Scope and sequence

Science

Year 7 to 10

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Science: Scope and sequence year 7 to 10

Contents

Context statement

The Australian Curriculum: Science is organised around 6 key ideas and 3 interrelated strands. The 6 key ideas are:

- patterns, order and organisation
- form and function
- stability and change
- scale and measurement
- matter and energy
- systems.

All units of work can be categorised in 1 or more of these key ideas to support students in constructing deep and coherent understandings of the scientific phenomena, comprising their world. The 3 strands include:

- science understanding
- science as a human endeavour
- science inquiry skills.

These 3 strands should be taught using an integrated approach.

Across these strands, 9 key science concepts are developed:

- form and function
- diversity and evolution
- interdependence and ecosystems
- properties of matter
- changes in matter
- forces and motion
- energy
- Earth in space
- Earth's surface.

Within this scope and sequence document, strands are used to structure the curriculum with the key ideas and key concepts highlighted to show how they develop in conceptual sophistication, from reception to year 10.

The South Australian science scope and sequence reception to year 10 provides:

- Achievement standards:
  - presented as dot points and separated into the three strands.
- Science understanding strand:
  - details depth and breadth of the key scientific concepts to be taught at each year level
  - focuses on the scientific concepts which enables flexibility of how they are taught within different content and contexts
  - is divided into four sub-strands : biological sciences, chemicals sciences, Earth and space sciences, and physical sciences
- Aboriginal knowledge and ways of knowing:
  - have been included from Australian Curriculum: Science elaborations
  - are highlighted up front and with purpose.
- Science as a human endeavour:
  - provides content examples of the nature of science and the ability to think and act scientifically, using a range of inquiry processes
  - examples are inclusive of South Australian scientists, occupations, developments and the use and influence of science locally, nationally and globally.
- Science inquiry skills
  - described as they are in the Australian Curriculum: Science.
- Science key ideas
  - translated to show how they connect with the key concepts for each content description.

Achievement standards

Together, the 3 interrelated strands of science understanding, science as a human endeavour, and science inquiry skills 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.

Year 7	Year 8	Year 9	Year 10
Science understanding By the end of year 7, students: • **describe** techniques to separate pure substances from mixtures • **represent** and **predict** the effects of unbalanced forces, including Earth's gravity, on motion • **explain** how the relative positions of Earth, the sun and moon affect phenomena on Earth • **analyse** how the sustainable use of resources depends on the way they are formed and cycle through Earth systems • **predict** the effect of human and environmental changes on interactions between organisms • **classify** and **organise** diverse organisms based on observable differences.	**Science understanding** 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 • **identify** different forms of energy and describe how energy transfers and transformations cause change in simple systems • **compare** processes of rock formation, including the timescales involved • **analyse** the relationship between structure and function at cell, organ and body system levels.	**Science understanding** By the end of year 9, students: • **explain** chemical processes and natural radioactivity in terms of atoms and energy transfers • **describe** examples of important chemical reactions • **describe** models of energy transfer and apply these to explain phenomena • **explain** global features and events in terms of geological processes and timescales • **analyse** how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter.	**Science understanding** 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 • **explain** how chemical reactions are used to produce particular products and how different factors influence the rate of reactions • **explain** the concept of energy conservation and represent energy transfer and transformation within systems • **apply** relationships between force, mass and acceleration to predict changes in the motion of objects • **describe** and analyse interactions and cycles within and between Earth's spheres • **evaluate** the evidence for scientific theories that explain the origin of the universe and the diversity of life on Earth • **explain** the processes that underpin heredity and evolution.
Science as a human endeavour By the end of year 7, students: • **describe** situations where scientific knowledge from different science disciplines and diverse cultures has been used to solve a real-world problem • **explain** possible implications of the solution for different groups in society.	**Science as a human Endeavour** By the end of year 8, students: • **examine** the different science knowledge used in occupations • **explain** how evidence has led to an improved understanding of a scientific idea • **describe** situations in which scientists collaborated to generate solutions to contemporary problems • **reflect** on implications of these solutions for different groups in society.	**Science as a human endeavour** By the end of year 9, students: • **describe** social and technological factors that have influenced scientific developments • **predict** how future applications of science and technology may affect people's lives.	**Science as a human endeavour** By the end of year 10, students: • **analyse** how the models and theories they use have developed over time and discuss the factors that prompted their review.
Science inquiry skills By the end of year 7, students: • **identify** questions that can be investigated scientifically • **plan** fair experimental methods, identifying variables to be changed and measured • **select** equipment that improves fairness and accuracy • **describe** how they considered safety • **draw** on evidence to support their conclusions • **summarise** data from different sources	**Science inquiry skills** By the end of year 8, students: • **identify** and construct questions and problems that they can investigate scientifically • **consider** safety and ethics when planning investigations, including designing field or experimental methods • **identify** variables to be changed, measured and controlled • **construct** representations of their data to reveal and **analyse** patterns and trends, and use these when **justifying** their conclusions	**Science inquiry skills** By the end of year 9, students: • **design** questions that can be investigated using a range of inquiry skills • **design** methods that include the control and accurate measurement of variables and systematic collection of data • **describe** how they considered ethics and safety. • **analyse** trends in data, **identify** relationships between variables and reveal inconsistencies in results	**Science inquiry skills** By the end of year 10, students: • **develop** questions and hypotheses and independently **design** and **improve** appropriate methods of investigation, including field work and laboratory experimentation • **explain** how they have considered reliability, safety, fairness and ethical actions in their methods • **identify** where digital technologies can be used to enhance the quality of data

Year 7	Year 8	Year 9	Year 10
• **describe** trends and refer to the quality of their data when suggesting improvements to their methods • **communicate** their ideas, methods and findings using scientific language and appropriate representations.	• **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 • **use** appropriate language and representations to **communicate** science ideas, methods and findings in a range of text types.	• **analyse** their methods and the quality of their data, and **explain** specific actions to improve the quality of their evidence • **evaluate** others' methods and explanations from a scientific perspective and use appropriate language and representations when **communicating** their findings and ideas to specific audiences.	• **analyse** data and **select** evidence to **develop** and **justify** conclusions' • **identify** alternative explanations for findings • **explain** any sources of uncertainty • **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 • **construct** evidence-based arguments and **select** appropriate representations and text types to communicate science ideas for specific purposes.

