The Australian Curriculum

Subjects	Science
Year levels	Foundation Year, Year 1, Year 2, Year 3, Year 4, Year 5, Year 6, Year 7, Year 8, Year 9 and Year 10
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acara AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

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Science

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Science

Overview

Rationale

Science provides an empirical way of answering interesting and important questions about the biological, physical and technological world. The knowledge it produces has proved to be a reliable basis for action in our personal, social and economic lives. Science is a dynamic, collaborative and creative human endeavour arising from our desire to make sense of our world through exploring the unknown, investigating universal mysteries, making predictions and solving problems. Science aims to understand a large number of observations in terms of a much smaller number of broad principles. Science knowledge is contestable and is revised, refined and extended as new evidence arises.

The Australian Curriculum: Science provides opportunities for students to develop an understanding of important science concepts and processes, the practices used to develop scientific knowledge, of science's contribution to our culture and society, and its applications in our lives. The curriculum supports students to develop the scientific knowledge, understandings and skills to make informed decisions about local, national and global issues and to participate, if they so wish, in science-related careers.

In addition to its practical applications, learning science is a valuable pursuit in its own right. Students can experience the joy of scientific discovery and nurture their natural curiosity about the world around them. In doing this, they develop critical and creative thinking skills and challenge themselves to identify questions and draw evidence-based conclusions using scientific methods. The wider benefits of this 'scientific literacy' are well established, including giving students the capability to investigate the natural world and changes made to it through human activity.

The ability to think and act in scientific ways helps build the broader suite of capabilities in students as confident, self-motivated and active members of our society.

Aims

The Australian Curriculum: Science aims to ensure that students develop:

- an interest in science as a means of expanding their curiosity and willingness to explore, ask questions about and speculate on the changing world in which they live
- an understanding of the vision that science provides of the nature of living things, of Earth and its place in the cosmos, and of the physical and chemical processes that explain the behaviour of all material things
- an understanding of the nature of scientific inquiry and the ability to use a range of scientific inquiry methods, including questioning; planning and conducting experiments and investigations based on ethical principles; collecting and analysing data; evaluating results; and drawing critical, evidence-based conclusions
- an ability to communicate scientific understanding and findings to a range of audiences, to justify ideas on the basis of evidence, and to evaluate and debate scientific arguments and claims
- an ability to solve problems and make informed, evidence-based decisions about current and future applications of science while taking into account ethical and social implications of decisions
- an understanding of historical and cultural contributions to science as well as contemporary science issues and activities and an understanding of the diversity of careers related to science
- a solid foundation of knowledge of the biological, chemical, physical, earth and space sciences, including being able to select and integrate the scientific knowledge and methods needed to explain and predict phenomena, to apply that understanding to new situations and events, and to appreciate the dynamic nature of science knowledge.

Key ideas

In the Australian Curriculum: Science, there are six key ideas that represent key aspects of a scientific view of the world and bridge knowledge and understanding across the disciplines of science, as shown Figure 1 below. These are embedded within each year level description and guide the teaching/learning emphasis for the relevant year level.

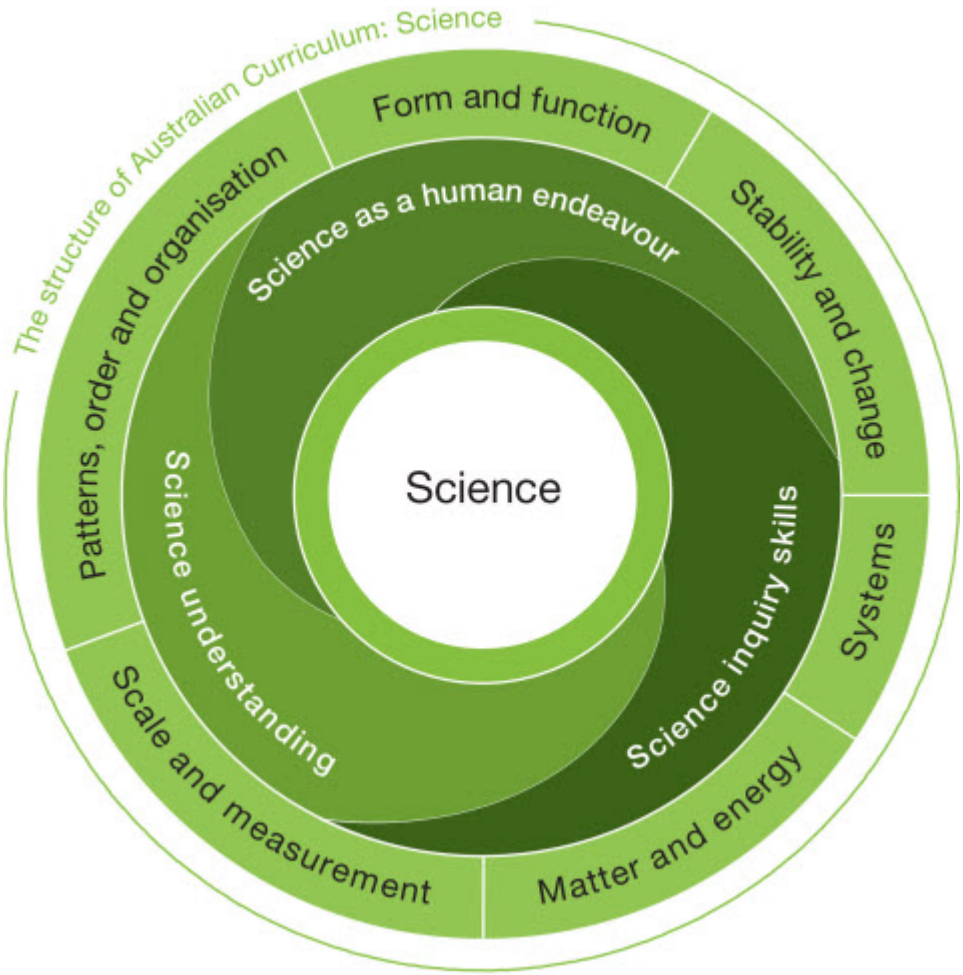

Figure 1: Key ideas of the science curriculum

These key ideas are designed to support the coherence and developmental sequence of science knowledge within and across year levels. The key ideas frame the development of concepts in the science understandingstrand, support key aspects of the science inquiry skills strand and contribute to developing students' appreciation of the nature of science.

The six key ideas that frame the Australian Curriculum: Science are:

Patterns, order and organisation

An important aspect of science is recognising patterns in the world around us, and ordering and organising phenomena at different scales. As students progress from Foundation to Year 10, they build skills and understanding that will help them to observe and describe patterns at different scales, and develop and use classifications to organise events and phenomena and make predictions. Classifying objects and events into groups (such as solid/liquid/gas or living/non-living) and developing criteria for those groupings relies on making observations and identifying patterns of similarity and difference.

As students progress through the primary years, they become more proficient in identifying and describing the relationships that underpin patterns, including cause and effect. Students increasingly recognise that scale plays an important role in the observation of patterns; some patterns may only be evident at certain time and spatial scales. For example, the pattern of day and night is not evident over the time scale of an hour.

Form and function

Many aspects of science are concerned with the relationships between form (the nature or make-up of an aspect of an object or organism) and function (the use of that aspect).

As students progress from Foundation to Year 10, they see that the functions of both living and non-living objects rely on their forms. Their understanding of forms such as the features of living things or the nature of a range of materials, and their related functions or uses, is initially based on observable behaviours and physical properties. In later years, students recognise that function frequently relies on form and that this relationship can be examined at many scales. They apply an understanding of microscopic and atomic structures, interactions of force and flows of energy and matter to describe relationships between form and function.

Stability and change

Many areas of science involve the recognition, description and prediction of stability and change. Early in their schooling, students recognise that in their observations of the world around them, some properties and phenomena appear to remain stable or constant over time, whereas others change.

As they progress from Foundation to Year 10, they also recognise that phenomena (such as properties of objects and relationships between living things) can appear to be stable at one spatial or time scale, but at a larger or smaller scale may be seen to be changing. They begin to appreciate that stability can be the result of competing, but balanced forces. Students become increasingly adept at quantifying change through measurement and looking for patterns of change by representing and analysing data in tables or graphs.

Scale and measurement

Quantification of time and spatial scale is critical to the development of science understanding as it enables the comparison of observations. Students often find it difficult to work with scales that are outside their everyday experience – these include the huge distances in space, the incredibly small size of atoms and the slow processes that occur over geological time.

As students progress from Foundation to Year 10, their understanding of relative sizes and rates of change develops and they are able to conceptualise events and phenomena at a wider range of scales. They progress from working with scales related to their everyday experiences and comparing events and phenomena using relative language (such as 'bigger' or 'faster') and informal measurement, to working with scales beyond human experience and quantifying magnitudes, rates of change and comparisons using formal units of measurement.

Matter and energy

Many aspects of science involve identifying, describing and measuring transfers of energy and/or matter. As students progress through Foundation to Year 10, they become increasingly able to explain phenomena in terms of the flow of matter and energy.

Initially, students focus on direct experience and observation of phenomena and materials. They are introduced to the ways in which objects and living things change and begin to recognise the role of energy and matter in these changes. In later years, they are introduced to more abstract notions of particles, forces and energy transfer and transformation. They use these understandings to describe and model phenomena and processes involving matter and energy.

Systems

Science frequently involves thinking, modelling and analysing in terms of systems in order to understand, explain and predict events and phenomena. As students progress through Foundation to Year 10, they explore, describe and analyse increasingly complex systems.

Initially, students identify the observable components of a clearly identified 'whole' such as features of plants and animals and parts of mixtures. Over Years 3 to 6, they learn to identify and describe relationships between components within simple systems, and they begin to appreciate that components within living and non-living systems are interdependent. In Years 7 to 10, they are introduced to the processes and underlying phenomena that structure systems such as ecosystems, body systems and the carbon cycle. They recognise that within systems, interactions between components can involve forces and changes acting in opposing directions and that for a system to be in a steady state, these factors need to be in a state of balance or equilibrium. They are increasingly aware that systems can exist as components within larger systems, and that one important part of thinking about systems is identifying boundaries, inputs and outputs.

Structure

The three interrelated strands of science

The Australian Curriculum: Science has three interrelated strands: science understanding, science as a human endeavour and science inquiry skills.

Together, the three strands of the science curriculum provide students with understanding, knowledge and skills through which they can develop a scientific view of the world. Students are challenged to explore science, its concepts, nature and uses through clearly described inquiry processes.

Science understanding

Science understanding is evident when a person selects and integrates appropriate science knowledge to explain and predict phenomena, and applies that knowledge to new situations. Science knowledge refers to facts, concepts, principles, laws, theories and models that have been established by scientists over time. This strand provides the content through which the key ideas of science and skills are developed within contexts appropriate to the learners.

The science understanding strand comprises four sub-strands. The content is described by year level.

Biological sciences

The biological sciences sub-strand is concerned with understanding living things. The key concepts developed within this sub-strand are that: a diverse range of living things have evolved on Earth over hundreds of millions of years; living things are interdependent and interact with each other and their environment; and the form and features of living things are related to the functions that their body systems perform.

Through this sub-strand, students investigate living things, including animals, plants and microorganisms, and their interdependence and interactions within ecosystems. They explore their life cycles, body systems, structural adaptations and behaviours, how these features aid survival, and how their characteristics are inherited from one generation to the next. Students are introduced to the cell as the basic unit of life and the processes that are central to its function.

Chemical sciences

The chemical sciences sub-strand is concerned with understanding the composition and behaviour of substances. The key concepts developed within this sub-strand are that: the chemical and physical properties of substances are determined by their structure at an atomic scale; substances change and new substances are produced by rearranging atoms through atomic interactions and energy transfer.

