	<b>Stage 4 outcomes</b> A student:	<b>Stage 5 outcomes</b> 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 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 analysing collected 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	<p>SC4-4WS identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge</p> <p>SC4-5WS collaboratively and individually produces a plan to investigate questions and problems</p> <p>SC4-6WS follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually</p> <p>SC4-7WS processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions</p> <p>SC4-8WS selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems</p>	<p>SC5-4WS develops questions or hypotheses to be investigated scientifically</p> <p>SC5-5WS produces a plan to investigate identified questions, hypotheses or problems, individually and collaboratively</p> <p>SC5-6WS undertakes first-hand investigations to collect valid and reliable data and information, individually and collaboratively</p> <p>SC5-7WS processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions</p> <p>SC5-8WS applies scientific understanding and critical thinking skills to suggest possible solutions to identified problems</p>

## SKILLS (CONTINUED)

<b>Early Stage 1 outcomes</b> A student:	<b>Stage 1 outcomes</b> A student:	<b>Stage 2 outcomes</b> A student:	<b>Stage 3 outcomes</b> A student:	<b>Stage 4 outcomes</b> A student:	<b>Stage 5 outcomes</b> A student:
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 address the design criteria and identified constraints	SC4-9WS presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations	SC5-9WS presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations

## KNOWLEDGE AND UNDERSTANDING

<b>Early Stage 1 outcomes</b> A student:	<b>Stage 1 outcomes</b> A student:	<b>Stage 2 outcomes</b> A student:	<b>Stage 3 outcomes</b> A student:	<b>Stage 4 outcomes</b> A student:	<b>Stage 5 outcomes</b> A student:
STe-6NE identifies that the way objects move depends on a variety of factors	ST1-6PW describes some sources of light and sound that they sense in their daily lives  ST1-7PW describes effects of pushes and pulls on objects they encounter	ST2-6PW identifies ways heat is produced and that heat moves from one object to another  ST2-7PW describes everyday interactions between objects that result from contact and non-contact forces	ST3-6PW describes how scientific understanding about the sources, transfer and transformation of electricity is related to making decisions about its use  ST3-7PW uses scientific knowledge about the transfer of light to solve problems that directly affect people's lives	SC4-10PW describes the action of unbalanced forces in everyday situations  SC4-11PW discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformations	SC5-10PW applies models, theories and laws to explain situations involving energy, force and motion  SC5-11PW explains how scientific 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	ST1-8ES describes some observable changes that occur in the sky and landscape  ST1-9ES identifies ways that people use science in their daily lives to care for the environment and the Earth's resources	ST2-8ES describes some observable changes over time on the Earth's surface that result from natural processes and human activity  ST2-9ES describes how relationships between the sun and the Earth cause regular changes	ST3-8ES describes how discoveries by people from different cultures and times have contributed to advancing scientific understanding of the solar system  ST3-9ES explains rapid change at the Earth's surface caused by natural events, using evidence provided by advances in technology and scientific understanding	SC4-12ES describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system  SC4-13ES explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource use and management	SC5-12ES 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  SC5-13ES 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

## KNOWLEDGE AND UNDERSTANDING (CONTINUED)

<b>Early Stage 1 outcomes</b> A student:	<b>Stage 1 outcomes</b> A student:	<b>Stage 2 outcomes</b> A student:	<b>Stage 3 outcomes</b> A student:	<b>Stage 4 outcomes</b> A student:	<b>Stage 5 outcomes</b> A student:
STe-8NE identifies the basic needs of living things	ST1-10LW describes external features, changes in and growth of living things  ST1-11LW describes ways that different places in the environment provide for the needs of living things	ST2-10LW describes that living things have life cycles, can be distinguished from non-living things and grouped, based on their observable features  ST2-11LW describes ways that science knowledge helps people understand the effect of their actions on the environment and on the survival of living things	ST3-10LW describes how structural features and other adaptations of living things help them to survive in their environment  ST3-11LW describes some physical conditions of the environment and how these affect the growth and survival of living things	SC4-14LW relates the structure and function of living things to their classification, survival and reproduction  SC4-15LW explains how new biological evidence changes people's understanding of the world	SC5-14LW analyses interactions between components and processes within biological systems  SC5-15LW explains how biological understanding has advanced through scientific discoveries, technological developments and the needs of society
STe-9ME identifies that objects are made of materials that have observable properties	ST1-12MW identifies ways that everyday materials can be physically changed and combined for a particular purpose  ST1-13MW relates the properties of common materials to their use for particular purposes	ST2-12MW identifies that adding or removing heat causes a change of state between solids and liquids  ST2-13MW identifies the physical properties of natural and processed materials, and how these properties influence their use	ST3-12MW identifies the observable properties of solids, liquids and gases, and that changes made to materials are reversible or irreversible  ST3-13MW describes how the properties of materials determine their use for specific purposes	SC4-16CW describes the observed properties and behaviour of matter, using scientific models and theories about the motion and arrangement of particles  SC4-17CW explains how scientific understanding of, and discoveries about the properties of elements, compounds and mixtures relate to their uses in everyday life	SC5-16CW explains how models, theories and laws about matter have been refined as new scientific evidence becomes available  SC5-17CW 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