Scope and sequence

Strand: 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 of four sub-strands.

Sub-strand	Year 7	Year 8	Year 9	Year 10
Biological sciences 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.	**Key idea: Pattern, order and organisation** • similarities and differences in patterns can be used to sort and classify organisms. **Diversity and evolution** **Understand that classification enables us to organise the diversity of organisms on Earth:** • there is a wide diversity of living things on earth • living things can be grouped according to their observable differences • scientists have an agreed classification system • there is a role for ordering and organising information • the history of classification and that it has developed over time • the use of dichotomous keys and how they are constructed • classification uses a hierarchical taxonomic system and has scientific conventions for naming species • there are more similarities at lower levels of genus and species. **Aboriginal science elaboration** Many living things are grouped by Aboriginal people based on their context and usage.	**Key idea: Scale and measurement** • cells can be observed using a microscope because most are too small to observe directly. **Key Idea: Form and function** • the structure and composition of cells and cell organelles can be used to explain their function • cells can be modelled to describe the relationships between organelles. **Form and function** **Understand that organisms are made up of cells, and the products of cells. Understand that cells have specialised structures and functions:** • cells are microscopic structures • understand and use a microscope • the structures of cells as seen with a light microscope • structure and function of these organelles (cell membrane, cell wall, nucleus, chloroplasts, cytoplasm and vacuoles) • the difference between plant and animal cells • cell division (mitosis) for reproduction, repair and growth.	**Key idea: Systems** • coordination of the systems within the human body responds to the changes in the environment to maintain balanced internal systems. **Key Idea: Form and function** • the relationships between the structure of the body systems, organs, tissues and cells determine how they function. **Form and function** **Understand that multi-cellular organisms rely on coordinated and interdependent internal systems to respond to changes to their environment:** • the coordination of the respiratory, circulatory, digestive, nervous and excretory systems provides the requirements of life (for example oxygen, nutrients, water and removal of waste) in complex organisms • models, flow diagrams and simulations can show how the body systems work together to maintain a functioning body.	**Key idea: Form and function** • cells contain genetic information in the form of DNA, which contain the code with instructions to determine the specific functions of cells • genes are a mechanism for passing on characteristics of form and function from one generation to the next. **Diversity and evolution, form and function** **Understand that transmission of heritable characteristics from one generation to the next involves DNA and genes:** • genetics and the role of genes, chromosomes and DNA (as the blueprint for controlling the characteristics of organisms), as a mechanism for passing on these adaptations of form and function from one generation to the next • genetic information passed on to offspring through sexual reproduction is from both parents by meiosis and fertilisation • due to meiosis there is variation in a species. Meiosis predicts the ratio of offspring genotypes and phenotypes in crosses involving dominant and recessive alleles or in genes that are sex-linked • inheritance using pedigree diagrams to show patterns of inheritance of a simple dominant and recessive characteristic through multigenerational families • karyotypes and applications of gene technologies such as gene therapy and genetic engineering • the use of genetic testing for decisions such as genetic counselling, embryo selection and insurance • mutations as changes in DNA or chromosomes and the factors that cause mutations. **Aboriginal science elaboration** Aboriginal people have complex societal systems such as strict adherence to kinship and family structures. This includes marriage laws that dictate who can marry

Sub-strand	Year 7	Year 8	Year 9	Year 10
				whom. The development of societal rules that impose regulations on marriage rests on the understanding that unions between individuals that are too closely related can lead to the inheritance of detrimental traits in their offspring.

	Key idea: Stability and change
	
	• models of food chains and food webs are used to understand and predict changes in interrelationships between living things.
	
	Interdependence and ecosystems
	
	Understand that interactions between organisms can be described in terms of food chains and food webs, and that human activity can affect these interactions:
	
	• food chains and food webs are models that represent the flow of energy and matter through ecosystems
	• environmental changes affect feeding relationships
	• humans' impact on food chains and food webs
	• food chains and webs show relationships between organisms in an environment and the feeding relationships in a habitat
	• the role of microorganisms within food chains and food webs.
	
	Aboriginal science elaboration
	
	Invasive species imported through human activity have an impact on important food webs of local ecosystems. This subsequently impacts Aboriginal communities who depend on these ecosystems for cultural continuance, food and medicine.
		Key idea: Form and function
		
		• the relationships between structure of cells, tissues, organs and body systems determines their functions at the microscopic and macroscopic scale.
		
		Key idea: Systems
		
		• understand that systems may interact with other systems; and be a part of larger systems.
		• the relationships of the components within body systems in terms of flows of matter between independent organs, tissues and cells.
		
		Form and function
		
		Understand that some organisms are made up of only one cell, whereas other organisms are made up of many cells.
		
		Understand that multi-cellular organisms contain systems of organs carrying out specialised functions that enable them to survive and reproduce:
		
		• multi-cellular organisms are made up of many cells
		• the relationship between structure and function at cell, organ and body system levels in multi-cellular organisms
		• the organisation of body systems in terms of flows of matter between interdependent organs
		• why and how cells reproduce through both asexual and sexual reproduction processes.
			Key idea: Systems
			
			• models are used to simulate systems and interactions within and between systems. The models are used to predict changes in an ecosystem.
			
			Key idea: Matter and energy
			
			• changes of energy and matter can be described in terms of how energy and matter flow into, out of, within and between ecosystems.
			
