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, explanatory principles. Science knowledge is contestable and is revised, refined and extended as new evidence arises.

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

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

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

Aims
The Australian Curriculum: Science aims to ensure that students develop:
- an interest in science as a means of expanding their curiosity and willingness to explore, ask questions about and speculate on the changing world in which they live
- an understanding of the vision that science provides of the nature of living things, of Earth and its place in the cosmos, and of the physical and chemical processes that explain the behaviour of all materials
- 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; 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 and order 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/nongrowing) and developing criteria for these groupings relies on making observations and identifying patterns of similarity and difference.

As students progress through the primary years, they become increasingly competent in identifying and describing the relationships that underpin patterns, including cause and effect. Students increasingly recognise that patterns 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 competition, but balanced forces. Students become increasingly adept at quantifying change through measurement and looking for patterns of change by representing and analyzing data in tables or graphs.

Scalability 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, they understand their understanding of relevant scales and rates of change and develop their ability 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 ‘taller’ 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 forces, 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 become increasingly able to explain phenomena in terms of system models.

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

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

Year 8 Level Description
The science pre-capitals and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

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

In Year 8, students are introduced to cells as microscopic structures that explain macroscopic properties of living systems. They link form and function and explore the organisation of body systems in terms of flows of matter between interdependent organs. Similarly, they explore changes in matter at a particle level, and distinguish between chemical and physical change. They begin to classify different forms of energy, and describe the role of energy in causing change in systems, including the role of heat and kinetic energy in the rock cycle. Students use experimentation to isolate relationships between components in systems and explain these relationships through increasingly complex representations. They make predictions and propose explanations, drawing on evidence to support their views while considering other points of view.
Cells are the basic units of living things; they have specialised structures and functions. Knowledge refers to facts, concepts, 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 physical sciences sub-strand comprises four sub-strands. The content is described by year level.

Biological sciences
The biological sciences sub-strand is concerned with living things. The key concepts developed within this sub-strand are that: living things are diverse; they are adapted to their environment; and living things are interdependent and interact with each other and their environment. Through this sub-strand, students investigate living things, including animals, plants and microorganisms, and their interdependences and interactions within ecosystems. They explore the life cycles, body systems, structural adaptations and behaviours that 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 chemical reactions 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 at Earth’s rotation and revolution, 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 Understanding:

- **Biological sciences**
  - Cells are the basic units of living things; they have specialised structures and functions.
  - Multi-cellular organisms contain systems of organs carrying out specialised functions that enable them to survive and reproduce.
- **Chemical sciences**
  - Properties of the different states of matter can be explained in terms of the motion and arrangement of particles.
  - Differences between elements, compounds and mixtures can be described at a particle level.
- **Physical sciences**
  - Energy appears in different forms, including movement (kinetic energy), heat and potential energy, and energy transformations and transfers cause change within systems.

Science Inquiry Skills:

- **Science inquiry involves identifying and posing questions; planning, conducting and reflecting on investigations; processing, analysing 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, and applying models 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).

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, test types and modes.

Year 8 Content Descriptions

<table>
<thead>
<tr>
<th>Science Understanding</th>
<th>Science as a Human Endeavour</th>
<th>Science Inquiry Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Science as a Human Endeavour</strong></td>
<td><strong>Science Understanding</strong></td>
<td><strong>Science Inquiry Skills</strong></td>
</tr>
</tbody>
</table>
| Nature and development of science | Scientific knowledge has changed peoples’ understanding of the world and is refined as new evidence becomes available. | Questioning and predicting:
| | Science knowledge can develop through collaboration across the disciplines and the science of the contributions from people of a range from cultures. | Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge.
| | Use and influence of science | Planning and conducting:
| | Solving and interpreting contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations. | Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed. Make and control variables, select equipment appropriate to the task and collect data with accuracy.
| | People use science understanding and their occupations and responsibilities in data using digital technologies as appropriate. | Process and analysing data and information:
| | Submerge 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.
| | **Chemical change involves substances reacting to form new substances.** | Evaluating:
| | Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales. | Reflect on scientific investigations including evaluating the quality of the data collected, and identifying improvements.
| | **Earth and space sciences** | Use scientific knowledge and findings from investigations to evaluate claims based on evidence. | Communicating:
| | Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales. | Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations, using digital technologies as appropriate.
| | **Science inquiry involves identifying and posing questions; planning, conducting and reflecting on investigations; processing, analysing 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. | **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 on the basis of evidence and is aimed at improving 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 science strands have been written so that at each year the 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. | **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, test types and modes. |