NSW Syllabus for the Australian curriculum

NSW EDUCATION STANDARDS AUTHORITY

Science and Technology

K–6

Syllabus

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Contents

Introduction

K–10 Curriculum

The NSW Education Standards Authority (NESA) syllabuses are developed with respect to some overarching views about education. These include the NESA *K–10 Curriculum Framework* and *Statement of Equity Principles,* and the *Melbourne Declaration on Educational Goals for Young Australians* (December 2008).

NESA syllabuses include agreed Australian Curriculum content and content that clarifies the scope, breadth and depth of learning. 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 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 provides structures and processes by which teachers can provide continuity of study for all students.

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

The continued relevance of the *K–10 Curriculum Framework* is consistent with the intent of the *Melbourne Declaration on Educational Goals for Young Australians* (December 2008), which sets the direction for Australian schooling for the next ten 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 and Technology K–6 Syllabus* contributes to the curriculum, and to students' achievement of the broad learning outcomes, is outlined in the syllabus rationale.

Diversity of Learners

NSW syllabuses are inclusive of the learning needs of all students. Syllabuses accommodate teaching approaches that support student diversity, including students with special education needs, gifted and talented students, and students learning English as an additional language or dialect (EAL/D). Students may have more than one learning need.

Students with Special Education Needs

All students are entitled to participate in and progress through the curriculum. Under the *Disability Standards for Education 2005*, schools are required to provide additional support or adjustments to teaching, learning and assessment activities for some students with special education needs. Adjustments are measures or actions taken in relation to teaching, learning and assessment that enable a student with special education needs to access syllabus outcomes and content and demonstrate achievement of outcomes.

Students with special education needs can access outcomes and content from K–6 syllabuses in a range of ways. Students may engage with:

- syllabus outcomes and content from their age-appropriate stage with adjustments to teaching, learning and/or assessment activities; or
- selected syllabus outcomes and content from their age-appropriate stage relevant to their learning needs; or
- syllabus outcomes from an earlier Stage, using age-appropriate content.

Decisions regarding curriculum options, including adjustments, should be made in the context of collaborative curriculum planning with the student, parent/carer and other significant individuals to ensure that syllabus outcomes and content reflect the learning needs and priorities of individual students.

Further information can be found in support materials for:

- Science and Technology
- Special education.

Gifted and Talented Students

Gifted and talented students have specific learning needs that may require adjustments to the pace, level and content of the curriculum. Differentiated educational opportunities assist in meeting the needs of gifted and talented 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 and talent. Gifted and talented students may also have learning disabilities and/or English as an additional language or dialect. These needs 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/carers and students, with reference to documents and advice available from NESA and the education sectors.

Gifted and talented students may also benefit from individual planning to determine the 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 students are those whose first language is a language or dialect 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 students whose first language is a language other than English, including creoles and related varieties
- Aboriginal and Torres Strait Islander students whose first language is Aboriginal English, including Kriol and related varieties.

EAL/D students 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 Standard Australian English. EAL/D students represent a significant and growing percentage of learners in NSW schools. For some, school is the only place they use Standard Australian English.

EAL/D students are simultaneously learning a new language and the knowledge, understanding and skills of a 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.

The *ESL Scales* and the *English as an Additional Language or Dialect: Teacher Resource* provide information about the English language development phases of EAL/D students. These materials and other resources can be used to support the specific needs of EAL/D students and to assist students to access syllabus outcomes and content.

Science and Technology Key

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

Outcome Coding

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

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

Stage	**Code**
Early Stage 1	e
Stage 1	1
Stage 2	2
Stage 3	3

Subjects are represented by the following codes:

Subject	**Code**
Science	S
Technology	T

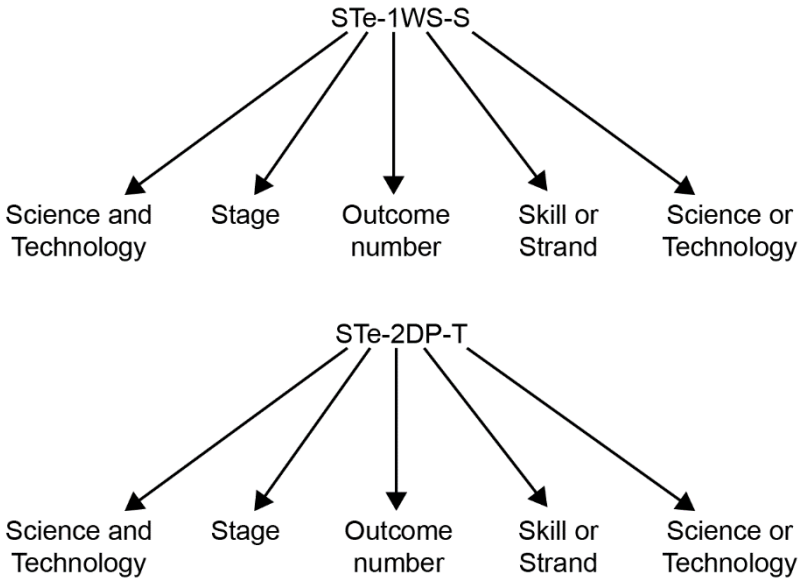
Skills are represented by the following codes:

Skill	**Code**
Design and Production	DP
Working Scientifically	WS

Strands are represented by the following codes:

Strand	**Code**
Digital Technologies	DI
Earth and Space	ES
Living World	LW
Material World	MW
Physical World	PW

In the *Science and Technology K–6 Syllabus*, outcome codes indicate subject, Stage, outcome number, skill or strand name and if the content is derived from Science or Technology. For example:

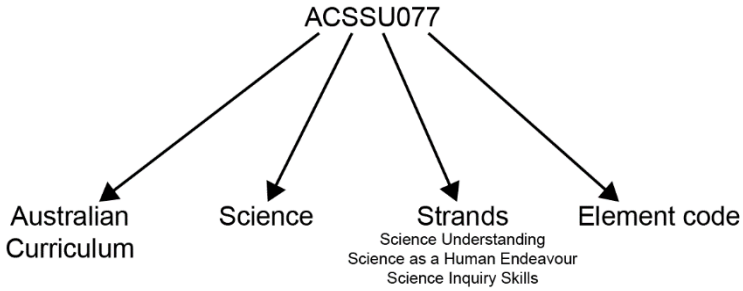


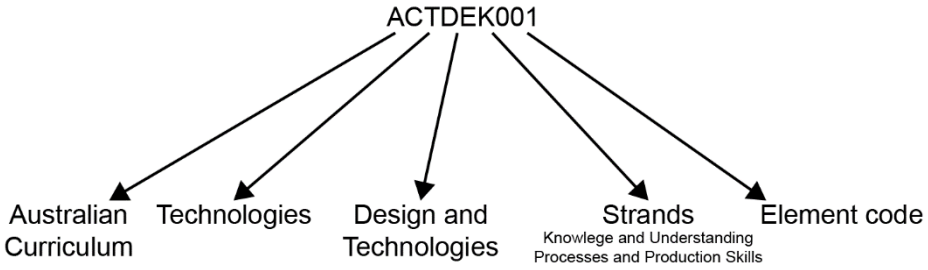
Outcome code	**Interpretation**
STe-1WS-S	Science and Technology, Early Stage 1 – Outcome number 1, Working Scientifically – Science
ST2-3DP-T	Science and Technology, Stage 2 – Outcome number 3, Design and Production – Technology

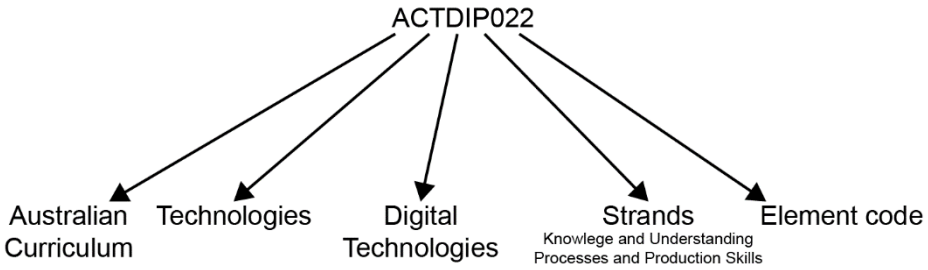
Coding of Australian Curriculum Content

The syllabus includes Australian Curriculum content for Science, Design and Technologies, and Digital Technologies, with Australian Curriculum codes in brackets at the end of each content description, for example:

- investigate and compare the properties of solids, liquids and gases (ACSSU077)







Where a number of content descriptions are jointly represented, all description codes are included, eg (ACTDEK001, ACTDIP022).

Coding of Thinking Skills

The syllabus provides opportunities for types of thinking to be incorporated into the knowledge, understanding and skills. These opportunities are identified by codes at the end of the relevant content descriptions.

Course tools	**Code**
Computational thinking	**ComT**
Design thinking	**DesT**
Scientific thinking	**SciT**
Systems thinking	**SysT**

For example:

- explore ways that heat can be transferred due to conduction (ACSSU049) **SciT**
- identify and describe how the properties of different materials suit their design purpose (ACTDEK004) **DesT**

Learning Across the Curriculum Icons

Learning across the curriculum content, including the cross-curriculum priorities, general capabilities and other areas identified as important learning for all students, is incorporated and identified by icons in the 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

Science and Technology K–6 is an integrated discipline that fosters in students a sense of wonder and curiosity about the world around them and how it works. Science and Technology K–6 encourages students to embrace new concepts, the unexpected and to learn through trialling, testing and refining ideas.

The study of science and technology develops the building blocks of inquiry and students' abilities to solve problems. Students are provided with opportunities to develop understanding based on evidence and reason. These skills enable students to participate responsibly in developing innovative ideas and solutions in response to questions and situations relevant to personal, social and environmental issues. The learning students experience enables them to contribute to the world as active global citizens both now and in the future.

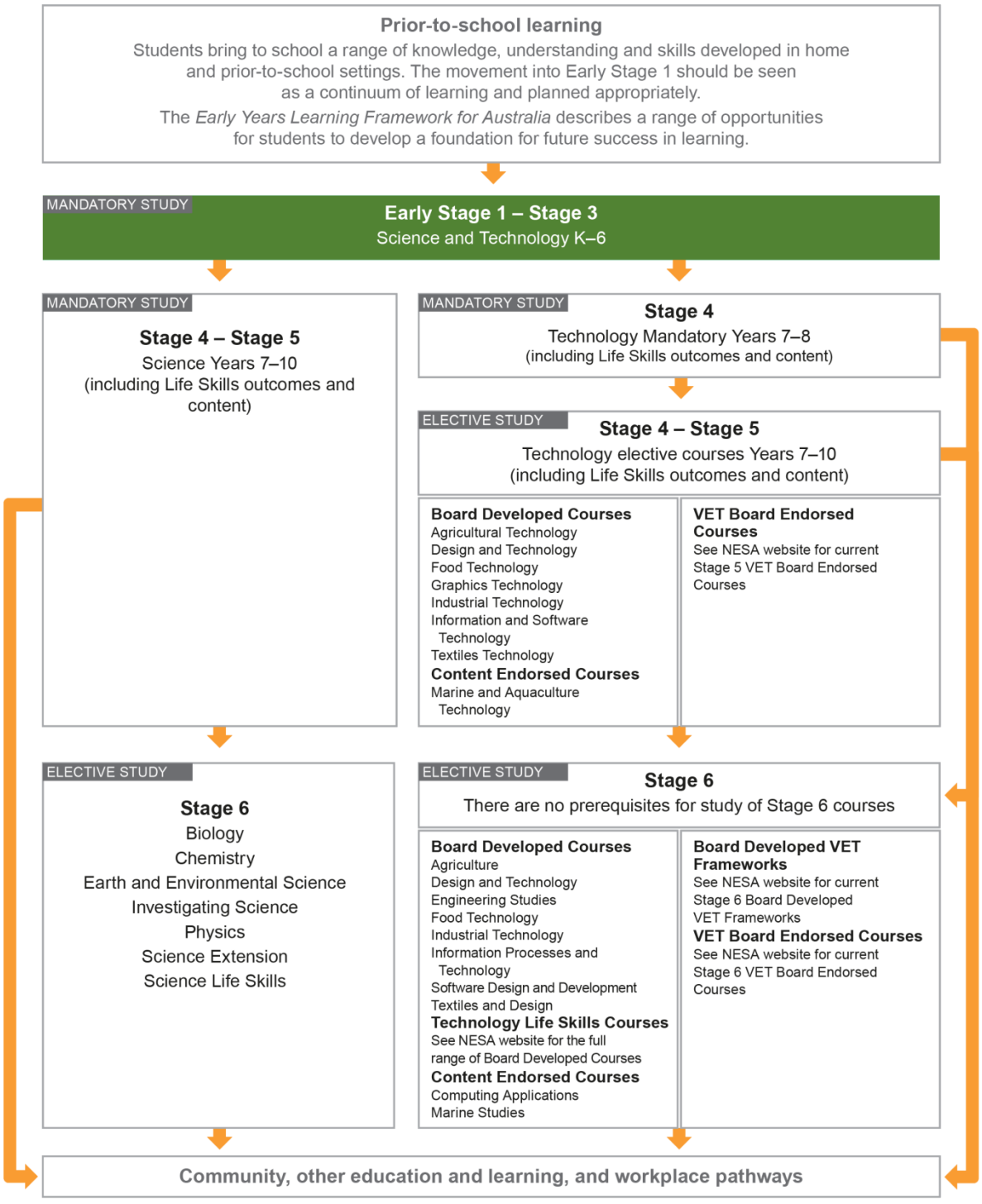
Science and technology are pedagogically linked and through their practical application promote genuine learning opportunities for students. The application of Working Scientifically, and Design and Production skills enables students to develop a sense of accomplishment and enhance their skills in inquiry and manipulating tools and materials to produce solutions. These skills are important in preparing students to succeed in a rapidly developing technological world.

Students studying science and technology are encouraged to question and seek solutions to problems through collaboration, investigation, critical thinking and creative problem-solving. Students are provided with opportunities to apply thinking skills and develop an appreciation of the processes they can apply as they encounter problems, unfamiliar information and new ideas. These attributes are fundamental to the development of students who use evidence to make decisions and solve problems.

Science and Technology K–6 provides students with the opportunity to make meaningful connections with the broader learning outcomes of the K–6 curriculum in English, Mathematics, History, Geography, Creative Arts, Languages and PDHPE through authentic application of relevant knowledge and acquired skills.

Science and Technology K–6 develops students' curiosity about natural phenomena and the built environment. It provides students with the opportunity to develop a sense of achievement by using the practical application of knowledge in the development of solutions. The skills and capabilities developed through the study of science and technology provide students with opportunities for skill development and a strong foundation for learning across the K–10 curriculum.

The Place of the Science and Technology K–6 Syllabus in the K–12 Curriculum



Aim

The study of Science and Technology in K–6 enables students to explore scientific and technological concepts and develop knowledge and understanding of the world; enabling them to inquire, plan, investigate and develop solutions to problems. Through the application of Working Scientifically, and Design and Production skills, students develop an interest in and an enthusiasm for understanding nature, phenomena and the built environment.

Objectives

Skills

Students develop and apply skills in:

- scientific inquiry through the process of working scientifically
- design and production processes in the development of solutions
- design and production of digital solutions.

Knowledge and Understanding

Students develop knowledge and understanding of:

- the natural world including living things, materials, forces, energy, and Earth and space
- the built environment including engineering principles and systems, food and fibre production, and material technologies
- digital technologies including digital systems and how digital technologies represent data.

Values and Attitudes

Students:

- value the importance and contribution of science and technology in developing solutions for current and future personal, social and global issues and in shaping a sustainable future
- appreciate the importance of using evidence and reason to engage with and respond to scientific and technological ideas as informed, reflective citizens
- value developing solutions to problems and meeting challenges through the application of Working Scientifically, and Design and Production skills.