			Interdependence and ecosystems
			
			Understand that ecosystems consist of communities of interdependent organisms and abiotic components of the environment. Matter and energy flow through these systems:
			
			• there are interrelations between biotic (living) and abiotic (non-living) components of ecosystems
			• biological systems respond to external changes based on the interdependencies of energy transfers and flow of matter
			• interactions between (biotic) organisms that affect population sizes include:
			  ○ predator and prey
			  ○ parasites
			  ○ competitors
			  ○ pollinators
			  ○ introduced species
			  ○ disease
			• abiotic factors that affect population sizes include:
			  ○ seasonal changes,
			  ○ destruction of habitats (bushfires, droughts and flooding)
			• scientific models can be used to predict how a change in the environment affects the equilibrium of an ecosystem now and in the future
				Key idea: Stability and change
				
				• the process of change in organisms and generations, over different periods of time result from natural diversity within a species.
				
				Diversity and evolution
				
				Understand that the theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence:
				
				• genetic characteristics relate to survival and reproductive rates
				• processes involved in natural selection including variation, isolation and selection
				• changes caused by natural selection in a particular population as a result of a specified selection pressure, for example artificial selection in breeding for desired characteristics
				• theory of evolution
				• evidence for evolution, including:
				  ○ the fossil record
				  ○ chemical and anatomical similarities
				  ○ geographical distribution of species
				• the theory of evolution by natural selection explains the diversity of living things
				• evidence from the past and present can predict possible futures of the diversity of life on Earth.
				
				Aboriginal science elaboration
				
				Traits or characteristics that confer a reproductive advantage will, over many generations, become more frequent throughout the entire population. Aboriginal peoples' long habitation in the diverse regions of Australia has led to the development of some of the structural and physiological adaptations that are favourable to living in those environments.

Sub-strand	Year 7	Year 8	Year 9	Year 10
			• the chemical processes of respiration and photosynthesis and their role in the energy flow in an ecosystem. Aboriginal science elaboration Aboriginal peoples' ecological perspective places humans as an integral part of an interdependent ecosystem, rather than being above or separate from it. This view incorporates a deep appreciation of, and respect for, the environment. It embodies a responsibility for maintaining ecosystems and utilising them in a sustainable way. That is for caring for country.	

Chemical sciences
 	
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.
	Key idea: Form and function
	
	• direct experience and observation of samples of substances that are pure; and a mixture can be separated based on the different physical properties of the substances that it contains.
	
	Properties of matter
	
	Understand that mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques:
	
	• the differences between pure substances and mixtures
	• the separation technique used is based on the physical properties of the substances that make up the mixture, for example:
	  ○ filtration separates on particle size
	  ○ decanting, panning and centrifuging on density
	  ○ evaporation on volatility.
	• a mixture is separated back into the original substances
	• other separation techniques:
	  ○ crystallisation
	  ○ chromatography
	  ○ distillation.
	
	Aboriginal science elaboration
	
	Aboriginal people developed separation methods such as hand picking, sieving, winnowing, yandying, filtering, cold pressing and steam distilling. These enable the procurement and processing of resources necessary for everyday
		Key idea: Form and function
		
		• models showing the arrangement of particles are used to predict, understand, and explain the behaviour of matter.
		
		Properties of matter
		
		Understand that properties of the different states of matter can be explained in terms of the motion and arrangement of particles:
		
		• the properties and behaviour of the states of matter are explained through the motion and arrangement of particles
		• models can be used to show the particles in the different states of matter such as solids, liquids, gases and plasma
		• the energy of particles and temperature affect the properties and behaviour of the states of matter.
			Key idea: Matter and energy
			
			• in nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.
			
			Key idea: Scale and measurement
			
			• the incredibly small size of atoms is critical to the development of science understanding, to enable comparisons using formal units of measurement.
			
			Properties of matter
			
			Understand that all matter is made up of atoms that are composed of the subatomic particles of protons, neutrons and electrons.
			
			Understand that natural radioactivity arises from the decay of nuclei in atoms:
			
			• matter is made up of atoms
			• atoms are made up of protons and neutrons in the nucleus, and electrons which orbit the nucleus
			• mass and charge of protons, neutrons and electrons
			• changes in the particles of the nucleus of unstable atoms can release alpha and beta particles and gamma radiation
			• the evidence that underpinned the different historical models and theories for the structure of the atom have been refined over time.
			
			Aboriginal science elaboration
			
			Radiocarbon dating procedures are used by archaeologists to study the migration patterns of early humans. They also look at the antiquity of the habitation
				Key idea: Pattern, order and organisation
				
				• elements can be organised based on the internal structure of their atoms and the patterns of chemical reactions they undergo.
				
				Properties of matter
				
				Understand that the atomic structure and properties of elements are used to organise them in the periodic table:
				
				• the periodic table organises the elements by their atomic structure
				• the electronic structure of an atom determines its position in the periodic table and its properties
				• elements in the same group of the periodic table have similar properties
				• there are trends in properties across rows and down groups of elements
				• the chemical activity of metals
				• the periodic table and its development have refined over time
				• electronic configuration is the arrangement of electrons in the shells of an atom and determine the formation of compounds.

Sub-strand	Year 7	Year 8	Year 9	Year 10
	life and for survival in times of food and water shortages.		of the Australian continent by Aboriginal people for more than 60,000 years.	

