

**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.

**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.

**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. These are embedded within each year level description and guide the teaching/learning emphasis for the relevant year level. 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 understanding strand, support key aspects of the science inquiry skills strand and contribute to developing students' appreciation of the nature of science.

**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.

**Year 6 Level Description**

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.

## Structure

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 skills strand 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.

## Year 6 Content Descriptions

Science Understanding	Science as a Human Endeavour	Science Inquiry Skills
<p><b>Biological sciences</b> The growth and survival of living things are affected by physical conditions of their environment.</p> <p><b>Chemical sciences</b> Changes to materials can be reversible or irreversible.</p> <p><b>Earth and space sciences</b> Sudden geological changes and extreme weather events can affect Earth's surface.</p> <p><b>Physical sciences</b> Electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources.</p>	<p><b>Nature and development of science</b> Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions.</p> <p><b>Use and influence of science</b> Scientific knowledge is used to solve problems and inform personal and community decisions.</p>	<p><b>Questioning and predicting</b> With guidance, pose clarifying questions and make predictions about scientific investigations.</p> <p><b>Planning and conducting</b> Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks. Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate.</p> <p><b>Processing and analysing data and information</b> 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. Compare data with predictions and use as evidence in developing explanations.</p> <p><b>Evaluating</b> Reflect on and suggest improvements to scientific investigations.</p> <p><b>Communicating</b> Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts.</p>