In this sub-strand, students classify substances based on their properties, such as solids, liquids and gases, or their composition, such as elements, compounds and mixtures. They explore physical changes such as changes of state and dissolving, and investigate how chemical reactions result in the production of new substances. Students recognise that all substances consist of atoms which can combine to form molecules, and chemical reactions involve atoms being rearranged and recombined to form new substances. They explore the relationship between the way in which atoms are arranged and the properties of substances, and the effect of energy transfers on these arrangements.

Earth and space sciences

The earth and space sciences sub-strand is concerned with Earth's dynamic structure and its place in the cosmos. The key concepts developed within this sub-strand are that: Earth is part of a solar system that is part of a larger universe; Earth is subject to change within and on its surface, over a range of timescales as a result of natural processes and human use of resources.

Through this sub-strand, students view Earth as part of a solar system, which is part of a galaxy, which is one of many in the universe, and explore the immense scales associated with space. They explore how changes on Earth, such as day and night and the seasons, relate to Earth's rotation and its orbit around the sun. Students investigate the processes that result in change to Earth's surface, recognising that Earth has evolved over 4.5 billion years and that the effect of some of these processes is only evident when viewed over extremely long timescales. They explore the ways in which humans use resources from Earth and appreciate the influence of human activity on the surface of Earth and its atmosphere.

Physical sciences

The physical sciences sub-strand is concerned with understanding the nature of forces and motion, and matter and energy. The two key concepts developed within this sub-strand are that: forces affect the behaviour of objects; energy can be transferred and transformed from one form to another.

Through this sub-strand, students gain an understanding of how an object's motion (direction, speed and acceleration) is influenced by a range of contact and non-contact forces such as friction, magnetism, gravity and electrostatic forces. They develop an understanding of the concept of energy and how energy transfer is associated with phenomena involving motion, heat, sound, light and electricity. They appreciate that concepts of force, motion, matter and energy apply to systems ranging in scale from atoms to the universe itself.

Science as a human endeavour

Through science, humans seek to improve their understanding and explanations of the natural world. Science involves the construction of explanations based on evidence and science knowledge can be changed as new evidence becomes available. Science influences society by posing, and responding to, social and ethical questions, and scientific research is itself influenced by the needs and priorities of society.

This strand highlights the development of science as a unique way of knowing and doing, and the importance of science in contemporary decision-making and problem-solving. It acknowledges that in making decisions about science practices and applications, ethical and social implications must be taken into account. This strand also recognises that science advances through the contributions of many different people from different cultures and that there are many rewarding science-based career paths. This strand provides context and relevance to students and to our broader community.

The content in the science as a human endeavour strand is described in two-year bands. There are two sub-strands of science as a human endeavour. These are:

Nature and development of science: This sub-strand develops an appreciation of the unique nature of science and scientific knowledge, including how current knowledge has developed over time through the actions of many people.

Use and influence of science: This sub-strand explores how science knowledge and applications affect peoples' lives, including their work, and how science is influenced by society and can be used to inform decisions and actions.

Science inquiry skills

Science inquiry involves identifying and posing questions; planning, conducting and reflecting on investigations; processing, analysing and interpreting evidence; and communicating findings. This strand is concerned with evaluating claims, investigating ideas, solving problems, drawing valid conclusions and developing evidence-based arguments. The skills students develop give them the tools they need to achieve deeper understanding of the science concepts and how scientific thinking applies to these understandings.

Science investigations are activities in which ideas, predictions or hypotheses are tested and conclusions are drawn in response to a question or problem. Investigations can involve a range of activities, including experimental testing, field work, locating and using information sources, conducting surveys, and using modelling and simulations. The choice of the approach taken will depend on the context (science as a human endeavour) and subject of the investigation (science understanding).

In science investigations, collection and analysis of primary data and evidence play a major role. This can involve collecting or extracting information and reorganising data in the form of tables, graphs, flow charts, diagrams, prose, keys, spreadsheets and databases. Students will also develop their understandings through the collection and analysis of secondary data and information.

The content in the science inquiry skillsstrand is described in two-year bands. There are five sub-strands of science inquiry skills. These are:

Questioning and predicting: Identifying and constructing questions, proposing hypotheses and suggesting possible outcomes.

Planning and conducting: Making decisions about how to investigate or solve a problem and carrying out an investigation, including the collection of data.

Processing and analysing data and information: Representing data in meaningful and useful ways; identifying trends, patterns and relationships in data, and using this evidence to justify conclusions.

Evaluating: Considering the quality of available evidence and the merit or significance of a claim, proposition or conclusion with reference to that evidence.

Communicating: Conveying information or ideas to others through appropriate representations, text types and modes.

Relationship between the strands

In the practice of science, the three strands of science understanding, science as a human endeavour and science inquiry skills are closely integrated; the work of scientists reflects the nature and development of science, is built around scientific inquiry and seeks to respond to and influence society's needs. Students' experiences of school science should mirror and connect to this multifaceted view of science.

To achieve this, the three strands of the Australian Curriculum: Science should be taught in an integrated way. The content descriptions of the three strands have been written so that at each year this integration is possible. In the earlier years, the nature and development of science sub-strand within the science as a human endeavour strand focuses on scientific inquiry. This enables students to make clear connections between the inquiry skills that they are learning and the work of scientists. As students progress through the curriculum they investigate how science understanding has developed, including considering some of the people and the stories behind these advances in science.

They will also recognise how this science understanding can be applied to their lives and the lives of others. As students develop a more sophisticated understanding of the knowledge and skills of science they are increasingly able to appreciate the role of science in society. The content of the science understanding strand will inform students' understanding of contemporary issues such as climate change, use of resources, medical interventions, biodiversity and the origins of the universe. The importance of these areas of science can be emphasised through the context provided by the science as a human endeavour strand, and students can be encouraged to view contemporary science critically through aspects of the science inquiry skills strand; for example, by analysing, evaluating and communicating.

Science Scope and Sequence (PDF)

Resources and support materials for the Australian Curriculum: Science are available as PDF documents.

Science: Sequence of content

Science: Sequence of achievement

Foundation Year

The Science content includes the three strands of science understanding, science inquiry skills and science as a human endeavour. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

From Foundation to Year 2, students learn that observations can be organised to reveal patterns, and that these patterns can be used to make predictions about phenomena.

In Foundation, students observe and describe the behaviours and properties of everyday objects, materials and living things. They explore change in the world around them, including changes that impact on them, such as the weather, and changes they can effect, such as making things move or change shape. They learn that seeking answers to questions they pose and making observations is a core part of science and use their senses to gather different types of information.

Foundation Year Content Descriptions

Science Understanding

Biological sciences	Elaborations
Living things have basic needs, including food and water (ACSSU002)	• identifying the needs of humans such as warmth, food and water, using students' own experiences • recognising the needs of living things in a range of situations such as pets at home, plants in the garden or plants and animals in bushland • comparing the needs of plants and animals

Chemical sciences	Elaborations
Objects are made of materials that have observable properties (ACSSU003)	• sorting and grouping materials on the basis of observable properties such as colour, texture and flexibility • thinking about how the materials used in buildings and shelters are suited to the local environment • investigating different forms of clothing used for different activities • comparing the traditional materials used for clothing from around the world

Earth and space sciences	Elaborations

Daily and seasonal changes in our environment affect everyday life (ACSSU004)	• linking the changes in the daily weather to the way we modify our behaviour and dress for different conditions, including examples from different cultures  • investigating how changes in the weather might affect animals such as pets, animals that hibernate, or migratory animals  • learning how Aboriginal and Torres Strait Islander concepts of time and weather patterns explain how things happen in the world around them 
Physical sciences	**Elaborations**
The way objects move depends on a variety of factors, including their size and shape (ACSSU005) 	• observing the way different shaped objects such as balls, blocks and tubes move  • comparing the way different sized, but similar shaped, objects such as tennis balls, golf balls, marbles and basketballs roll and bounce  • observing how the movement of different living things depends on their size and shape 
Science as a Human Endeavour	
Nature and development of science	**Elaborations**
Science involves observing, asking questions about, and describing changes in, objects and events (ACSHE013)	• recognising that observation is an important part of exploring and investigating the things and places around us  • sharing observations with others and communicating their experiences  • exploring and observing using the senses: hearing, smell, touch, sight and taste 
Science Inquiry Skills	
Questioning and predicting	**Elaborations**
Pose and respond to questions about familiar objects and events (ACSIS014) 	• considering questions relating to the home and school and objects used in everyday life 
Planning and conducting	**Elaborations**

Participate in guided investigations and make observations using the senses (ACSIS011)	• using sight, hearing, touch, taste and smell so that students can gather information about the world around them 
Processing and analysing data and information	**Elaborations**
Engage in discussions about observations and represent ideas (ACSIS233) 	• taking part in informal and guided discussions relating to students'observations  • using drawings to represent observations and ideas and discussing their representations with others 
Communicating	**Elaborations**
Share observations and ideas (ACSIS012) 	• working in groups to describe what students have done and what they have found out  • communicating ideas through role play and drawing 

Foundation Year Achievement Standard

By the end of the Foundation year, students describe the properties and behaviour of familiar objects. They suggest how the environment affects them and other living things.

Students share and reflect on observations, and ask and respond to questions about familiar objects and events.

Year 1

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

From Foundation to Year 2, students learn that observations can be organised to reveal patterns, and that these patterns can be used to make predictions about phenomena.

In Year 1, students infer simple cause-and-effect relationships from their observations and experiences, and begin to link events and phenomena with observable effects and to ask questions. They observe changes that can be large or small and happen quickly or slowly. They explore the properties of familiar objects and phenomena, identifying similarities and differences. Students begin to value counting as a means of comparing observations, and are introduced to ways of organising their observations.

Year 1 Content Descriptions

Science Understanding	
Biological sciences	**Elaborations**
Living things have a variety of external features (ACSSU017)	• recognising common features of animals such as head, legs and wings • describing the use of animal body parts for particular purposes such as moving and feeding • identifying common features of plants such as leaves and roots • describing the use of plant parts for particular purposes such as making food and obtaining water
Living things live in different places where their needs are met (ACSSU211)	• exploring different habitats in the local environment such as the beach, bush and backyard • recognising that different living things live in different places such as land and water • exploring what happens when habitats change and some living things can no longer have their needs met
Chemical sciences	**Elaborations**

Everyday materials can be physically changed in a variety of ways (ACSSU018)	• predicting and comparing how the shapes of objects made from different materials can be physically changed through actions such as bending, stretching and twisting  • exploring how materials such as water, chocolate or play dough change when warmed or cooled 
Earth and space sciences	**Elaborations**
Observable changes occur in the sky and landscape (ACSSU019)	• exploring the local environment to identify and describe natural, managed and constructed features  • recording short and longer term patterns of events that occur on Earth and in the sky, such as the appearance of the moon and stars at night, the weather and the seasons 
Physical sciences	**Elaborations**
Light and sound are produced by a range of sources and can be sensed (ACSSU020)	• recognising senses are used to learn about the world around us: our eyes to detect light, our ears to detect sound, and touch to feel vibrations  • identifying the sun as a source of light  • recognising that objects can be seen when light from sources is available to illuminate them  • exploring different ways to produce sound using familiar objects and actions such as striking, blowing, scraping and shaking  • comparing sounds made by musical instruments using characteristics such as loudness, pitch and actions used to make the sound 
Science as a Human Endeavour	
Nature and development of science	**Elaborations**
Science involves observing, asking questions about, and describing changes in, objects and events (ACSHE021)	• jointly constructing questions about the events and features of the local environment with teacher guidance  • recognising that descriptions of what we observe are used by people to help identify change 
Use and influence of science	**Elaborations**

People use science in their daily lives, including when caring for their environment and living things (ACSHE022)	• considering how science is used in activities such as cooking, fishing, transport, sport, medicine and caring for plants and animals • considering that technologies used by Aboriginal and Torres Strait Islander people require an understanding of how materials can be used to make tools and weapons, musical instruments, clothing, cosmetics and artworks • exploring how musical instruments can be used to produce different sounds • comparing how different light sources are used in daily life • identifying ways that science knowledge is used in the care of the local environment such as animal habitats, and suggesting changes to parks and gardens to better meet the needs of native animals