Sub-strand	Year 7	Year 8	Year 9	Year 10
		Key Idea: Matter and energy • when some substances are combined, they form new substances with properties that are different from the original ones. Other substance simply mix without changing permanently and can often be separated again. **Changes in matter** **Understand that differences between elements, compounds and mixtures can be described at a particle level:** • compounds can have a number of pure substances or elements joined together through chemical reactions • the symbols and formulas of elements and simple compounds • the differences that exist between elements, compounds and mixtures • the chemical separation of compounds involves the breaking of chemical bonds, whereas the physical separation of mixtures does not. **Aboriginal science elaboration** Aboriginal people have employed many chemical reactions such as: • calcination as used to produce plaster (calcium sulfate), and pigments such as iron oxide • pyrolysis used in the production of charcoal, quicklime, pyrolignious acid and salts • fermentation in the production of ethanol • combustion in the production of heat and light.	**Key Idea: Matter and energy** • the total amount of matter in closed systems is conserved **Key idea: Stability and change** • matter can be rearranged through chemical change and these changes play an important role in many systems. **Changes in matter** **Understand that chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed:** • chemical reactions involve the rearrangement of atoms to form new substances • the law of conservation of mass • during a chemical reaction mass is not created or destroyed and can be represented in balanced chemical equations.	**Key Idea: Systems** • the rate of a chemical reaction can be measured by the rate of formation of a product and predicted through models. The chemical system is in a state of dynamic equilibrium when the rate of the forwards and reverse reactions are at the same. **Changes in matter** **Understand that different types of chemical reactions are used to produce a range of products and can occur at different rates:** • different types of chemical reactions are used to produce a range of products such as fuels, metals and pharmaceuticals • different factors such as temperature, light, size of particles, and adding a catalyst can influence the rate of reactions • the classification of patterns of interactions with natural and processed materials and their properties and structures • chemical reactions can be represented by word and balanced symbol equation. **Aboriginal science elaboration** The development of complex detoxification processes provide evidence of Aboriginal peoples' extensive scientific knowledge of chemical and physical processes, and an acute ability to draw conclusions that are consistent with evidence. The recognition of patterns in data, gathered from experiments that attempted to remove toxins, allowed this cultural group to modify and perfect the detoxification processes.

Sub-strand	Year 7	Year 8	Year 9	Year 10
		Changes in matter **Understand that new substances are formed when a chemical reaction occurs:** • the difference between a physical and a chemical change • evidence that a chemical reaction has occurred • the chemical properties of a substance affects its use.	**Changes in matter** **Understand that chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer:** • chemical reactions consist of reactants and products • word equations and simple symbolic equations are used to describe chemical reactions • the types and patterns of chemical reactions, such as combustion, acids with metals, bases, and carbonates • endothermic or exothermic reactions. **Aboriginal science elaboration** Many chemical reactions require the input of energy to initiate them. Fire, the result of a combustion reaction, is important in ecosystems because it promotes the recycling of nutrients. This process is well-known by Aboriginal people, as fire has been used for millennia to control the transfer of matter and energy through the ecosystem in a practice known as 'firestick farming'.	

Sub-strand	Year 7	Year 8	Year 9	Year 10

Earth and space sciences
 	
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.
	Key idea: Pattern, order and organisation
	
	• patterns of change can be used to make predictions for day and night, the seasons and eclipses.
	
	Earth in space
	
	Understand that predictable phenomena on Earth, including seasons and eclipses, are caused by the relative positions of the sun, Earth and the moon:
	
	• predictable patterns such as day and night are based on the relative positions between the Earth, sun and moon
	• causes of seasons through the combination of:
	  ○ the tilt of the Earth's axis,
	  ○ the Earth's rotation on that axis
	  ○ revolution of Earth around the sun
	• seasonal variation in connection with the angle of the sun, shadow length, and day length
	• similarities and differences within contemporary models explain solar and lunar eclipses relative to the movements of the Earth, moon and sun
	• there are different times for the rotation of Earth, the sun and moon, and the times for the orbits of Earth and the moon
	• the phases of the moon (lunar cycles) and ocean tides
	• changes on Earth such as day and night and seasons relate to the Earth's rotation and its orbit around the sun
	• the seasons on Earth have similarities and differences with the seasons on other planets.
	
	Aboriginal science elaboration
	
	The traditional astronomical knowledge of Aboriginal communities includes an intricate understanding of the relationship between the moon and tides. This knowledge was acquired through empirical observation of how ocean tides relate to the positioning of the moon and sun relative to the Earth.
	
	While the seasonal calendar used in most western societies is based on specific dates to mark each season, Aboriginal people observe the position of stars in the sky and follow water, plant and animal cycles as ways of identifying seasonal phenomena.
	
	Some cultural stories refer to either the moon pursuing the sun or vice versa, while other cultures believe that an eclipse is caused by the convergence of the sun and the moon. These cultural stories not only demonstrate traditional understandings of the apparent movements of the sun and the moon in the sky, but also provide detailed observational descriptions of solar and lunar phenomena.
				Key idea: Scale and measurement
				
				• the significance of a phenomenon in the solar system, other galaxies or the universe is dependent on the scale, proportion, and quantity at which it occurs; and can only be studied indirectly, as they are too large and at enormous distances to observe directly. Using the concept of 'orders of magnitude' aid understanding of how a model at one scale relates to a model at another scale.
				
				Key idea: Systems
				
				• systems can exist as components within larger systems, and that one important part of thinking about systems is identifying boundaries, inputs and outputs. For example, the solar system is part of the milky way galaxy, which is one of billions of galaxies in the universe.
				
				Earth in space
				
				Understand that 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:
				
				• the evidence that supports the Big Bang Theory and calculation of the age of the universe
				• the evolution of the universe, including the formation of galaxies, stars and planetary systems.
				
				Aboriginal science elaboration
				
				The astronomical knowledge of Aboriginal people as evidenced in histories inscribed in bark, rock and sand painting set the context to study traditional and modern understandings about the structure and origin of the universe. The exceptional observation skills of Aboriginal people are embedded in histories and handed down through generations, and is used, to aid navigation and to construct seasonal calendars.