<b>Early Stage 1 to Stage 3 outcomes</b> A student:	<b>Stage 4 outcomes</b> 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

<b>Early Stage 1 outcomes</b> A student:	<b>Stage 1 outcomes</b> A student:	<b>Stage 2 outcomes</b> A student:	<b>Stage 3 outcomes</b> A student:	<b>Stage 4 outcomes</b> 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 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 analysing collected 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 address the design criteria and identified 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

<b>Early Stage 1 outcomes</b> A student:	<b>Stage 1 outcomes</b> A student:	<b>Stage 2 outcomes</b> A student:	<b>Stage 3 outcomes</b> A student:	<b>Stage 4 outcomes</b> A student:
STe-6NE identifies that the way objects move depends on a variety of factors	ST1-6PW describes some sources of light and sound that they sense in their daily lives  ST1-7PW describes effects of pushes and pulls on objects they encounter	ST2-6PW identifies ways heat is produced and that heat moves from one object to another  ST2-7PW describes everyday interactions between objects that result from contact and non-contact forces	ST3-6PW describes how scientific understanding about the sources, transfer and transformation of electricity is related to making decisions about its use  ST3-7PW uses scientific knowledge about the transfer of light to solve problems that directly affect people's lives	SC4-10PW describes the action of unbalanced forces in everyday situations  SC4-11PW discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformations
STe-7NE observes, using their senses, how daily and seasonal changes in the environment affect them and other living things	ST1-8ES describes some observable changes that occur in the sky and landscape  ST1-9ES identifies ways that people use science in their daily lives to care for the environment and the Earth's resources	ST2-8ES describes some observable changes over time on the Earth's surface that result from natural processes and human activity  ST2-9ES describes how relationships between the sun and the Earth cause regular changes	ST3-8ES describes how discoveries by people from different cultures and times have contributed to advancing scientific understanding of the solar system  ST3-9ES explains rapid change at the Earth's surface caused by natural events, using evidence provided by advances in technology and scientific understanding	SC4-12ES describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system  SC4-13ES explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource use and management



## KNOWLEDGE AND UNDERSTANDING (CONTINUED)

<b>Early Stage 1 outcomes</b> A student:	<b>Stage 1 outcomes</b> A student:	<b>Stage 2 outcomes</b> A student:	<b>Stage 3 outcomes</b> A student:	<b>Stage 4 outcomes</b> A student:
STe-8NE identifies the basic needs of living things	ST1-10LW describes external features, changes in and growth of living things  ST1-11LW describes ways that different places in the environment provide for the needs of living things	ST2-10LW describes that living things have life cycles, can be distinguished from non-living things and grouped, based on their observable features  ST2-11LW describes ways that science knowledge helps people understand the effect of their actions on the environment and on the survival of living things	ST3-10LW describes how structural features and other adaptations of living things help them to survive in their environment  ST3-11LW describes some physical conditions of the environment and how these affect the growth and survival of living things	SC4-14LW relates the structure and function of living things to their classification, survival and reproduction  SC4-15LW explains how new biological evidence changes people's understanding of the world
STe-9ME identifies that objects are made of materials that have observable properties	ST1-12MW identifies ways that everyday materials can be physically changed and combined for a particular purpose  ST1-13MW relates the properties of common materials to their use for particular purposes	ST2-12MW identifies that adding or removing heat causes a change of state between solids and liquids  ST2-13MW identifies the physical properties of natural and processed materials, and how these properties influence their use	ST3-12MW identifies the observable properties of solids, liquids and gases, and that changes made to materials are reversible or irreversible  ST3-13MW 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

## KNOWLEDGE AND UNDERSTANDING (CONTINUED)

<b>Early Stage 1 outcomes</b> A student:	<b>Stage 1 outcomes</b> A student:	<b>Stage 2 outcomes</b> A student:	<b>Stage 3 outcomes</b> A student:	<b>Stage 4 outcomes</b> A student:
STe-10ME recognises how familiar products, places and spaces are made to suit their purpose	ST1-14BE describes a range of places and spaces in the local environment and how their purposes influence their design  ST1-15I describes a range of familiar information sources and technologies and how their purposes influence their design  ST1-16P describes a range of manufactured products in the local environment and how their different purposes influence their design	ST2-14BE describes how people interact within built environments and the factors considered in their design and construction  ST2-15I describes ways that information solutions are designed and produced, and factors to consider when people use and interact with information sources and technologies  ST2-16P describes how products are designed and produced, and the ways people use them	ST3-14BE describes systems in built environments and how social and environmental factors influence their design  ST3-15I describes how social influences impact on the design and use of information and communication systems  ST3-16P 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

# ASSESSMENT

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## 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 three interrelated elements:

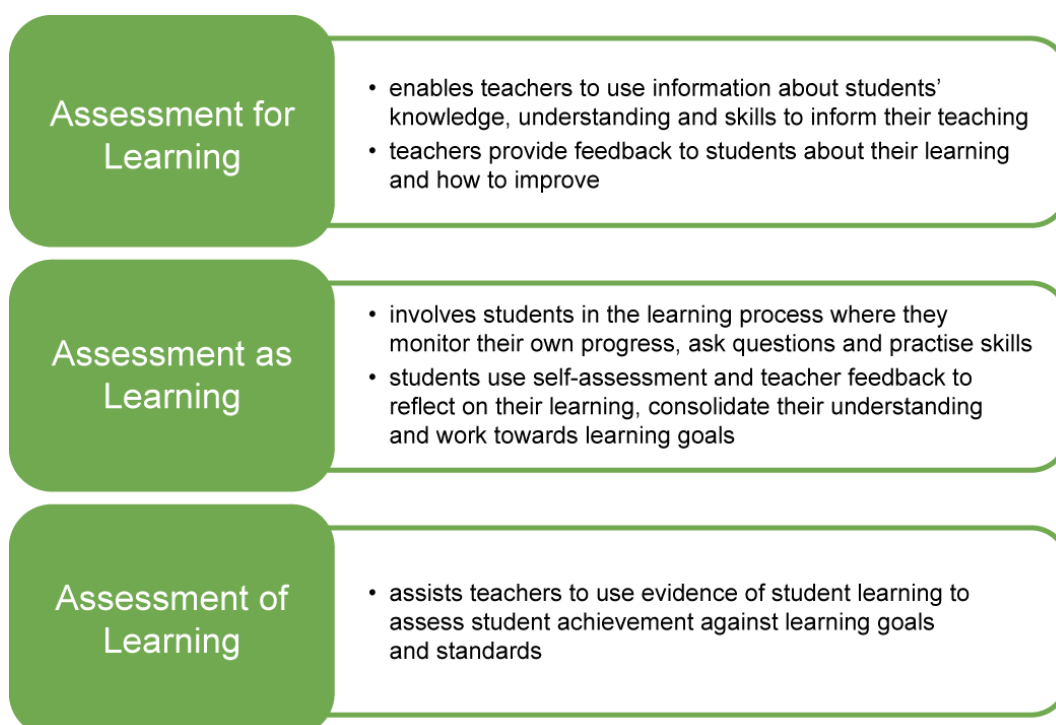
- outcomes and content in syllabuses showing what is to be learned
- stage statements that summarise student achievement
- samples of work on the Board's Assessment Resource Centre (ARC) website, which provide examples of levels of achievement within a stage.

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

## ASSESSMENT

Assessment is an integral part of teaching and learning. Well-designed assessment is central to engaging students and should be closely aligned to the outcomes within a stage. Effective assessment increases student engagement in their learning and leads to enhanced student outcomes.

*Assessment for Learning*, *Assessment as Learning* and *Assessment of Learning* are three approaches to assessment that play an important role in teaching and learning. The Board of Studies Years K–10 syllabuses particularly promote *Assessment for Learning* as an essential component of good teaching.



Further advice on programming and appropriate assessment practice in relation to the *Science K–10 (incorporating Science and Technology K–6) Syllabus* is contained in *Science and Technology K–6: Advice on Programming and Assessment* as well as *Science Years 7–10:*

*Advice on Programming and Assessment.* This support document provides general advice on assessment as well as strategies to assist teachers in planning education programs.

## 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, eg additional time, rest breaks, quieter conditions, or the use of a reader and/or scribe or specific technology
- adjustments to assessment activities, eg rephrasing questions, using simplified language, fewer questions or alternative formats for questions
- alternative formats for responses, eg written point form instead of essays, scaffolded structured responses, short objective answers 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 Science Years 7–10 Life Skills 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*.

## 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, 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. Teachers use the Common Grade Scale (A–E) or equivalent to report student levels of achievement from Stages 1 to 5.

The objectives and outcomes for the values and attitudes 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.

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. There is no requirement for schools to use the Common Grade Scale (A–E) or equivalent to report achievement of students undertaking Life Skills outcomes and content.

## GLOSSARY

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

<b>accuracy (plausible)</b>	Accuracy estimated taking into consideration the evident sources of error and the limitations of the instruments used in making the measurements.
<b>biotechnology</b>	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.
<b>conclusions</b>	An opinion or judgement based on evidence.
<b>context</b>	Contexts are devised by teachers and are the framework within which the learning experiences take place. The skills and the knowledge and understanding content is developed in contexts relevant to the needs, interests, experiences and cultural backgrounds of students. The syllabus does not specify contexts, as these will be selected by the teacher.
<b>control (the control in an experiment)</b>	The sample in an experiment to which all the other samples are compared.
<b>data</b>	Facts or figures that can be used to draw conclusions.
<b>dependent variable</b>	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.
<b>Earth's spheres</b>	The four interacting spheres, ie atmosphere, biosphere, lithosphere and hydrosphere.
<b>evidence</b>	In science, evidence is valid/reliable data that can be used to support a particular theory, hypothesis, idea or conclusion.
<b>fair test</b>	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.
<b>fieldwork</b>	An investigation that is undertaken in the normal environment of the subject of the study.
<b>first-hand investigation</b>	Inquiry based on the direct use of observation or measurement.
<b>formal measurement</b>	Measurement that is based on an agreed standard unit, for example metre, second and gram.
<b>hypothesis</b>	A predictive statement that can be tested using a range of methods, most often associated with experimental procedure; can be supported or refuted by experiment.

<b>independent variable</b>	The variable that is deliberately changed, often through a series of preset values. Conventionally plotted on the horizontal (x) axis of a graph.
<b>interactions</b>	Relationships between components within and between systems that lead to a greater understanding of how our world works.
<b>investigate</b>	Plan, inquire into and draw conclusions.
<b>investigation</b>	A type of first-hand activity that can be used to answer a question, explore an idea or solve a problem. A scientific investigation is a systematic inquiry usually involving using and applying the processes of planning a course of action, safely manipulating tools and equipment in collecting and interpreting data, drawing evidence-based conclusions and communicating findings.
<b>law</b>	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.
<b>model</b>	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.
<b>multi-modal text</b>	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.
<b>natural world</b>	Relates to and includes phenomena in the biological and physical (including chemical and geological components) world on and beyond the Earth.
<b>observation</b>	That which can be sensed either directly by an individual or indirectly by measuring devices.
<b>qualitative</b>	To use descriptive explanations involving features, characteristics or properties to identify important components. Data and information that is not numerical in nature.
<b>quantitative</b>	Data or components that can be expressed or measured numerically, including chemical formulae or numbers.
<b>relate</b>	To identify connections or associations between ideas and/or relationships between components of systems and structures.
<b>reliability of first-hand data</b>	The degree to which repeated observation and/or measurements taken under identical circumstances will yield the same results.
<b>research</b>	To locate, gather, record and analyse information through literature and/or first-hand investigation to develop understanding.
<b>scientific inquiry</b>	The processes of scientific inquiry enable scientists to develop answers to questions and to improve explanations for phenomena in the natural world. A scientific idea must be framed in a way that is testable and can be either refuted or confirmed by observation or experiment (empirical evidence). Scientific knowledge is refined and extended as new evidence arises or existing evidence is re-conceptualised. As students engage in applying the skills and processes of Working Scientifically, they extend their understanding of scientific ideas and concepts and

how these are developed through scientific inquiry.

<b>secondary sources</b>	A range of forms of information and data that have resulted from the investigations of other people, including graphs, diagrams and images.
<b>senses</b>	Perceptions that a living organism uses to take in information about its surroundings. The five main senses are hearing, sight, touch, taste and smell.
<b>structure</b>	Entities in which the parts are linked together to form a whole.
<b>survey</b>	A type of investigation to obtain data and information that involves asking respondents a range of questions.
<b>sustainability</b>	The patterns of activities that meet the needs of the present generation without prejudicing the ability of future generations to meet their needs.
<b>system</b>	A set of components within the natural and made environments that interact. An understanding of natural complex systems requires the integration and application of concepts from more than one Science discipline.
<b>technological design</b>	The process of design, produce and evaluate.
<b>technologies</b>	The knowledge and creative processes that assist people to use tools, resources and systems to solve problems and meet human needs and wants.
<b>text types</b>	Different forms of writing for particular purposes, including discussion, explanation, exposition, procedure, recount and report.
<b>theory</b>	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.
<b>validity of first-hand data</b>	The extent to which the processes and resultant data measure what was intended.
<b>variable</b>	A factor that can be changed, kept the same or measured in an investigation.
<b>variable held constant</b>	Factors that may vary, but for the purposes of an experiment are deliberately held constant so that a valid conclusion is possible.