Outcomes

Table of Objectives and Outcomes – Continuum of Learning

Skills

<table>
<tr><td colspan="4">Objectives
Students develop and apply skills in:
scientific inquiry through the process of working scientifically
design and production processes in the development of solutions
design and production of digital solutions</td></tr>
<tr><td>Early Stage 1 outcomes
A student:</td><td>Stage 1 outcomes
A student:</td><td>Stage 2 outcomes
A student:</td><td>Stage 3 outcomes
A student:</td></tr>
<tr><td>STe-1WS-S
observes, questions and collects data to communicate ideas</td><td>ST1-1WS-S
observes, questions and collects data to communicate and compare ideas</td><td>ST2-1WS-S
questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations</td><td>ST3-1WS-S
plans and conducts scientific investigations to answer testable questions, and collects and summarises data to communicate conclusions</td></tr>
<tr><td rowspan="2">STe-2DP-T
develops solutions to an identified need</td><td>ST1-2DP-T
uses materials, tools and equipment to develop solutions for a need or opportunity</td><td>ST2-2DP-T
selects and uses materials, tools and equipment to develop solutions for a need or opportunity</td><td>ST3-2DP-T
plans and uses materials, tools and equipment to develop solutions for a need or opportunity</td></tr>
<tr><td>ST1-3DP-T
describes, follows and represents algorithms to solve problems</td><td>ST2-3DP-T
defines problems, describes and follows algorithms to develop solutions</td><td>ST3-3DP-T
defines problems, and designs, modifies and follows algorithms to develop solutions</td></tr>
</table>

Knowledge and Understanding

Objectives

Students develop knowledge and understanding of:

- the natural world including living things, materials, forces, energy, and Earth and space
- the built environment including engineering principles and systems, food and fibre production, and material technologies
- digital technologies including digital systems and how digital technologies represent data

Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:
STe-3LW-ST explores the characteristics, needs and uses of living things	**ST1-4LW-S** describes observable features of living things and their environments	**ST2-4LW-S** compares features and characteristics of living and non-living things	**ST3-4LW-S** examines how the environment affects the growth, survival and adaptation of living things
	ST1-5LW-T identifies how plants and animals are used for food and fibre products	**ST2-5LW-T** describes how agricultural processes are used to grow plants and raise animals for food, clothing and shelter	**ST3-5LW-T** explains how food and fibre are produced sustainably in managed environments for health and nutrition
STe-4MW-ST identifies that objects are made of materials that have observable properties	**ST1-6MW-S** identifies that materials can be changed or combined	**ST2-6MW-S** describes how adding or removing heat causes a change of state	**ST3-6MW-S** explains the effect of heat on the properties and behaviour of materials
	ST1-7MW-T describes how the properties of materials determine their use	**ST2-7MW-T** investigates the suitability of natural and processed materials for a range of purposes	**ST3-7MW-T** explains how the properties of materials determines their use for a range of purposes

Objectives

Students develop knowledge and understanding of:

- the natural world including living things, materials, forces, energy, and Earth and space
- the built environment including engineering principles and systems, food and fibre production, and material technologies
- digital technologies including digital systems and how digital technologies represent data

Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:
STe-5PW-ST observes the way objects move and relates changes in motion to push and pull forces	**ST1-8PW-S** describes common forms of energy and explores some characteristics of sound energy	**ST2-8PW-ST** describes the characteristics and effects of common forms of energy, such as light and heat	**ST3-8PW-ST** explains how energy is transformed from one form to another
	ST1-9PW-ST investigates how forces and energy are used in products	**ST2-9PW-ST** describes how contact and non-contact forces affect an object's motion	**ST3-9PW-ST** investigates the effects of increasing or decreasing the strength of a specific contact or non-contact force
STe-6ES-S identifies how daily and seasonal changes in the environment affect humans and other living things	**ST1-10ES-S** recognises observable changes occurring in the sky and on the land and identifies Earth's resources	**ST2-10ES-S** investigates regular changes caused by interactions between the Earth and the Sun, and changes to the Earth's surface	**ST3-10ES-S** explains regular events in the solar system and geological events on the Earth's surface
STe-7DI-T identifies digital systems and explores how instructions are used to control digital devices	**ST1-11DI-T** identifies the components of digital systems and explores how data is represented	**ST2-11DI-T** describes how digital systems represent and transmit data	**ST3-11DI-T** explains how digital systems represent data, connect together to form networks and transmit data

Stage Statements

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 the relevant 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 about 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 engage in the processes of Working Scientifically, and Design and Production to make sense of the world around them. They explore their immediate surroundings and ask questions about their observations and experiences. They collect data and communicate their ideas and observations in a variety of ways. Students investigate possibilities and solutions, individually and in collaboration with others, and use the design process to develop solutions. They effectively use a range of classroom equipment and learn to work safely when using resources and materials.

Students recognise that living things have different features and basic needs which can be met. They recognise that plants and animals can be used for food, clothing and shelter. Students identify that objects are made from materials that have observable properties, and that these properties influence their design and use. They describe how objects move and observe the effects of push and pull forces. Students identify daily and seasonal changes in the environment. Students also identify familiar digital systems and follow a simple set of instructions.

Stage 1

By the end of Stage 1, students engage in the processes of Working Scientifically, and Design and Production. They participate in guided investigations, pose and respond to questions and make predictions. Students collect and represent information using a variety of methods. They safely manipulate equipment and materials, making sustainable and time-efficient choices. Students generate and develop design ideas and solutions that they communicate with labelled drawings and models and through the use of digital technologies where appropriate. They provide explanations about what they have done and evaluate their ideas using predetermined criteria.

Students describe the external features, changes and growth of living things and how their environments provide for their needs. They identify how plants and animals are produced for food and fibre. Students investigate the characteristics and properties of materials, how they can be changed and combined for a purpose. Students identify heat, light and sound energy and explore how forces and energy can be used. They are able to identify observable changes that occur on the Earth and in the sky and how humans care for the environment and Earth's resources. Students identify the components of digital systems and explore how data is represented through pictures, symbols and diagrams. They describe, follow and represent algorithms that are needed to solve problems.

Stage 2

By the end of Stage 2, students engage in the processes of Working Scientifically, and Design and Production by asking questions, predicting outcomes and undertaking guided investigations with increasing independence. Students make and record observations, using formal units where appropriate, and compare results with predictions. They reflect on whether methods undertaken are fair and identify ways to improve subsequent investigations. Students organise and identify patterns in data and create tables to organise and represent information.

Students develop solutions that address specific criteria. They generate and develop ideas, using research to inform their design ideas, which are represented using sketches, brainstorms and where appropriate, digital technologies. Students select materials appropriate for their purposes, with consideration of sustainability and constraints to produce designed solutions. They are guided to develop specific criteria to critically evaluate designed solutions.

Students compare living things and identify the life cycles which support the survival of plant and animal species. They describe how agricultural processes are used to grow plants and raise animals for food, clothing and shelter. Students identify the physical properties of materials and how heat can alter their state. They investigate the suitability of natural and manufactured materials for specific purposes. They explain how energy is transferred from one place to another, and how forces affect objects and the behaviour of a product or system. Students describe the regular changes caused by interactions between the Earth and the Sun, and the changes to the Earth's surface that are caused over time by natural processes and human activity. They describe how digital systems transmit data, explore different types of data and how data patterns can be represented and interpreted.

Stage 3

By the end of Stage 3, students have developed an appreciation of the role of Science and Technology in local, national and global issues relevant to their lives and a sustainable future. Students engage in the skills of Working Scientifically, and Design and Production independently and collaboratively. They pose questions for investigation, predict likely outcomes, and demonstrate accuracy and honesty when collecting, recording and analysing data and information. Students plan and conduct fair tests, isolate variables and select appropriate measurement methods. They construct tables and graphs to organise data and are able to identify patterns, using evidence to compare with predictions, draw conclusions and develop explanations. Students develop criteria to evaluate success based on their intended outcome. They examine needs and opportunities for design projects, using research and existing solutions to inform their ideas. Students are able to reflect on their processes to identify risks and improve their design ideas, methods and findings. They communicate their ideas in tables, graphs, diagrams and multimodal texts, using digital technologies where applicable.

Students examine how environmental conditions affect the growth, adaptations, structural features and survival of living things. They explain how food and fibre are produced sustainably in managed environments for health and nutrition. Students examine the properties of materials and observe how changes of state occur and new substances are formed. Students explain how energy is transformed, describe the difference between contact and non-contact forces, and investigate how electrical energy can control movement. They compare the regular events in the solar system with the irregular events that cause rapid changes to the Earth's surface. Students collect, store and interpret different types of data and explain how digital systems connect to form networks that transmit data. They define problems, and design, modify and follow simple algorithms that involve branching, iteration and user input.

Stage 4 – Science Years 7–10

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

Students describe the action of unbalanced forces on the motion of objects in everyday situations, including 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 4 – Technology Mandatory Years 7–8

By the end of Stage 4, students explore problems and opportunities considering functional, economic, environmental, social, technical and/or usability constraints. They investigate, select, justify and safely use a range of tools, materials, components, equipment and processes to develop, test and communicate design ideas using appropriate technical terms and technologies. Students plan, manage and evaluate the production of design solutions. They develop thinking skills to communicate the development of digital and non-digital solutions.

Students investigate how managed systems are used to sustainably produce food and fibre. They explain food selection and preparation, food safety, and make informed and healthy food choices. Students collect and interpret data from a range of sources to assist in making informed judgements. They explain how data is represented in digital systems, and transmitted and secured in networks.

Students explain how force, motion and energy can be used in systems, machines and structures. They investigate characteristics and properties of a range of materials, develop skills and techniques in the use of a broad range of tools and safely apply them in the production of projects.

Students are responsible users of technology, capable of designing and producing solutions to identified needs or opportunities. They develop an appreciation of the contribution of technologies on their lives now and the impact of innovations for creating preferred futures. They develop an appreciation of the dynamic nature of design and production processes and how thinking skills are used to develop solutions to personal, social and global issues.

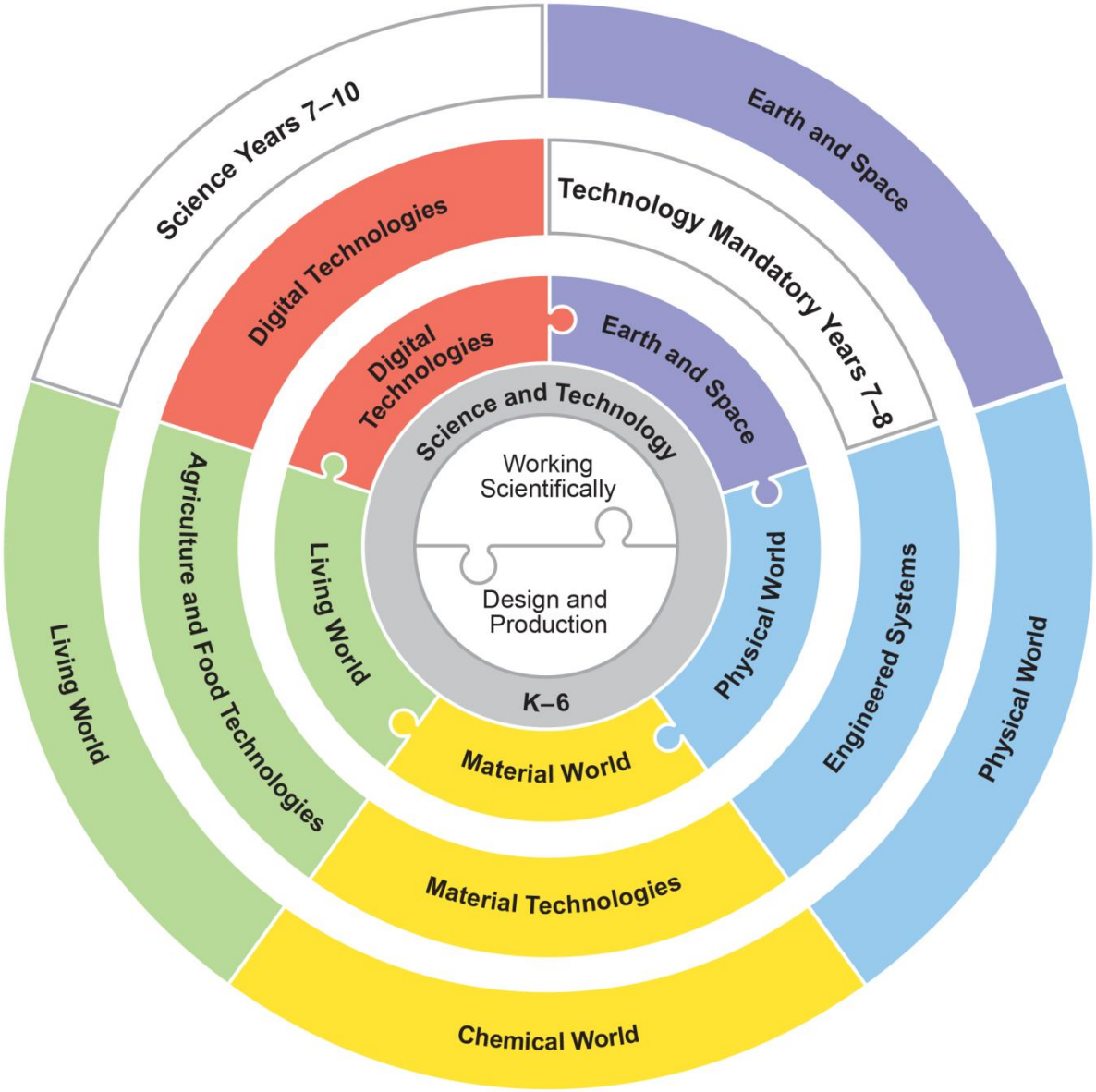
Content

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.

Organisation of Content

The following diagram provides an illustrative representation of elements of the course and their relationship.



The Science and Technology K–6 syllabus content is organised into Stages from Early Stage 1 to Stage 3. The outcomes are presented as:

- Skills
- Knowledge and Understanding.

The knowledge and understanding in Science and Technology K–6 are developed through the skills of Working Scientifically, and Design and Production. By the end of each Stage, students will have had opportunities to investigate scientifically and apply their knowledge and understanding in the creation of designed solutions.

The five content strands in Science and Technology K–6 are the basis for the continuum of learning for both Science Years 7–10 and Technology Mandatory Years 7–8. All five content strands are to be delivered by the end of each Stage. Content strands may be taught individually or integrated. The five content strands are:

- Living World
- Material World
- Physical World
- Earth and Space
- Digital Technologies.

The continuum for each strand is identified below.

Science and Technology K–6	**Science Years 7–10 and Technology Mandatory Years 7–8**
Working Scientifically	Working Scientifically
Design and Production	Design and Production Processes
Living World	Living World
	Agriculture and Food Technologies
Material World	Chemical World
	Material Technologies
Physical World	Physical World
	Engineered Systems
Earth and Space	Earth and Space
Digital Technologies	Digital Technologies

Skills Focus

By the end of each Stage students should be provided with opportunities to engage with the full range of Working Scientifically, and Design and Production skills. The focus skills identified for each content strand complement the content and are a suggested focus when delivering that content. Teachers will make decisions regarding the sequence and emphasis of skills, based on the needs, abilities and prior learning of students.

Inquiry and Focus Questions

The inquiry and focus questions are included to guide and frame the syllabus content within each strand. The depth of knowledge, understanding and skills development required to fully address the inquiry and focus questions may vary. This allows for differentiation of the course content catering for the diverse needs and abilities of students. The inquiry and focus questions provided should be used as a guide when developing contextual teaching and learning experiences.

Practical Experiences

Students must undertake a range of practical experiences to develop knowledge, understanding and skills in Science and Technology. Student capability, confidence and expertise at their current stage of development are important considerations in determining the teaching and learning experiences.

Students with special education needs may require adjustments and/or additional support in order to engage in practical experiences.

Safety

Schools have a legal obligation in relation to safety. Teachers need to ensure they comply with relevant legislation as well as system and school requirements in relation to safety when implementing their programs. This includes legislation and guidelines relating to Work Health and Safety, and the handling and storage of chemicals and dangerous goods. Teachers need to be aware of activities that may require notification, certification, permission, permits and licences.

Schools need to be aware of legal, ethical and cyber security considerations of digital solutions, including copyright and intellectual property, cultural considerations, accessibility, privacy issues and digital footprints.

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 foods to be handled and consumed.

Animal Welfare

Schools have a legal responsibility in relation to the welfare of animals. The keeping of animals and all practical activities involving animals must comply with relevant guidelines and legislation that are interpreted for schools on the *Animals in Schools* website.

Working Scientifically, and Design and Production Skills

The skills of Working Scientifically, and Design and Production, enable students to develop and consolidate their knowledge and understanding of science and technology.

These two processes are dynamic and nonlinear, and various aspects of both processes are used according to the demands of the task. Elements of Working Scientifically, and Design and Production may be repeated to generate results, conclusions, solutions or products. Unexpected results are to be welcomed and used to initiate further scientific investigation and design.

As students develop skills and gain experience with Working Scientifically, and Design and Production, they are encouraged to progress from guided to independent learning.

Working Scientifically

The skills of Working Scientifically are at the core of inquiry and are developed by conducting practical investigations and research in Science and Technology. When investigating, opportunities are to be provided for students to engage with all of the Working Scientifically skills.

Students develop an understanding that the Working Scientifically processes are applied in every scientific investigation in a way that is determined by the task. Through regular involvement in applying these skills in a variety of situations, students develop an understanding that the Working Scientifically processes are more than a series of predictable steps that confirm what we know.

Working Scientifically challenges students to imagine and pose questions, develop processes that can be used to solve problems and, explain observations and phenomena. These scientific processes are informed by the unexpected. An unexpected result, or no observable change, does not necessarily indicate that an investigation was unsuccessful, but rather can be used to direct further questioning and scientific investigation.

An investigation is a scientific process of answering a question, exploring an idea or solving a problem that includes practical activities, such as planning a course of action using fair testing and replication, collection and interpretation of data, reaching a conclusion and communicating findings.

Working Scientifically Skills

Questioning and predicting

Students question and make predictions about familiar events and outcomes of investigations. They pose relevant questions to initiate a scientific investigation and predict outcomes to unfamiliar situations.

Planning and conducting investigations

Students explore their surroundings and develop strategies for planning and conducting fair testing. They work collaboratively and individually to plan appropriate investigations to test predictions and find answers to questions. Students make observations using their senses and use measurement and appropriate technologies to collect and record these observations. They use appropriate materials, tools or equipment and recognise risks in conducting practical investigations.

Processing and analysing data

Students organise, share and compare data and information. They engage with a range of representations including graphs, tables and labelled diagrams. Students discuss observations and use reasoning to describe patterns and relationships. They develop mathematical skills to represent data, justify conclusions and share their findings. Students analyse their findings and reflect on the effectiveness of the investigation by assessing the reliability and validity of the data collected.

Communicating

Students communicate by using and constructing a range of representations, including tables and graphs, to represent and describe observations and identify relationships in data, using appropriate technologies. They share and communicate their observations and ideas in a variety of ways to explain processes and their understanding of concepts.

Design and Production

Design and Production skills are based on aspects of design thinking, and design and production processes. The practical nature of Design and Production engages students in critical and creative thinking, including understanding interrelationships between systems as they solve complex problems.

Students develop skills to plan, organise and monitor activities and processes as they manage projects to completion. Students are taught to plan for the sustainable use of resources and identify the benefits and potential risks of solutions. Design and Production provides students with opportunities to consider how solutions will be used to create preferred futures.

Design and Production Skills

Identifying and defining

Students consider the contribution of technologies to their lives and make judgements about them, and explore needs and opportunities for designing. They question and review existing products, processes and systems, explore needs or opportunities for designing, define problems to be solved, describe a sequence of steps and decisions (algorithms) needed to solve a problem and establish criteria for a successful design solution.

Researching and planning

Students identify factors that may influence and dictate the focus of the design idea, explore options and represent and refine ideas. They investigate materials, components, tools, equipment and/or processes to achieve intended design solutions. Students generate, develop and communicate design ideas and information, using appropriate technical terms and graphical representations. They develop project plans that include consideration of resources and design, modify and follow simple algorithms and steps in the development of a design solution.

Producing and implementing

Students develop and apply a variety of skills and techniques to create products, services or environments to meet specific purposes. They select and use materials, components, tools, equipment and processes to safely produce designed solutions. Students implement digital solutions using visual programs.

Testing and evaluating

Students evaluate design ideas, processes and solutions to inform decision-making about the quality and effectiveness of designed solutions. They determine effective ways to test and judge designed solutions against predetermined criteria, reflect on processes and transfer their learning to other design opportunities. Students explore how people use information systems to meet needs and opportunities.

Working Scientifically Skills Continuum

Questioning and predicting

Early Stage 1	Stage 1	Stage 2	Stage 3
• pose questions about familiar objects and events • respond to questions about familiar objects and events (ACSIS014)	• pose questions about familiar objects and events • respond to posed questions • make predictions about possible findings (ACSIS024, ACSIS037)	• identify and pose questions in familiar contexts that can be investigated scientifically • make predictions based on prior knowledge (ACSIS053, ACSIS064)	• pose testable questions • make and justify predictions about scientific investigations (ACSIS231, ACSIS232)

Planning and conducting investigations

Early Stage 1	Stage 1	Stage 2	Stage 3
• make observations using senses through participation in guided scientific investigations • record observations using drawings, simple digital recording methods, oral descriptions and/or simple visual representations (ACSIS011) • work collaboratively with others to investigate ideas • develop safe skills when using materials and equipment	• explore and answer questions through participation in guided scientific investigations (ACSIS025, ACSIS038) • collect data from observations • record observations accurately and honestly using observational drawings, labelling, informal measurements and digital technologies (ACSIS026, ACSIS039) • compare observations with those of others (ACSIS213, ACSIS041) • develop collaboration skills to effectively conduct investigations • make safe choices when using materials and equipment	• plan scientific investigations with guidance • conduct scientific investigations to find answers to questions • use appropriate materials and equipment safely (ACSIS054, ACSIS065) • consider and apply the elements of fair tests • collect and record accurate, honest observations using labelled observational drawings, basic formal measurements and digital technologies as appropriate (ACSIS055, ACSIS066) • reflect on investigations, including whether testing was fair or not (ACSIS058, ACSIS069) • participate individually and collaboratively with clear roles and goals	• identify questions to investigate scientific ideas • plan and apply the elements of scientific investigations to answer problems • identify potential risks in planning investigations • manage resources safely (ACSIS086, ACSIS103) • decide which variable(s) is to be changed, measured and kept the same, in fair tests • select appropriate measurement methods, including formal measurements and digital technologies, to record data accurately and honestly (ACSIS087, ACSIS104) • reflect on and make suggestions to improve fairness, accuracy and efficacy of a scientific investigation (ACSIS091, ACSIS108) • manage investigations effectively, individually and in groups

Processing and analysing data

Early Stage 1	Stage 1	Stage 2	Stage 3
• engage in discussions about observations • represent ideas based on results of investigations (ACSIS233)	• use a range of methods to sort and collate information • represent information using drawings and simple tables, including digital representation methods (ACSIS027, ACSIS040)	• use a range of methods to represent data, including tables and column graphs • identify patterns and trends in gathered data (ACSIS057, ACSIS068) • compare results with predictions • suggest possible reasons for findings (ACSIS215, ACSIS216)	• construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data • employ appropriate technologies to represent data (ACSIS090, ACSIS107) • compare data with predictions • present data as evidence in developing explanations (ACSIS218, ACSIS221)

Communicating

Early Stage 1	Stage 1	Stage 2	Stage 3
• share observations and ideas based on guided investigations (ACSIS012)	• represent and communicate observations and ideas in a variety of ways (ACSIS029, ACSIS042)	• represent and communicate observations, ideas and findings, using formal and informal representations (ACSIS060, ACSIS071)	• communicate ideas, explanations and processes, using scientific representations including multimodal forms (ACSIS093, ACSIS110)

Design and Production Skills Continuum

Identifying and defining

Early Stage 1	Stage 1	Stage 2	Stage 3
• identify and describe needs or opportunities for designing • identify the technologies needed to achieve designed solutions (ACTDEP005) • follow a sequence of steps and decisions (algorithms) needed to solve problems • order a sequence of steps and decisions (algorithms) needed to solve problems (ACTDIP004)	• recognise needs or opportunities for designing solutions through evaluating products • investigate and explain the needs of an audience in defining a problem • identify technologies and appropriate materials needed to realise designed solutions (ACTDEP005) • follow a sequence of steps and decisions (algorithms) to solve problems • segment, describe and represent a sequence of steps and decisions (algorithms) needed to solve problems (ACTDIP004)	• critique needs or opportunities for designing solutions through evaluating products and processes • define a need or opportunity according to functional and aesthetic criteria • consider potential resources in defining design needs and opportunities • investigate and research materials, components, tools and techniques to produce design solutions (ACTDEP014) • define simple problems by determining and defining a process • develop a sequence of steps and decisions (algorithms) to solve a problem (ACTDIP010)	• examine and critique needs, opportunities or modifications using a range of criteria to define a project • define a need or opportunity according to functional and aesthetic criteria • consider availability and sustainability of resources when defining design needs and opportunities • investigate materials, components, tools, techniques and processes required to achieve intended design solutions (ACTDEP024) • examine and determine functional requirements to define a problem • identify data required to formulate algorithms to improve a process (ACTDIP017)

Researching and planning

Early Stage 1	Stage 1	Stage 2	Stage 3
• generate and express ideas for design possibilities • consider available resources when planning design solutions • record and express design ideas through drawings and play-based models, supported with explanations and descriptions, including digital recordings (ACTDEP006)	• generate ideas for design solutions for a defined purpose • consider sustainable use of resources in planning design solutions • develop design ideas in response to defined brief • record design ideas using labelled and annotated drawings including simple digital graphic representations (ACTDEP006)	• identify and define a design problem with consideration of practical and aesthetic needs • consider sustainable use of resources and time constraints in planning design solutions • develop, record and communicate design ideas and decisions using appropriate technical terms • produce labelled and annotated drawings including digital graphic representations (ACTDEP015) • plan a sequence of production steps when producing designed solutions individually and collaboratively (ACTDEP018)	• research, identify and define design ideas and processes for an audience • consider functional and aesthetic needs in planning a design solution • develop, record and communicate design ideas, decisions and processes using appropriate technical terms • produce labelled and annotated drawings including digital graphic representations for an audience (ACTDEP025) • consider sustainability of resources when researching and planning design solutions • manage projects within time constraints • design, modify and follow simple algorithms • extend sequences of steps to provide a series of possibilities through branching • develop solutions through trialling and refining using iterations (ACTDIP019)

Producing and implementing

Early Stage 1	Stage 1	Stage 2	Stage 3
• develop skills to safely manage tools • explore and manipulate materials to discover possibilities of their uses • produce designed solutions through iteration (ACTDEP007) • sequence steps to solve a problem with guidance • collaborate to improve ideas and solve a problem (ACTDEP009)	• effectively manage a variety of tools • manipulate a range of materials for a purpose • consider safety, sustainability and time constraints when producing solutions (ACTDEP007) • segment and sequence steps for making designed solutions • collaborate to develop designed solutions • perform strategic roles within a group to solve a problem (ACTDEP009) • collect, sort, organise and present data to communicate information (ACTDIP003)	• select appropriate tools for a specific purpose • select and effectively manipulate appropriate materials for a specific purpose • use safe work practices • consider sustainability and constraints when choosing resources and managing time in the production of designed solutions (ACTDEP016) • generate visual programs using algorithms to create simple digital solutions • organise and perform strategic roles within a group to solve a problem • collect, access and present data, using software to present and communicate information and solve problems (ACTDIP009)	• select and use tools competently for specific purposes • accurately cut, join, bend and measure a range of selected materials to construct the designed solution • demonstrate safety and sustainability when choosing resources to produce designed solutions, managing constraints and maximising opportunities (ACTDEP026) • develop project plans that consider resources when producing designed solutions individually and collaboratively (ACTDEP028) • implement digital solutions as visual programs involving branching, iteration and user input (ACTDIP020) • work collaboratively to share, appraise and improve ideas to achieve design purposes • identify, organise and perform strategic roles within a group to solve a problem • acquire, store, access and validate different types of data, and use a range of software to present, interpret and visualise data (ACTDIP016)

Testing and evaluating

Early Stage 1	Stage 1	Stage 2	Stage 3
• evaluate success of design ideas, processes or solutions according to personal preferences and/or predetermined criteria • consider and discuss the impact of a design solution within an environment (ACTDEP008) • explore how people safely use information systems to meet information, communication and recreation needs (ACTDIP005)	• evaluate the success of design ideas, processes and solutions according to a scale of personal preference • identify the positive and negative impact of a design solution within an environment (ACTDEP008) • explore how people safely use information systems to meet information, communication and recreation needs (ACTDIP005)	• develop a set of criteria for success with guidance, based on defined needs and opportunities • develop criteria to evaluate the environmental impact of a design with guidance • devise a fair process to test a designed solution with guidance • evaluate design ideas, processes and solutions, based on criteria for success (ACTDEP017) • explain how existing information systems meet personal, school or community needs (ACTDIP012)	• negotiate criteria for success, based on defined needs, sustainability and aesthetics • develop appropriate and fair processes to test a designed solution according to criteria • evaluate design ideas, processes and solutions according to criteria for success (ACTDEP027) • explain how students' solutions and existing information systems meet current and future local community needs (ACTDIP021)

Thinking Skills

Productive, purposeful and intentional thinking underpins effective learning in Science and Technology. Students are provided with opportunities to apply thinking skills, develop an understanding of the processes they can use as they encounter problems, unfamiliar information and new ideas.

Thinking skills are coded throughout the syllabus content. Where appropriate, teachers are encouraged to identify further opportunities to develop these skills in their students.

Computational thinking – ComT

Computational thinking is a process where a problem is analysed and solved so that a human, machine or computer can effectively implement the solution. It involves using strategies to organise data logically, break down problems into parts, interpret patterns and design and implement algorithms to solve problems.

Design thinking – DesT

Design thinking is a process where a need or opportunity is identified and a design solution is developed. The consideration of economic, environmental and social impacts that result from designed solutions are core to design thinking. Design thinking methods can be used when trying to understand a problem, generate ideas and refine a design based on evaluation and testing.

Scientific thinking – SciT

Scientific thinking is purposeful thinking that has the objective to enhance knowledge. A scientific thinker raises questions and problems, observes and gathers data, draws conclusions based on evidence, tests conclusions, thinks with an open mind and communicates research findings appropriately.

Systems thinking – SysT

Systems thinking is an understanding of how related objects or components interact to influence how a system functions. Students are provided with opportunities to recognise the connectedness of, and interactions between phenomena, people, places and events in local and wider contexts and consider the impact of their decisions. Understanding the complexity of systems and the interdependence of components is important for scientific research and for the creation of solutions to technical, economic and social issues.

Content Strand Summaries

Living World

The Living World strand explores living things and their needs. The key concepts developed within this strand are: living things have similar characteristics; are interdependent and interact with each other and their environment; living things and their features are related to the environments in which they live. Through this strand, students explore life cycles, structural adaptations and behaviours of living things. These developmental features and characteristics aid survival in particular environments.

Food and fibre are the human-produced or harvested resources used to directly sustain human life and are produced in managed environments, such as farms and plantations. Students develop knowledge and understanding about the managed systems that produce food and fibre through creating designed solutions. Students also develop knowledge, understanding and an appreciation for a variety of foods, sound nutrition principles and food preparation skills when making food decisions.

Material World

The Material World strand explores the characteristics and observable properties of substances and materials. Students explore how materials can be changed and combined. They explore change of state and investigate how chemicals can be combined and separated.

Students develop knowledge and understanding of the characteristics and properties of a range of materials in the development of projects. They build an awareness of the strengths and limitations of materials and integrate this knowledge into design decisions. Students develop an appreciation that the selection of materials and processes should be guided by informed consideration of ethical issues and the sustainability of resources.

Physical World

The Physical World strand explores the physical characteristics of objects and how this affects their movement. Light, sound and heat are identified as forms of energy that may be transferred and transformed, and explore the difference between contact and non-contact forces.

Students develop knowledge and understanding of forces, energy and the properties of materials and their behaviour on the performance of designed engineering solutions. They investigate how electrical energy can control movement in products and systems and learn how engineered products, services and environments can be designed and produced sustainably.

Earth and Space

The Earth and Space strand explores the Earth’s dynamic structure and its place in the universe. Students explore changes on Earth, such as day and night, and the seasons related to Earth’s rotation and its orbit around the Sun.

Students investigate the processes that result in changes to the Earth’s surface. They explore the ways in which we use Earth’s resources and consider the influence of human activity on the Earth’s surface and its atmosphere.

Digital Technologies

The Digital Technologies strand provides students with opportunities to investigate existing technologies and create digital solutions. They explore the automation of repetitive tasks through developing their own software and by using existing software packages. Through knowledge and understanding of digital technologies, students are encouraged to become critical consumers of information and creative producers of digital solutions.

Digital Technologies explores key concepts from computer science, information systems, software engineering and project management. These key concepts form the intellectual underpinning of Digital Technologies that take it beyond the current technologies and skills students learn in the ICT capability.

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 NESA *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
- 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

NESA 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 and Technology K–6 Syllabus* in the following ways.

Aboriginal and Torres Strait Islander Histories and Cultures

Science and Technology 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 and responding to environmental factors within specific contexts. It emphasises the relationships people have with places and their interconnectedness with the environments in which they live. Students learn about Aboriginal and Torres Strait Islander Peoples' understanding of the environment and the ways that traditional knowledge and Western scientific knowledge can be complementary. Students learn that there are different ways of interacting with the environment and how this can influence sustainability.

When planning and programming content relating to Aboriginal and Torres Strait Islander histories and cultures, teachers are encouraged to:

- involve local Aboriginal communities and/or appropriate knowledge holders in determining suitable resources, or to use Aboriginal or Torres Strait Islander authored or endorsed publications
- read the *Principles and Protocols* relating to teaching and learning about Aboriginal and Torres Strait Islander histories and cultures and the involvement of local Aboriginal communities.

Asia and Australia's Engagement with Asia

The syllabus provides students with opportunities to recognise that the Asia region includes diverse environments. Students develop an appreciation of how interactions within and between these environments impact on human activity and influence the region and the rest of the world. Students identify how the Asia region plays an important role in scientific research and development in manufacturing technologies.

Sustainability

Science and Technology provides students with opportunities to develop an awareness of sustainable practices, careful and responsible management of natural resources to ensure that they are available for future generations. Sustainability content is focused on renewable resources, the protection of environments and requires consideration of environmental, social, cultural and economic systems and their interdependence. Students are encouraged to consider sustainability and develop an appreciation of the impact that design solutions can have on the Earth's resources. Sustainability education is futures-oriented, creating a more ecologically and socially just world through informed choices. Actions that support more sustainable patterns of living require students to participate critically and act creatively in determining more sustainable ways of living.

Critical and Creative Thinking

Critical and creative thinking are embedded in the skills and processes of Working Scientifically, and Design and Production. Students develop critical and creative thinking skills as they pose questions, make predictions, engage in firsthand investigations, design projects, make evidence-based decisions, and analyse and evaluate evidence. Through critical and creative thinking students are encouraged to apply new ideas, make connections, explore alternative explanations, recognise or develop an argument, use evidence in support of that argument, draw reasoned conclusions, and use information to solve problems.

Ethical Understanding

Students identify and investigate the nature of ethical concepts, values and principles, and understand how reasoning can assist ethical judgement. The syllabus provides opportunities for students to form and make ethical judgements in relation to scientific investigations, design solutions, codes of practice, use of digital technologies and online collaborative environments. Students apply ethical guidelines in their investigations and design projects, particularly in their implications for others and the environment. Students are encouraged to demonstrate ethical digital citizenship as they learn the importance of protecting data, intellectual property, and social and ethical protocols.

Information and Communication Technology Capability

Students have opportunities to develop ICT capability when they develop design ideas and solutions, research scientific concepts and applications, investigate scientific phenomena, and communicate their scientific and technological understandings. Students access information enabling them to communicate scientific and technological ideas. They collect and analyse and, where appropriate, model and interpret concepts and relationships. Digital technologies, through animations and simulations, provide opportunities to view phenomena, test predictions and visualise designs that cannot be investigated or produced through practical experiences in the classroom and may enhance students' understanding and engagement with science and technology.

The ICT capability enables students to become effective users of information and communication technologies. The Digital Technologies strand is distinguished by providing students with the skills to become confident developers of digital solutions.

Intercultural Understanding

Students develop intercultural understanding and value their own culture and those of others as they engage with people of diverse cultures in ways that recognise similarities and differences, create connections and cultivate respect. The 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 recognise that people in science and technology professions work in culturally diverse teams. They learn about the interactions between technologies and society, and take responsibility for securing positive outcomes for members of all cultural groups.

Literacy

Literacy is the ability to use a repertoire of knowledge and skills to effectively communicate and comprehend 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/or digital forms of expression. The syllabus provides students with 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 discuss, question and evaluate ideas, provide explanations, formulate predictions, draw conclusions, and construct evidence-based arguments as they communicate ideas and findings. They learn that scientific and technological information can be presented in the form of diagrams, infographics, flowcharts, models, tables and graphs.

Numeracy

Science and Technology provides students with opportunities to develop numeracy skills through practical measurement and the collection, representation and interpretation of data from firsthand investigations and secondary sources. Students become numerate as they develop the confidence, willingness and ability to apply mathematics in their lives in constructive and meaningful ways. Students develop data analysis skills as they identify trends and patterns from numerical data and graphs. They use three-dimensional models, create accurate technical drawings and use computational thinking in decision-making processes when designing and creating solutions. They develop skills in working mathematically as they problem-solve, communicate, reason and justify their choices and decisions.

Personal and Social Capability

The study of Science and Technology enhances personal and social capability by expanding a student's capacity to question and solve problems. Students develop personal and social capability as they establish positive relationships, make responsible decisions, persevere and handle challenging situations. Through applying processes of Working Scientifically, and Design and Production, students are provided with opportunities to communicate, set goals, make decisions and develop independent and collaborative work practices.

Civics and Citizenship

The syllabus provides students with opportunities to engage with scientific and technological advances to develop informed consumers. It equips them with the skills to make responsible and sustainable choices. Science and Technology aims to develop informed, evidence-based understanding and the capacity for responsible innovative problem-solving to positively contribute to Australian society in a global context. Students develop a sense of local responsibility and global citizenship as they improve and advance Australia through their investigations and future focused solutions.

Difference and Diversity

Difference and diversity comprises gender, ethnicity, ability and socio-economic circumstances. The syllabus provides opportunities for students to understand and appreciate the difference and diversity they experience in their everyday lives. Working Scientifically, and Design and Production provide opportunities for students to work collaboratively and 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

Science and Technology develops work-related skills and an appreciation of individual and collaborative work practices as students conduct investigations and participate in a process of design. Students have opportunities to innovate, be enterprising, practise value judgements and make responsible decisions. Students are provided with opportunities to prioritise safe practices as they consider the potential risks and hazards associated with the use of a variety of tools to conduct investigations and construct design solutions.

Content for Early Stage 1

Living World

Outcomes

A student:

› observes, questions and collects data to communicate ideas STe-1WS-S
› develops solutions to an identified need STe-2DP-T
› explores the characteristics, needs and uses of living things STe-3LW-ST

Content Focus

Early Stage 1 of the Living World strand focuses on living things, their characteristics, needs, behaviours, and the environment in which they live. Students explore how plants and animals satisfy our needs by providing us with the resources for the production of food and fibre. Early Stage 1 of this strand introduces students to the biological sciences and how food and fibre are used and are essential to society and its needs.

Skills Focus

Working Scientifically

Planning and conducting investigations

- make observations using senses through participation in guided scientific investigations
- record observations using drawings, simple digital recording methods, oral descriptions and/or simple visual representations (ACSIS011)
- work cooperatively with others to investigate ideas
- develop safe skills when using materials and equipment

Communicating

- share observations and ideas based on guided investigations (ACSIS012)

Design and Production

Identifying and defining

- identify and describe needs or opportunities for designing
- identify the technologies needed to achieve designed solutions (ACTDEP005)

Inquiry and Focus Questions

- What do we notice about living things?
- How can living things be used to meet our needs?

Content

Characteristics and basic needs of living things

Inquiry question: What do we notice about living things?

Students:

- recognise that living things have basic needs including air, food and water (ACSSU002)
- compare the basic needs of some plants and animals
- participate in guided investigations to identify living things and the external features of plants and animals in the local environment **SciT**
- communicate findings of observations of living things in their environment **SciT**

Using living things as food and fibre

Focus question: How can living things be used to meet our needs?

Students:

- recognise that plants and animals can be used as food, or materials (fibres) for clothing and shelter (ACTDEK003)
- explore a range of foods obtained from plants and animals, for example:
  - customary Aboriginal and Torres Strait Islander foods
  - foods from a range of cultures, eg African, American, German, Indian, Japanese
- explore everyday items that are designed and produced from fibres sourced from plants and animals, for example: **DesT**
  - fabrics and yarns used for clothing
  - wood products used for shelters

Material World

Outcomes

A student:

› observes, questions and collects data to communicate ideas STe-1WS-S
› develops solutions to an identified need STe-2DP-T
› identifies that objects are made of materials that have observable properties STe-4MW-ST

Content Focus

Early Stage 1 of the Material World strand focuses on the observable properties of materials and how they can be used for making useful products. Students investigate how the properties of materials determine their use in design solutions. Early Stage 1 of this strand introduces students to the materials sciences and design thinking.

Skills Focus

Working Scientifically

Planning and conducting investigations

- make observations using senses through participation in guided scientific investigations
- record observations using drawings, simple digital recording methods, oral descriptions and/or simple visual representations (ACSIS011)
- work cooperatively with others to investigate ideas
- develop safe skills when using materials and equipment (ACSIS011)

Processing and analysing data

- engage in discussions about observations
- represent ideas based on results of investigations (ACSIS233)

Design and Production

Researching and planning

- generate and express ideas for design possibilities
- consider available resources when planning design solutions
- record and express design ideas through drawings and play-based models, supported with explanations and/or descriptions, including digital recordings (ACTDEP006)

Producing and implementing

- develop skills to safely manage tools
- explore and manipulate materials to discover possibilities of their uses
- produce designed solutions through iteration (ACTDEP007)
- sequence steps to solve a problem with guidance
- collaborate to improve ideas and solve a problem (ACTDEP009)

Testing and evaluating

- evaluate success of design ideas, processes or solutions according to personal preferences and/or predetermined criteria
- consider and discuss the impact of a design solution within an environment (ACTDEP008)

Inquiry and Focus Questions

- What are some of the observable properties of materials?
- How do the properties of materials affect their use?

Content

Properties of materials can be observed

Inquiry question: What are some of the observable properties of materials?

Students:

- observe and describe some properties of a range of materials (ACSSU003) **SciT**
- explore the use of materials in the built environment based on their properties **DesT**

Materials are selected to suit specific purposes

Focus question: How do the properties of materials affect their use?

Students:

- identify and describe how the properties of different materials suit their design purpose (ACTDEK004) **DesT**
- plan, design and evaluate a product considering an identified need or opportunity (ACTDEK001) **DesT**

Physical World

Outcomes

A student:

› observes, questions and collects data to communicate ideas STe-1WS-S
› develops solutions to an identified need STe-2DP-T
› observes the way objects move and relates changes in motion to push and pull forces STe-5PW-ST

Content Focus

Early Stage 1 of the Physical World strand focuses on the physical characteristics of objects and the effects of these on how they move. This Early Stage 1 strand allows students to investigate how push and pull forces create movement and introduces the fundamental concepts of force and motion.

Skills Focus

Working Scientifically

Questioning and predicting

- pose questions about familiar objects and events
- respond to questions about familiar objects and events (ACSIS014)

Planning and conducting investigations

- make observations using senses through participation in guided scientific investigations
- record observations using drawings, simple digital recording methods, oral descriptions and/or simple visual representations (ACSIS011)
- work cooperatively with others to investigate ideas
- develop safe skills when using materials and equipment

Design and Production

Identifying and defining

- identify and describe needs or opportunities for designing
- identify the technologies needed-to achieve designed solutions (ACTDEP005)

Producing and implementing

- develop skills to safely manage tools
- explore and manipulate materials to discover possibilities of their uses
- produce designed solutions through iteration (ACTDEP007)
- sequence steps to solve a problem with guidance
- collaborate to improve ideas and solve a problem (ACTDEP009)

Inquiry and Focus Questions

- What causes objects to move in different ways?

Content

Movement of objects

Inquiry question: What causes objects to move in different ways?

Students:

- observe the way a variety of familiar objects move, for example: (ACSSU005)
  - sliding
  - rolling
  - spinning
  - bouncing
- observe the effects of push and pull forces on familiar objects, for example: (ACSSU033) **SciT**
  - changes in motion, eg starting, stopping, changing speed or direction
  - changes in shape, eg stretching, breaking
- participate in guided investigations to explore how particular objects move on land, water and/or in the air, and how these objects are affected by forces (ACTDEK002) **SciT**

Earth and Space

Outcomes

A student:

› observes, questions and collects data to communicate ideas STe-1WS-S
› identifies how daily and seasonal changes in the environment affect humans and other living things STe-6ES-S

Content Focus

Early Stage 1 of the Earth and Space strand focuses on daily and seasonal changes in the environment. Students investigate how living things respond to these changes in the environment. Early Stage 1 of this strand introduces students to the foundational understanding of the Earth as a dynamic interrelated part of physical and biological systems.

Skills Focus

Working Scientifically

Questioning and predicting

- pose questions about familiar objects and events
- respond to questions about familiar objects and events (ACSIS014)

Processing and analysing data

- engage in discussions about observations
- represent ideas based on results of investigations (ACSIS233)

Design and Production

Identifying and defining

- identify and describe needs or opportunities for designing
- identify the technologies needed to achieve designed solutions (ACTDEP005)

Inquiry and Focus Questions

- How do daily and seasonal changes affect the environment?

Content

Changes in the environment

Inquiry question: How do daily and seasonal changes affect the environment?

Students:

- identify daily and seasonal changes that occur in our environment, such as day and night, and changes in the weather, for example: (ACSSU004) **ComT, SysT**
  - daily temperature variation
  - monthly rain, snow or frost
- explore how living things respond to regular changes in their environment, for example:
  - animals that migrate or hibernate
  - changes in human behaviour and clothing
- observe, ask questions about and describe changes in objects and events (ACSHE013) **SciT**

Digital Technologies

Outcomes

A student:

› develops solutions to an identified need STe-2DP-T
› identifies digital systems and explores how instructions are used to control digital devices STe-7DI-T

Content Focus

Early Stage 1 of the Digital Technologies strand focuses on digital systems and how they are used to communicate. Students explore how algorithms can be used to solve problems. Early Stage 1 of this strand introduces students to computational thinking.

Skills Focus

Working Scientifically

Communicating

- share observations and ideas based on guided investigations (ACSIS012)

Design and Production

Identifying and defining

- follow a sequence of steps and decisions (algorithms) needed to solve problems
- order a sequence of steps and decisions (algorithms) needed to solve problems (ACTDIP004)

Testing and evaluating

- evaluate success of design ideas, processes or solutions according to personal preferences and/or predetermined criteria
- explore how people safely use information systems to meet information, communication and recreation needs (ACTDIP005)

Inquiry and Focus Questions

- How are digital technologies used in everyday life?
- How does following steps help to achieve a goal?

Content

Digital systems

Focus question: How are digital technologies used in everyday life?

Students:

- explore familiar digital devices, for example: (ACTDIK001) **ComT SysT**
  - a computer
  - a device to take a digital image
- explore how people use digital systems to communicate
- explore the uses of digital devices in developing and sustaining Aboriginal and Torres Strait Islander histories, cultures and languages, for example:
  - a language app
  - an online video for storytelling

Sequencing instructions

Focus question: How does following steps help to achieve a goal?

Students:

- follow and describe a sequence of steps (algorithms), for example: **ComT DesT SysT**
  - following a procedure, eg getting dressed for school in the morning
  - following a recipe, eg baking a cake
- design a process to solve an identified problem, for example: **ComT SysT**
  - set of instructions to get from one point to another
  - set of instructions to log on to a computer

Content for Stage 1

Living World

Outcomes

A student:

› observes, questions and collects data to communicate and compare ideas ST1-1WS-S
› uses materials, tools and equipment to develop solutions for a need or opportunity ST1-2DP-T
› describes observable features of living things and their environments ST1-4LW-S
› identifies how plants and animals are used for food and fibre products ST1-5LW-T

Content Focus

Stage 1 of the Living World strand focuses on the features of living things, their environment and how they change and reproduce. Students investigate how plants and animals are used to satisfy our needs for food and fibre. Stage 1 of this strand develops students' understanding of how living things and their environment play a central role in the support for and survival of humans.

Skills Focus

Working Scientifically

Planning and conducting investigations

- explore and answer questions through participation in guided scientific investigations (ACSIS025, ACSIS038)
- collect data from observations
- record observations accurately and honestly using observational drawings, labelling, informal measurements and digital technologies (ACSIS026, ACSIS039)
- compare observations with those of others (ACSIS041, ACSIS213)
- develop collaboration skills to effectively conduct investigations
- make safe choices when using materials and equipment

Processing and analysing data

- use a range of methods to sort and collate information
- represent information using drawings and simple tables, including digital representation methods (ACSIS027, ACSIS040)

Design and Production

Researching and planning

- generate ideas for design solutions for a defined purpose
- consider sustainable use of resources in planning design solutions
- develop design ideas in response to defined brief
- record design ideas using labelled and annotated drawings including simple digital graphic representations (ACTDEP006)

Producing and implementing

- effectively manage a variety of tools
- manipulate a range of materials for a purpose
- consider safety, sustainability and time constraints when producing solutions (ACTDEP007)
- segment and sequence steps for making designed solutions
- collaborate to develop designed solutions
- perform strategic roles within a group to solve a problem (ACTDEP009)

Inquiry and Focus Questions

- What are the external features of living things?
- How can we improve a local environment to encourage living things to thrive?
- How do living things change as they grow?
- How do humans use plants and animals?

Content

External features of living things

Inquiry question: What are the external features of living things?

Students:

- describe the external features of a variety of living things (ACSSU017)
- identify and group plants and animals using their external features, for example: **SciT SysT**
  - native and introduced plants and animals
  - worms, insects, fish, reptiles, birds and mammals

Living things live in different places

Inquiry question: How can we improve a local environment to encourage living things to thrive?

Students:

- identify that living things live in different places that suit their needs (ACSSU211)
- design and produce an environment to cater for the needs of a living thing, for example: **DesT**
  - encourage the growth of a plant, eg greenhouses, hydroponics
  - encourage the return of a living thing to a local habitat
- recognise that people use science and technology in their daily lives, including when caring for their environment and living things (ACSHE022, ACSHE035)

Living things change

Inquiry question: How do living things change as they grow?

Students:

- explore how living things grow, change and have offspring similar to themselves (ACSSU030) **SciT**
- record the changes in growth of a common plant or animal, using uniform informal units and appropriate technologies **ComT SysT**

Plants and animals used for food and fibre

Focus question: How do humans use plants and animals?

Students:

- identify some plants and animals that are grown and used for food production (ACTDEK003) **SysT**
- explore the plants and animals used in customary practices of Aboriginal and Torres Strait Islander Peoples
- explore the tools, equipment and techniques used to prepare food safely and hygienically for healthy eating (ACTDEK003) **SysT**
- investigate ways people use scientific and technological knowledge and skills to sustainably grow plants and animals to produce fibre for clothing and/or shelter **SciT**

Material World

Outcomes

A student:

› observes, questions and collects data to communicate and compare ideas ST1-1WS-S
› uses materials, tools and equipment to develop solutions for a need or opportunity ST1-2DP-T
› identifies that materials can be changed or combined ST1-6MW-S
› describes how the properties of materials determine their use ST1-7MW-T

Content Focus

Stage 1 of the Material World strand focuses on how materials can be changed, manipulated and combined. Students have the opportunity to develop a design solution demonstrating the suitability of materials for a purpose. Stage 1 of this strand develops students' understanding of the properties of materials and their uses.

Skills Focus

Working Scientifically

Questioning and predicting

- pose questions about familiar objects and events
- respond to questions and make predictions about familiar objects and events (ACSIS024, ACSIS037)

Planning and conducting investigations

- explore and answer questions through participation in guided scientific investigations (ACSIS025, ACSIS038)
- collect data from observations
- record observations accurately and honestly using observational drawings, labelling, informal measurements and digital technologies (ACSIS026, ACSIS039)
- compare observations with those of others (ACSIS041, ACSIS213)
- develop collaboration skills to effectively conduct investigations
- make safe choices when using materials and equipment

Design and Production

Producing and implementing

- effectively manage a variety of tools
- manipulate a range of materials for a purpose
- consider safety, sustainability and time constraints when producing solutions (ACTDEP007)
- segment and sequence steps for making designed solutions
- collaborate to develop designed solutions
- perform strategic roles within a group to solve a problem (ACTDEP009)

Testing and evaluating

- evaluate the success of design ideas, processes and solutions according to a scale of personal preference
- identify the positive and negative impact of a design solution within an environment (ACTDEP008)

Inquiry and Focus Questions

- What changes occur when materials are combined?
- How do the properties of materials determine their use?

Content

Materials can be combined and changed

Inquiry question: What changes occur when materials are combined?

Students:

- investigate how materials can be changed by bending, twisting and stretching (ACSSU018) **DesT SysT**
- investigate how different materials can be combined (ACSSU031) **SciT**

Materials are used for a specific purpose

Focus question: How do the properties of materials determine their use?

Students:

- identify a range of natural materials available locally or through trade used by Aboriginal and/or Torres Strait Islander Peoples for a specific cultural purpose **DesT SysT**
- design and evaluate a product, demonstrating understanding of the suitability of materials for a purpose **DesT SysT**

Physical World

Outcomes

A student:

› observes, questions and collects data to communicate and compare ideas ST1-1WS-S
› uses materials, tools and equipment to develop solutions for a need or opportunity ST1-2DP-T
› describes common forms of energy and explores some characteristics of sound energy ST1-8PW-S
› investigates how forces and energy are used in products ST1-9PW-ST

Content Focus

Stage 1 of the Physical World strand focuses on the identification of light, sound and heat energy, and how they are sensed and produced. Stage 1 of this strand allows students to further develop their understanding of forces and energy and how these can be used for specific purposes in products.

Skills Focus

Working Scientifically

Processing and analysing data

- use a range of methods to sort and collate information
- represent information using drawings and simple tables, including digital representation methods (ACSIS027, ACSIS040)

Communicating

- represent and communicate observations and ideas in a variety of ways (ACSIS029, ACSIS042)

Design and Production

Researching and planning

- generate ideas for design solutions for a defined purpose
- consider sustainable use of resources in planning design solutions
- record design ideas using labelled and annotated drawings including simple digital graphic representations (ACTDEP006)

Producing and implementing

- effectively manage a variety of tools
- manipulate a range of materials for a purpose
- consider safety, sustainability and time constraints when producing solutions (ACTDEP007)
- segment and sequence steps for making designed solutions
- collaborate to develop designed solutions
- perform strategic roles within a group to solve a problem (ACTDEP009)

Inquiry and Focus Questions

- What are the different forms of energy around us and how can we detect them?
- How are forces used for a purpose?

Content

Energy comes in different forms that can be detected

Inquiry question: What are the different forms of energy around us and how can we detect them?

Students:

- produce and describe different sounds, for example:
  - by blowing, scraping, striking, shaking
  - by observing musical instruments from different cultures
- explore how the volume and pitch of a sound can be changed **SciT**
- identify sound, light, heat, electricity and movement as forms of energy (ACSSU020)
- explore sound, light and heat from various sources, using the senses (ACSSU020) **SciT**

Forces and energy in products

Focus question: How are forces used for a purpose?

Students:

- explore how technologies use forces to create movement in products (ACTDEK002) **SysT**
- design and develop a product that uses one or more forms of energy to create change **DesT SysT**

Earth and Space

Outcomes

A student:

› observes, questions and collects data to communicate and compare ideas ST1-1WS-S
› recognises observable changes occurring in the sky and on the land and identifies Earth's resources ST1-10ES-S

Content Focus

Stage 1 of the Earth and Space strand focuses on the observable changes that occur in the sky and landscape. Students explore how the Earth's resources are used and investigate their conservation. Stage 1 of this strand introduces students to regular atmospheric and astronomical events and their effect on the Earth and develops students' understanding of sustainability.

Skills Focus

Working Scientifically

Planning and conducting investigations

- explore and answer questions through participation in guided scientific investigations (ACSIS025, ACSIS038)
- collect data from observations
- record observations accurately and honestly using observational drawings, labelling, informal measurements and digital technologies (ACSIS026, ACSIS039)
- compare observations with those of others (ACSIS041, ACSIS213)
- develop collaboration skills to effectively conduct investigations
- make safe choices when using materials and equipment

Processing and analysing data

- use a range of methods to sort and collate information
- represent information using drawings and simple tables, including digital representation methods (ACSIS027, ACSIS040)

Design and Production

Identifying and defining

- recognise needs or opportunities for designing solutions through evaluating products
- investigate and explain the needs of an audience in defining a problem
- identify technologies and appropriate materials needed to realise designed solutions (ACTDEP005)

Inquiry and Focus Questions

- How can we investigate the observable changes that occur in the sky and on the land?
- What are Earth's resources and how do we use and care for them?

Content

Changes in the sky and on the land

Inquiry question: How can we investigate the observable changes that occur in the sky and on the land?

Students:

- record the observable changes that occur in the sky and on the land, for example: (ACSSU019) **SysT**
  - patterns in the position of the Sun across a day
  - the appearance of the Moon and stars at night
  - changes in the shape of the Moon
- identify how seasonal changes in our daily lives affect living things **SciT**
- collect data related to short-term weather events and long-term seasonal patterns, to inform others using appropriate communication techniques **SciT**
- observe, ask questions about and describe changes in objects and events (ACSHE021, ACSHE034) **SciT**

Earth's resources

Inquiry question: What are Earth's resources and how do we use and care for them?

Students:

- identify and explore the use of a variety of Earth's resources including water and soil (ACSSU032)
- identify how Aboriginal Peoples care for Earth's resources on-Country, for example:
  - ochre
  - fish
  - seeds
- plan and implement strategies considering conservation of resources to address sustainability and to meet personal and/or community needs, for example: (ACTDEK001) **DesT SysT**
  - turning off dripping taps
  - turning off unnecessary lights
  - reusing/recycling campaigns

Digital Technologies

Outcomes

A student:

› uses materials, tools and equipment to develop solutions for a need or opportunity ST1-2DP-T
› describes, follows and represents algorithms to solve problems ST1-3DP-T
› identifies the components of digital systems and explores how data is represented ST1-11DI-T

Content Focus

Stage 1 of the Digital Technologies strand focuses on digital systems and their components. Students investigate how digital systems display data and use a sequence of steps and decisions (algorithms) to solve problems. Stage 1 of this strand develops students' understanding of how digital systems use algorithms to communicate.

Skills Focus

Working Scientifically

Processing and analysing data

- use a range of methods to sort and collate information
- represent information using drawings and simple tables, including digital representation methods (ACSIS027, ACSIS040)

Communicating

- represent and communicate observations and ideas in a variety of ways (ACSIS029, ACSIS042)

Design and Production

Identifying and defining

- follow a sequence of steps and decisions (algorithms) to solve problems
- segment, describe and represent a sequence of steps and decisions (algorithms) needed to solve problems (ACTDIP004)

Producing and implementing

- collaborate to develop designed solutions
- perform strategic roles within a group to solve a problem (ACTDEP009)
- collect, sort, organise and present data to communicate information (ACTDIP003)

Testing and evaluating

- explore how people safely use information systems to meet information, communication and recreation needs (ACTDIP005)

Inquiry and Focus Questions

- What components might make up a digital system?
- What is data and how can we store and represent it?
- How can we record instructions for others to follow and understand?

Content

Digital systems and their components

Focus question: What components might make up a digital system?

Students:

- identify hardware and software components of digital systems (ACTDIK001) **ComT SysT**
- identify a variety of uses for digital systems, for example: **ComT SysT**
  - recording information, eg a digital photograph
  - storing information, eg saving a digital file
- communicate, collaborate and share information safely, using digital systems, for example: (ACTDIP006)
  - email
  - online collaboration tools

Representation and analysis of data

Focus question: What is data and how can we store and represent it?

Students:

- identify how data is represented as pictures, symbols and diagrams
- collect, explore and sort data, and use digital systems to present the data creatively
- explore and identify patterns in data (ACTDIK002) **ComT SysT**

Writing and recording sequences and instructions

Focus question: How can we record instructions for others to follow and understand?

Students:

- follow and represent sequences of steps and decisions (algorithms) to solve problems, for example: **ComT SysT**
  - controlling a digital device remotely
  - presenting a sequence of instructions, eg using a visual programming language
- test and evaluate the effectiveness of steps and decisions (algorithms) in solving a problem

Content for Stage 2

Living World

Outcomes

A student:

› questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations ST2-1WS-S
› selects and uses materials, tools and equipment to develop solutions for a need or opportunity ST2-2DP-T
› compares features and characteristics of living and non-living things ST2-4LW-S
› describes how agricultural processes are used to grow plants and raise animals for food, clothing and shelter ST2-5LW-T

Content Focus

Stage 2 of the Living World strand focuses on the classification, life cycles and survival of living things. Students consider the agricultural processes used to grow plants and raise animals. Students design and produce a product or system to support the growth of a plant and/or animal.

Skills Focus

Working Scientifically

Planning and conducting investigations

- plan scientific investigations with guidance
- conduct scientific investigations to find answers to questions
- use appropriate materials and equipment safely (ACSIS054, ACSIS065)
- consider and apply the elements of fair tests
- collect and record accurate, honest observations using labelled observational drawings, basic formal measurements and digital technologies as appropriate (ACSIS055, ACSIS066)
- reflect on investigations, including whether testing was fair or not (ACSIS058, ACSIS069)
- participate individually and collaboratively with clear roles and goals

Processing and analysing data

- use a range of methods to represent data, including tables and column graphs
- identify patterns and trends in gathered data (ACSIS057, ACSIS068)
- compare results with predictions
- suggest possible reasons for findings (ACSIS215, ACSIS216)

Communicating

- represent and communicate observations, ideas and findings, using formal and informal representations (ACSIS060, ACSIS071)

Design and Production

Identifying and defining

- critique needs or opportunities for designing solutions through evaluating products and processes
- define a need or opportunity according to functional and aesthetic criteria
- consider potential resources in defining design needs and opportunities
- investigate and research materials, components, tools and techniques to produce design solutions (ACTDEP014)

Researching and planning

- identify and define a design problem with consideration of practical and aesthetic needs
- consider sustainable use of resources and time constraints in planning design solutions
- develop, record and communicate design ideas and decisions using appropriate technical terms
- produce labelled and annotated drawings including digital graphic representations (ACTDEP015)
- plan a sequence of production steps when producing designed solutions individually and collaboratively (ACTDEP018)

Inquiry and Focus Questions

- How can we group living things?
- What are the similarities and differences between the life cycles of living things?
- How are environments and living things interdependent?
- How do we create food and fibre products from animals and plants?

Content

Classification of living things

Inquiry question: How can we group living things?

Students:

- collect data and identify patterns to group living things according to their external features, and distinguish them from non-living things (ACSSU044) **SysT**
- identify that science involves making predictions and describing patterns and relationships (ACSHE050, ACSHE061) **SciT**

Life cycles of living things

Inquiry question: What are the similarities and differences between the life cycles of living things?

Students:

- identify that living things have life cycles (ACSSU072)
- conduct an investigation into the life cycle of plants and/or animals (ACSSU072) **SciT**

Survival of living things

Inquiry question: How are environments and living things interdependent?

Students:

- describe how living things depend on each other and the environment to survive, for example: (ACSSU073) **SysT**
  - bees and flowers
  - birds eat and disperse seeds

Producing food and fibre from living things

Focus question: How do we create food and fibre products from animals and plants?

Students:

- investigate and compare advancing technologies used in food and fibre production in Australian agriculture and those used in traditional agriculture, for example: (ACTDEK012) **DesT SciT SysT**
  - automated farming using microcontrollers and sensors compared to animal-drawn equipment
  - autonomous vehicles to harvest crops compared to manual harvesting processes
- investigate food technologies and techniques used to produce healthy food, for example: **SciT**
  - peeling and segmenting/slicing fruits and vegetables
  - follow a recipe step by step
  - measure and mix dry ingredients
- design, plan and produce a product, system or environment to support the growth of a plant and/or animal that could be used in a healthy meal, for example: **DesT**
  - a greenhouse
  - a chicken coop
  - a watering system

Material World

Outcomes

A student:

› questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations ST2-1WS-S
› selects and uses materials, tools and equipment to develop solutions for a need or opportunity ST2-2DP-T
› describes how adding or removing heat causes a change of state ST2-6MW-S
› investigates the suitability of natural and processed materials for a range of purposes ST2-7MW-T

Content Focus

Stage 2 of the Material World strand focuses on how solids and liquids change state and the properties of natural and processed materials. Students investigate how different properties of materials affect their suitability for products. They have the opportunity to develop a design solution to an identified need or opportunity, using a variety of materials. Stage 2 of this strand develops students' knowledge and understanding of the properties and performance of materials and the material sciences.

Skills Focus

Working Scientifically

Questioning and predicting

- identify and pose questions in familiar contexts that can be investigated scientifically
- make predictions based on prior knowledge (ACSIS053, ACSIS064)

Planning and conducting investigations

- plan scientific investigations with guidance
- conduct scientific investigations to find answers to questions
- use appropriate materials and equipment safely (ACSIS054, ACSIS065)
- consider and apply the elements of fair tests
- collect and record accurate, honest observations using labelled observational drawings, basic formal measurements and digital technologies as appropriate (ACSIS055, ACSIS066)
- reflect on investigations, including whether testing was fair or not (ACSIS058, ACSIS069)
- participate individually and collaboratively with clear roles and goals

Design and Production

Researching and planning

- identify and define a design problem with consideration of practical and aesthetic needs
- consider sustainable use of resources and time constraints in planning design solutions
- develop, record and communicate design ideas and decisions using appropriate technical terms
- produce labelled and annotated drawings including digital graphic representations (ACTDEP015)
- plan a sequence of production steps when producing designed solutions individually and collaboratively (ACTDEP018)

Producing and implementing

- select appropriate tools for a specific purpose
- select and effectively manipulate appropriate materials for a specific purpose
- use safe work practices
- consider sustainability and constraints when choosing resources and managing time in production of designed solutions (ACTDEP016)

Inquiry and Focus Questions

- How do materials change when heated and cooled?
- How do you decide upon which material to use for a particular purpose?

Content

Changes of state

Inquiry question: How do materials change when heated and cooled?

Students:

- identify solids, liquids and gases as states of matter **SciT**
- recognise that a change of state can be caused by adding or removing heat (ACSSU046) **ComT SciT**
- describe examples of changes of state in everyday life **SysT**
- predict and observe the effects of adding or removing heat on a variety of solids and/or liquids **SciT**

Materials are used for a specific purpose

Focus question: How do you decide upon which material to use for a particular purpose?

Students:

- investigate how the properties of natural and processed materials influence their suitability and use in products, services and/or environments, for example: (ACSSU074, ACTDEK013) **DesT SciT**
  - elasticity
  - thermal conductivity
- develop a design solution for an identified need or opportunity, using a variety of tools and materials that considers factors such as sustainability and time (ACTDEK010) **DesT**
- identify the roles of people working in science and technology occupations (ACTDEK010)

Physical World

Outcomes

A student:

› questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations ST2-1WS-S
› selects and uses materials, tools and equipment to develop solutions for a need or opportunity ST2-2DP-T
› describes the characteristics and effects of common forms of energy, such as light and heat ST2-8PW-ST
› describes how contact and non-contact forces affect an object's motion ST2-9PW-ST

Content Focus

Stage 2 of the Physical World strand focuses on light, heat and electrical energy and how contact forces affect the behaviour of objects. Stage 2 of this strand develops their understanding of energy as a resource that can be generated and transferred. They investigate the interdependent relationship between energy and forces that affects the behaviour of objects. Students observe how energy and forces are used in the manufacture of products and in systems.

Skills Focus

Working Scientifically

Planning and conducting investigations

- plan scientific investigations with guidance
- conduct scientific investigations to find answers to questions
- use appropriate materials and equipment safely (ACSIS054, ACSIS065)
- consider and apply the elements of fair tests
- collect and record accurate, honest observations using labelled observational drawings, basic formal measurements and digital technologies as appropriate (ACSIS055, ACSIS066)
- reflect on investigations, including whether testing was fair or not (ACSIS058, ACSIS069)
- participate individually and collaboratively with clear roles and goals

Processing and analysing data

- use a range of methods to represent data, including tables and column graphs
- identify patterns and trends in gathered data (ACSIS057, ACSIS068)
- compare results with predictions
- suggest possible reasons for findings (ACSIS215, ACSIS216)

Design and Production

Identifying and defining

- critique needs or opportunities for designing solutions through evaluating products and processes
- define a need or opportunity according to functional and aesthetic criteria
- consider potential resources in defining design needs and opportunities
- investigate and research materials, components, tools and techniques to produce design solutions (ACTDEP014)
- define simple problems by determining and defining a process
- develop a sequence of steps and decisions (algorithms) to solve a problem (ACTDIP010)

Testing and evaluating

- develop a set of criteria for success with guidance, based on defined needs and opportunities
- develop criteria to evaluate the environmental impact of a design with guidance
- devise a fair process to test a designed solution with guidance
- evaluate design ideas, processes and solutions, based on criteria for success (ACTDEP017)

Inquiry and Focus Questions

- How do light, heat and electrical energy make things happen?
- How can objects affect other objects with or without touching them?
- How can we use forces and energy in a product or system?

Content

Energy makes things happen (heat, light and electricity)

Inquiry question: How do heat, light and electrical energy make things happen?

Students:

- investigate the behaviour of light, for example: (ACSSU080) **SciT**
  - light reflecting in a mirror and on a variety of different surfaces
  - shadows resulting from interruption of light by an object
- describe the effects of heat energy, for example:
  - melting
  - expanding
- explore ways that heat can be transferred due to conduction (ACSSU049) **SciT**
- explore some common sources and uses of electrical energy and describe different ways electrical energy can be generated sustainably, for example: (ACSSU219)
  - solar cells
  - hydroelectric power
  - wind turbines
  - geothermal power generation
  - wave power

Contact and non-contact forces

Inquiry question: How can objects affect other objects with or without touching them?

Students:

- identify that both pushes and pulls can be classified as contact and non-contact forces (ACSSU076)
- observe how contact and non-contact forces cause changes in the motion of objects, for example: (ACSSU076)
  - changes in speed
  - changes in direction

Forces and energy in products and systems

Focus question: How can we use forces and energy in a product or system?

Students:

- investigate how forces and materials interact in a product or system to perform a function (ACTDEK011) **ComT SciT SysT**

Earth and Space

Outcomes

A student:

› questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations ST2-1WS-S
› investigates regular changes caused by interactions between the Earth and the Sun, and changes to the Earth's surface ST2-10ES-S

Content Focus

Stage 2 of the Earth and Space strand focuses on the Earth's surface and how it changes over time. Students investigate natural processes and human activity in order to develop a view in relation to sustainable practices. Students explore the effect of the interactions between the Earth and the Sun.

Skills Focus

Working Scientifically

Processing and analysing data

- use a range of methods to represent data, including tables and column graphs
- identify patterns and trends in gathered data (ACSIS057, ACSIS068)
- compare results with predictions
- suggest possible reasons for findings (ACSIS215, ACSIS216)

Communicating

- represent and communicate observations, ideas and findings, using formal and informal representations (ACSIS060, ACSIS071)

Design and Production

Researching and planning

- identify and define a design problem with consideration of practical and aesthetic needs
- consider sustainable use of resources and time constraints in planning design solutions
- develop, record and communicate design ideas and decisions using appropriate technical terms
- produce labelled and annotated drawings including digital graphic representations (ACTDEP015)
- plan a sequence of production steps when producing designed solutions individually and collaboratively (ACTDEP018)

Inquiry and Focus Questions

- How do natural processes and human actions change the Earth's surface over time?
- What occurs as a result of the interactions between the Earth and the Sun?

Content

How the Earth's surface changes over time

Inquiry question: How do natural processes and human actions change the Earth's surface over time?

Students:

- investigate why the Earth's surface changes over time as a result of natural processes and human activity, for example: (ACSSU075) **SciT**
  - characteristics of soils
  - identify evidence of natural changes in landforms, rocks or fossils
- identify that scientific knowledge helps people understand the effect of their actions, for example: (ACSHE051, ACSHE062) **SciT**
  - investigate how erosion is caused by human activity, eg walking on bush trails
  - investigate how erosion can be minimised, eg constructing boardwalks

Earth's relationship with the Sun

Inquiry question: What occurs as a result of the interactions between the Earth and the Sun?

Students:

- identify the Sun as a major source of energy
- investigate how the Earth's rotation on its axis causes regular changes including night and day (ACSSU048) **SciT SysT**
- explore the relative sizes and movement of the Earth and the Sun, for example: **DesT SysT**
  - construct a way of observing and recording changes in the Sun's position in one day
  - compare times for the Earth to orbit the Sun
- investigate how changes in the environment are used by Aboriginal and Torres Strait Islander Peoples to develop seasonal calendars **SciT SysT**

Digital Technologies

Outcomes

A student:

› selects and uses materials, tools and equipment to develop solutions for a need or opportunity ST2-2DP-T
› defines problems, describes and follows algorithms to develop solutions ST2-3DP-T
› describes how digital systems represent and transmit data ST2-11DI-T

Content Focus

Stage 2 of the Digital Technologies strand focuses on digital systems and how they transmit data. Students explore different types of data, have the opportunity to learn how to interpret patterns and develop skills in visual programming. Stage 2 of this strand further develops students' knowledge and understanding of computational thinking and abstraction.

Skills Focus

Working Scientifically

Processing and analysing data

- use a range of methods to represent data, including tables and column graphs
- identify patterns and trends in gathered data (ACSIS057, ACSIS068)
- compare results with predictions
- suggest possible reasons for findings (ACSIS215, ACSIS216)

Design and Production

Identifying and defining

- consider potential resources in defining design needs and opportunities
- investigate and research materials, components, tools and techniques to produce design solutions (ACTDEP014)
- define simple problems by determining and defining a process
- develop a sequence of steps and decisions (algorithms) to solve a problem (ACTDIP010)

Producing and implementing

- generate visual programs using algorithms to create simple digital solutions
- organise and perform strategic roles within a group to solve a problem
- collect, access and present data, using software to present and communicate information and solve problems (ACTDIP009)

Testing and evaluating

- develop criteria to evaluate the environmental impact of a design with guidance
- explain how existing information systems meet common personal, school or community needs (ACTDIP012)

Inquiry and Focus Questions

- How do digital systems share information and instructions?
- Why do we represent data in different ways?
- How are algorithms used to develop digital systems?

Content

Digital Systems and the transmission of data

Focus question: How do digital systems share information and instructions?

Students:

- identify and explore a range of digital systems and peripheral devices (ACTDIK007) **ComT DesT SysT**
- explore how digital systems transmit different types of data **ComT SysT**
- investigate digital and information systems, and explore how they meet personal, school or community needs **SciT**

Representation and analysis of data

Focus question: Why do we represent data in different ways?

Students:

- recognise that numbers, text, images, sounds, animations and videos are all forms of data when stored or viewed using a digital system (ACTDIK008) **ComT SysT**
- investigate how the same data can be represented in different ways, eg codes and symbols **SciT**
- collect, access and present different types of data using simple software to create information and solve problems, for example: **ComT**
  - selecting appropriate formats or layouts for data, depending on its type and audience, eg graphs, tables or infographics
  - using software to sort and calculate data when solving problems, eg calculations in spreadsheets
- plan, create and communicate ideas and information, applying agreed ethical and social protocols (ACTDIP013) **ComT SysT**

Visual Programming

Focus question: How are algorithms used to develop digital systems?

Students:

- describe and follow a sequence of steps and decisions (algorithms) to solve defined problems involving branching and user input, for example: **ComT DesT SysT**
  - present food production instructions using a series of sequenced images, a set of written instructions and/or a flowchart involving branching
  - create and follow algorithms using branching
- design and produce digital solutions using a visual programming language (ACTDIP011) **ComT DesT**

Content for Stage 3

Living World

Outcomes

A student:

› plans and conducts scientific investigations to answer testable questions, and collects and summarises data to communicate conclusions ST3-1WS-S
› plans and uses materials, tools and equipment to develop solutions for a need or opportunity ST3-2DP-T
› examines how the environment affects the growth, survival and adaptation of living things ST3-4LW-S
› explains how food and fibre are produced sustainably in managed environments for health and nutrition ST3-5LW-T

Content Focus

Stage 3 of the Living World strand focuses on the growth and survival of living things and how their adaptations over time suit their environment. Students investigate how and why food and fibre are produced in sustainable, managed environments that enable people to grow and be healthy. This strand further develops students' knowledge and understanding of the environmental and biological sciences.

Skills Focus

Working Scientifically

Questioning and predicting

- pose testable questions
- make and justify predictions about scientific investigations (ACSIS231, ACSIS232)

Planning and conducting investigations

- identify questions to investigate scientific ideas
- plan and apply the elements of scientific investigations to answer problems
- identify potential risks in planning investigations
- manage resources safely (ACSIS086, ACSIS103)
- decide which variable(s) is to be changed, measured and kept the same, in fair tests
- select appropriate measurement methods, including formal measurements and digital technologies, to record data accurately and honestly (ACSIS087, ACSIS104)
- reflect on and make suggestions to improve fairness, accuracy and efficacy of a scientific investigation (ACSIS091, ACSIS108)
- manage investigations effectively, individually and in groups

Processing and analysing data

- construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data
- employ appropriate technologies to represent data (ACSIS090, ACSIS107)
- compare data with predictions
- present data as evidence in developing explanations (ACSIS218, ACSIS221)

Design and Production

Identifying and defining

- examine and critique needs, opportunities or modifications using a range of criteria to define a project
- define a need or opportunity according to functional and aesthetic criteria for an audience
- consider availability and sustainability of resources when defining design needs and opportunities
- investigate materials, components, tools, techniques and processes required to achieve intended design solutions (ACTDEP024)

Researching and planning

- research, identify and define design ideas and processes for an audience
- consider functional and aesthetic needs in planning a design solution
- develop, record and communicate design ideas, decisions and processes using appropriate technical terms
- produce labelled and annotated drawings including digital graphic representations for an audience (ACTDEP025)
- consider sustainability of resources when researching and planning design solutions
- manage projects within time constraints

Inquiry and Focus Questions

- How do physical conditions affect the survival of living things?
- How do the structural and behavioural features of living things support survival?
- Why is it important for food and/or fibre to be produced sustainably?

Content

Growth and survival of living things

Inquiry question: How do physical conditions affect the survival of living things?

Students:

- plan and conduct a fair test to show the conditions needed for a particular plant or animal to grow and survive in its environment (ACSSU094) **SciT**
- describe how changing physical conditions in the environment affect the growth and survival of living things, for example:
  - Aboriginal Peoples' use of fire-stick farming
  - temperature of water in aquatic environments
- test predictions by gathering data and use evidence to develop explanations of events and phenomena **(**ACSHE081, ACSHE098) **SciT**
- understand that scientific and technological knowledge is used to solve problems and inform personal and community decisions (ACSHE083, ACSHE100) **SciT**

Adaptations of living things

Inquiry question: How do the structural and behavioural features of living things support survival?

Students:

- describe adaptations as existing structures or behaviours that enable living things to survive in their environment (ACSSU043) **SciT**
- describe the structural and/or behavioural features of some native Australian animals and plants and why they are considered to be adaptations, for example: **ComT SciT**
  - shiny surfaces of leaves on desert plants
  - rearward facing pouch of a burrowing wombat
  - spines on an echidna

Sustainably managing environments to source food and fibre

Focus question: Why is it important for food and/or fibre to be produced sustainably?

Students:

- explore examples of managed environments used to produce food and fibre, for example: **SysT**
  - cattle farms
  - fish and oyster farms
  - timber plantations
- investigate how and why food and fibre are produced in managed environments (ACTDEK021) **SciT**
- identify and sequence the process of converting 'on-farm' food and fibre products into a product suitable for retail sale **SysT**
- explore plants and animals, tools and techniques used to prepare food to enable people to grow and be healthy (ACTDEK021)
- plan, design and produce a healthy meal, for example: **DesT**
  - a bush tucker meal
  - sushi
  - salad
- explain a sustainable practice used by Aboriginal and/or Torres Strait Islander communities to manage food and fibre resources

- investigate how people in design and technological occupations address considerations, including sustainability, in the design of products, services and environments for current and future use (ACTDEK019) **SciT**

Material World

Outcomes

A student:

› plans and conducts scientific investigations to answer testable questions, and collects and summarises data to communicate conclusions ST3-1WS-S
› plans and uses materials, tools and equipment to develop solutions for a need or opportunity ST3-2DP-T
› explains the effect of heat on the properties and behaviour of materials ST3-6MW-S
› explains how the properties of materials determine their use for a range of purposes ST3-7MW-T

Content Focus

Stage 3 of the Material World strand focuses on how the properties of a range of materials and the way in which they are combined, determine their use and inform design solutions. Students investigate the different properties of solids, liquids and gases, and consider combining and separating mixtures. Stage 3 of this strand introduces students to fundamental concepts of chemistry and is an introduction to materials technologies.

Skills Focus

Working Scientifically

Questioning and predicting

- pose testable questions
- make and justify predictions about scientific investigations (ACSIS231, ACSIS232)

Planning and conducting investigations

- identify questions to investigate scientific ideas
- plan and apply the elements of scientific investigations to answer problems
- identify potential risks in planning investigations
- manage resources safely (ACSIS086, ACSIS103)
- decide which variable(s) is to be changed, measured and kept the same, in fair tests
- select appropriate measurement methods, including formal measurements and digital technologies, to record data accurately and honestly (ACSIS087, ACSIS104)
- reflect on and make suggestions to improve fairness, accuracy and efficacy of a scientific investigation (ACSIS091, ACSIS108)
- manage investigations effectively, individually and in groups

Processing and analysing data

- construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data
- employ appropriate technologies to represent data (ACSIS090, ACSIS107)
- compare data with predictions
- present data as evidence in developing explanations (ACSIS218, ACSIS221)

Design and Production

Researching and planning

- research, identify and define design ideas and processes for an audience
- consider functional and aesthetic needs in planning a design solution
- develop, record and communicate design ideas, decisions and processes using appropriate technical terms
- produce labelled and annotated drawings including digital graphic representations for an audience (ACTDEP025)
- consider sustainability of resources when researching and planning design solutions
- manage projects within time constraints

Producing and implementing

- select and use tools competently for specific purposes
- accurately cut, join, bend and measure a range of selected materials to construct the designed solution
- demonstrate safety and sustainability when choosing resources to produce designed solutions, managing constraints and maximising opportunities (ACTDEP026)
- develop project plans that consider resources when producing designed solutions individually and collaboratively (ACTDEP028)

Inquiry and Focus Questions

- How can the state of materials be changed and manipulated?
- What is the result of combining materials?
- Why are the characteristics of materials important when designing and producing?

Content

States of matter

Inquiry question: How can the state of materials be changed and manipulated?

Students:

- investigate and compare the properties of solids, liquids and gases (ACSSU077) **SciT**

Mixtures

Inquiry question: What is the result of combining materials?

Students:

- explore that when materials are combined the result is either a mixture or a new substance, for example: (ACSSU095) **SciT**
  - salt and water
  - bicarbonate of soda and vinegar
- identify that mixtures can be separated using different techniques **ComT SciT**

Properties of materials determine their use

Focus question: Why are the characteristics of materials important when designing and producing?

Students:

- investigate characteristics and properties of a range of materials and evaluate the impact of their use (ACTDEK023) **DesT SciT**
- identify and evaluate the functional and structural properties of materials, for example: (ACTDEK023)
  - shade cloth for shelter
  - aluminium for playground seats
  - canvas for boat sails
- critique needs or opportunities for designing using sustainable materials **DesT**
- design a sustainable product, system or environment individually and/or collaboratively considering the properties of materials **SysT DesT**
- select appropriate materials, components, tools, equipment and techniques and apply safe procedures to produce designed solutions **DesT**

Physical World

Outcomes

A student:

› plans and conducts scientific investigations to answer testable questions, and collects and summarises data to communicate conclusions ST3-1WS-S
› plans and uses materials, tools and equipment to develop solutions for a need or opportunity ST3-2DP-T
› explains how energy is transformed from one form to another ST3-8PW-ST
› investigates the effects of increasing or decreasing the strength of a specific contact or non-contact force ST3-9PW-ST

Content Focus

Stage 3 of the Physical World strand focuses on the difference between contact and non-contact forces and how energy is transformed from one form to another. Students are provided with an opportunity to investigate how electrical energy can control movement in products and systems. Stage 3 of this strand develops students' abilities to design, test and evaluate a product or system that demonstrates energy transformation, further developing an understanding of the interrelationship between force and energy.

Skills Focus

Working Scientifically

Questioning and predicting

- pose testable questions
- make and justify predictions about scientific investigations (ACSIS231, ACSIS232)

Planning and conducting investigations

- identify questions to investigate scientific ideas
- plan and apply the elements of scientific investigations to answer problems
- identify potential risks in planning investigations
- manage resources safely (ACSIS086, ACSIS103)
- decide which variable(s) is to be changed, measured and kept the same, in fair tests
- select appropriate measurement methods, including formal measurements and digital technologies, to record data accurately and honestly (ACSIS087, ACSIS104)
- reflect on and make suggestions to improve fairness, accuracy and efficacy of a scientific investigation (ACSIS091, ACSIS108)
- manage investigations effectively, individually and in groups

Processing and analysing

- construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data
- employ appropriate technologies to represent data (ACSIS090, ACSIS107)
- compare data with predictions
- present data as evidence in developing explanations (ACSIS218, ACSIS221)

Communicating

- communicate ideas, explanations and processes, using scientific representations including multimodal forms (ACSIS093, ACSIS110)

Design and Production

Producing and implementing

- select and use tools competently for specific purposes
- accurately cut, join, bend and measure a range of selected materials to construct the designed solution
- demonstrate safety and sustainability when choosing resources to produce designed solutions, managing constraints and maximising opportunities (ACTDEP026)
- develop project plans that consider resources when producing designed solutions individually and collaboratively (ACTDEP028)

Testing and evaluating

- negotiate criteria for success based on defined needs, sustainability and aesthetics
- develop appropriate and fair processes to test a designed solution according to criteria
- evaluate design ideas, processes and solutions according to criteria for success (ACTDEP027)

Inquiry and Focus Questions

- How can we make a force stronger or weaker?
- What types of energy transformations can be observed?
- How can electricity be used in a product or system?

Content

Describing and exploring specific forces

Inquiry question: How can we make a force stronger or weaker?

Students:

- explore and describe some common contact or non-contact forces, for example:
  - applied force (eg pushing, kicking)
  - friction and air resistance
  - tension and elastic force
  - gravity
  - magnetism
  - buoyancy
- perform a scientific investigation to explore the effects of changing the strength of a single contact or non-contact force, for example: **SciT**
  - how a stronger or weaker applied force, such as a push or kick, results in objects travelling longer or shorter distances
  - how increasing or decreasing the strength of the force of air resistance by changing the shape of an object results in increases or decreases in speed

Transfer and transformation of energy

Inquiry question: What types of energy transformations can be observed?

Students:

- identify different types of energy transformations, for example: (ACSSU097)
  - gravitational energy to energy of movement
  - heat energy to light energy
- investigate how electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources (ACSSU097) **SciT SysT**

Forces and energy in products and systems

Focus question: How can electricity be used in a product or system?

Students:

- describe examples where light, sound, heat and electrical energy transform from one type of energy to another, for example: **ComT SysT**
  - a toaster transforms electrical energy into heat energy
  - a microphone transforms sound energy into electrical energy
  - a solar panel transforms light energy into electrical energy
- investigate how electrical energy can control movement, sound, or light in a product or system (ACTDEK020) **ComT SciT**
- design, test and evaluate a product or system that involves an energy transformation to meet an identified need using electrical energy **ComT DesT**

Earth and Space

Outcomes

A student:

› plans and conducts scientific investigations to answer testable questions, and collects and summarises data to communicate conclusions ST3-1WS-S
› explains regular events in the solar system and geological events on the Earth's surface ST3-10ES-S

Content Focus

Stage 3 of the Earth and Space strand focuses on Earth's place in the solar system, changes on its surface caused by natural disasters and the exploration of how these may be mitigated. Stage 3 of this strand further develops students' understanding of the Earth, its position in the solar system and as a dynamic part of a complex, interrelated system.

Skills Focus

Working Scientifically

Processing and analysing data

- construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data
- employ appropriate technologies to represent data (ACSIS090, ACSIS107)
- compare data with predictions
- present data as evidence in developing explanations (ACSIS218, ACSIS221)

Communicating

- communicate ideas, explanations and processes, using scientific representations including multimodal forms (ACSIS093, ACSIS110)

Design and Production

Researching and planning

- research, identify and define design ideas and processes for an audience
- consider functional and aesthetic needs in planning a design solution
- develop, record and communicate design ideas, decisions and processes using appropriate technical terms
- produce labelled and annotated drawings including digital graphic representations for an audience (ACTDEP025)
- consider sustainability of resources when researching and planning design solutions
- manage projects within time constraints

Inquiry and Focus Questions

- How does the Earth compare to other planets in the solar system?
- How do sudden geological changes and extreme weather events affect the Earth's surface?

Content

Earth's place in our solar system

Inquiry question: How does the Earth compare to other planets in the solar system?

Students:

- identify that Earth is part of a system of planets orbiting around a star (the Sun) (ACSSU078) **SysT**
- investigate the role of light energy in how we observe the Sun, Moon and planets **SysT**
- compare the key features of the planets of our solar system, for example:
  - time it takes for the planets to revolve around the Sun
  - size of the planets
  - distance of the planets from the Sun
- research and communicate how Aboriginal and/or Torres Strait Islander Peoples use observations of the night sky to inform decisions about resources and significant cultural events, for example: **SysT**
  - gathering food
  - ceremonies
  - song lines
  - navigation
- examine and discuss current developments in astronomy, space and planetary science, particularly related to making observations and gathering data **SciT**

Changes to Earth's surface

Inquiry question: How do sudden geological changes and extreme weather events affect the Earth's surface?

Students:

- investigate the effects of sudden geological changes and extreme weather events on the Earth's surface, for example: (ACSSU096) **SciT SysT**
  - earthquakes, volcanic eruptions, tsunamis
  - cyclones, storms, drought and floods
- investigate ways that advances in science and technology have assisted people to plan for and manage natural disasters to minimise their effect, for example: **DesT SciT SysT**
  - design and construction of buildings and roads
  - detection systems for tsunamis
  - digital flood and fire warning systems

Digital Technologies

Outcomes

A student:

› plans and uses materials, tools and equipment to develop solutions for a need or opportunity ST3-2DP-T
› defines problems, and designs, modifies and follows algorithms to develop solutions ST3-3DP-T
› explains how digital systems represent data, connect together to form networks and transmit data ST3-11DI-T

Content Focus

Stage 3 of the Digital Technologies strand focuses on understanding the role individual components of digital systems play in processing and representing data. Students design, modify and follow algorithms involving branching and iteration. Stage 3 of this strand further develops students' knowledge and understanding of project management, abstraction and the relationship between models and the real-world systems they represent.

Skills Focus

Working Scientifically

Processing and analysing data

- construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data
- employ appropriate technologies to represent data (ACSIS090, ACSIS107)
- compare data with predictions
- present data as evidence in developing explanations (ACSIS218, ACSIS221)

Design and Production

Identifying and defining

- examine and critique needs, opportunities or modifications using a range of criteria to define a project
- examine and determine functional requirements to define a problem
- identify data required to formulate algorithms to improve a process (ACTDIP017)

Researching and planning

- develop, record and communicate design ideas, decisions and processes using appropriate technical terms
- manage projects within time constraints
- design, modify and follow simple algorithms
- extend sequences of steps to provide a series of possibilities through branching
- develop solutions through trialling and refining using iterations (ACTDIP019)

Producing and implementing

- develop project plans that consider resources when producing designed solutions individually and collaboratively (ACTDEP028)
- implement digital solutions as visual programs involving branching, iteration and user input (ACTDIP020)
- work collaboratively to share, appraise and improve ideas to achieve design purposes
- identify, organise and perform strategic roles within a group to solve a problem
- acquire, store, access and validate different types of data, and use a range of software to present, interpret and visualise data (ACTDIP016)

Testing and evaluating

- evaluate design ideas, processes and solutions according to criteria for success (ACTDEP027)
- explain how students' solutions and existing information systems meet current and future local community needs (ACTDIP021)

Inquiry and Focus Questions

- How do components of digital systems interact with each other to transmit data?
- How do the components of digital systems connect together to form networks?
- How do we represent decision-making in an algorithm?

Content

Using and Interpreting Data

Focus question: How do components of digital systems interact with each other to transmit data?

Students:

- identify how whole numbers are used to represent all data (binary) in digital systems (ACTDIK015) **ComT SysT**
- collect, store and interpret different types of data, for example: **ComT SysT**
  - using sensors to collect data
- use software to interpret and visualise data

Digital Systems and Networks

Focus question: How do the components of digital systems connect together to form networks?

Students:

- investigate internal and external components of digital systems that perform functions **SciT**
- explore how the main components of digital systems connect together to form networks that transmit data (ACTDIK014) **ComT SysT**
- describe how data can be transmitted between two digital components, for example:
  - wired networks
  - wireless networks
- identify and explain how existing information systems meet the needs of present and future communities, for example: **DesT SysT**
  - school databases
- explore current ethical, social and technical protocols when communicating using information systems (ACTDIP022)

Designing Digital Solutions

Focus question: How do we represent decision-making in an algorithm?

Students:

- design a user interface for a digital system, for example: (ACTDIP018) **DesT**
  - developing a storyboard for a game
- design, modify and follow algorithms involving branching and iteration **ComT DesT SysT**
- define problems, and plan and implement digital solutions, using an appropriate visual programming language involving branching and iteration, and requiring user input **ComT DesT SysT**

Assessment

Standards

The NSW Education Standards Authority (NESA) *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:

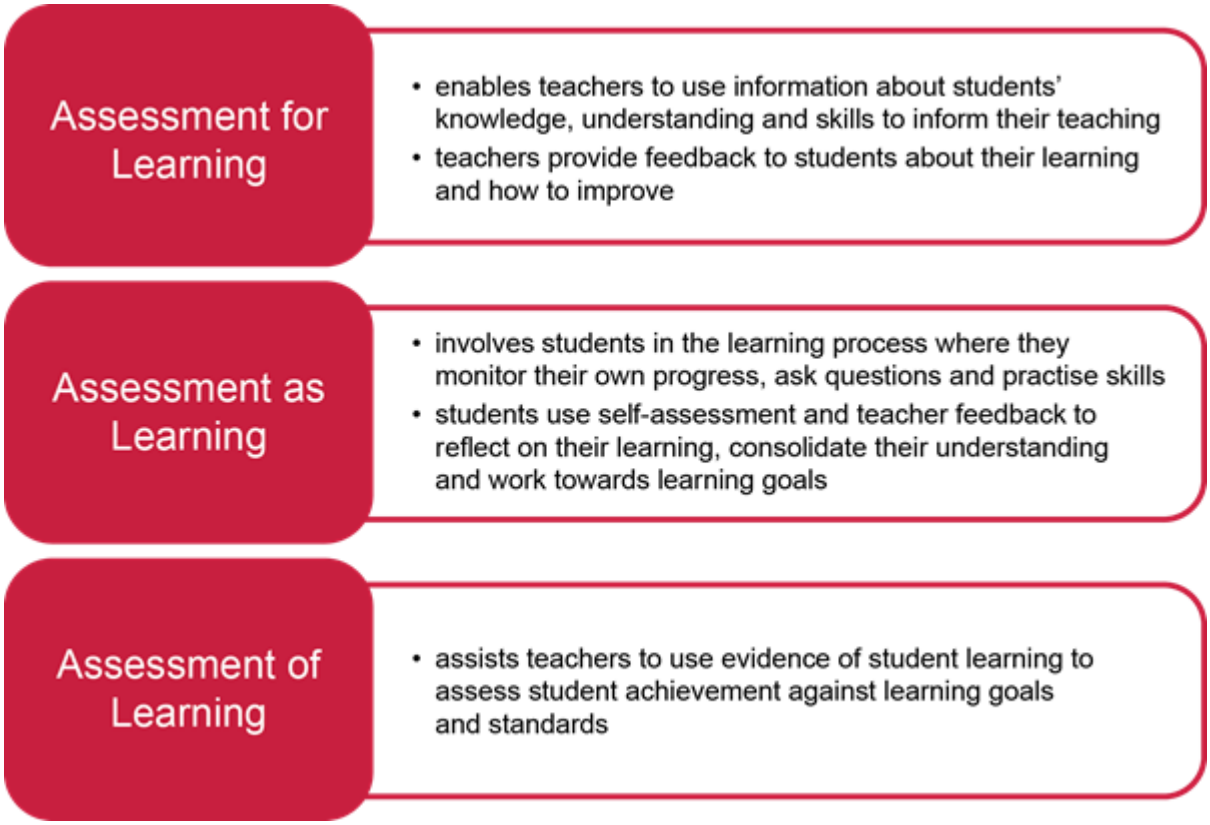
- outcomes and content in syllabuses showing what is to be learned
- Stage statements that summarise student achievement
- samples of work on the NESA Assessment Resource Centre (ARC) website which provide examples of levels of achievement within a Stage.