Sub-strand	Year 7	Year 8	Year 9	Year 10
	Key idea: Stability and change • resources cycle through the environment at different rates and timescales, which determines how renewable they are **Key Idea: Systems** Water is a resource essential to life on Earth. An understanding of the water cycle as a system can be used to explain and predict the effect of human activity, leading to sustainable management decisions.	**Key idea: Stability and change** • recognise that rock formation is cyclical in nature and occurs within the Earth over a variety of timescales • the Earth's surface changes slowly over time, with mountains being eroded by weather, and new ones produced when the crust is forced upwards.	**Key idea: Stability and change** • below the surface heat from the Earth's interior causes movement in the molten rock. This in turn leads to movement of the plates over a long time period, which forms the Earth's crust, creating volcanoes and earthquakes.	**Key idea: Systems** • 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. • Earth's systems can exist as components within larger systems, identify the inputs and outputs, and boundaries of systems, to predict the cycles of elements through the systems.
	The Earth's surface **Understand that some of Earth's resources are renewable but others are non-renewable.** **Understand that water is an important resource that cycles through the environment:** • the Earth's resources can be distinguished as 'renewable' and 'non-renewable' • the similarities and differences between renewable and non-renewable resource • the changes of state of water and factors that influence the water cycle in nature • water is a resource that cycles through the environment • resources cycle through the environment at different rates, which determines how renewable they are • human use and management of resources affects their availability • the timescales for regeneration of resources. **Aboriginal science elaboration** Aboriginal people have deep connections to country in its totality, placing significant socio-cultural, economic and environmental values on the land, and also its associated water sources and other water features. These connections extend to the custodial responsibilities in managing the inter-related parts of their traditional estates in a sustainable way.	**The Earth's surface** **Understand that sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales:** • the forces of contraction, expansion and freezing of water can lead to the weathering of rocks • the structure of the Earth • the stages in the formation of igneous, metamorphic and sedimentary rocks, and an indication of timescales involved • the mode of formation determines the rock texture and the minerals contained within the rock • common rock types are based on observable physical and chemical properties • the relationship between rate of cooling and crystal formation size • igneous rocks are formed when molten material from inside the Earth cools • sedimentary rocks are formed when other rocks are weathered into small pieces, deposited and cemented together • metamorphic rocks are formed when other types of rock are changed by heat or pressure. **Aboriginal science elaboration** Traditionally, the mineral quartz and fine-grained quartz-rich rocks such as silcrete, chert and quartzite, as well as hard volcanic rocks such as basalt, were important resources for Aboriginal people. Traditional geological knowledge enabled suitable rock types to be identified, quarried or mined, and worked into a variety of sophisticated tools.	**The Earth's surface** **Understand that the theory of plate tectonics explains global patterns of geological activity and continental movement:** • the Earth's crust is made of separate plates • these plates move slowly and in different directions • tectonic plate movement is caused by heat energy and convection currents in the molten rock of the mantle • the age of rocks can be determined by looking at variations in their magnetic fields • seafloor spreading and continental drift theories can be used to explain and predict geological activity, such as earthquakes and volcanic activity • the age and stability of a large part of the Australian continent is related to its plate tectonic history • the technical advances associated with Earth science, such as ultrasound, laser, sonar, satellites and seismometers, and their use in government and industry.	**The Earth's surface** **Understand that global systems, including the carbon cycle, rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere:** • the long-term effects of loss of biodiversity • the impact of changes to permafrost and sea ice • the factors that drive the deep ocean currents, their role in regulating global climate, and their effects on marine life • human activity affects global systems • the causes and effects of the greenhouse effect • climate change affects sea levels and biodiversity • the systems on the surface of the Earth, result from interactions in the atmosphere, hydrosphere, biosphere and lithosphere • water, carbon, nitrogen and phosphorus cycle through the atmosphere, hydrosphere, biosphere and lithosphere. These cycles are predictable, but each element cycle has a different duration. **Aboriginal science elaboration** Aboriginal peoples' traditional fire management practices are recognised by contemporary science and are being used for bushfire management. Due to this management, greenhouse gas emissions are reduced effectively because of the interactions between the biosphere and the atmosphere.

Sub-strand	Year 7	Year 8	Year 9	Year 10
Physical sciences Two conceptual threads – Forces and motion, and Energy. Forces affect the behaviour of objects, and energy can be transferred and transformed from one form to another.	Key idea: Stability and change • stability can be the result of competing, but balanced forces. • consider the interaction between multiple forces when explaining changes in an object's motion and quantify change through measurements and analyse patterns of change represented in tables or graphs. Forces and motion **Understand that change to an object's motion is caused by unbalanced forces acting on the object; including Earth's gravity pulls objects towards the centre of Earth:** • constant motion is when an object is not changing its speed or direction. That is, the object is moving at the same rate, in the same direction and includes when objects are stationary • constant motion occurs when forces are balanced. If forces are unbalanced, there will be a change in speed (speeding up or slowing down), and/or direction of movement • force diagrams represent situations where balanced or unbalanced forces are being applied to objects • simple machines such as a lever, pulley, wheel and axle, inclined plane, screw, and wedge • gravity affects objects on the surface of Earth and also keeps planets in orbit around the sun • different types of forces including friction, air resistance, upthrust, and weight • distinguish between mass and weight. Aboriginal science elaboration Across Australia, Aboriginal people created a range of tools to increase the velocity and accuracy of projectiles. Various styles of spear-throwers were developed and refined on much of the mainland. Spear-throwers were effective as they provided an extension to the human thrower's arm.			Key idea: Systems • interactions between components can involve forces and changes acting in opposing directions; so for a system to be in a steady state, these factors need to be in a state of balance or equilibrium. Key idea: Stability and change • stability can be the result of competing but balanced forces. Students become adept at quantifying change through measurement and looking for patterns of change by representing and analysing data in tables or graphs. Forces and motion **Understand that the motion of objects can be described and predicted using the laws of physics:** • Newton's first law of motion states that an object at rest will remain this way unless it is acted upon by a force • an object that is moving will continue to move at the same speed and in the same direction, unless an unbalanced force acts upon it • Newton's second law of motion states that an object will accelerate in the direction of an unbalanced force acting upon it. The size of this acceleration depends upon the mass the object and the size of the force acting upon it. Speed is the distance an object travels over time • Newton's third law states that for every action force there is an equal (in size) and opposite (in direction) reaction force • acceleration is a change in motion (an increase or decrease in velocity) • velocity is the rate at which an object changes position in a certain direction. Aboriginal science elaboration The laws of physics can be applied to explain the effectiveness of hunting tools used in Aboriginal cultures. Aboriginal people achieve an increase in velocity, acceleration, reach and subsequent impact force through the use of spear-throwers and bows.