Science Inquiry Skills

Questioning and predicting	Elaborations
Pose and respond to questions, and make predictions about familiar objects and events (ACSIS024)	• thinking about "What will happen if……?" type questions about everyday objects and events • using the senses to explore the local environment to pose interesting questions and making predictions about what will happen

Planning and conducting	Elaborations
Participate in guided investigations to explore and answer questions (ACSIS025)	• manipulating objects and making observations of what happens • researching ideas collaboratively using big books, web pages and ICT within the classroom • exploring different ways of solving science questions through guided discussion • sorting information and classifying objects based on easily observable characteristics with teacher guidance

Use informal measurements to collect and record observations, using digital technologies as appropriate (ACSIS026) 	• using units that are familiar to students from home and school, such as cups (cooking), hand spans (length) and walking paces (distance) to make and record observations with teacher guidance 
Processing and analysing data and information	**Elaborations**
Use a range of methods to sort information, including drawings and provided tables and through discussion, compare observations with predictions (ACSIS027) 	• using matching activities, including identifying similar things, odd-one-out and opposites  • discussing original predictions and, with guidance, comparing these to their observations  • exploring ways of recording and sharing information through class discussion  • jointly constructing simple column graphs and picture graphs to represent class investigations 
Evaluating	**Elaborations**
Compare observations with those of others (ACSIS213) 	• discussing observations as a whole class to identify similarities and differences in their observations 
Communicating	**Elaborations**
Represent and communicate observations and ideas in a variety of ways (ACSIS029) 	• discussing or representing what was discovered in an investigation  • engaging in whole class or guided small group discussions to share observations and ideas 

Year 1 Achievement Standard

By the end of Year 1, students describe objects and events that they encounter in their everyday lives, and the effects of interacting with materials and objects. They describe changes in their local environment and how different places meet the needs of living things.

Students respond to questions, make predictions, and participate in guided investigations of everyday phenomena. They follow instructions to record and sort their observations and share them with others.

Year 2

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

From Foundation to Year 2, students learn that observations can be organised to reveal patterns, and that these patterns can be used to make predictions about phenomena.

In Year 2, students describe the components of simple systems, such as stationary objects subjected to pushes or pulls, or combinations of materials, and show how objects and materials interact through direct manipulation. They observe patterns of growth and change in living things, and describe patterns and make predictions. They explore the use of resources from Earth and are introduced to the idea of the flow of matter when considering how water is used. They use counting and informal measurements to make and compare observations and begin to recognise that organising these observations in tables makes it easier to show patterns.

Year 2 Content Descriptions

Science Understanding	
Biological sciences	**Elaborations**
Living things grow, change and have offspring similar to themselves (ACSSU030)	• representing personal growth and changes from birth • recognising that living things have predictable characteristics at different stages of development • exploring different characteristics of life stages in animals such as egg, caterpillar and butterfly • observing that all animals have offspring, usually with two parents
Chemical sciences	**Elaborations**

Different materials can be combined for a particular purpose (ACSSU031)	• exploring the local environment to observe a variety of materials, and describing ways in which materials are used  • investigating the effects of mixing materials together  • suggesting why different parts of everyday objects such as toys and clothes are made from different materials  • identifying materials such as paper that can be changed and remade or recycled into new products 
Earth and space sciences	**Elaborations**
Earth's resources are used in a variety of ways (ACSSU032)	• identifying the Earth's resources including water, soil and minerals, and describing how they are used in the school  • describing how a resource such as water is transferred from its source to its point of use  • considering what might happen to humans if there were a change in a familiar available resource, such as water  • identifying actions at school such as turning off dripping taps, that can conserve resources 
Physical sciences	**Elaborations**
A push or a pull affects how an object moves or changes shape (ACSSU033)	• exploring ways that objects move on land, through water and in the air  • exploring how different strengths of pushes and pulls affect the movement of objects  • identifying toys from different cultures that use the forces of push or pull  • considering the effects of objects being pulled towards the Earth 
Science as a Human Endeavour	
Nature and development of science	**Elaborations**

Science involves observing, asking questions about, and describing changes in, objects and events (ACSHE034)	• describing everyday events and experiences and changes in our environment using knowledge of science  • suggesting how everyday items work, using knowledge of forces or materials  • identifying and describing sources of water 
Use and influence of science	**Elaborations**
People use science in their daily lives, including when caring for their environment and living things (ACSHE035) 	• monitoring information about the environment and Earth's resources, such as rainfall, water levels and temperature  • finding out about how Aboriginal and Torres Strait Islander people use science to meet their needs, including food supply  • exploring how different cultures have made inks, pigments and paints by mixing materials  • identifying the ways humans manage and protect resources, such as reducing waste and caring for water supplies  • recognising that many living things rely on resources that may be threatened, and that science understanding can contribute to the preservation of such resources 
Science Inquiry Skills	
Questioning and predicting	**Elaborations**
Pose and respond to questions, and make predictions about familiar objects and events (ACSIS037) 	• using the senses to explore the local environment to pose interesting questions, make inferences and predictions  • thinking about 'What will happen if...?' type questions about everyday objects and events 
Planning and conducting	**Elaborations**

Participate in guided investigations to explore and answer questions (ACSIS038) 	• manipulating objects and materials and making observations of the results  • researching with the use of simple information sources  • sorting objects and events based on easily identified characteristics 
Use informal measurements to collect and record observations, using digital technologies as appropriate (ACSIS039) 	• using units that are familiar to students from home and school, such as cups (cooking), hand spans (length) and walking paces (distance) to make and compare observations 
Processing and analysing data and information	**Elaborations**
Use a range of methods to sort information, including drawings and provided tables and through discussion, compare observations with predictions (ACSIS040) 	• constructing column and picture graphs with teacher guidance to record gathered information  • comparing and discussing, with guidance, whether observations were expected  • sorting information in provided tables or graphic organisers 
Evaluating	**Elaborations**
Compare observations with those of others (ACSIS041) 	• discussing observations with other students to see similarities and differences in results 
Communicating	**Elaborations**
Represent and communicate observations and ideas in a variety of ways (ACSIS042) 	• presenting ideas to other students, both one-to-one and in small groups  • discussing with others what was discovered from an investigation 

Year 2 Achievement Standard

By the end of Year 2, students describe changes to objects, materials and living things. They identify that certain materials and resources have different uses and describe examples of where science is used in people's daily lives.

Students pose and respond to questions about their experiences and predict outcomes of investigations. They use informal measurements to make and compare observations. They record and represent observations and communicate ideas in a variety of ways.

Year 3

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

Over Years 3 to 6, students develop their understanding of a range of systems operating at different time and geographic scales.

In Year 3, students observe heat and its effects on solids and liquids and begin to develop an understanding of energy flows through simple systems. In observing day and night, they develop an appreciation of regular and predictable cycles. Students order their observations by grouping and classifying; in classifying things as living or non-living they begin to recognise that classifications are not always easy to define or apply. They begin to quantify their observations to enable comparison, and learn more sophisticated ways of identifying and representing relationships, including the use of tables and graphs to identify trends. They use their understanding of relationships between components of simple systems to make predictions.

Year 3 Content Descriptions

Science Understanding	
Biological sciences	**Elaborations**
Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044)	• recognising characteristics of living things such as growing, moving, sensitivity and reproducing • recognising the range of different living things • sorting living and non-living things based on characteristics • exploring differences between living, once living and products of living things
Chemical sciences	**Elaborations**
A change of state between solid and liquid can be caused by adding or removing heat (ACSSU046)	• investigating how liquids and solids respond to changes in temperature, for example water changing to ice, or melting chocolate • exploring how changes from solid to liquid and liquid to solid can help us recycle materials • predicting the effect of heat on different materials

Earth and space sciences	Elaborations
Earth's rotation on its axis causes regular changes, including night and day (ACSSU048)	• recognising the sun as a source of light • constructing sundials and investigating how they work • describing timescales for the rotation of the Earth • modelling the relative sizes and movement of the sun, Earth and moon

Physical sciences	Elaborations
Heat can be produced in many ways and can move from one object to another (ACSSU049)	• describing how heat can be produced such as through friction or motion, electricity or chemically (burning) • identifying changes that occur in everyday situations due to heating and cooling • exploring how heat can be transferred through conduction • recognising that we can feel heat and measure its effects using a thermometer

Science as a Human Endeavour

Nature and development of science	Elaborations
Science involves making predictions and describing patterns and relationships (ACSHE050)	• making predictions about change and events in our environment • researching how knowledge of astronomy has been used by some Aboriginal and Torres Strait Islander people • considering how posing questions helps us plan for the future

Use and influence of science	Elaborations

Science knowledge helps people to understand the effect of their actions (ACSHE051)	• considering how heating affects materials used in everyday life • investigating how science helps people such as nurses, doctors, dentists, mechanics and gardeners • considering how materials including solids and liquids affect the environment in different ways • deciding what characteristics make a material a pollutant • researching Aboriginal and Torres Strait Islander people's knowledge of the local natural environment, such as the characteristics of plants and animals

Science Inquiry Skills

Questioning and predicting	Elaborations
With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge (ACSIS053)	• choosing questions to investigate from a list of possibilities • jointly constructing questions that may form the basis for investigation • listing shared experiences as a whole class and identifying possible investigations • working in groups to discuss things that might happen during an investigation

Planning and conducting	Elaborations
With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (ACSIS054)	• working with teacher guidance to plan investigations to test simple cause-and-effect relationships • discussing as a whole class ways to investigate questions and evaluating which ways might be most successful • discussing safety rules for equipment and procedures

Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (ACSIS055)	• recording measurements using familiar formal units and appropriate abbreviations, such as seconds (s), grams (g), centimetres (cm) • using a variety of tools to make observations, such as digital cameras, thermometers, rulers and scales
Processing and analysing data and information	**Elaborations**
Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS057)	• using provided tables to organise materials and objects based on observable properties • discussing how to graph data presented in a table • identifying and discussing numerical and visual patterns in data collected from students' own investigations and from secondary sources
Compare results with predictions, suggesting possible reasons for findings (ACSIS215)	• discussing how well predictions matched results from an investigation and sharing ideas about what was learnt
Evaluating	**Elaborations**
Reflect on investigations, including whether a test was fair or not (ACSIS058)	• describing experiences of carrying out investigations to the teacher, small group or whole class • discussing as a whole class the idea of fairness in testing
Communicating	**Elaborations**
Represent and communicate observations, ideas and findings using formal and informal representations (ACSIS060)	• communicating with other students carrying out similar investigations to share experiences and improve investigation skill • exploring different ways to show processes and relationships through diagrams, models and role play • using simple explanations and arguments, reports or graphical representations to communicate ideas to other students

Year 3 Achievement Standard

By the end of Year 3, students use their understanding of the movement of Earth, materials and the behaviour of heat to suggest explanations for everyday observations. They group living things based on observable features and distinguish them from non-living things. They describe how they can use science investigations to respond to questions.

Students use their experiences to identify questions and make predictions about scientific investigations. They follow procedures to collect and record observations and suggest possible reasons for their findings, based on patterns in their data. They describe how safety and fairness were considered and they use diagrams and other representations to communicate their ideas.

Year 4

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

Over Years 3 to 6, students develop their understanding of a range of systems operating at different time and geographic scales.

In Year 4, students broaden their understanding of classification and form and function through an exploration of the properties of natural and processed materials. They learn that forces include non-contact forces and begin to appreciate that some interactions result from phenomena that can't be seen with the naked eye. They begin to appreciate that current systems, such as Earth's surface, have characteristics that have resulted from past changes and that living things form part of systems. They understand that some systems change in predictable ways, such as through cycles. They apply their knowledge to make predictions based on interactions within systems, including those involving the actions of humans.

Year 4 Content Descriptions

Science Understanding	
Biological sciences	**Elaborations**
Living things have life cycles (ACSSU072)	• making and recording observations of living things as they develop through their life cycles • describing the stages of life cycles of different living things such as insects, birds, frogs and flowering plants • comparing life cycles of animals and plants • recognising that environmental factors can affect life cycles such as fire and seed germination

Living things depend on each other and the environment to survive (ACSSU073)	• investigating how plants provide shelter for animals  • investigating the roles of living things in a habitat, for instance producers, consumers or decomposers  • observing and describing predator-prey relationships  • predicting the effects when living things in feeding relationships are removed or die out in an area  • recognising that interactions between living things may be competitive or mutually beneficial 
Chemical sciences	**Elaborations**
Natural and processed materials have a range of physical properties that can influence their use (ACSSU074)	• describing a range of common materials, such as metals or plastics, and their uses  • investigating a particular property across a range of materials  • selecting materials for uses based on their properties • considering how the properties of materials affect the management of waste or can lead to pollution 
Earth and space sciences	**Elaborations**
Earth's surface changes over time as a result of natural processes and human activity (ACSSU075) 	• collecting evidence of change from local landforms, rocks or fossils  • exploring a local area that has changed as a result of natural processes, such as an eroded gully, sand dunes or river banks  • investigating the characteristics of soils  • considering how different human activities cause erosion of the Earth's surface  • considering the effect of events such as floods and extreme weather on the landscape, both in Australia and in the Asia region 
Physical sciences	**Elaborations**

Forces can be exerted by one object on another through direct contact or from a distance (ACSSU076)	• observing qualitatively how speed is affected by the size of a force • exploring how non-contact forces are similar to contact forces in terms of objects pushing and pulling another object • comparing and contrasting the effect of friction on different surfaces, such as tyres and shoes on a range of surfaces • investigating the effect of forces on the behaviour of an object through actions such as throwing, dropping, bouncing and rolling • exploring the forces of attraction and repulsion between magnets

Science as a Human Endeavour

Nature and development of science	Elaborations
Science involves making predictions and describing patterns and relationships (ACSHE061)	• exploring ways in which scientists gather evidence for their ideas and develop explanations • considering how scientific practices such as sorting, classification and estimation are used by Aboriginal and Torres Strait Islander people in everyday life

Use and influence of science	Elaborations
Science knowledge helps people to understand the effect of their actions (ACSHE062)	• investigating how a range of people, such as clothing designers, builders or engineers use science to select appropriate materials for their work • considering methods of waste management and how they can affect the environment • exploring how science has contributed to a discussion about an issue such as loss of habitat for living things or how human activity has changed the local environment • considering how to minimise the effects of erosion caused by human activity

Science Inquiry Skills

Questioning and predicting	Elaborations
With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge (ACSIS064) 	• considering familiar situations in order to think about possible areas for investigation  • reflecting on familiar situations to make predictions with teacher guidance  • choosing questions to investigate from a list of possibilities 

Planning and conducting	Elaborations
With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (ACSIS065) 	• exploring different ways to conduct investigations and connecting these to the types of questions asked with teacher guidance  • working in groups, with teacher guidance, to plan ways to investigate questions  • discussing and recording safety rules for equipment as a whole class 
Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (ACSIS066) 	• making and recording measurements using familiar formal units and appropriate abbreviations, such as seconds (s), grams (g), centimetres (cm) and millilitres (mL)  • recognising the elements of a fair test and using these when planning the steps and processes of an investigation 

Processing and analysing data and information	Elaborations
Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS068) 	• identifying and discussing numerical and visual patterns in data collected from students' investigations and from other sources  • using provided graphic organisers to sort and represent information  • discussing with teacher guidance which graphic organisers will be most useful in sorting or organising data arising from investigations 

Compare results with predictions, suggesting possible reasons for findings (ACSIS216)	• discussing how well predictions matched results from an investigation and proposing reasons for findings • comparing, in small groups, proposed reasons for findings and explaining their reasoning
Evaluating	**Elaborations**
Reflect on investigations, including whether a test was fair or not (ACSIS069)	• reflecting on investigations, identifying what went well, what was difficult or didn't work so well, and how well the investigation helped answer the question • discussing which aspects of the investigation helped improve fairness, and any aspects that weren't fair
Communicating	**Elaborations**
Represent and communicate observations, ideas and findings using formal and informal representations (ACSIS071)	• communicating with other students carrying out similar investigations to share experiences and improve investigation skills • using simple explanations and arguments, reports or graphical representations to communicate ideas to other students

Year 4 Achievement Standard

By the end of Year 4, students apply the observable properties of materials to explain how objects and materials can be used. They describe how contact and non-contact forces affect interactions between objects. They discuss how natural processes and human activity cause changes to Earth's surface. They describe relationships that assist the survival of living things and sequence key stages in the life cycle of a plant or animal. They identify when science is used to understand the effect of their actions.

Students follow instructions to identify investigable questions about familiar contexts and make predictions based on prior knowledge. They describe ways to conduct investigations and safely use equipment to make and record observations with accuracy. They use provided tables and column graphs to organise data and identify patterns. Students suggest explanations for observations and compare their findings with their predictions. They suggest reasons why a test was fair or not. They use formal and informal ways to communicate their observations and findings.

Year 5

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

Over Years 3 to 6, students develop their understanding of a range of systems operating at different time and geographic scales.

In Year 5, students are introduced to cause and effect relationships through an exploration of adaptations of living things and how this links to form and function. They explore observable phenomena associated with light and begin to appreciate that phenomena have sets of characteristic behaviours. They broaden their classification of matter to include gases and begin to see how matter structures the world around them. Students consider Earth as a component within a solar system and use models for investigating systems at astronomical scales. Students begin to identify stable and dynamic aspects of systems, and learn how to look for patterns and relationships between components of systems. They develop explanations for the patterns they observe.

Year 5 Content Descriptions

Science Understanding	
Biological sciences	**Elaborations**
Living things have structural features and adaptations that help them to survive in their environment (ACSSU043)	• explaining how particular adaptations help survival such as nocturnal behaviour, silvery coloured leaves of dune plants • describing and listing adaptations of living things suited for particular Australian environments • exploring general adaptations for particular environments such as adaptations that aid water conservation in deserts
Chemical sciences	**Elaborations**

Solids, liquids and gases have different observable properties and behave in different ways (ACSSU077)	• recognising that substances exist in different states depending on the temperature  • observing that gases have mass and take up space, demonstrated by using balloons or bubbles  • exploring the way solids, liquids and gases change under different situations such as heating and cooling  • recognising that not all substances can be easily classified on the basis of their observable properties 
Earth and space sciences	**Elaborations**
The Earth is part of a system of planets orbiting around a star (the sun) (ACSSU078)	• identifying the planets of the solar system and comparing how long they take to orbit the sun  • modelling the relative size of and distance between Earth, other planets in the solar system and the sun  • recognising the role of the sun as a provider of energy for the Earth 
Physical sciences	**Elaborations**
Light from a source forms shadows and can be absorbed, reflected and refracted (ACSSU080)	• drawing simple labelled ray diagrams to show the paths of light from a source to our eyes  • comparing shadows from point and extended light sources such as torches and fluorescent tubes  • classifying materials as transparent, opaque or translucent based on whether light passes through them or is absorbed  • recognising that the colour of an object depends on the properties of the object and the colour of the light source  • exploring the use of mirrors to demonstrate the reflection of light • recognising the refraction of light at the surfaces of different transparent materials, such as when light travels from air to water or air to glass 
Science as a Human Endeavour	

Nature and development of science	Elaborations
Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE081)	• developing an understanding of the behaviour of light by making observations of its effects • testing predictions relating to the behaviour of solids, liquids and gases by conducting observational experiments • researching how scientists were able to develop ideas about the solar system through the gathering of evidence through space exploration • describing how scientists from a range of cultures have improved our understanding of the solar system, such as Copernicus, KhayyÃ¡m and Galileo • researching the different types of scientists who work in teams in space exploration, and Australia's involvement in space exploration • learning how Aboriginal and Torres Strait Islander Peoples used observation of the night sky to assist with navigation

Use and influence of science	Elaborations

Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE083)	• considering how best to ensure growth of plants • considering how decisions are made to grow particular plants and crops depending on environmental conditions • comparing the benefits of using solid, liquid or gaseous fuels to heat a home • describing the safety aspects of using gases • investigating how the development of materials such as plastics and synthetic fabrics have led to the production of useful products • describing how technologies developed to aid space exploration have changed the way people live, work and communicate • exploring objects and devices that include parts that involve the reflection, absorption or refraction of light such as mirrors, sunglasses and prisms

Science Inquiry Skills

Questioning and predicting	Elaborations
With guidance, pose clarifying questions and make predictions about scientific investigations (ACSIS231)	• exploring the range of questions that can be asked about a problem or phenomena and with guidance, identifying those questions that could be investigated • applying experience from similar situations in the past to predict what might happen in a new situation

Planning and conducting	Elaborations

Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS086)	• experiencing a range of ways of investigating questions, including experimental testing, internet research, field observations and exploring simulations • explaining rules for safe processes and use of equipment • discussing the advantages of certain types of investigation for answering certain types of questions • considering different ways to approach problem solving, including researching, using trial and error, experimental testing and creating models
Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSIS087)	• discussing in groups how investigations can be made as fair as possible • using tools to accurately measure objects and events in investigation and exploring which tools provide the most accurate measurements • using familiar units such as grams, seconds and meters and developing the use of standard multipliers such as kilometres and millimetres • recording data in tables and diagrams or electronically as digital images and spreadsheets
Processing and analysing data and information	**Elaborations**
Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate (ACSIS090)	• constructing tables, graphs and other graphic organisers to show trends in data • identifying patterns in data and developing explanations that fit these patterns • identifying similarities and differences in qualitative data in order to group items or materials
Compare data with predictions and use as evidence in developing explanations (ACSIS218)	• sharing ideas as to whether observations match predictions, and discussing possible reasons for predictions being incorrect
Evaluating	**Elaborations**

Reflect on and suggest improvements to scientific investigations (ACSIS091) 	• working collaboratively to identify where methods could be improved, including where testing was not fair and practices could be improved 
Communicating	**Elaborations**
Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts (ACSIS093) 	• discussing how models represent scientific ideas and constructing physical models to demonstrate an aspect of scientific understanding  • constructing multi-modal texts to communicate science ideas  • using labelled diagrams, including cross-sectional representations, to communicate ideas 

Year 5 Achievement Standard

By the end of Year 5, students classify substances according to their observable properties and behaviours. They explain everyday phenomena associated with the transfer of light. They describe the key features of our solar system. They analyse how the form of living things enables them to function in their environments. Students discuss how scientific developments have affected people's lives, help us solve problems and how science knowledge develops from many people's contributions.

Students follow instructions to pose questions for investigation and predict the effect of changing variables when planning an investigation. They use equipment in ways that are safe and improve the accuracy of their observations. Students construct tables and graphs to organise data and identify patterns in the data. They compare patterns in their data with predictions when suggesting explanations. They describe ways to improve the fairness of their investigations, and communicate their ideas and findings using multimodal texts.

Year 6

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

Over Years 3 to 6, students develop their understanding of a range of systems operating at different time and geographic scales.

In Year 6, students explore how changes can be classified in different ways. They learn about transfer and transformations of electricity, and continue to develop an understanding of energy flows through systems. They link their experiences of electric circuits as a system at one scale to generation of electricity from a variety of sources at another scale and begin to see links between these systems. They develop a view of Earth as a dynamic system, in which changes in one aspect of the system impact on other aspects; similarly, they see that the growth and survival of living things are dependent on matter and energy flows within a larger system. Students begin to see the role of variables in measuring changes and the value of accuracy in these measurements. They learn how to look for patterns and to use these to identify and explain relationships by drawing on evidence.

Year 6 Content Descriptions

Science Understanding	
Biological sciences	**Elaborations**
The growth and survival of living things are affected by physical conditions of their environment (ACSSU094)	• investigating how changing the physical conditions for plants impacts on their growth and survival such as salt water, use of fertilizers and soil types • observing the growth of fungi such as yeast and bread mould in different conditions • researching organisms that live in extreme environments such as Antarctica or a desert • considering the effects of physical conditions causing migration and hibernation
Chemical sciences	**Elaborations**

Changes to materials can be reversible or irreversible (ACSSU095)	• describing what happens when materials are mixed  • investigating the solubility of common materials in water  • investigating the change in state caused by heating and cooling of a familiar substance  • investigating irreversible changes such as rusting, burning and cooking  • exploring how reversible changes can be used to recycle materials  • investigate reversible reactions such as melting, freezing and evaporating 
Earth and space sciences	**Elaborations**
Sudden geological changes and extreme weather events can affect Earth's surface (ACSSU096)	• investigating major geological events such as earthquakes, volcanic eruptions and tsunamis in Australia, the Asia region and throughout the world  • recognising that earthquakes can cause tsunamis • describing how people measure significant geological events  • exploring ways that scientific understanding can assist in natural disaster management to minimise both long- and short-term effects  • considering the effect of drought on living and non-living aspects of the environment 
Physical sciences	**Elaborations**

Electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources (ACSSU097)	• recognising the need for a complete circuit to allow the flow of electricity  • investigating different electrical conductors and insulators  • exploring the features of electrical devices such as switches and light globes  • investigating how moving air and water can turn turbines to generate electricity  • investigating the use of solar panels  • considering whether an energy source is sustainable 

Science as a Human Endeavour

Nature and development of science	Elaborations

Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE098) 	• investigating how knowledge about the effects of using the Earth's resources has changed over time  • describing how understanding of the causes and effects of major natural events has changed as new evidence has become available  • investigating the use of electricity, including predicting the effects of changes to electric circuits  • considering how gathering evidence helps scientists to predict the effect of major geological or climatic events  • investigating how people from different cultures have used sustainable sources of energy, for example water and solar power  • exploring institutions and locations where contemporary Australian scientists conduct research on catastrophic natural events  • learning how Aboriginal and Torres Strait Islander knowledge, such as the medicinal and nutritional properties of Australian plants, is being used as part of the evidence base for scientific advances  • investigating the development of earthquake measurements from the Chinese invention of the seismograph in the second century 
Use and influence of science	**Elaborations**

Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE100)	• considering how personal and community choices influence our use of sustainable sources of energy • investigating how understanding of catastrophic natural events helps in planning for their early detection and minimising their impact • recognising that science can inform choices about where people live and how they manage natural disasters • considering how guidelines help to ensure the safe use of electrical devices • discussing the use of electricity and the conservation of sources of energy • researching the scientific work involved in global disaster alerts and communication, such as cyclone, earthquake and tsunami alerts • investigating how electrical energy is generated in Australia and around the world • researching the use of methane generators in Indonesia • considering how electricity and electrical appliances have changed the way some people live

Science Inquiry Skills

Questioning and predicting	Elaborations
With guidance, pose clarifying questions and make predictions about scientific investigations (ACSIS232)	• refining questions to enable scientific investigation • asking questions to understand the scope or nature of a problem • applying experience from previous investigations to predict the outcomes of investigations in new contexts

Planning and conducting	Elaborations

Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS103)	• following a procedure to design an experimental or field investigation • discussing methods chosen with other students, and refining methods accordingly • considering which investigation methods are most suited to answer a particular question or solve a problem
Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSIS104)	• using familiar units such as grams, seconds and metres and developing the use of standard multipliers such as kilometres and millimetres • using the idea of an independent variable (note: this terminology does not need to be used at this stage) as something that is being investigated by changing it and measuring the effect of this change • using digital technologies to make accurate measurements and to record data
Processing and analysing data and information	**Elaborations**
Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate (ACSIS107)	• exploring how different representations can be used to show different aspects of relationships, processes or trends • using digital technologies to construct representations, including dynamic representations
Compare data with predictions and use as evidence in developing explanations (ACSIS221)	• sharing ideas as to whether observations match predictions, and discussing possible reasons for predictions being incorrect • discussing the difference between data and evidence • referring to evidence when explaining the outcomes of an investigation
Evaluating	**Elaborations**
Reflect on and suggest improvements to scientific investigations (ACSIS108)	• discussing improvements to the methods used, and how these methods would improve the quality of the data obtained

Communicating	Elaborations
Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts (ACSIS110) 	• discussing the best way to communicate science ideas and what should be considered when planning a text  • using a variety of communication modes, such as reports, explanations, arguments, debates and procedural accounts, to communicate science ideas  • using labelled diagrams, including cross-sectional representations, to communicate ideas and processes within multi-modal texts 

Year 6 Achievement Standard

By the end of Year 6, students compare and classify different types of observable changes to materials. They analyse requirements for the transfer of electricity and describe how energy can be transformed from one form to another when generating electricity. They explain how natural events cause rapid change to Earth's surface. They describe and predict the effect of environmental changes on individual living things. Students explain how scientific knowledge helps us to solve problems and inform decisions and identify historical and cultural contributions.

Students follow procedures to develop investigable questions and design investigations into simple cause-and-effect relationships. They identify variables to be changed and measured and describe potential safety risks when planning methods. They collect, organise and interpret their data, identifying where improvements to their methods or research could improve the data. They describe and analyse relationships in data using appropriate representations and construct multimodal texts to communicate ideas, methods and findings.

Year 7

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

Over Years 7 to 10, students develop their understanding of microscopic and atomic structures; how systems at a range of scales are shaped by flows of energy and matter and interactions due to forces, and develop the ability to quantify changes and relative amounts.

In Year 7, students explore the diversity of life on Earth and continue to develop their understanding of the role of classification in ordering and organising information. They use and develop models such as food chains, food webs and the water cycle to represent and analyse the flow of energy and matter through ecosystems and explore the impact of changing components within these systems. They consider the interaction between multiple forces when explaining changes in an object's motion. They explore the notion of renewable and non-renewable resources and consider how this classification depends on the timescale considered. They investigate relationships in the Earth-sun-moon system and use models to predict and explain events. Students make accurate measurements and control variables to analyse relationships between system components. They explore and explain these relationships through appropriate representations and consider the role of science in decision making processes.

Year 7 Content Descriptions

Science Understanding	
Biological sciences	**Elaborations**
Classification helps organise the diverse group of organisms (ACSSU111)	• considering the reasons for classifying such as identification and communication • grouping a variety of organisms on the basis of similarities and differences in particular features • considering how biological classifications have changed over time • classifying using hierarchical systems such as kingdom, phylum, class, order, family, genus, species • using scientific conventions for naming species • using provided keys to identify organisms surveyed in a local habitat

Interactions between organisms, including the effects of human activities can be represented by food chains and food webs (ACSSU112)	• using food chains to show feeding relationships in a habitat • constructing and interpreting food webs to show relationships between organisms in an environment • classifying organisms of an environment according to their position in a food chain • recognising the role of microorganisms within food chains and food webs • investigating the effect of human activity on local habitats, such as deforestation, agriculture or the introduction of new species • exploring how living things can cause changes to their environment and impact other living things, such as the effect of cane toads • researching specific examples of human activity, such as the use of fire by traditional Aboriginal people and the effects of palm oil production in Sumatra and Borneo
Chemical sciences	**Elaborations**
Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques (ACSSU113)	• recognising the differences between pure substances and mixtures and identifying examples of each • identifying the solvent and solute in solutions • investigating and using a range of physical separation techniques such as filtration, decantation, evaporation, crystallisation, chromatography and distillation • exploring and comparing separation methods used in the home
Earth and space sciences	**Elaborations**

Predictable phenomena on Earth, including seasons and eclipses, are caused by the relative positions of the sun, Earth and the moon (ACSSU115)	• investigating natural phenomena such as lunar and solar eclipses, seasons and phases of the moon • comparing times for the rotation of Earth, the sun and moon, and comparing the times for the orbits of Earth and the moon • modelling the relative movements of the Earth, sun and moon and how natural phenomena such as solar and lunar eclipses and phases of the moon occur • explaining why different regions of the Earth experience different seasonal conditions
Some of Earth's resources are renewable, including water that cycles through the environment, but others are non-renewable (ACSSU116)	• considering what is meant by the term 'renewable' in relation to the Earth's resources • considering timescales for regeneration of resources • comparing renewable and non-renewable energy sources, including how they are used in a range of situations • considering the water cycle in terms of changes of state of water • investigating factors that influence the water cycle in nature • exploring how human management of water impacts on the water cycle
Physical sciences	**Elaborations**

Change to an object's motion is caused by unbalanced forces, including Earth's gravitational attraction, acting on the object (ACSSU117)	• investigating the effects of applying different forces to familiar objects • investigating common situations where forces are balanced, such as stationary objects, and unbalanced, such as falling objects • investigating a simple machine such as lever or pulley system • exploring how gravity affects objects on the surface of Earth • considering how gravity keeps planets in orbit around the sun

Science as a Human Endeavour

Nature and development of science	Elaborations
Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE119)	• investigating how advances in telescopes and space probes have provided new evidence about space • researching different ideas used in the development of models of the solar system developed by scientists such as Copernicus, Khayyám and Galileo • researching developments in the understanding of astronomy, such as the predictions of eclipses and the calculation of the length of the solar year by Al‑Battani in the tenth century

Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures (ACSHE223)	• considering how water use and management relies on knowledge from different areas of science, and involves the application of technology • identifying the contributions of Australian scientists to the study of human impact on environments and to local environmental management projects • investigating how land management practices of Aboriginal and Torres Strait Islander peoples can help inform sustainable management of the environment • studying transnational collaborative research in the Antarctic • recognising that traditional and Western scientific knowledge can be used in combination to care for Country/Place
Use and influence of science	**Elaborations**
Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE120)	• relating regulations about wearing seatbelts or safety helmets to knowledge of forces and motion • considering issues relating to the use and management of water within a community • considering decisions made in relation to the recycling of greywater and blackwater • considering how human activity in the community can have positive and negative effects on the sustainability of ecosystems • investigating ways to control the spread of the cane toad

People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE121) 	• investigating everyday applications of physical separation techniques such as filtering, sorting waste materials, reducing pollution, extracting products from plants, separating blood products and cleaning up oil spills  • investigating how advances in science and technology have been applied to the treatment of water in industrial and household systems  • investigating how Aboriginal and Torres Strait Islander knowledge is being used to inform scientific decisions, for example care of waterways  • researching the different scientific responses to the rabbit plagues in Australian agricultural areas  • recognising that water management plays a role in areas such as farming, land management and gardening • investigating how separation techniques are used in the food and wine industries • considering how seasonal changes affect people in a variety of activities such as farming • considering how sports scientists apply knowledge of forces to improve performance

Science Inquiry Skills

Questioning and predicting	Elaborations
Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS124) 	• working collaboratively to identify a problem to investigate  • recognising that the solution of some questions and problems requires consideration of social, cultural, economic or moral aspects rather than or as well as scientific investigation  • using information and knowledge from previous investigations to predict the expected results from an investigation 

Planning and conducting	Elaborations

Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125)	• working collaboratively to decide how to approach an investigation • learning and applying specific skills and rules relating to the safe use of scientific equipment • identifying whether the use of their own observations and experiments or the use of other research materials is appropriate for their investigation • developing strategies and techniques for effective research using secondary sources, including use of the internet
Measure and control variables, select equipment appropriate to the task and collect data with accuracy (ACSIS126)	• recognising the differences between controlled, dependent and independent variables • using a digital camera to record observations and compare images using information technologies • using specialised equipment to increase the accuracy of measurement within an investigation
Processing and analysing data and information	**Elaborations**
Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (ACSIS129)	• understanding different types of graphical and physical representation and considering their advantages and disadvantages • using spreadsheets to aid the presentation and simple analysis of data • describing the trends shown in collected data
Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (ACSIS130)	• using diagrammatic representations to convey abstract ideas and to simplify complex situations • comparing and contrasting data from a number of sources in order to create a summary of collected data • identifying data which provides evidence to support or negate the hypothesis under investigation • referring to relevant evidence when presenting conclusions drawn from an investigation

Evaluating	Elaborations
Reflect on scientific investigations including evaluating the quality of the data collected, and identifying improvements (ACSIS131) 	• discussing investigation methods with others to share ideas about the quality of the inquiry process  • identifying and considering indicators of the quality of the data when analysing results  • suggesting improvements to inquiry methods based on experience 
Use scientific knowledge and findings from investigations to evaluate claims based on evidence (ACSIS132) 	• using the evidence provided by scientific investigations to evaluate the claims or conclusions of their peers 
Communicating	**Elaborations**
Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations, using digital technologies as appropriate (ACSIS133) 	• presenting the outcomes of research using effective forms of representation of data or ideas and scientific language that is appropriate for the target audience  • using digital technologies to access information and to communicate and collaborate with others on and off site 

Year 7 Achievement Standard

By the end of Year 7, students describe techniques to separate pure substances from mixtures. They represent and predict the effects of unbalanced forces, including Earth's gravity, on motion. They explain how the relative positions of Earth, the sun and moon affect phenomena on Earth. They analyse how the sustainable use of resources depends on the way they are formed and cycle through Earth systems. They predict the effect of human and environmental changes on interactions between organisms and classify and organise diverse organisms based on observable differences. Students describe situations where scientific knowledge from different science disciplines and diverse cultures has been used to solve a real-world problem. They explain possible implications of the solution for different groups in society.

Students identify questions that can be investigated scientifically. They plan fair experimental methods, identifying variables to be changed and measured. They select equipment that improves fairness and accuracy and describe how they considered safety. Students draw on evidence to support their conclusions. They summarise data from different sources, describe trends and refer to the quality of their data when suggesting improvements to their methods. They communicate their ideas, methods and findings using scientific language and appropriate representations.

Year 8

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

Over Years 7 to 10, students develop their understanding of microscopic and atomic structures; how systems at a range of scales are shaped by flows of energy and matter and interactions due to forces, and develop the ability to quantify changes and relative amounts.

In Year 8, students are introduced to cells as microscopic structures that explain macroscopic properties of living systems. They link form and function at a cellular level and explore the organisation of body systems in terms of flows of matter between interdependent organs. Similarly, they explore changes in matter at a particle level, and distinguish between chemical and physical change. They begin to classify different forms of energy, and describe the role of energy in causing change in systems, including the role of heat and kinetic energy in the rock cycle. Students use experimentation to isolate relationships between components in systems and explain these relationships through increasingly complex representations. They make predictions and propose explanations, drawing on evidence to support their views while considering other points of view.

Year 8 Content Descriptions

Science Understanding

Biological sciences	Elaborations
Cells are the basic units of living things; they have specialised structures and functions (ACSSU149)	• examining a variety of cells using a light microscope, by digital technology or by viewing a simulation • distinguishing plant cells from animal or fungal cells • identifying structures within cells and describing their function • recognising that some organisms consist of a single cell • recognising that cells reproduce via cell division • describing mitosis as cell division for growth and repair

Multi-cellular organisms contain systems of organs carrying out specialised functions that enable them to survive and reproduce (ACSSU150)	• identifying the organs and overall function of a system of a multicellular organism in supporting the life processes • describing the structure of each organ in a system and relating its function to the overall function of the system • examining the specialised cells and tissues involved in structure and function of particular organs • comparing similar systems in different organisms such as digestive systems in herbivores and carnivores, respiratory systems in fish and mammals • distinguishing between asexual and sexual reproduction • comparing reproductive systems of organisms
Chemical sciences	**Elaborations**
Properties of the different states of matter can be explained in terms of the motion and arrangement of particles (ACSSU151)	• explaining why a model for the structure of matter is needed • modelling the arrangement of particles in solids, liquids and gases • using the particle model to explain observed phenomena linking the energy of particles to temperature changes
Differences between elements, compounds and mixtures can be described at a particle level (ACSSU152)	• modelling the arrangement of particles in elements and compounds • recognising that elements and simple compounds can be represented by symbols and formulas • locating elements on the periodic table

Chemical change involves substances reacting to form new substances (ACSSU225)	• identifying the differences between chemical and physical changes  • identifying evidence that a chemical change has taken place  • investigating simple reactions such as combining elements to make a compound  • recognising that the chemical properties of a substance, for example its flammability and ability to corrode, will affect its use 
Earth and space sciences	**Elaborations**
Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales (ACSSU153)	• representing the stages in the formation of igneous, metamorphic and sedimentary rocks, including indications of timescales involved  • identifying a range of common rock types using a key based on observable physical and chemical properties  • recognising that rocks are a collection of different minerals  • considering the role of forces and energy in the formation of different types of rocks and minerals  • recognising that some rocks and minerals, such as ores, provide valuable resources 
Physical sciences	**Elaborations**

Energy appears in different forms, including movement (kinetic energy), heat and potential energy, and energy transformations and transfers cause change within systems (ACSSU155)	• recognising that kinetic energy is the energy possessed by moving bodies  • recognising that potential energy is stored energy, such as gravitational, chemical and elastic energy  • investigating different forms of energy in terms of the effects they cause, such as gravitational potential causing objects to fall and heat energy transferred between materials that have a different temperature  • recognising that heat energy is often produced as a by-product of energy transfer, such as brakes on a car and light globes  • using flow diagrams to illustrate changes between different forms of energy 

Science as a Human Endeavour

Nature and development of science	Elaborations
Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE134)	• investigating developments in the understanding of cells and how this knowledge has impacted on areas such as health and medicine  • discovering how people's understanding of the nature of matter has changed over time as evidence for particle theory has become available through developments in technology  • considering how the idea of elements has developed over time as knowledge of the nature of matter has improved  • investigating the development of the microscope and the impact it has had on the understanding of cell functions and division 

Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures (ACSHE226)	• investigating how knowledge of the location and extraction of mineral resources relies on expertise from across the disciplines of science  • considering how advances in technology, combined with scientific understanding of the functioning of body systems, has enabled medical science to replace or repair organs  • researching the use of reproductive technologies and how developments in this field rely on scientific knowledge from different areas of science 
Use and influence of science	**Elaborations**
Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE135) 	• investigating requirements and the design of systems for collecting and recycling household waste  • investigating strategies implemented to maintain part of the local environment, such as bushland, a beach, a lake, a desert or a shoreline  • investigating how energy efficiency can reduce energy consumption  • investigating the development of vehicles over time, including the application of science to contemporary designs of solar-powered vehicles  • discussing ethical issues that arise from organ transplantation 

People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE136)	• describing how technologies have been applied to modern farming techniques to improve yields and sustainability • investigating how Aboriginal people recognise relationships in ecosystems by burning to promote new growth, attract animals and afford easier hunting and food gathering • describing the impact of plant cloning techniques (asexual production) in agriculture such as horticulture, fruit production and vineyards • investigating the role of science in the development of technology important to the economies and communities of the Asia–Pacific regions, for example car manufacture, earthquake prediction and electronic optics • recognising the role of knowledge of the environment and ecosystems in a number of occupations • considering how engineers improve energy efficiency of a range of processes • recognising the role of knowledge of cells and cell divisions in the area of disease treatment and control • investigating how scientists have created new materials such as synthetic fibres, heat-resistant plastics and pharmaceuticals

Science Inquiry Skills

Questioning and predicting	Elaborations
Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS139)	• considering whether investigation using available resources is possible when identifying questions or problems to investigate • recognising that the solution of some questions and problems requires consideration of social, cultural, economic or moral aspects rather than or as well as scientific investigation • using information and knowledge from their own investigations and secondary sources to predict the expected results from an investigation

Planning and conducting	Elaborations
Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS140)	• working collaboratively to decide how to best approach an investigation • identifying any ethical considerations that may apply to the investigation • taking into consideration all aspects of fair testing, available equipment and safe investigation when planning investigations
Measure and control variables, select equipment appropriate to the task and collect data with accuracy (ACSIS141)	• using specialised equipment to increase the accuracy of measurement within an investigation • identifying and explaining the differences between controlled, dependent and independent variables

Processing and analysing data and information	Elaborations
Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (ACSIS144)	• describing measures of central tendency and identifying outliers for quantitative data • explaining the strengths and limitations of representations such as physical models, diagrams and simulations in terms of the attributes of systems included or not included
Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (ACSIS145)	• constructing tables, graphs, keys and models to represent relationships and trends in collected data • drawing conclusions based on a range of evidence including primary and secondary sources

Evaluating	Elaborations
Reflect on scientific investigations including evaluating the quality of the data collected, and identifying improvements (ACSIS146)	• suggesting improvements to investigation methods that would improve the accuracy of the data recorded • discussing investigation methods with others to share ideas about the quality of the inquiry process

Use scientific knowledge and findings from investigations to evaluate claims based on evidence (ACSIS234) 	• identifying the scientific evidence available to evaluate claims  • deciding whether or not to accept claims based on scientific evidence  • identifying where science has been used to make claims relating to products and practices 
Communicating	**Elaborations**
Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations, using digital technologies as appropriate (ACSIS148) 	• using digital technologies to construct a range of text types to present science ideas  • selecting and using appropriate language and representations to communcate science ideas within a specified text type and for a specified audience 

Year 8 Achievement Standard

By the end of Year 8, students compare physical and chemical changes and use the particle model to explain and predict the properties and behaviours of substances. They identify different forms of energy and describe how energy transfers and transformations cause change in simple systems. They compare processes of rock formation, including the timescales involved. They analyse the relationship between structure and function at cell, organ and body system levels. Students examine the different science knowledge used in occupations. They explain how evidence has led to an improved understanding of a scientific idea and describe situations in which scientists collaborated to generate solutions to contemporary problems. They reflect on implications of these solutions for different groups in society.

Students identify and construct questions and problems that they can investigate scientifically. They consider safety and ethics when planning investigations, including designing field or experimental methods. They identify variables to be changed, measured and controlled. Students construct representations of their data to reveal and analyse patterns and trends, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their own scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate language and representations to communicate science ideas, methods and findings in a range of text types.

Year 9

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

Over Years 7 to 10, students develop their understanding of microscopic and atomic structures, how systems at a range of scales are shaped by flows of energy and matter and interactions due to forces, and develop the ability to quantify changes and relative amounts.

In Year 9, students consider the operation of systems at a range of scales. They explore ways in which the human body as a system responds to its external environment and the interdependencies between biotic and abiotic components of ecosystems. They are introduced to the notion of the atom as a system of protons, electrons and neutrons, and how this system can change through nuclear decay. They learn that matter can be rearranged through chemical change and that these changes play an important role in many systems. They are introduced to the concept of the conservation of matter and begin to develop a more sophisticated view of energy transfer. They begin to apply their understanding of energy and forces to global systems such as continental movement.

Year 9 Content Descriptions

Science Understanding

Biological sciences	Elaborations
Multi-cellular organisms rely on coordinated and interdependent internal systems to respond to changes to their environment (ACSSU175)	• describing how the requirements for life (for example oxygen, nutrients, water and removal of waste) are provided through the coordinated function of body systems such as the respiratory, circulatory, digestive, nervous and excretory systems • explaining how body systems work together to maintain a functioning body using models, flow diagrams or simulations • identifying responses using nervous and endocrine systems • investigating the response of the body to changes as a result of the presence of micro-organisms • investigating the effects on humans of exposure to electromagnetic radiations such as X-rays and microwaves

Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems (ACSSU176)	• exploring interactions between organisms such as predator/prey, parasites, competitors, pollinators and disease • examining factors that affect population sizes such as seasonal changes, destruction of habitats, introduced species • considering how energy flows into and out of an ecosystem via the pathways of food webs, and how it must be replaced to maintain the sustainability of the system • investigating how ecosystems change as a result of events such as bushfires, drought and flooding
Chemical sciences	**Elaborations**
All matter is made of atoms that are composed of protons, neutrons and electrons; natural radioactivity arises from the decay of nuclei in atoms (ACSSU177)	• describing and modelling the structure of atoms in terms of the nucleus, protons, neutrons and electrons • comparing the mass and charge of protons, neutrons and electrons • describing in simple terms how alpha and beta particles and gamma radiation are released from unstable atoms
Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed (ACSSU178)	• identifying reactants and products in chemical reactions • modelling chemical reactions in terms of rearrangement of atoms • describing observed reactions using word equations • considering the role of energy in chemical reactions • recognising that the conservation of mass in a chemical reaction can be demonstrated by simple chemical equations

Chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer (ACSSU179)	• investigating reactions of acids with metals, bases, and carbonates • investigating a range of different reactions to classify them as exothermic or endothermic • recognising the role of oxygen in combustion reactions and comparing combustion with other oxidation reactions • comparing respiration and photosynthesis and their role in biological processes • describing how the products of combustion reactions affect the environment
Earth and space sciences	**Elaborations**
The theory of plate tectonics explains global patterns of geological activity and continental movement (ACSSU180)	• recognising the major plates on a world map • modelling sea-floor spreading • relating the occurrence of earthquakes and volcanic activity to constructive and destructive plate boundaries • considering the role of heat energy and convection currents in the movement of tectonic plates • relating the extreme age and stability of a large part of the Australian continent to its plate tectonic history
Physical sciences	**Elaborations**

Energy transfer through different mediums can be explained using wave and particle models (ACSSU182)	• exploring how and why the movement of energy varies according to the medium through which it is transferred  • discussing the wave and particle models and how they are useful for understanding aspects of phenomena  • investigating the transfer of heat in terms of convection, conduction and radiation, and identifying situations in which each occurs  • understanding the processes underlying convection and conduction in terms of the particle model  • investigating factors that affect the transfer of energy through an electric circuit  • exploring the properties of waves, and situations where energy is transferred in the form of waves, such as sound and light 

Science as a Human Endeavour

Nature and development of science	Elaborations
Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community (ACSHE157) 	• investigating the historical development of models of the structure of the atom  • investigating how the theory of plate tectonics developed, based on evidence from sea-floor spreading and occurrence of earthquakes and volcanic activity  • considering how ideas about disease transmission have changed from medieval time to the present as knowledge has developed  • investigating the work of scientists such as Ernest Rutherford, Pierre Curie and Marie Curie on radioactivity and subatomic particles  • investigating how models can be used to predict the changes in populations due to environmental changes, such as the impact of flooding or fire on rabbit or kangaroo populations 

Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries (ACSHE158)	• considering how common properties of electromagnetic radiation relate to its uses, such as radar, medicine, mobile phone communications and microwave cooking • investigating technologies involved in the mapping of continental movement • considering how the development of imaging technologies have improved our understanding of the functions and interactions of body systems
Use and influence of science	**Elaborations**
People use scientific knowledge to evaluate whether they accept claims, explanations or predictions, and advances in science can affect people's lives, including generating new career opportunities (ACSHE160)	• investigating how technologies using electromagnetic radiation are used in medicine, such as in the detection and treatment of cancer • using knowledge of science to test claims made in advertising or expressed in the media • investigating the use of nanotechnology in medicine, such as the delivery of pharmaceuticals • describing how science is used in the media to explain a natural event or justify actions • evaluating claims relating to products such as electrical devices, fuels, indigestion tablets • considering the impact of technological advances developed in Australia, such as the cochlear implant and bionic eye • considering the impacts of human activity on an ecosystem from a range of different perspectives • considering how communication methods are influenced by new mobile technologies that rely on electromagnetic radiation • recognising aspects of science, engineering and technology within careers such as medicine, medical technology, telecommunications, biomechanical engineering, pharmacy and physiology

Values and needs of contemporary society can influence the focus of scientific research (ACSHE228) 	• considering how technologies have been developed to meet the increasing needs for mobile communication  • investigating how scientific and technological advances have been applied to minimising pollution from industry  • considering how choices related to the use of fuels are influenced by environmental considerations  • investigating the work of Australian scientists such as Fiona Wood and Marie Stoner on artificial skin  • considering safe sound levels for humans and implications in the workplace and leisure activities  • investigating contemporary science issues related to living in a Pacific country located near plate boundaries, for example Japan, Indonesia, New Zealand 

Science Inquiry Skills

Questioning and predicting	Elaborations
Formulate questions or hypotheses that can be investigated scientifically (ACSIS164) 	• using internet research to identify problems that can be investigated  • evaluating information from secondary sources as part of the research process  • revising and refining research questions to target specific information and data collection or finding a solution to the specific problem identified  • developing ideas from students own or others' investigations and experiences to investigate further 

Planning and conducting	Elaborations

Plan, select and use appropriate investigation types, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods (ACSIS165) 	• explaining the choice of variables to be controlled, changed and measured in an investigation  • identifying the potential hazards of chemicals or biological materials used in experimental investigations  • ensuring that any investigation involving or impacting on animals is justified, humane and considerate of each animal's needs  • using modelling and simulations, including using digital technology to investigate situations and events  • combining research using primary and secondary sources with students' own experimental investigation  • considering how investigation methods and equipment may influence the reliablity of collected data 
Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately (ACSIS166) 	• using probes and data loggers to record information  • applying specific skills for the use of scientific instruments
Processing and analysing data and information	**Elaborations**
Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (ACSIS169) 	• using spreadsheets to present data in tables and graphical forms and to carry out mathematical analyses on data  • describing sample properties (such as mean, median, range, large gaps visible on a graph) to predict characteristics of the larger population  • designing and constructing appropriate graphs to represent data and analysing graphs for trends and patterns 
Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS170) 	• comparing conclusions with earlier predictions and reviewing scientific understanding where appropriate  • suggesting more than one possible explanation of the data presented 
Evaluating	**Elaborations**

Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data (ACSIS171)	• identifying gaps or weaknesses in conclusions (their own or those of others) • identifying alternative explanations that are also consistent with the evidence
Critically analyse the validity of information in primary and secondary sources and evaluate the approaches used to solve problems (ACSIS172)	• discussing what is meant by 'validity' and how we can evaluate the validity of information in secondary sources • researching the methods used by scientists in studies reported in the media • describing how scientific arguments are used to make decisions regarding personal and community issues
Communicating	**Elaborations**
Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (ACSIS174)	• presenting results and ideas using formal experimental reports, oral presentations, slide shows, poster presentations and contributing to group discussions • using secondary sources as well as students' own findings to help explain a scientific concept • using the internet to facilitate collaboration in joint projects and discussions

Year 9 Achievement Standard

By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter. They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people's lives.

Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others' methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences.

Year 10

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Incorporating the key ideas of science

In the Year 10 curriculum students explore systems at different scales and connect microscopic and macroscopic properties to explain phenomena. Students explore the biological, chemical, geological and physical evidence for different theories, such as the theories of natural selection and the Big Bang.

Students develop their understanding of atomic theory to understand relationships within the periodic table. They understand that motion and forces are related by applying physical laws. They learn about the relationships between aspects of the living, physical and chemical world that are applied to systems on a local and global scale and this enables them to predict how changes will affect equilibrium within these systems.

Year 10 Content Descriptions

Science Understanding

Biological sciences	Elaborations
Transmission of heritable characteristics from one generation to the next involves DNA and genes (ACSSU184)	• describing the role of DNA as the blueprint for controlling the characteristics of organisms • using models and diagrams to represent the relationship between DNA, genes and chromosomes • recognising that genetic information passed on to offspring is from both parents by meiosis and fertilisation • representing patterns of inheritance of a simple dominant/recessive characteristic through generations of a family • predicting simple ratios of offspring genotypes and phenotypes in crosses involving dominant/recessive gene pairs or in genes that are sex-linked • describing mutations as changes in DNA or chromosomes and outlining the factors that contribute to causing mutations

The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence (ACSSU185)	• outlining processes involved in natural selection including variation, isolation and selection • describing biodiversity as a function of evolution • investigating changes caused by natural selection in a particular population as a result of a specified selection pressure such as artificial selection in breeding for desired characteristics • relating genetic characteristics to survival and reproductive rates • evaluating and interpreting evidence for evolution, including the fossil record, chemical and anatomical similarities, and geographical distribution of species
Chemical sciences	**Elaborations**
The atomic structure and properties of elements are used to organise them in the Periodic Table (ACSSU186)	• recognising that elements in the same group of the periodic table have similar properties • describing the structure of atoms in terms of electron shells • explaining how the electronic structure of an atom determines its position in the periodic table and its properties • investigating the chemical activity of metals
Different types of chemical reactions are used to produce a range of products and can occur at different rates (ACSSU187)	• investigating how chemistry can be used to produce a range of useful substances such as fuels, metals and pharmaceuticals • predicting the products of different types of simple chemical reactions • using word or symbol equations to represent chemical reactions • investigating the effect of a range of factors, such as temperature and catalysts, on the rate of chemical reactions
Earth and space sciences	**Elaborations**

The universe contains features including galaxies, stars and solar systems, and the Big Bang theory can be used to explain the origin of the universe (ACSSU188)	• identifying the evidence supporting the Big Bang theory, such as Edwin Hubble's observations and the detection of microwave radiation • recognising that the age of the universe can be derived using knowledge of the Big Bang theory • describing how the evolution of the universe, including the formation of galaxies and stars, has continued since the Big Bang
Global systems, including the carbon cycle, rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere (ACSSU189)	• investigating how human activity affects global systems • modelling a cycle, such as the water, carbon, nitrogen or phosphorus cycle within the biosphere • explaining the causes and effects of the greenhouse effect • investigating the effect of climate change on sea levels and biodiversity • considering the long-term effects of loss of biodiversity • investigating currently occurring changes to permafrost and sea ice and the impacts of these changes • examining the factors that drive the deep ocean currents, their role in regulating global climate, and their effects on marine life
Physical sciences	**Elaborations**

Energy conservation in a system can be explained by describing energy transfers and transformations (ACSSU190)	• recognising that the Law of Conservation of Energy explains that total energy is maintained in energy transfer and transformation  • recognising that in energy transfer and transformation, a variety of processes can occur, so that the usable energy is reduced and the system is not 100% efficient  • comparing energy changes in interactions such as car crashes, pendulums, lifting and dropping  • using models to describe how energy is transferred and transformed within systems 
The motion of objects can be described and predicted using the laws of physics (ACSSU229)	• gathering data to analyse everyday motions produced by forces, such as measurements of distance and time, speed, force, mass and acceleration  • recognising that a stationary object, or a moving object with constant motion, has balanced forces acting on it  • using Newton's Second Law to predict how a force affects the movement of an object  • recognising and applying Newton's Third Law to describe the effect of interactions between two objects 

Science as a Human Endeavour

Nature and development of science	Elaborations

Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community (ACSHE191)	• considering the role of different sources of evidence including biochemical, anatomical and fossil evidence for evolution by natural selection • investigating the development of the Watson and Crick double helix model for the structure of DNA • investigating the history and impact of developments in genetic knowledge • investigating the development of the periodic table and how this was dependent on experimental evidence at the time • considering the role of science in identifying and explaining the causes of climate change • recognising that Australian scientists such as Brian Schmidt and Penny Sackett are involved in the exploration and study of the universe
Advances in scientific understanding often rely on technological advances and are often linked to scientific discoveries (ACSHE192)	• recognising that the development of fast computers has made possible the analysis of DNA sequencing, radio astronomy signals and other data • considering how computer modelling has improved knowledge and predictability of phenomena such as climate change and atmospheric pollution • researching examples of major international scientific projects, for example the Large Hadron Collider and the International Space Station • considering how information technology can be applied to different areas of science such as bioinformatics and the Square Kilometre Array
Use and influence of science	**Elaborations**

People use scientific knowledge to evaluate whether they accept claims, explanations or predictions, and advances in science can affect people's lives, including generating new career opportunities (ACSHE194)	• describing how science is used in the media to explain a natural event or justify people's actions  • predicting future applications of aspects of nanotechnology on people's lives  • recognising that the study of the universe and the exploration of space involve teams of specialists from the different branches of science, engineering and technology  • using knowledge of science to test claims made in advertising  • considering how the computing requirements in many areas of modern science depend on people working in the area of information technology  • considering the scientific knowledge used in discussions relating to climate change  • investigating the applications of gene technologies such as gene therapy and genetic engineering  • evaluating claims relating to environmental footprints  • recognising that scientific developments in areas such as sustainable transport and low-emissions electrical generation require people working in a range of fields of science, engineering and technology 

Values and needs of contemporary society can influence the focus of scientific research (ACSHE230)	• investigating technologies associated with the reduction of carbon pollution, such as carbon capture • considering innovative energy transfer devices, including those used in transport and communication • investigating the use and control of CFCs based on scientific studies of atmospheric ozone • recognising that financial backing from governments or commercial organisations is required for scientific developments and that this can determine what research is carried out • considering the use of genetic testing for decisions such as genetic counselling, embryo selection, identification of carriers of genetic mutations and the use of this information for personal use or by organisation such as insurance companies or medical facilities

Science Inquiry Skills

Questioning and predicting	Elaborations
Formulate questions or hypotheses that can be investigated scientifically (ACSIS198)	• developing hypotheses based on well-developed models and theories • using internet research to identify problems that can be investigated • formulating questions that can be investigated within the scope of the classroom or field with available resources • developing ideas from students own or others' investigations and experiences to investigate further • evaluating information from secondary sources as part of the research process

Planning and conducting	Elaborations

Plan, select and use appropriate investigation types, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods (ACSIS199)	• combining research using primary and secondary sources with a student's own experimental investigation • using modelling and simulations, including using digital technology, to investigate situations and events • deciding how much data are needed to produce reliable measurements • considering possible confounding variables or effects and ensuring these are controlled • identifying the potential hazards of chemicals or biological materials used in experimental investigations • identifying safety risks and impacts on animal welfare and ensuring these are effectively managed within the investigation
Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately (ACSIS200)	• selecting and using probes and data loggers to record information • applying specific skills for the use of scientific instruments • identifying where human error can influence the reliability of data
Processing and analysing data and information	**Elaborations**
Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (ACSIS203)	• using spreadsheets to present data in tables and graphical forms and to carry out mathematical analyses on data • describing sample properties (such as mean, median, range, large gaps visible on a graph) to predict characteristics of the larger population, acknowledging uncertainties and the effects of outliers • exploring relationships between variables using spreadsheets, databases, tables, charts, graphs and statistics

Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS204)	• using primary or secondary scientific evidence to support or refute a conclusion • constructing a scientific argument showing how their evidence supports their claim
Evaluating	**Elaborations**
Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data (ACSIS205)	• evaluating the strength of a conclusion that can be inferred from a particular data set • distinguishing between random and systematic errors and how these can affect investigation results • identifying alternative explanations that are also consistent with the evidence
Critically analyse the validity of information in primary and secondary sources, and evaluate the approaches used to solve problems (ACSIS206)	• researching the methods used by scientists in studies reported in the media • judging the validity of science-related media reports and how these reports might be interpreted by the public • describing how scientific arguments, as well as ethical, economic and social arguments, are used to make decisions regarding personal and community issues
Communicating	**Elaborations**
Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (ACSIS208)	• using the internet to facilitate collaboration in joint projects and discussions • constructing evidence based arguments and engaging in debate about scientific ideas • presenting results and ideas using formal experimental reports, oral presentations, slide shows, poster presentations and contributing to group discussions • using a range of representations, including mathematical and symbolic forms, to communicate science ideas

Year 10 Achievement Standard

By the end of Year 10, students analyse how the periodic table organises elements and use it to make predictions about the properties of elements. They explain how chemical reactions are used to produce particular products and how different factors influence the rate of reactions. They explain the concept of energy conservation and represent energy transfer and transformation within systems. They apply relationships between force, mass and acceleration to predict changes in the motion of objects. Students describe and analyse interactions and cycles within and between Earth's spheres. They evaluate the evidence for scientific theories that explain the origin of the universe and the diversity of life on Earth. They explain the processes that underpin heredity and evolution. Students analyse how the models and theories they use have developed over time and discuss the factors that prompted their review.

Students develop questions and hypotheses and independently design and improve appropriate methods of investigation, including field work and laboratory experimentation. They explain how they have considered reliability, safety, fairness and ethical actions in their methods and identify where digital technologies can be used to enhance the quality of data. When analysing data, selecting evidence and developing and justifying conclusions, they identify alternative explanations for findings and explain any sources of uncertainty. Students evaluate the validity and reliability of claims made in secondary sources with reference to currently held scientific views, the quality of the methodology and the evidence cited. They construct evidence-based arguments and select appropriate representations and text types to communicate science ideas for specific purposes.

Glossary

adaptation

A physical or behavioural *characteristic* that is inherited and which results in an individual being more likely to survive and reproduce in its *environment*.

analyse

To consider in detail for the purpose of finding meaning or relationships, and identifying patterns, similarities and differences.

characteristic

A distinguishing aspect (including features and behaviours) of an object material, living thing or event.

chart

A visual display of information.

classify

To arrange items into named categories in order to sort, group or identify them.

collaborate

To work with others to perform a specific task.

conclusion

A judgement based on *evidence*.

contemporary science

New and emerging science *research* and issues of current relevance and interest.

continuous data

Quantitative data with a potentially infinite number of possible values along a continuum.

controlled variable

A *variable* that is kept constant (or changed in constant ways) during an investigation.

convention

An agreed method of representing concepts, information and behaviours.

data

The plural of *datum*; the measurement of an attribute, the volume of gas or the type of rubber. This does not necessarily mean a single measurement: it may be the result of averaging several repeated measurements and these could be quantitative or qualitative.

dependent variable

A *variable* that changes in response to changes to the *independent variable* in an *investigation*.

design

To plan and evaluate the construction of a product or process, including an *investigation.*

digital technologies

Systems that handle digital *data,* including hardware and software, for specific purposes.

discrete data

Quantitative *data* consisting of a number of separate values where intermediate values are not permissible.

environment

All the surroundings, both living and non-living.

evaluate

To examine and judge the merit or significance of something, including processes, events, descriptions, relationships or *data.*

evidence

In science, *evidence* is *data* that is considered reliable and valid, and that can be used to support a particular idea, *conclusion* or decision. Evidence gives weight or value to *data* by considering its credibility, acceptance, bias, status, appropriateness and reasonableness.

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experiment / experimental investigation

An *investigation* that involves carrying out a practical activity.

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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.*

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familiar

well-known; something that a student has encountered previously on a number of occasions.

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field study / work

An observational or practical *research* undertaken in a normal *environment* of the subject of a study, that is, an *investigation* can be conducted outside the laboratory.

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force

A push or pull between objects, which may cause one or both objects to change speed and/or direction of their motion (that is, accelerate) or change their shape. Scientists identify four fundamental *forces*: gravitational, electromagnetic (involving both electrostatic and magnetic forces), weak nuclear forces and strong nuclear forces. All interactions between *matter* can be explained as an action of one or a combination of the four fundamental forces.

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formal measurement

Measurement based on an agreed standard unit (metre, second, gram).

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formal unit

A unit of measurement based on an agreed fixed standard (metre, second, gram).

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graph

A visual representation of the *relationship* between quantities plotted with reference to a set of axes.

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guided investigation

An *investigation* partly directed by a teacher.

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hypothesis

A tentative idea or explanation for an observation, which can be tested and either supported or refuted by *investigation*.

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independent variable

A *variable* that is changed in an *investigation* to see what effect it has on the *dependent variable*.

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informal measurement

Measurement that is not based on any agreed standard unit (for example, hand spans, paces, cups).

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informal units

Measurements based on *variable* quantities (for example, hand spans, paces, cups).

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information research

A study involving collection of information from primary and *secondary sources*.

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investigation

A scientific process of answering a question, exploring an idea or solving a problem that requires activities such as planning a course of action, collecting *data*, interpreting data, reaching a *conclusion* and communicating these activities.

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law

A statement of a *relationship* based on available evidence.

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local environment

Surroundings that can be considered as proximal or *familiar* to the subject of *investigation* (for example, an organism, mountain, student).

material

A substance with particular qualities or that is used for specific purposes.

matter

A physical substance; anything that has mass and occupies space.

model

A representation that describes, simplifies, clarifies or provides an explanation of the workings, structure or relationships within an object, *system* or idea.

multimodal text

A text that combines two or more communication modes, for example, print text, image and spoken word as in film or computer presentations.

natural materials

Products or physical *matter* that come from plants, animals, or earth and have undergone very little modification by humans, minerals and metals that can be extracted from them (without further modification) are considered *natural materials*.

observable

Something that can be seen, heard, felt, tasted or smelled either directly by an individual or indirectly by a measuring device, for example, a ruler, camera or thermometer.

pattern

A repeated occurrence or sequence.

primary sources

Information created by a person or persons directly involved in a study or observing an event.

processed materials

Products of physical *matter* that have been modified from natural *materials* by human intervention or that do not occur at all in the *natural environment*, but have been designed and manufactured to fulfil a particular purpose.

property

An attribute of an object or material, normally used to describe attributes common to a group.

qualitative data

Information that is not numerical in nature.

quantitative data

Numerical information.

reflect on

To think carefully about something, such as past experiences, activities or events.

relate

To identify connections or associations between ideas or relationships or between components of systems and structures.

relationship

A connection or association between ideas or between components of systems and structures.

reliability

An extent to which repeated observations and/or measurements taken under identical circumstances will yield similar results.

reliable data

Data that have been judged to have a high level of *reliability*; *reliability* is the degree to which an assessment instrument or protocol consistently and repeatedly measures an attribute achieving similar results for the same population.

repeat trial

A test within an experimental investigation that is carried out more than once under the same set of conditions.

replicate

An independent experiment that uses the same method in order to validate findings.

report

A written account of an investigation.

research

To locate, gather, record and *analyse* information in order to develop understanding.

scientific language

Terminology that has specific meaning in a scientific context.

scientific literacy

An ability to use scientific knowledge, understanding, and inquiry skills to identify questions, acquire new knowledge, explain science phenomena, solve problems and draw evidence-based conclusions in making sense of the world, and to recognise how understandings of the nature, development, use and influence of science help us make responsible decisions and shape our interpretations of information.

scientist

A person who works within a recognised field of science.

secondary source

Information that has been compiled from *primary sources* by a person or persons not directly involved in the original study or event.

senses

Hearing, sight, smell, touch and taste.

simulation

A representation of a process, event or *system,* which imitates the real situation.

survey

An investigation method involving asking questions of a range of respondents.

sustainable

Supports the needs of the present without compromising the ability of future generations to support their needs.

system

A group of interacting objects, materials or processes that form an integrated whole.

table

An arrangement of *data* or observations in rows and columns.

technology

A development of products, services, systems and environments, using various types of knowledge, to meet human needs and wants.

theory

An explanation of a set of observations that is based on one or more proven hypotheses, which has been accepted through consensus by a group of scientists.

tools

Equipment used to make a task easier.

trend

General direction in which something is changing.

validity

An extent to which tests measure what was intended; an extent to which *data*, inferences and actions produced from tests and other processes are accurate.

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variable

A factor that can be changed, kept the same or measured in an investigation, for example, time, distance, light, temperature.