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 NESA K–10 syllabuses particularly promote *Assessment for Learning* as an essential component of good teaching.



Further advice on programming and appropriate assessment practice is provided on the NESA website. This support material 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. The type of adjustments and support will vary according to the particular needs of the student and the requirements of the activity. These may be:

- adjustments to the assessment process, for example scaffolded instructions, additional guidance provided, highlighted key-words or phrases, the use of specific technology, extra time in an examination
- adjustments to assessment activities, for example rephrasing questions, using simplified language, fewer questions or alternative formats for questions
- alternative formats for responses, for example written point form instead of essays, scaffolded structured responses, short objective questions or multimedia presentations.

It is a requirement under the *Disability Standards for Education 2005* for schools to ensure that assessment tasks are accessible to students with disability. Schools are responsible for any decisions made at school level to offer adjustments to coursework, assessment activities and tasks, including in-school tests. Decisions regarding adjustments should be made in the context of collaborative curriculum planning.

Further examples of adjustments to assessment for students with special education needs can be found in support materials for:

- Science and Technology
- Special education.

Reporting

Reporting is the process of providing feedback to students, parents/carers 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.

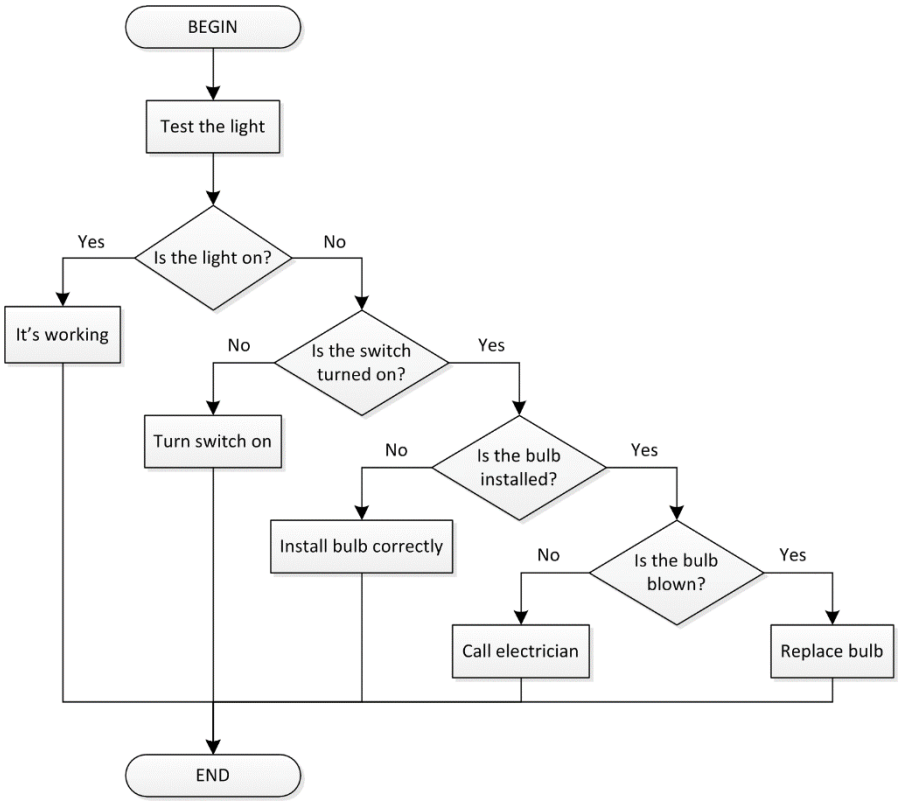
Descriptions of student achievement provide schools with a useful tool to report consistent information about student achievement to students and parents/carers, and to the next teacher to help plan the future steps in the learning process.

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 Stage 1 to Stage 5.

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.

Glossary

Glossary term	Definition
Aboriginal and/or Torres Strait Islander Peoples	Aboriginal Peoples are the first peoples of Australia and are represented by over 250 language groups, each associated with a particular Country or territory. Torres Strait Islander Peoples are represented by five major island groups, and are associated with island territories to the north of Australia's Cape York which were annexed by Queensland in 1879. An Aboriginal and/or Torres Strait Islander person is someone who: • is of Aboriginal and/or Torres Strait Islander descent • identifies as an Aboriginal person and/or Torres Strait Islander person, and • is accepted as such by the Aboriginal and/or Torres Strait Islander community(ies) in which they live.
abstraction	Abstraction is the process by which data and programs are defined with a representation similar in form to its meaning while hiding away the implementation details. Abstraction tries to temporarily ignore details so that the programmer can focus on a few concepts at a time. Algorithms must ultimately be broken down into simple instructions for a digital system to execute.
accessibility	The extent to which a system, environment or object may be used irrespective of a user's capabilities or abilities. For example, the use of assistive technologies to allow people with disabilities to use computer systems, or the use of icons in place of words to allow young children to use a system.
adaptation	The process of change by which a species becomes better suited to its environment.
algorithm	A step-by-step procedure required to solve a problem. In digital technologies algorithms may be presented in many ways, for example in written instructions, flowcharts or by using a computer programming language.
app	A software application designed to run on mobile devices through a web browser or on a personal computer.
binary	Binary digit (or bits) in digital technologies describes a numbering scheme with either 0 or 1. Computers use binary to store data.

Glossary term	Definition
branching	An instruction in a computer program or algorithm that causes different actions to be performed depending on specified conditions. For example, in testing whether a light works, the following algorithm uses branching: 
built environment	The manufactured artefacts and surroundings that provide the setting for human activity.
change of state	A change from one state (solid, liquid or gas) to another without a change in chemical composition.
characteristics	A set of distinguishing aspects (including attributes and behaviours) of a living thing, object or material. The characteristics of living things are often used to classify them and might include how they move or reproduce. When discussing materials the characteristics are the qualities used by humans to determine their use and the way people work with them. They might include colour, hardness and opacity.
classification	A category into which something is organised.
components	Parts or elements that make up a system or whole object. At the simplest level a computer has two main components: the hardware and the software. The components of a computer system may include a central processing unit, memory chips and a hard drive, a screen, a keyboard and a mouse.
computational thinking	A problem-solving method involved in identifying a problem and expressing the solution in such a way that a human, machine or computer can effectively carry it out. Techniques and strategies may include organising data logically and breaking down problems into parts.

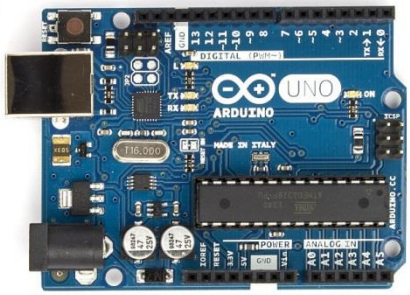
Glossary term	Definition
conclusions	An opinion or judgement based on evidence.
criteria for success	A descriptive list of essential features against which success can be measured and evaluated.
customary	Relates to customs or practices associated with a particular society, place or set of circumstances.
data	In science data refers to information that can be used to derive patterns, inform decisions and draw conclusions. In digital technologies data refers to information using number codes. Data may include characters, images, sounds and/or instructions that, when represented by number codes, can be manipulated.
database	A structured set of data held in a computer that is organised by records and fields.
design process	The process of designing (*see* designing).
design thinking	Thought process involved in understanding and developing solutions to design needs and opportunities.
designed solution	A product, service or environment that has been created for a specific purpose or intention as a result of design thinking, and design and production processes.
designing	A process that typically involves identifying and defining, researching and planning, producing and implementing, and testing and evaluating to create a designed solution.
digital citizenship	An acceptance and upholding of the norms of appropriate, responsible behaviour in the use of digital technologies. Digital citizenship includes appropriate online etiquette, literacy in how digital technologies work and how to use them, an understanding of ethics, knowing how to stay safe online, and advice on related health and safety issues, such as predators and the permanence of data.
digital footprint	A total set of data left behind by a person using a digital system.
digital solution	The result (or output) of transforming data into a physical or virtual product, using digital systems, skills, techniques and processes to meet a need or opportunity.
digital system	Digital hardware and software components (internal and external) used to transform data in a digital solution. When digital systems are connected, they form a network.
digital technologies	Digital technologies are electronic tools, systems, devices and resources that generate, store or process data. These may include games, applications (apps), multimedia, mobile devices, networks, robotics, microcontrollers.

Glossary term	Definition
disability	An umbrella term for any or all of the following components: • impairments: challenges in body function or structure • activity limitations: difficulties in executing activities • participation restrictions: challenges an individual may experience in involvement in life situations.
diversity	Differences that exist within a group, for example, age, sex, gender, gender expression, sexuality, ethnicity, ability/disability, body shape and composition, culture, religion, learning differences, socioeconomic background, values and experiences.
elasticity	The ability of an object or material to resume its normal shape after being stretched or compressed; stretchiness.
energy	Something that causes a change and exists in different forms, for example: electrical, thermal, mechanical, electromagnetic, sound, and chemical.
environment	The surroundings or conditions in which a person, animal or plant lives or operates. An environment may be natural, managed, constructed or digital (*see* natural environment and managed environment).
evaluate	Measuring performance against established criteria.
evidence	Evidence is valid/reliable data that can be used to support a particular theory, prediction, idea or conclusion.
fair test	An investigation where one variable (the independent variable) is changed and all other conditions (controlled variables) are kept the same; what is measured or observed is referred to as the dependent variable.
features	The distinctive attributes, characteristics, properties and qualities of an object, material, living thing, system or event.
fibre	Plant or animal-based materials that can be used for clothing or construction, for example wool, silk, cotton, bamboo, hemp and timber.
food and fibre production	A process of producing food and/or fibre as natural materials for the design and development of a range of products.
force	An influence that acts to change the motion of a body or to impose an elastic strain on it. A contact force is any force that requires contact to be enforced. A force which acts on an object without coming physically in contact with it is called a non-contact force, for example magnetism.
formal measurement	Measurement that is based on an agreed standard unit, for example metre, second and gram.
function	The natural activity of a living thing or the intended design of a product, system or environment to ensure it is fit for purpose and meets a need or opportunity.
health	A state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity (World Health Organization 1948).

Glossary term	Definition
healthy eating	Dietary patterns that aim to promote health and wellbeing, including types and amounts of foods and food groups that reduce the risk of diet-related conditions and chronic disease (National Health and Medical Research Council 2013).
Indigenous	Internationally recognised term for the first people of a land. In NSW the term Aboriginal person/Peoples is preferred.
information system	A combination of digital hardware and software components, data, processes and people that interact to create, control and communicate information.
input	Data or information put into a digital system to activate or modify a process.
inquiry	The application of the process of Working Scientifically.
investigate	Carry out a systematic or formal inquiry to discover and examine information.
investigation	A scientific investigation is a systematic inquiry 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.

iteration	A repetition of a process in computer programming where each repeated cycle builds towards a desired result. An example of an iterative process with code designed to add the numbers from 1 to 9 is shown below.
	
	`sum = 0`
	`for number = 1 to 9`
	`sum = sum + number`

managed environment	An environment coordinated by humans for a purpose, for example a farm or marine park.
material	A substance from which something can be made. Materials can be manipulated and are used to create products or environments.

Glossary term	Definition
microcontroller	A microcontroller is a small computer built for the purpose of dealing with specific tasks, such as managing the engine in a car, displaying information in a microwave control panel or receiving information from a television's remote control. Microcontrollers process data inputted by users (eg keypad) or sensors (eg light).  Description: English: Arduino Uno Date: 14 April 2014, 13:49 Source: ARDU-UNO-03-Front Author: oomlout
model	A representation of an idea that provides an explanation of the structure, workings or relationships within an object, system or idea.
multimodal text	Text that combines two or more modes of communication, for example text, images, animations, video, audio.
natural environment	An environment in which humans do not make significant interventions, for example ocean environments or national parks.
network	A group or system of interconnected digital technology components.
on-Country	Taking place on Aboriginal land or Country of origin.
output	A result of something (physical or virtual), such as power, energy, action, material or information produced by a person, machine or a system.
peripheral device	A digital component that can be connected to a digital system but is not essential to the operation of the system, for example printer, scanner, digital camera.
predict	Forecast a happening or event.
preferred futures	Preferences for the future identified by a student to inform the creation and evaluation of solutions.
producing	Actively making designed solutions, using appropriate resources and means of production.
product	The tangible end results of natural, human, mechanical, manufacturing, electronic or digital production and processes to meet a need or want.
project	An individual or collaborative problem-solving activity undertaken by students that is planned to achieve an aim.

Glossary term	Definition
project management	The process of planning, organising, controlling resources, monitoring timelines and activities, and completing a project to achieve a goal that meets identified criteria.
properties	Distinctive characteristics of a material that can be identified, tested and used to help people select the most suitable material for a particular use.
protocol	A set of generally accepted standards or 'rules' that govern relationships and interactions between and within information systems.
resources	In science this refers to the resources, such as plants, animals, water and energy, found in the natural environment. In technologies this refers to tools, materials and components used in the development of designed solutions. This can include technologies, energy, time, finance and human input.
scientific representations	Diagrams, graphs, symbols and texts used to communicate patterns, and quantitative and qualitative relationships.
senses	Perceptions that a living organism uses to take in information about its surroundings. The five main senses are hearing, sight, touch, taste and smell.
sensor	A sensor is a device that detects and responds to some type of input from the physical environment. The specific input could be light, heat, motion, moisture or pressure. The output is generally a signal that is converted to human-readable display at the sensor location or transmitted electronically over a network for further processing. For example a motion sensor used on automatic doors and light sensors to automatically control garden lights.
services	A system supplying a public need, such as transport, communications, or utilities, such as electricity and water. Services are a less tangible outcome of design and production processes (compared to products) but are still designed to meet a need or want.
social protocols	Generally accepted 'rules' or behaviours for when people interact in online environments, for example using language that is not rude or offensive to particular cultures, and not divulging personal details about people without their permission.
strength	The state, property or quality of a material or object being physically strong and able to withstand or resist a significant amount of force or pressure without breaking.
structure	Entities in which the parts are linked together to form a whole.
sustainable	Supporting the needs of the present without compromising the ability of future generations to support their needs.
system	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 (*see* digital system).

Glossary term	Definition
technologies	Materials, data, systems, components, tools and equipment used to create solutions for identified needs and opportunities, and the knowledge, understanding and skills used by people involved in the selection and use of these.
testable	Able to be tested or tried.
thermal conductivity	The property of matter or materials to conduct heat.
transfer of energy	The movement of energy from one place to another.
transformation of energy	The change of energy from one form to another (*see* energy).
transmit data	The process of sending digital or analog data over a communication channel to a computer or network, for example wi-fi or cable.
user interface	The means by which users interact with computer software or hardware. In software, this usually comprises fields for text and number entry, mouse pointers, buttons and other graphical elements. In hardware, switches, dials and light-emitting diodes (LEDs) provide information about the interactions between a user and a machine.
variable	A factor that can be changed, kept the same or measured in an investigation. Often categorised as independent (the variable that is deliberately changed), dependent (changes as a result of changes to the independent variable) and controlled (kept the same throughout the experiment).
viewing	Observing and comprehending a visual text, for example, diagram, illustration, photograph, film, television documentary, multimedia. This sometimes involves listening to and reading accompanying written text.
visual programming	A programming language or environment where a program is represented and manipulated graphically, such as graphic blocks that can be connected to form programs rather than as text.
wireless network	Computer networks that are not connected by cables of any kind.