Sub-strand	Year 7	Year 8	Year 9	Year 10
		Key idea: Systems • models can be used to represent energy flows within systems. **Key idea: Matter and Energy** • energy may take different forms that can be transferred and transformed. **Energy** **Understand that energy appears in different forms, including movement (kinetic energy), heat and potential energy, and energy transformations and transfers cause change within systems:** • kinetic, potential, heat, sound, light, electrical, and chemical are different forms of energy • flow diagrams illustrate how energy is transferred and transformed • heat energy is often a by-product of energy transfer and transformation. **Aboriginal science elaboration** Various fire-starting techniques developed and used by Aboriginal people rely on the transformation of energy.	**Key idea: Matter and Energy** • the transfer of energy can be tracked as energy flows through a designed or natural system. Models of sound and light can be used to explain the transfer of energy through different media **Key idea: Form and function** • the properties of particles and waves determine the behaviour of light and sound. **Energy** **Understand that energy transfer through different mediums can be explained using wave and particle models:** • models of sound and light can be used to explain the transfer of energy through different media • the features of the wave and particle models to explain the behaviour of sound and light • the limitations of physical models used to explain light • the particle model can be used to explain conduction and convection of heat • heat transfer by radiation. **Aboriginal science elaboration** As in all cultures, Aboriginal people have many diverse technologies, knowledges and processes that involve the transfer of sound energy. Aboriginal peoples' knowledge of sound propagation through different mediums influences the design of technologies including sound instruments herding and signalling devices. Aboriginal cultures provide a context for understanding thermal energy transfer mechanisms. Aboriginal people living in cool and temperate climatic regions of Australia developed effective clothing technologies using the thermal conductivity of various materials. These affect the rate at which energy is transferred as heat between bodies.	**Key idea: Matter and Energy** • the total amount of energy and matter in closed systems is conserved. • Energy cannot be created or destroyed. Energy can be transferred and transformed from one place and another place, between object and/or fields, or between systems. **Energy** **Understand that energy conservation in a system can be explained by describing energy transfers and transformations:** • the Law of Conservation of Energy explains that total energy is maintained in energy transfer and transformation • Law of Conversation of Energy says that energy cannot be created or destroyed • energy transfer and transformation in systems is not 100% efficient • models can be used to show how energy is transferred and transformed within systems.

Strand: 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. There are two sub-strands of science as a human endeavour.

Sub-strand	Year 7	Year 8	Year 9	Year 10
Nature and development of science Develop 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.	**Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available.** Content examples: • Adelaide aerospace engineer Andy Thomas is a NASA astronaut who has advocated for South Australian Space Industry Centre. The centre will research advances in: - Space observation and travel - Predicting climate patterns - Improving the communication on Earth and in space Aboriginal science elaboration Aboriginal peoples' knowledge in the identification of medicinal and endemic plants contributes to current scientific knowledge.	**Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available.** Content examples: • Nanotechnology has changed how society develops and uses materials to design innovative products, for example sunscreen, paint, and medicine. • Changes in our understanding of matter has enabled us to use plasma technology. • One of the biggest scientific advancements from 2013 is the production of Organoids. Organoids are tiny immature organs that enable scientists to study disease and treatments in a laboratory without using live animals. • The treatment for gastric ulcers changed in 2005 when Professor Barry Marshall and Adelaide born scientist Robin Warren jointly won the Nobel Prize in Medicine. They won it for their discovery of 'the bacterium Helicobacter pylori and its role in gastritis and peptic ulcer disease'.	**Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community.** Content examples: • Historical development of models that show the structure of the atom have been refined over time and reviewed by the scientific community. • Theory of plate tectonics has been contested and changed over time. • Models used to predict changes in population or spread of disease have refined and sophisticated over time with the advancement in data technologies. • Models and theories for the nature of light have been refined over time through questioning and experimentation. The new evidence forms the basis of explanations used by scientists. • The Physicist Chien-Shiung Wu was the first scientist to confirm — and later refine — Enrico Fermi's theory of radioactive beta decay. • Neurophysiologist John Eccles won the 1963 Nobel Prize in Physiology or Medicine for his research on the synapse – the junction between 2 neurons or a neuron and a muscle. • Marie and Pierre Curie first discovered the radioactive elements polonium and radium. Marie continued to investigate their properties. In 1910, she successfully produced radium as a pure metal, which proved the new element's existence beyond a doubt. Aboriginal science elaboration Aboriginal peoples' fire regimes have influenced fire management policy throughout Australia.	**Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community.** Content examples: • The chemist Rosalind Franklin is known for her revolutionary work in discovering the double helix structure of DNA which has been contested and refined overtime. Her male colleagues James Watson and Francis Crick were awarded with the Nobel Prize in 1962. • The development of the periodic table has steadily evolved over time. It has been disputed, altered and improved as science has progressed and new elements have been discovered. • Square kilometre array (SKA) in Australia has the capability to answer profound questions in cosmology and challenge current scientific theories of the universe. • The climate change model is used by scientists to make predictions about changes on Earth; however, it is contested by some people in society. • Father and son Adelaide scientists William Lawrence Bragg and William Henry Bragg, were winners of the Nobel prize for physics. They successfully constructed the first X-ray spectroscope, revolutionizing the study of X-ray crystallography. • Astronomer Vera Rubin discovered the existence of dark matter, the strange glue that holds our universe together. Her contribution is regarded as one of the most significant discoveries of the 20th century. Aboriginal science elaboration Prior to germ theory, Aboriginal people used their scientific observations to develop traditional medicines to treat wounds and infections of the skin.

Sub-strand	Year 7	Year 8	Year 9	Year 10
	Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures. Content examples: • Water treatment plants and drinkable water have developed through collaboration across the disciplines of science, and the contributions of people from a range of cultures. • Dame Jane Goodall is a primatologist and anthropologist, and an expert in wild chimpanzees. She collaborated with people from a range of cultures. • South Australian inventor, David Unaipon, an Aboriginal man of the Ngarrindjeri people, was famous for inventions like an improved mechanical sheep shearing hand tool. He applied for patents for as many as 19 inventions and conceptualized the helicopter 22 years before it became a reality. He is featured on the Australian $50 note in commemoration of his work. Aboriginal science elaboration Land management practices of Aboriginal people informs contemporary management of the environment to protect biodiversity.	Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures. Content examples: • Extraction of mineral resources relies on the collaboration of geologists, physicists and chemists from a range of cultural backgrounds. • Advances in medical science such as reproductive technologies depend on the collaboration of a range of scientists. • Adelaide pharmacologist and pathologist Baron Howard Florey won a Nobel prize in medicine for the development of penicillin in collaboration with Sir Ernst Chain and Sir Alexander Fleming. • Rebecca Richards, an Adnyamathanha and Barngarla woman from the Northern Flinders Ranges, was the first Aboriginal Australian Rhodes Scholar and South Australia's 2012 Young Australian of the Year. Rebecca is an early career researcher in anthropology at the South Australian Museum, investigating the best use of the museum's materials to show the history of Aboriginal people. Aboriginal science elaboration Aboriginal people connect knowledge from the disciplines of physics, chemistry, biology and geology in the development of material culture and pigments and dyes.	Advances in scientific understanding often rely on technological advances and are often linked to scientific discoveries. Content examples: • Advances in the scientific understanding of electromagnetic radiation used in radar, medicine, mobile phones and microwaves have improved with technological advances. • Advances in the scientific understanding of the functions of the human body have improved with advanced imaging technologies. For example, bone density scanners, ultrasounds, and MRIs. • Advances in the scientific understanding of dental care and the longevity of fillings has improved with technological advances such as 3D printed tooth fillings. • Australian doctor and researcher Graeme Clark helped develop the Bionic Ear. • Frances Arnold was the first woman to receive a Nobel Prize in Chemistry 'for the directed evolution of enzymes' in 2018. She shared it with George Smith and Gregory Winter.	Advances in scientific understanding often rely on technological advances and are often linked to scientific discoveries. Content examples: • An increase in the speed of computers has enable us to sequence the human genome and enabled the sequencing of DNA in common and complex diseases. • SAHMRI in South Australia has improved our radiation therapy treatment for cancer patients. • The technological advances of the Large Hadron Collider has enabled scientists to understand Einstein's theory of relativity. • South Australia's new Space Agency Centre and Smart SAT CRC technological advances will improve communication, travel in space and may contribute to new scientific discoveries. • Technological advances have enabled biofuels to be used as alternative energy for a number of machines. Biofuels are fuels produced directly or indirectly from organic material biomass, including plant materials and animal waste. • Monitoring greenhouse gas emissions using advanced technologies and other environmental factors have contributed to the reinstatement of traditional fire management practices. • In 2018 Physicist Donna Strickland received the Nobel Prize in Physics with Arthur Ashkin and Gerard Mourou 'for ground-breaking inventions in the field of laser physics'. Aboriginal science elaboration Technological advances in dating methods of Aboriginal peoples' material culture, contribute to our understanding of the changing climatic conditions and human interaction with Australian megafauna.

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<tr><th>Sub-strand</th><th>Year 7</th><th>Year 8</th><th>Year 9</th><th>Year 10</th></tr>
<tr><td rowspan="2">Use and influence of science

Explore 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.</td><td>Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations.

Content examples:

• Solutions to water conservation, for example, recycling grey water and black water, have developed through new science and technologies. However, the use of this recycled water is determined through society's ethical considerations and environmental regulations.
• Science and technology provide solutions to road safety issues such as wearing seatbelts, but implementation depends on societies' ethics and legal regulations.
• The use of biological control to decrease or exterminate introduced species can impact on other areas of society, for example myxomatosis. Australian virologist Frank Fenner is known for his work on the prevention of smallpox and introducing the Myxoma virus to control rabbit numbers during a rabbit plague.

Aboriginal science elaboration

Intellectual property rights and bio-piracy must be considered with the development of commercial products that are founded on the traditional knowledge and practices of Aboriginal people.</td><td>Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations.

Content examples:

• Home batteries for storage of solar energy are being trialled in an investigation by SA Power. This scientific research will help find a solution to reach Australia's zero emissions target by 2050 and take ethical considerations into account.
• The future of energy generation must consider renewable energy technologies. It also needs to look at the effects on the sustainability of systems and the ethical issues surrounding society's energy-dependent lifestyle.
• Ethical considerations are required for organ transplantation between humans and humans, and animals and humans.
• Local councils and community groups require solutions on sustainability of coastline dune regeneration based on scientific knowledge.

Aboriginal science elaboration

Ethical considerations for the use of sustainable technologies in remote Aboriginal communities.</td><td>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.

Content examples:

• New career opportunities and advances in science have led to augmented reality in medical training for surgeons.
• Scientific predictions and explanations are improved with the use of virtual reality. For example:
o for geologists in finding ores
o medicine in radiation therapy training
o for biologists in determining the energy flows through ecosystems.
• Xenobots are living machines which promote self-healing in patients.
• New career opportunities have been generated through innovative scientific developments such as lifi (light waves), and funtenna (use of sound and radio waves to hack internet of things).
• Australian Ophthalmologist Fred Hollows is known for his extraordinary work that helped to restore the eyesight of thousands of people.
• Adelaide geologist and explorer Sir Douglas Mawson led the Heroic Age of Antarctic Exploration which continues today.

Aboriginal science elaboration

Aboriginal people are at the forefront of the development of scientific measures to prevent the transfer of certain infectious diseases and pests to the Australian continent.</td><td>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.

Content examples:

• New discoveries and scientific explanations through space exploration and the use of nanosatellites will advance the life of all societies.
• Bioinformatics are helping scientists accept claims of uncertain knowledge.
• Advances in sustainable transport, based on scientific evidence can create entrepreneurial and start-up opportunities for South Australia and may even take people to Mars.
• Adelaide nuclear physicist Sir Mark Oliphant was the winner of the Hughes Medal and the Faraday Medal for his work on nuclear fusion and fission which has led to many new career opportunities and research.
• Australian Biologist Elizabeth Blackburn helped discover an enzyme called telomerase.
• Flavia Tata Nardini is co-founder and CEO of Australia's Fleet Space Technologies, which is improving communication connectivity on Earth and in space through the development and refinement of nano-satellites.

Aboriginal science elaboration

Traditional ecological knowledge of Aboriginal people is being reaffirmed by modern science and is generating new career opportunities in the field of restorative ecology.</td></tr>
<tr><td>People use science understanding and skills in their occupations, and these have influenced the development of practices in areas of human activity.

Content examples:

• Science has influenced developments in supporting disabled people to walk again.
• Recycling industries and waste disposal practices have been developed using scientific understandings and skills.
• Medical separation techniques such as blood transfusions are based on science understandings.</td><td>People use science understanding and skills in their occupations, and these have influenced the development of practices in areas of human activity.

Content examples:

• People use science to improve farming through the development of precision agriculture.
• Science understanding is used to influence the development of earthquake and tsunami prediction alarms.
• Science understanding is used in disease treatment and to influence human activity during pandemics.
• Australian doctor and pioneer Helen Mayo influenced the prevention of infant mortality.</td><td>Values and needs of contemporary society can influence the focus of scientific research.

Content examples:

• Australian scientific research on artificial skin by Dr Fiona Wood and Dr Marie Stoner is valued by contemporary society.
• Dr James Muecke won the Australian of the Year in 2020 for his work and influence on diabetes-induced blindness in society.
• Australian physicist, Joan Freeman became the first woman to be awarded the British Institute of Physics' Rutherford Medal for her work on atomic energy.</td><td>Values and needs of contemporary society can influence the focus of scientific research.

Content examples:

• Contemporary society values scientific knowledge on climate change and increasing atmospheric pollution. The scientific data is used to influence decisions which affects all of our lives. Australian researcher David Karoly is known for his research on climate change and stratospheric ozone depletion.
• Contemporary society values scientific knowledge on gene therapy and more funding is being provided to research further solutions.</td></tr>
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Sub-strand	Year 7	Year 8	Year 9	Year 10
	Aboriginal science elaboration The knowledge and experience of Aboriginal people are being used to inform scientific decisions, such as the care of Country.	• Australian epidemiologist Professor Fiona Stanley noted for her research into pregnant women taking folate to prevent defects such as spina bifida. **Aboriginal science elaboration** Aboriginal people used scientific understandings of complex ecological relationships to develop specific fire based agricultural practices.		• Pharmaceutical nanotechnology research on toxicological assessment is influenced by contemporary society's issues with drug development. Advanced detection of cancer using gold nanoparticles research is supported by society. **Aboriginal science elaboration** Disease outbreaks and the emergence of drug resistant infections have focused scientific research into Aboriginal peoples' traditional medicines. This is to identify effective therapeutic compounds for use in pharmaceuticals. The values of 19th and early 20th century Australian society, combined with scientific misconceptions about heredity and evolution, influenced policies and attitudes towards Aboriginal people.

Strand: 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. There are five sub-strands of science inquiry skills.

Sub-strand	Year 7	Year 8	Year 9	Year 10
Questioning and predicting Identifying and constructing questions, proposing hypotheses and suggesting possible outcomes.	Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge.	Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge.	Formulate questions or hypotheses that can be investigated scientifically.	Formulate questions or hypotheses that can be investigated scientifically.
Planning and conducting Making decisions about how to investigate or solve a problem and carrying out an investigation, including the collection of data.	Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed. Measure and control variables and select equipment appropriate to the task and collect data with accuracy.	Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed. Measure and control variables and select equipment appropriate to the task and collect data with accuracy.	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. Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately.	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. Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately.
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.	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. Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence.	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. Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence.	Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies. Use knowledge of scientific concepts to draw conclusions that are consistent with evidence.	Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies. Use knowledge of scientific concepts to draw conclusions that are consistent with evidence.
Evaluating Considering the quality of available evidence and the merit or significance of a claim, proposition or conclusion with reference to that evidence.	Reflect on scientific investigations including evaluating the quality of the data collected and identifying improvements. Use scientific knowledge and findings from investigations to evaluate claims based on evidence.	Reflect on scientific investigations including evaluating the quality of the data collected and identifying improvements. Use scientific knowledge and findings from investigations to evaluate claims based on evidence.	Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data. Critically analyse the validity of information in primary and secondary sources and evaluate the approaches used to solve problems.	Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data. Critically analyse the validity of information in primary and secondary sources and evaluate the approaches used to solve problems.

Sub-strand	Year 7	Year 8	Year 9	Year 10
Communicating Conveying information or ideas to others through appropriate representations, text types and modes.	Communicate ideas, findings and evidence-based solutions to problems using scientific language, and representations, using digital technologies as appropriate.	Communicate ideas, findings and evidence-based solutions to problems using scientific language, and representations, using digital technologies as appropriate.	Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations.	Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations.