National Assessment Program – Science Literacy 2026

Assessment Framework

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1. Overview

1.1. Background

The National Assessment Program assessment in Science Literacy (NAP–SL) is one of 3 national sample assessments developed and managed by the Australian Curriculum, Assessment and Reporting Authority (ACARA). Together with the NAP–Civics and Citizenship (NAP–CC) and the NAP–Information and Communication Technology Literacy (NAP–ICTL), this assessment supports measurement of progress towards the objectives outlined in the Alice Springs (Mparntwe) Education Declaration (2019). Each of these national sample assessments is conducted on a rolling 3-yearly basis and uses stratified random samples of students in Year 6 and Year 10 to monitor the extent to which Australian schooling meets the goals of the Declaration.

One of the main objectives of NAP–SL is to monitor and report trends in science literacy achievement. The assessment is an important source of information about what Australian students know, understand and can do in the context of science literacy. It seeks to measure students' cognitive competencies in science by assessing both students' science knowledge and their capacity to use this knowledge as they engage in processes of scientific inquiry.

Furthermore, NAP–SL administers a questionnaire to understand students' attitudes to, and engagement with, science as well as their science experiences both at school and outside of school. Student achievement data are complimented with this and additional background information on student demographic factors and educational context, such as NAPLAN performance, geographic location and school size, are considered during sample selection. This allows for the analysis of contextual factors that influence students' educational outcomes to be considered in relation to science literacy achievement.

NAP–SL contributes to the measurement of commitments in the Alice Springs (Mparntwe) Education Declaration by measuring the science literacy of Australian students in Years 6 and 10. The Declaration has 2 interrelated *Education Goals for Young Australians:*

1. The Australian education system promotes excellence and equity
2. All young Australians become:
    - confident and creative individuals
    - successful lifelong learners
    - active and informed members of the community.

NAP–SL is designed to ensure that student progress and achievement in science literacy are measured in meaningful ways. It contributes to:

- assessment **for** learning – enabling teachers to use information about student science literacy to inform their teaching
- assessment **of** learning – assisting teachers, education leaders, parents/carers, the community, researchers and policymakers to use evidence of student proficiency in science literacy to assess student achievement against recognised goals and standards, and drive improvements in student outcomes.

The first science literacy assessment was conducted in 2003 with Year 6 students only. The assessment has been repeated with a new sample of Year 6 students every 3 years to identify trends over time. In 2015, NAP–SL transitioned to online administration, enabling the incorporation of innovative assessment approaches. In July 2016, the Education Council decided to extend NAP–SL to Year 10 students from 2018. This decision was intended to reinforce assessment of science literacy progress of Australian students through assessment at the end of primary schooling and at the end of compulsory science education. In addition, assessment at both Year 6 and Year 10 enables comparisons with international assessments that assess science literacy at these levels.

These developments, along with the publication of the Australian Curriculum: Science in 2010, necessitated the development of a new framework for assessing science literacy, which was undertaken in 2018. The framework for NAP–SL 2023 (ACARA 2022) maintained the 2018 assessment framework but was updated to reflect the new national declaration on education goals for all Australians (The Alice Springs [Mparntwe] Education Declaration) and contained refined specifications for both the Year 6 and the Year 10 science literacy assessments. The NAP–SL 2026 framework maintains the underlying construct of the NAP–SL assessment to continue to provide the basis for an effective measure of students' science literacy over time.

1.2. What does NAP–Science Literacy measure?

NAP–SL measures science literacy as defined in the Australian Curriculum: Science: "An ability to use scientific knowledge, understanding, and inquiry skills to identify questions, acquire new knowledge, explain science phenomena, solve problems and draw evidence-based conclusions in making sense of the world, and to recognise how understandings of the nature, development, use and influence of science help us make responsible decisions and shape our interpretations of information" (ACARA n.d.).

The construct of science literacy is further informed by the rationale of the Australian Curriculum: Science (ACARA 2023a) that aims for students to develop:

- an understanding of important science concepts and processes, the practices used to develop scientific knowledge, science's contribution to our culture and society, and its uses in our lives
- the scientific knowledge, understandings and skills to make informed decisions about local, national and global issues, and to succeed in science-related careers.

In developing scientific literacy, students use critical and creative thinking skills. They challenge themselves to ask questions and draw evidence-based conclusions using scientific knowledge and practices.

This construct of science literacy is consistent with recent definitions of science literacy internationally. The Programme for International Student Assessment (PISA) assesses the competencies developed by a scientific education. The competencies are defined in terms of "the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen" (OECD 2023). Science literacy requires competencies in explaining phenomena scientifically, constructing and evaluating designs for scientific enquiry, interpreting scientific data and evidence critically, and researching, evaluating and using scientific information for decision-making and action.

Similarly, the United States National Academies of Sciences, Engineering and Medicine define scientific literacy as the "knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" (National Research Council 1996). Aspects of science literacy are described as:

- the understanding of scientific practices (for example, formulation and testing of hypotheses, probability/risk, causation versus correlation)
- content knowledge (for example, knowledge of basic facts, concepts and vocabulary)
- understanding of science as a social process (for example, the criteria for the assignment of expertise, the role of peer review, the accumulation of accepted findings, the existence of venues for discussion and critique, and the nature of funding and conflicts of interest).

The NAP–SL student questionnaire was introduced for Year 6 students in 2009 and expanded to include questions relevant for Year 10 students in 2018. It provides descriptive information about student attitudes and their understanding of activities related to science. It also provides information about factors that influence students' science literacy proficiency. The student questionnaire gathers information about students' attitudes to, and interests in, science and their science experiences in school and non-school settings. The questionnaire also includes questions of relevance for Year 10 students, gathering information about students' perception of the importance of science and their potential intentions of pursuing careers in science, technology, engineering and mathematics (STEM) related fields.

NAP–SL 2026 again includes a student questionnaire intended to evaluate student attitudes to science. It may include content on contemporary issues such as the use of artificial intelligence for scientific activities, space exploration, climate science, Australia's future energy infrastructure and developments in medical technology.

1.3. Organisation of the framework

The NAP–SL 2026 Assessment Framework provides historical information about the origin and development of NAP–SL, a description of what is assessed in NAP–SL aligned with the Australian Curriculum: Science, and the structure of the assessment.

The framework includes the following chapters:

Chapter 1: Overview provides background information on the NAP–SL 2026 Assessment Framework.

Chapter 2: Content dimension describes the content domains — the specific subject matter to be covered in the assessment.

Chapter 3: Cognitive dimension describes the targeted thinking skills and intellectual processes elicited as students respond to the assessment tasks.

Chapter 4: Contextual framework describes the various contextual factors that are considered within the NAP–SL assessment, as well as the instruments used to collect them.

Chapter 5: Assessment structure and reporting outlines the reporting structure as well as the design of the assessment. This includes the types of assessment items and response formats that are required to capture the variability and complexity of student performance in relation to the dimensions discussed in chapters 2 and 3.

2. Content dimension

The content dimension defines the content domains – the specific subject matter covered in the assessment. For the NAP–SL 2026 Assessment Framework, the content domains and sub-domains are organised according to the strands and sub-strands of the Australian Curriculum: Science, respectively, and guide the content to be covered in NAP–SL 2026.

The following section, 2.1 Content in the Australian Curriculum: Science, describes each of the strands in the Australian Curriculum, including refinements to the Australian Curriculum: Science made following the 2021 cycle of curriculum review recommended by Australian education ministers. However, as the rollout of the Australian Curriculum Version 9.0 is staggered due to each state, territory and jurisdiction overseeing their own implementation process, differences between Version 8.4 and Version 9.0 are indicated throughout this assessment framework as footnotes, ensuring continuity and comparability across jurisdictions.

Following a general description of the content of each strand is an outline of the organisation of the content for the NAP–SL Year 6 and Year 10 assessments. Content domains and the target percentages of items to be allocated to each domain are specified, based on the 2018 NAP–SL assessment framework.

2.1. Content in the Australian Curriculum: Science

The Australian Curriculum: Science has 3 interrelated strands: *Science understanding, Science as a human endeavour* and *Science inquiry*[1] (ACARA 2023a). Each strand of the Australian Curriculum: Science is populated with content descriptions that describe at each year level what is to be taught and what students are expected to learn. This includes the knowledge, understanding and skills relating to the learning area of science. A set of achievement standards describe the depth of understanding and the sophistication of knowledge and skill expected of students.

2.1.1. Science understanding

Science understanding refers to the selection and integration of appropriate science knowledge to explain and predict phenomena, and to the application of that knowledge to new situations. Science knowledge refers to facts, concepts, principles, laws, theories and models that have been established over time.

The *Science understanding* strand comprises 4 sub-strands.

Biological sciences

The *Biological sciences* sub-strand is concerned with understanding living things including animals, plants and microorganisms, and their interdependence and interactions within ecosystems. The core concepts developed within this sub-strand are:

- a diverse range of living things have evolved on Earth over hundreds of millions of years; this process is ongoing
- biological systems are interdependent and interact with each other and their environment
- the form and features of living things are related to the functions that their body systems perform.

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 core concepts developed within this sub-strand are:

- Earth is part of an astronomical system; interactions between Earth and celestial bodies influence the Earth system
- the Earth system comprises dynamic and interdependent systems; interactions between these systems cause continuous change over a range of scales

[1] Science Inquiry Skills, AC Version 8.4

- all living things are connected through Earth’s systems and depend on sustainability of the Earth system.

Physical sciences

The *Physical sciences* sub-strand is concerned with understanding the nature of forces and motion, and matter and energy. The core concepts developed within this sub-strand are:

- forces affect the motion and behaviour of objects
- energy can be transferred and transformed from one form to another, and is conserved within systems.

Chemical sciences

The *Chemical sciences* sub-strand is concerned with understanding the composition and behaviour of substances. The core concepts developed within this sub-strand are:

- the chemical and physical properties of substances are determined by their structure at a range of scales
- substances change and new substances are produced by rearranging atoms; these changes involve energy transfer and transformation.

2.1.2. Science as a human endeavour

Science as a human endeavour refers to the nature of science, including the role of science inquiry in developing science knowledge, and the factors that affect the use and advancement of science. This strand highlights the development of science as a unique way of knowing and doing, and the role of science in contemporary decision-making and problem-solving.

The *Science as a human endeavour* strand comprises 2 sub-strands.

Nature and development of science

This sub-strand develops an appreciation of the unique nature of science and scientific knowledge, including that scientific knowledge is based on empirical evidence and can be modified in light of new or reinterpreted evidence. The core concepts developed within this sub-strand are:

- science inquiry values curiosity, creativity, accuracy, objectivity, perseverance and scepticism
- science knowledge is a result of individual and collaborative efforts, and advances reflect historical and global contributions
- science knowledge, balanced with ethical and social considerations, contributes to understanding complex contemporary issues and identifying responses.

Use and influence of science

This sub-strand explores how science knowledge and applications affect individuals and communities, including informing their decisions and identifying responses to contemporary issues. The core concepts developed within this sub-strand are:

- scientific knowledge, practices and products are influenced by ethical, environmental, social and economic factors
- science, technology and engineering are interconnected; advances in one field can lead to advances in other fields
- science knowledge, balanced with ethical and social considerations, contributes to understanding complex contemporary issues and identifying responses.

2.1.3. Science inquiry

Science inquiry is concerned with the diverse ways that scientists study the natural world and propose explanations based on evidence (National Research Council 2000). This strand is concerned with investigating ideas, developing explanations, solving problems, drawing valid conclusions, evaluating claims and constructing evidence-based arguments. This strand provides opportunities for students to achieve deeper understanding of the science concepts and how scientific thinking applies to these understandings. This strand has been renamed from “Science Inquiry Skills” to reflect that scientific inquiry involves both skill and cognitive dimensions.

The *Science inquiry* strand comprises 5 sub-strands.

Questioning and predicting

This sub-strand involves identifying and constructing investigable questions, proposing hypotheses and predicting possible outcomes. The core concepts developed within this sub-strand are:

- science inquiry involves making observations and predictions, asking questions, and constructing and testing explanations for natural and physical phenomena
- science inquiry may be done to describe a phenomenon, explore relationships, test a theory or model, or design solutions.

Planning and conducting

This sub-strand involves making decisions about how to investigate or solve a problem and carrying out an investigation, including the generation and recording of data. The core concept developed within this sub-strand is:

- science inquiries should be designed to systematically generate or collect valid and reliable primary and secondary data in a safe, ethical and interculturally aware way.

Processing, modelling and analysing[2]

This sub-strand involves analysing and representing data in meaningful and useful ways, and identifying trends, patterns and relationships in data. The core concept developed within this sub-strand is:

- mathematical thinking underpins science practices of representing objects and events, analysing data and modelling relationships.

Evaluating

This sub-strand involves considering the quality of available evidence and the merit or significance of a claim, proposition, explanation or argument with reference to that evidence. The core concept developed within this sub-strand is:

- evaluating evidence enables development of explanations, decision-making and designed solutions.

Communicating

This sub-strand involves conveying information or ideas to others in ways appropriate to the purpose and audience. The core concept developed within this sub-strand is:

- critiquing and communicating science ideas effectively is critical to advancing science and influencing environmental, social and economic futures.

Appendix A shows examples of the Year 5 and Year 9 content descriptions from the 3 strands of the Australian Curriculum: Science mapped to the core concepts and key ideas of the Australian Curriculum: Science. The content of the assessment aligning with the *Science understanding* strand is limited to a Year 5 or Year 9 level, even though it is administered to Year 6 or Year 10 students respectively. This is due to

[2] Processing and analysing data and information, AC Version 8.4

test administration occurring before students have had the opportunity to cover the full curriculum of that year level.

2.2. NAP–SL 2026 content domains and target percentages

Table 1 shows the proposed content domains, sub-domains and target percentages of assessment items for domains for the Year 6 and Year 10 assessment. The assessments comprise 3 content domains that align to the 3 strands of the Australian Curriculum: Science — *Science understanding, Science as a human endeavour* and *Science inquiry*.

To maintain consistency with previous NAP–SL cycles, and to ensure representative distribution of domains in alignment with the Australian Curriculum: Science, the target percentages of items for NAP–SL 2026 remain similar. There is an even distribution of items across the *Science understanding* sub-domains, consistent both with the equivalent percentages of content statements in each sub-strand of the Australian Curriculum and the equivalent percentages in the previous NAP–SL assessment frameworks.

The content for the Year 6 assessment incorporates concepts from the *Science understanding* strand for Foundation to Year 5, while the Year 10 assessment includes concepts up to Year 9. This approach ensures alignment with students' prior learning, as test administration occurs before they have completed the full curriculum for their respective year levels. The distribution of items across sub-domains of *Science as a human endeavour* and *Science inquiry* content domains may vary from an even distribution, but provides some coverage of all sub-domains.

Table 1: Target percentages for content domains and sub-domains in the Year 6 and Year 10 assessment

Content domain	Target percentage	Content sub-domain
Science understanding	45%	• Biological sciences • Chemical sciences • Earth and space sciences • Physical sciences
Science as a human endeavour	15%	• Nature and development science • Use and influence of science
Science inquiry	40%	• Questioning and predicting • Planning and conducting • Processing, modelling and analysing • Evaluating • Communicating

2.2.1. Year 6 assessment

The Year 6 assessment aligns with both the organisation and content of the Australian Curriculum: Science. The content of the Year 6 assessment addresses the range of levels required for effective demonstration of scientific literacy across the curriculum. The content is refined to incorporate concepts in the *Science understanding* strand for Foundation to Year 5. This is because administration of the assessment is scheduled before students have had the opportunity to cover the full Year 6 curriculum. The concepts outlined in the *Science as human endeavour* and *Science inquiry* strands are described in 2-year bands. Therefore concepts outlined in these strands from Foundation to Year 6 are incorporated in the content of the Year 6 assessment.

The recommended target percentages of assessment items for the content domains in NAP–SL 2026 are broadly consistent with those of the previous NAP–SL assessments. The NAP–SL 2018 assessment framework carefully mapped the content domains to earlier NAP–SL assessments, ensuring similar coverage of content across domains. The recommended target percentages for the *Science understanding* sub-domains are consistent with the equivalent percentages for the content statements in each sub-strand of the Australian Curriculum: Science, and with the equivalent sub-domain percentages in the previous NAP–SL assessment frameworks.

Items written for the *Science as a human endeavour* domain may assess applications of science to students' everyday lives and to society, or they may assess students' understanding of the nature and development of science (for example, students' understanding of the nature of scientific predictions, tests and evidence). *Science as a human endeavour* may also serve as a context for assessment items related to the *Science understanding* and *Science inquiry* content domains. However, only those items that explicitly assess students' understanding related to the nature, development and applications of science are be classified explicitly within *Science as a human endeavour*.

The distribution of items across sub-domains of *Science as a human endeavour* and *Science inquiry* content domains may vary from an equivalent distribution but provides coverage of all sub-domains.

2.2.2. Year 10 assessment

The Year 10 assessment aligns with the organisation and content of the Australian Curriculum: Science. The content of the Year 10 assessment addresses the range of levels required for effective demonstration of scientific literacy across the curriculum. The content is refined to incorporate concepts in the *Science understanding* strand up to Year 9. This is because administration of the assessment is scheduled before students have had the opportunity to cover the full Year 10 curriculum. The concepts outlined in the *Science as human endeavour* and *Science inquiry* strands are described in 2-year bands. Therefore, concepts outlined in these strands to Year 10 are incorporated in the content of the Year 10 assessment.

The target percentages of assessment items show the recommended targets where each domain is the primary focus of the assessment, consistent with previous NAP–SL assessments. In the practice of science, the 3 strands of *Science understanding, Science as a human endeavour* and *Science inquiry* 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. The strands of the Australian Curriculum: Science are intended to be implemented in an integrated manner. Similarly, the NAP–SL assessment is structured to require students to, at times, engage with a combination of domains. This occurs particularly at Year 10, when it is expected that students have developed a more sophisticated understanding of the knowledge and skills of science.

For example, in addition to items that focus explicitly on *Science inquiry*, students are engaged in science practices as they use science knowledge to respond to items and tasks classified under the *Science understanding* domain. For example, students may be asked to use knowledge to make predictions, construct explanations, create and use models, etc. Similarly, in addition to items that explicitly assess content on *Use and influence of science* in the *Science as a human endeavour* domain, some items within the *Science understanding* domain require students to use science knowledge by applying it to societal issues.

The expected even distribution of items for the *Science understanding* sub-domains in Year 10 reflect the intent of the Australian Curriculum, which places equal emphasis on the science disciplines.

The distribution of items across sub-domains of *Science as a human endeavour* and *Science inquiry* content domains may vary from an equivalent distribution but provides coverage of all sub-domains.

2.3. Content sequences

Designing effective assessment for NAP–SL requires the articulation of content sequences for the science content outlined in the Australian Curriculum: Science. These content sequences describe the essential elements of the construct(s) in sufficient detail to guide item development and illustrate how the construct(s) can be assessed at different levels of sophistication. Through a process of identifying sub-topics within the content domain, aligning content descriptions with the Australian Curriculum: Science to these sub-topics, and consulting relevant published research regarding sequences of learning, content sequences were developed to inform item development for NAP–SL 2018.

The content sequences developed in 2018 to guide item development are used again for NAP–SL 2026 to ensure consistency with previous NAP–SL cycles. The content sequences and alignment to the content descriptions are updated to reflect refinements to the Australian Curriculum: Science since the initial development in 2018. The content sequence for the *Science understanding* domain is shown in Table 2.

Table 2: Content sequences for the Science understanding domain of NAP–SL

Biological sciences	Chemical sciences	Earth and space sciences	Physical sciences
Interdependence of life	Matter – structure, properties and changes	Earth in space	Forces and motion
Flow of matter and energy in ecosystems		Earth structure and processes	Energy forms, transfer and conservation
Multi-cellular systems		Earth's resources and geochemical cycles	
DNA and inherited characteristics			
Diversity and evolution			

The content descriptions addressed in each *Science understanding* content sequence are refined to include only the content described in section 2.3 of this assessment framework. For example, in the assessment of content relating to DNA and inherited characteristics, content such as the following is incorporated:

- compare characteristics of living and non-living things and examine the differences between the life cycles of plants and animals (Year 3, AC9S3U01)[3]
- examine how particular structural features and behaviours of living things enable their survival in specific habitats (Year 5, AC9S5U01)[4]
- analyse the relationship between structure and function of cells, tissues and organs in a plant and an animal organ system and explain how these systems enable survival of the individual (Year 8, AC9S8U02)[5].

2.4. Content sequences

2.4.1. Key ideas

The inclusion of the key ideas in the Australian Curriculum is designed to support the coherence of science understanding within and across year levels, enabling students to connect diverse phenomena and frame their deepening understanding in the context of systems thinking (ACARA 2023a).

The 6 overarching key ideas of the Australian Curriculum: Science that represent key aspects of a scientific view of the world, and bridge knowledge and understanding across the disciplines of science, are:

[3] The content description in the Australian Curriculum (AC) Version 9.0 is a combination of "Living things grow, change and have offspring similar to themselves" (Year 2, ACSSU030), "Living things can be grouped on the basis of observable features and can be distinguished from non-living things" (Year 4, ACSSU044) and "Living things have life cycles" (Year 4, ACSSU072) of the AC Version 8.4.
[4] The content description in the AC Version 9.0 is refined from "Living things have structural features and adaptations that help them to survive in their environment" (Year 5, ACSSU043) of the AC Version 8.4.
[5] The content description in the AC Version 9.0 is refined from "Multi-cellular organisms contain systems of organs carrying out specialised functions that enable them to survive and reproduce" (Year 8, ACSSU150) of the AC Version 8.4.

- Patterns, order and organisation
- Form and function
- Stability and change
- Scale and measurement
- Matter and energy
- Systems.

These align closely with the cross-cutting concepts described by the National Research Council's *A Framework for K-12 Science Education* (2012) (Patterns; Cause and effect: Mechanism and explanation; Scale, proportion and quantity; Systems and system models; Energy and matter: Flows, cycles and conservation; Structure and function; Stability and change).

Furthermore, the 6 key ideas of the Australian Curriculum: Science encompass the 10 ideas of science (Harlen 2015) that make explicit core ideas that can be used to explain and make predictions about a range of related phenomena in the natural world. These concepts, fundamental to an understanding of science, provide a way of connecting knowledge in a multi-disciplinary manner across the content of the Australian Curriculum: Science.

In the Australian Curriculum: Science, there are 6 key ideas that represent key aspects of a scientific view of the world and bridge knowledge and understanding across the disciplines 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 help them to observe and describe patterns at different scales. They develop and use classifications to organise events and phenomena, and make predictions.

Form and function

Many aspects of science are concerned with the relationships between form (the 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, such as the features of living things or the nature of a range of materials, and their related functions or uses.

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. 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. As students progress from Foundation to Year 10, their understanding of relative sizes and rates of change develops. They are able to conceptualise events and phenomena at a wider range of scales, including 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 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.

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. Students become 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.

Appendix A shows examples of the Year 5 and Year 9 content descriptions from the 3 strands of the Australian Curriculum: Science mapped to the key ideas. This mapping is not exhaustive and the ability to incorporate key ideas may depend on the context underpinning assessment items. The grey shaded cells indicate where this is the case, and the context is likely to inform alignment, if any, to the key ideas.

2.4.2. Cross-curriculum priorities

The Australian Curriculum includes 3 cross-curriculum priorities: Aboriginal and Torres Strait Islander Histories and Cultures, Asia and Australia's Engagement with Asia, and Sustainability. The priorities give students the tools and language to engage with and better understand their world at national, regional and global dimensions.

Aboriginal and Torres Strait Islander Histories and Cultures

The Aboriginal and Torres Strait Islander Histories and Cultures priority refers to the opportunity for all students to deepen their knowledge of Australia by engaging with the world's oldest continuous living cultures. Aboriginal and Torres Strait Islander histories and cultures are relevant to many of the aspects of the core concepts of the Australian Curriculum: Science including knowledges, technologies, processes, contributions to science and ethical considerations.

Asia and Australia's Engagement with Asia

The Asia and Australia's Engagement with Asia priority reflects Australia's extensive engagement with Asia in social, cultural, political and economic spheres. The Asia region plays an important role in scientific research and development, including research and development in areas such as medicine, natural resource management, nanotechnologies, communication technologies and natural disaster prediction and management.

Sustainability

The Sustainability priority is fundamental to understanding the ways social, economic and environmental systems interact to support and maintain human life; appreciating and respecting the diversity of views and values that influence sustainable development; and participating critically and acting creatively in determining more sustainable ways of living. Within the context of science literacy, sustainability refers to the importance of predicting possible effects of human and other activity, and to developing management plans or alternative technologies that minimise these effects.

In the NAP–SL 2026 assessment, key concepts of all cross-curriculum priorities may provide contexts for assessing specific understandings of the content domains.

Sustainability may provide contexts for assessing science literacy in the disciplines of chemical, biological, physical, and Earth and space systems, such as the interconnectedness of Earth's biosphere, geosphere, hydrosphere and atmosphere.

Aboriginal and Torres Strait Islander Histories and Cultures may provide contexts for assessing students' science understanding, such as knowledges relating to chemistry, physics, geology, botany, zoology, physiology, genetics, meteorology, astronomy, nutrition, hydrology, ecology, and the development and use of technologies.

Asia and Australia's Engagement with Asia may provide contexts for assessing students' science literacy through knowledge about diverse environments, the interactions between human activity and the environment, how these influences impact the region, including Australia, and how that can have global impact.

All cross-curriculum priorities may be integrated in contexts for assessing aspects of the *Science as a human endeavour* and *Science inquiry* content domains. Such contexts may include the contributions of scientists, including First Nations Peoples, to scientific research and development, and the influence of cultural perspectives and world views on individual and collaborative scientific endeavours.

2.4.3. General capabilities

The general capabilities are a significant dimension of the Australian Curriculum that encompass the knowledge, skills, behaviours and dispositions that support students to live and work successfully. The Australian Curriculum includes 7 general capabilities that are addressed through the content of the learning areas. Aspects of all 7 general capabilities relevant to the assessment of science literacy are incorporated into NAP–SL 2026 where appropriate, as indicated below.

Critical and Creative Thinking

NAP–SL is particularly well-suited to incorporating aspects of the Critical and Creative Thinking (CCT) capability. Aspects of critical and creative thinking arise from important cognitive skills inherent in scientific inquiry and in broader scientific thinking. These elements of the Critical and Creative Thinking capability from the Australian Curriculum guided the development of the cognitive dimension of the NAP–SL 2023 assessment framework. This is the thinking skills and intellectual processes to be engaged in by the students as they respond to the assessment tasks (see Section 3).

While NAP–SL 2023 trialled the possibility of measuring CCT as a subscale in the context of scientific literacy, the data show that the correlation between science inquiry and Critical and Creative Thinking was very high, indicating they are measuring the same student capability. Section 3 in this framework provides additional information about how the elements of the Critical and Creative Thinking capability are reflected in the cognitive dimension for NAP–SL 2026.

Literacy

Literacy encompasses the knowledge and skills students need to access, understand, evaluate and communicate information in oral, print, visual and digital texts. Within the context of the NAP–SL, aspects of the literacy capability are found within the reading comprehension demands of both the stimuli and the questions, and in the requirements of students to compose responses to questions.

Explicit definitions of terms are not part of the NAP–SL. However, vocabulary is important in science communication and the selection of science terms to be included in the assessment items is guided by the range of terms that appear in the Australian Curriculum: Science. The Year 6 assessment includes vocabulary relating to the *Science understanding* strand for Foundation to Year 5, and Foundation to Year 6 for the *Science as a human endeavour* and *Science inquiry* strands. The Year 10 assessment includes vocabulary relating to the *Science understanding* strand up to Year 9, and to Year 10 for the *Science as a human endeavour* and *Science inquiry* strands. Where the intent of an item is to assess understanding of a science idea, then specific scientific terminology does not impede a student's ability to respond to the item.

While literacy plays an important role in science learning and assessment, it is important that the difficulty of items does not derive primarily from the amount and the complexity of the stimulus material and instructions. The NAP–SL stimuli and items are written to a level appropriate for the students assessed. The literacy demand of items is monitored by expert review to ensure suitability for the students undertaking the assessment.

Numeracy

Numeracy encompasses the skills, behaviours and dispositions that students need to use mathematics in a wide range of situations. It involves students recognising and understanding the role of mathematics in the world and having the dispositions and capacities to use mathematical knowledge and skills purposefully.

In the NAP–SL assessment, students are expected to show dispositions and capacities to use appropriate mathematical knowledge and skills. In particular, students are required to use aspects of the numeracy learning progression. This includes using measurement, analysing data, identifying trends and patterns from numerical data and graphs, using mathematical relationships to calculate and predict values, and using mathematical tools to provide evidence in support of hypotheses or positions.

Items that assess predominantly numeracy skills are avoided. If numeracy is required for understanding and responding to an item, it is at a level appropriate to the assessment. Numeracy content in NAP–SL is monitored by expert review.

Digital Literacy[6]

Digital Literacy refers to the ability to use digital technologies effectively and appropriately to access, create and communicate information and ideas, solve problems and work collaboratively. Within NAP–SL, aspects of digital literacy arise from the online delivery of the NAP–SL assessment, in which students use the online system to undertake specific tasks. Students are expected to use their digital literacy to access information and collect, record, analyse and represent data.

Ethical Understanding

Ethical Understanding refers to identifying and investigating the nature of ethical concepts and understanding how reasoning can assist ethical judgement. Within the Australian Curriculum: Science, students develop their understanding of ethical concepts and ethical decision-making processes in relation to science investigations, codes of practice, and the use of scientific information and science applications. They learn about ethical procedures for investigating and working with people, animals, data and materials. Students use scientific information to evaluate claims and to inform ethical decisions about a range of social, environmental and personal issues. They consider their own roles as discerning citizens. They learn to analyse biases and assumptions as they apply ethical concepts when making decisions in complex situations.

In the context of NAP–SL, aspects of ethical understanding arise in the context of planning investigations and considering solutions to social and personal issues. Students are expected to consider the implications of their investigations on the environment and living organisms. They are also expected to take into account ethical considerations when reporting data and when asked to make decisions about social or environmental issues.

Intercultural Understanding

Intercultural Understanding requires students to learn about and engage with diverse cultures in ways that recognise commonalities and differences, create connections and cultivate mutual respect. Intercultural understanding is an essential part of living with others in the diverse world of the twenty-first century.

In the context of NAP–SL, students are expected to recognise that intercultural understanding refers to the contributions that diverse cultural perspectives have made to the development, breadth and diversity of science knowledge and applications. They are expected to consider how science benefits from participation and collaboration with a diversity of cultures. Students recognise that scientists work in and engage with culturally diverse communities to address issues of local and international importance.

Personal and Social capability

Personal and Social capability in the Australian Curriculum: Science requires students to direct their own learning, plan and carry out investigations, and become independent learners who can apply science understanding and practices to make decisions. Students are expected to use their scientific knowledge to propose solutions to issues that impact their lives (such as health, nutrition and environmental change), and to consider the application of science to meet personal and social needs.

2.5. Assessment item contexts

The Australian Curriculum: Science aims to develop students' scientific literacy, including providing students with the capability to investigate the natural world and changes made to it through human activity. Further, students are encouraged to develop scientific capacities, including the ability to think and act in scientific ways. This contributes to their development as confident, self-motivated and active members of society. As such, NAP–SL assesses students' scientific literacy and cognitive competencies in specific contexts that have relevance to their lives.

[6] Information and Communication Technology (ICT) capability, AC Version 8.4

Contexts are also required to remain sensitive to cultural identities in acknowledgment of the demographic diversity of Australian classrooms. Science literacy items focus on situations relating to personal, school, local, national, global, contemporary and historical contexts. The focus is on providing contexts from real-world situations of importance, while providing significant assessment opportunities. For example, historical contexts can provide the opportunity for assessing students' understanding of the processes and practices involved in advancing scientific knowledge. Contemporary contexts can provide opportunity to assess students' understanding of the use and influences of science as society continues to be faced with challenges relating to environmental sustainability, health and natural resources.

Formal specifications are not set for context allocations in NAP–SL. Assessment items may be embedded in both familiar and less familiar contexts. The contexts are designed to avoid irrelevant extraneous information that is not relevant to the construct. Contexts are selected to be appropriate for the ages of the students undertaking the assessment.

3. Cognitive dimension

3.1. Cognitive dimension and cognitive processes

An important feature of the NAP–SL 2023 assessment framework was the inclusion of an explicit definition of a cognitive dimension within the assessment of science literacy and across all 3 content domains. This is consistent with other major assessments of scientific literacy such as PISA (OECD 2023) and Trends in International Mathematics and Science (TIMSS) (Centurino and Kelly 2021, Mullis and Martin 2017). The purpose of this chapter is to establish nationally consistent definitions and to provide an explanation of the cognitive dimension of the science literacy measurement construct in the NAP–SL assessments. The definitions and taxonomy used to develop the cognitive domain are consistent with those used in international science assessments including PISA and TIMSS. The cognitive dimension seeks to make explicit the science focused thinking skills that are engaged by the students to respond to the assessment tasks.

The cognitive dimension in this framework is guided by the ways that science knowledge, science inquiry and knowledge about science can be used by students, and the cognitive complexities that are inherent in these uses. It draws on several frameworks that define cognitive skills, including the revised Bloom's Taxonomy (Anderson and Krathwohl 2001). It also draws on the cognitive processes that underpin critical and creative thinking as defined by the general capability in the Australian Curriculum (ACARA 2023b). It is adapted here to link more explicitly to both conceptual understandings and abilities, applying one dimension to all 3 content domains of the NAP–SL (*Science understanding, Science as a human endeavour* and, most evidently, *Science inquiry*). This is consistent with other international frameworks, which incorporate aspects of science inquiry skills into a single cognitive demand rating scale. For example, the OECD also drew inspiration from the revised Bloom's taxonomy (Anderson and Krathwohl 2001), in addition to Webb's Depth of Knowledge (Webb 1997) in their PISA Science assessment.

The cognitive dimension in NAP–SL represents the cognitive processes required in the application of science concepts.

The cognitive dimension in NAP–SL has 3 areas:

- Knowing and using procedures
- Reasoning, analysing and evaluating
- Synthesising and creating.

It is recommended that the cognitive dimension is used by item writers, along with the content descriptions and achievement standards, as a guide to designing items, rather than merely as a framework to classify items. While there is no prescribed target percentage of items for each of the areas, NAP–SL provides coverage of all areas of the cognitive dimension consistent with previous cycles. The coverage of the 3 cognitive dimensions recommended from the 2018 cycle is provided in Table 3.

Table 3: NAP–SL 2018 coverage of the 3 cognitive dimensions

Cognitive dimension	Target percentage of overall assessment
Knowing and using procedures	50%
Reasoning, analysing and evaluating	35%
Synthesising and creating	15%

Knowing and using procedures requires knowledge of facts and definitions as well as the ability to illustrate scientific concepts by providing or identifying examples. In this area of the cognitive domain, students should be able to relate scientific concepts to simple observable phenomena. It also includes knowing simple procedures as well as the ability to perform simple science processes or procedures (for example, make simple observations, measure, use a scale or units).

In the context of *Science inquiry* specifically, this area encompasses the knowledge and use of (practical) skills and procedures. These include the use and identification of appropriate measuring instruments and the mechanical aspects of constructing simple tables and graphs, which are necessary but not in themselves sufficient to carry out most aspects of inquiry.

Reasoning, analysing and evaluating requires students to engage in applying knowledge, skills, processes, equipment and methods (for example, classify, compare, contrast, organise data, collect, display data, use a diagram to illustrate a relationship, give a simple explanation) in contexts likely to be familiar or straightforward. It also requires students to analyse information and evaluate evidence and arguments with respect to quality, relevance and sufficiency of data.

In the context of *Science inquiry* specifically, this area also encompasses the application of procedural understanding related to inquiry processes (for example, when students need to make decisions about what and when to measure, how many times and over what time period, as well as errors that could arise given a particular experimental set-up).

Synthesising and creating requires students to consider a number of different factors, variables or concepts, put elements together (for example, concepts, evidence, procedures, skills) into a coherent whole, or compile elements in new ways or into something new and different. Through compiling elements, students should be able to form a coherent hypothesis, argument or explanation. Tasks in *Synthesising and creating* are generally more open-ended or unstructured, can use more complex or unfamiliar scientific phenomena, and can involve more than one approach or strategy. They require considerable cognitive effort because there is not likely to be a well-rehearsed method or pathway to approaching the task.

In the context of *Science inquiry* specifically, this area encompasses creating and using models, planning and designing scientific investigations, and carrying out extended investigations to solve a problem. Solving a problem extends from specifying a problem to designing and conducting the investigation, to analysing and evaluating the data (critically interpreting the data and methods of data collection), and forming conclusions drawing on concepts and evidence.

Table 4, Table 5 and Table 6 further specify and define the cognitive processes within the 3 cognitive areas. They focus on cognitive processes that can be used to characterise cognitive tasks that students may perform when they use science knowledge and skills.

Table 4: Knowing and using procedures

Knowing and using procedures	
Cognitive area	**Description**
Recognise	Make or identify accurate statements about science phenomena, concepts, relationships, procedures or statements about the scientific endeavour; recognise an instance of a concept, entity or generalisation (e.g. producers or decomposers in a food web).
Define	Identify statements that define particular concepts and content.
Describe	Make straightforward observations of features/objects; identify and extract information from simple data sources or diagrams; describe factual information, processes and relationships about science or the scientific endeavour.
Illustrate with examples	Identify or provide examples that support or clarify statements about the scientific endeavour or statements about particular science concepts, relationships and theories.
Relate	Relate science concepts to phenomena and observations.
Use tools and procedures	Demonstrate skills in the use of science equipment, tools, measurement devices or scales, mechanical aspects of constructing and reading graphs and tables.

Table 5: Reasoning, analysing and evaluating

Reasoning, analysing and evaluating	
Cognitive area	**Description**
Compare/ Contrast/Classify	Identify similarities and differences between objects, processes or ideas; organise and process information; classify objects or processes based on characteristics/properties.
Represent	Make representations (e.g. diagrams) to describe and illustrate aspects of concepts, structures, relationships, processes; make or use representations to communicate or find solutions to problems.
Collect, analyse and interpret data	Make decisions about variables to be investigated and controlled, measurements to conduct; represent data in tables and graphs using appropriate labelling and scales; identify and summarise patterns in the data; interpolate/extrapolate from data.
Make inferences	Make inferences from data, information given and/or own knowledge; give reasons/evidence to support an inference.
Predict/Explain	Make predictions based on evidence and concepts; give reasons to support predictions; construct and defend explanations based on evidence and/or concepts; transfer knowledge into new contexts by making predictions and constructing explanations in new situations.
Analyse information, evidence and arguments	Pose questions to probe assumptions, to identify gaps in information, evidence or arguments, or to investigate ideas or issues; prioritise information/evidence required to draw a conclusion or to make a decision; identify facts, observations or data that can be used as evidence to support an explanation, conclusion or argument; identify whether there is sufficient evidence to justify a claim, explanation or conclusion; identify evidence needed to decide among competing claims, explanations or solutions; integrate new information or evidence into ideas.
Evaluate information, evidence, procedures and arguments	Evaluate information and evidence according to criteria such as relevance, bias, validity and/or reliability; evaluate claims, conclusions and arguments with respect to quality of evidence and reasoning supporting them; recognise flaws (e.g. gaps) in reasoning; consider and evaluate alternative explanations, processes and solutions; evaluate steps of investigations.

Table 6: Synthesising and creating

Synthesising and creating	
Cognitive area	**Description**
Generate hypotheses	Generate hypotheses based on background knowledge, preliminary observations and logic; generate and test alternative hypotheses; identify and justify the thinking processes behind such hypotheses.
Construct arguments and draw conclusions	Construct sound and valid arguments supported by evidence and logical reasoning; draw conclusions that address questions/hypotheses and are supported with evidence; draw or support conclusions using evidence and scientific understanding; adapt conclusions as new evidence becomes available; draw general conclusions that go beyond the experimental or given conditions.
Create and use models	Create models to explain a phenomenon or make a prediction (using imagery or analogies, as relevant); adapt models as new evidence becomes available; use computer simulations to test models under different conditions.
Plan and design investigations	Plan and design whole investigations appropriate for answering scientific questions or solving problems.
Make connections	Make connections between different concepts and areas of science; make decisions considering both scientific and social factors and trade-offs; synthesise complex information to inform a course of action.

Synthesising and creating	
Solve problems	Seek and provide solutions to problems that require consideration of different factors and/or concepts; identify, assess and test options, implications and consequences when seeking solutions; propose alternative solutions to problems; justify the reasons behind choosing particular options/solutions; design solutions to problems of social significance, using science knowledge, considering a range of perspectives and trade-offs, and assessing risks.

3.2. Critical and Creative Thinking in NAP–SL

To highlight the extent to which CCT is integrated into the cognitive dimension as assessed by the NAP–SL assessment, an explicit map of the CCT continuum aligned to the cognitive dimension, developed for NAP–SL 2023, is provided in Appendix B. This mapping demonstrates the integration of CCT within the assessment of science literacy. The cognitive dimension represents the cognitive processes required in the application of science concepts. It shows the elements of CCT assessed in the context of scientific literacy. CCT elements are assessed through all 3 cognitive areas.

Science literacy is a particularly well-suited construct within which to consider CCT. There are numerous opportunities to apply CCT and the associated processes in the cognitive dimension in science literacy in the classroom. These scenarios can be transformed into assessment items. For example, a primary school teacher who has been teaching students about plants asks them, “What experiment could we do to test what we know about plants?” Before coming up with ideas for the experiment, students are assisted by the teacher in a brainstorming exercise about everything they know about plants: types of plants, parts of plants, conditions they need and so on. This assists them to consider what aspect of their knowledge of plants could be a suitable basis for an experiment (Cognitive dimension – Collect, analyse, and interpret data; CCT – Inquiring: Identify, process and evaluate information[7]). To advance, this a science teacher can ask their class to brainstorm ideas for an experimental design to ascertain whether plants need light to survive (Plan and design investigations – Cognitive dimension). The class work together to categorise the ideas and make judgements about how different the ideas are from each other (Cognitive dimension – Compare/Contrast/Classify; CCT – Inquiring: Identify, process and evaluate information). The categories might focus on, for example, ideas with a common metric for considering survival or a common way of excluding light. The teacher encourages the students to think of any other types of ideas (CCT – Analysing: Draw conclusions and provide reasons[8]).

3.3. Cognitive processes in a balanced assessment

NAP–SL items are classified according to the cognitive areas and cognitive processes they seek to engage in students. This ensures that the NAP–SL assessment includes items that cover a range of complexity and that students are asked to use knowledge and skills in a variety of ways, some associated with higher and some with lower demand. This means that the assessment can provide information on how students across the ability range can deal with tasks at different levels of demand.

The difficulty of an item is differentiated from the complexity or cognitive demand of the item. Item difficulty relates to the proportion of students answering a given item correctly, while item demand relates to the cognitive processes necessary for successful completion of a task. NAP–SL aims to develop items that ultimately provide both a broad coverage of item difficulties and include items with a range of cognitive demands.

In NAP–SL, often elements such as reasoning and inquiry are most commonly associated with scientific tasks; however, there are many opportunities in which to also measure creative elements. For example, in the context of “the chemical and physical properties of substances are determined by their structure at a range of scales” (*Science understanding* core concept) students can demonstrate their ability to “connect ideas and create possibilities” (CCT) by brainstorming different procedural aspects of investigating

[7] Inquiring – identifying, exploring, and organising information and ideas element; Identify and clarify information and ideas sub-element, AC Version 8.4

[8] Analysing, synthesising, and evaluating reasoning and procedures element; Draw conclusions and design a course of action, AC Version 8.4

substances. They can then explore and combine ideas to create an innovative solution (Synthesising and creating – Cognitive dimension).

3.4. Developing performance expectations

The science content sequence and the cognitive processes listed in Table 4, Table 5 and Table 6 provide the foundation for the development of "performance expectations". These articulate the types of tasks that provide evidence of student understanding and proficiency with the constructs assessed. Statements within content sequences, which are linked to the content descriptions of the Australian Curriculum: Science, specify the knowledge and skills expected of students. The processes in Table 4, Table 5 and Table 6 specify how the students are envisaged to engage with the knowledge and skills. The combination of statements relating to content sequence and a cognitive process can lead to a performance expectation for a given content statement. The collective performance expectations for each content statement across the sequence further articulate the assessment domain, and reflect the expectations stated in the Australian Curriculum: Science achievement standards.

4. Contextual framework

In addition to measuring students' cognitive competencies in science literacy, the NAP–SL also collects contextual information about participating students. This contextual element was first introduced in 2009 with the inclusion of a questionnaire about students' attitudes and behaviours related to various aspects of science literacy. The incorporation of these largely affective processes has been complemented by the collection of student background data via jurisdictional- or school-level provision of student enrolment data. For NAP–SL, the inclusion of this contextual aspect not only allows for the examination of rich attitudinal and behavioural data of participating students, but also permits a better understanding of the factors associated with variations in student achievement.

This section documents the various contextual factors that are considered within the NAP–SL assessment, as well as the instruments used to collect them.

4.1. Student questionnaire

The NAP–SL student questionnaire, which was first introduced in 2009 and administered to all students immediately following the assessment, has been improved and enhanced to provide information that is better aligned with the Australian Curriculum: Science and the definition of science literacy (section 1.2), particularly pertaining to the *Science as a human endeavour* strand. The questionnaire covers 3 broad areas, aligned to the relevant curricula:

- Science understanding
- Science as a human endeavour
- Science inquiry.

Further, the questionnaire gathers information about Year 10 students' perceptions of the relevance of science for future study and career opportunities in science, technology, engineering and mathematics (STEM) related fields.

The questionnaire has had large changes in the volume and type of content over various cycles. To monitor changes in student experiences, attitudes, values and engagement with various aspects of science literacy, the following constructs administered in previous NAP–SL assessments are intended to be included in the student questionnaire:

- students' interest in science
- student perceptions of the nature of science
- student perceptions of the influence of science
- students' self-concept of science ability
- student reports of science-related activities undertaken at school
- student reports of science-related activities undertaken outside of school
- student reports of science topics studied at school
- students' experiences relating to science teachers
- students' attitudes towards equality in science.

Further details about these constructs can be found in the 2023 NAP–SL technical report (ACARA 2024).

To ensure the questionnaire reflects the most recent changes in NAP–SL since the previous cycle, the 2026 questionnaire is revised in the following ways:

- less coverage of critical and creative thinking to allow greater balance to other aspects of the curriculum

- new content developed aligned with strands of curriculum including technological developments such as the use of artificial intelligence for scientific activities, space exploration, climate science, Australia's future energy infrastructure and developments in medical technology
- reduction in topics that are less relevant for the 2026 cycle.

The questionnaire outcomes will be reported, including their correlation with students' overall achievement in science literacy at the national as well as state and territory levels. The questionnaire responses will be scaled to provide construct indicators of students' perceptions and engagement.

4.2. Student background data

For NAP–SL, additional contextual variables at a student and school level are examined in tandem with the attitudinal and behavioural data collected via the student questionnaire. Student background data, as these variables are collectively known, is used to construct a more extensive profile of individual- and school-level factors for participating students.

The provision of this data is facilitated at a school and jurisdictional level, allowing for a range of variables to be reliably collected. The data is informed by the information provided by students' caregivers at the time of enrolment in school.

The specific background variables collected for use in NAP–SL are:

- state or territory in which students' attend school
- school sector (Catholic, government or independent)
- geographic location of the school
- students' gender
- students' age
- students' Indigenous status
- students' language background
- occupation category of students' parents/guardians/caregivers
- highest level of education of students' parents/guardians/caregivers.

5. Assessment structure and reporting

5.1. Assessment structure

The specifications for distributions of items across content domains in this framework also reflect the item distributions from previous NAP–SL cycles (see Chapter 2). The assessment of the cognitive dimension within science literacy for 2026 also reflects the construct of earlier NAP–SL cycles.

The NAP–SL uses a cluster rotation design similar to that used in other sample-based international assessments. NAP–SL 2026 follows a similar cluster rotation design to NAP–SL 2023, where additional test forms were added to allow for the rotation of the inquiry tasks across the test forms, as shown in Table 7.

Table 7: Test design for Year 6 main study, NAP–SL 2023

Test form	Block 1	Block 2	Block 3
1	Cluster 1	Cluster 7	Task 1
2	Cluster 2	Cluster 8	Task 5
3	Cluster 3	Cluster 9	Task 3
4	Cluster 4	Cluster 10	Task 4
5	Cluster 5	Cluster 11	Task 2
6	Cluster 6	Cluster 12	Task 6
7	Cluster 7	Task 6	Cluster 4
8	Cluster 8	Task 1	Cluster 5
9	Cluster 9	Task 2	Cluster 6
10	Cluster 10	Task 3	Cluster 1
11	Cluster 11	Task 4	Cluster 2
12	Cluster 12	Task 5	Cluster 3
13	Task 1	Cluster 6	Cluster 11
14	Task 2	Cluster 1	Cluster 12
15	Task 3	Cluster 2	Cluster 7
16	Task 4	Cluster 3	Cluster 8
17	Task 5	Cluster 4	Cluster 9
18	Task 6	Cluster 5	Cluster 10

In the rotation design, assessment forms are assembled so that each form is linked through common clusters to other forms. To achieve the rotation design for the NAP–SL, the items are written in contextual units. Each unit contains between one and 5 items that are developed around a single theme or stimulus. Clusters are then constructed by grouping units together. Clusters are grouped together into assessment forms. Each assessment form contains 3 components: a set of objective test items, an inquiry task and a set of questionnaire items.

Clusters that are intended to contain vertical link items should provide a good sampling of the content and cognitive domains of the assessment framework across both year levels. As the Year 10 science literacy proficiency levels and proficient standard were defined for the first time during the reporting phase of NAP–SL 2018, it was possible to include an inquiry task as a link between Year 6 and Year 10 in NAP–SL 2023. This model will again be implemented for the 2026 cycle.

5.2. Online assessment delivery system

The NAP–SL 2026 assessment is delivered to students exclusively via the national online assessment platform. This platform is the same as that used each year for NAPLAN and consequently enjoys widespread compatibility with schools' established IT systems. As was the case for the NAP–SL 2023 cycle, all student cognitive and questionnaire data is captured using this online method, with participating students using either their own devices or school-supplied devices that are connected to the internet to complete the assessment. The item types and response formats used by the online assessment delivery system are described below.

5.2.1. Item types and response formats

The content and cognitive dimension and ensuing performance expectations suggest that to capture the variability and different levels of complexity of performance, different types of assessment items and response formats are required. To take an extreme case, an assessment that consists only of multiple-choice questions would not be representative of the construct(s) nor capture the range of cognitive demands as defined in Chapters 2 and 3 of this framework.

Within the limitations of the item authoring and test delivery systems, 2 main types of response formats are suitable for use in NAP–SL to assess the understandings and abilities identified in the framework. These response formats are selected response and constructed response formats, which provide a range of opportunities for students to demonstrate their proficiency across the content and cognitive dimensions.

Response formats can be categorised by how much they constrain student responses on a continuum from highly constrained items to items with few constraints. Highly constrained item types are response formats such as multiple-choice, which limits student responses to a set of predefined options but has the benefit of being able to be scored automatically. Items with few constraints conventionally include constructed response item types. These item types can offer insight into student reasoning and understanding. However, scoring of constructed response items cannot be automated and requires human marking.

Intermediate-constrained response type items are a type of digital assessment format that falls between highly constrained selected response item types and fully constructed open-response type items. Intermediate-constrained response type items provide greater openness of student response than highly constrained items and can be automatically scored. Examples of intermediate-constrained items include items where students are given a choice of words to complete a statement, position organisms in a food web or place objects in a particular order based on their size or position.

These formats resolve 2 main concerns with multiple-choice items: when a limited set of options is provided, students can back solve (rather than directly solve a problem/answer a question) by testing each of the provided options, or student thinking may be prompted by the option (students "recognise" the answer). Intermediate-constrained response types are supported by the NAP–SL item authoring and test delivery systems. They provide the opportunity to combine automated scoring with appropriately targeted content and cognitive demand.

Each of the response formats is associated with multiple item types. As outlined by Scalise (2009), there are many item types that can be used in computer-based testing.

Selected response item types

In selected response formats, students respond to a question by selecting the answer(s) they consider most justifiable from a given set of alternatives. With computer-based testing, there is a wide variety of selected response formats to use (Scalise 2009). However, a greater variety of formats in the assessment does not necessarily make a better test. Items that use "drag and drop" utility can often be completed more efficiently using a multiple-choice format. The uses of "drag and drop" listed below are less constrained in assessing categorising, ranking and sequencing than multiple-choice or their paper-and-pencil equivalents. In general, the type of performance expectation(s) identified for development should guide the response format(s) used, not the other way around. The item types listed are sequenced here from highly constrained item response types to the more intermediate constrained item response types.

- **Multiple-choice:** Options may be words, graphical or pictorial and may incorporate new media. In the NAP–SL 2026 assessment, whenever possible, there are 4 options in each multiple-choice item. When assessing use of knowledge to predict and explain phenomena, or understanding of the nature of evidence, students' misconceptions, mental models and alternative ways of thinking about the natural world should guide the development of item contexts. Misconceptions and alternative ways of thinking will not explicitly become distractors as this can often make the psychometric profile of an item different to conventional items in standardised tests (Sadler 1998).
- **Multiple-choices:** Select more than one option (including "all that apply").
- **Two-tier multiple choice:** Select an option for a prediction, explanation, etc. and then select from a different set of options to justify reasoning. This format appears to offer an efficient way of assessing higher cognitive demand items related to making and justifying hypotheses, predictions, explanations and arguments. The sequential responses need to be integrated in a way that avoids interdependence of items.
- **Interactive match (drag and drop):** Select, drag and drop words, graphical or pictorial elements for classification purposes or to place items in order.
- **Interactive match (draw lines):** Connect two columns of options by drawing a line from an option in one column to an option in the second column. Options for this item type may be images, numbers, words or descriptions.
- **Interactive match (checkbox):** Select a checkbox from columns within a table. Multiple responses are required, generally using a dichotomous scale; for example, odd/even or yes/no. Checkbox can also be used for items comparing aspects or properties of 2 or more concepts against 2 or more criteria, such as a list of variables that can be classified as independent, dependent or controlled.
- **Interactive gap match:** Select from multiple words to insert at various points in a sentence or passage.
- **Interactive graphic gap match:** Select from a range of options (either text or image) that can be dragged or dropped into one or more destinations on an image. This is used for ordering, classification, completion of tables or labelling of diagrams and graphs.
- **Hotspot:** Select one or more predefined areas on a diagram, graph or other image.
- **Composite (inline choice):** Select an answer from a drop-down menu. Options in the drop-down menu are usually numbers, single words or short sentence fragments of 2 to 3 words. An item may contain several inline choices where multiple responses are required.
- **Composite (multiple interactions):** Two or more interactions of the listed item types, where there are related concepts that constitute parts of a whole. The use of multiple interactions is appropriate where different cognitive demands are required. This is because multiple interactions with an item with identical cognitive demands increase the time taken to respond without eliciting any further information about student ability.

Constructed response item types

In constructed response formats, students respond to a question by generating a response (rather than selecting a response from a given set of alternatives). Constructed response items include short-constructed response and extended-constructed response items.

- **Short-constructed:** Enter one or 2 words, a phrase or numerical response as a response to an item. Short-constructed response items that could instead be completed with multiple-choice format should be avoided. The short-constructed format might be more appropriate when recall rather than recognition of information is important, or when greater depth of understanding is required than what can be probed with a multiple-choice question. Supplying titles for tables and graphs, graph labels and table headings are also classified as short-response items.

- **Single numerical:** Enter a single numerical answer in a text box, including setting values for input variables in simulations.
- **Extended-constructed (extended text):** Enter one sentence up to a couple of paragraphs as a response to an item. This format is used to respond to a question that requires students to apply or integrate concepts, probe students' deeper understanding, and/or probe students' ability to communicate. It is particularly useful for tasks targeting the Synthesising and creating cognitive dimension.

  Extended-constructed items in the past NAP–SL assessments had scoring categories with up to 6 score points. Items with higher scoring categories can be used to tap into the more multifaceted content descriptions and advanced cognitive dimensions (in particular those that require integration/synthesis of concepts or ideas/evidence from different sources). Trialled items with higher scoring categories that could distinguish student scientific literacy proficiency by Rasch analysis were used in the 2018 NAP–SL assessment. Open questions that enable students to use their own words to explain a scientific concept or draw conclusions based on evidence, especially in an unfamiliar context, facilitate assessment of higher science proficiency levels (Hackling 2012). These items can be composite items, as defined in QTI v2.1, if the item requires multiple interactions and the strength of the relationship between these interactions is such that the item cannot be broken easily into independent, standalone parts.

5.3. Additional technological enhancements

The NAP–SL 2026 assessments take advantage of technology-based enhancements to items. These enhancements can broaden the ranges of stimulus material presented, of content assessed, and of the cognitive complexity of the responses required.

Examples of technology-based enhancements include:

- Students may observe a video or animation describing a phenomenon, experiment or investigation (instead of reading a stimulus text). Several phenomena, processes, experiments, etc. have been excluded from previous assessments as stimulus material because they are difficult to describe or make accessible to students, and/or their description results in high reading load. This includes phenomena and processes that happen over time, too quickly or too slowly, or are on too small or too large a scale to observe directly.
- Students may view data from various external sources, multiple sources of information or media presentations as stimulus material for assessing interactions between science and society.
- Students may be asked to respond to a Predict-Observe-Explain situation, in which they make a prediction about an event, observe video or animation that is likely to surprise them, and are asked to add to or change their ideas about what happened. Other enhancements are presented in the next section on inquiry tasks. Note: Where possible, additional non-subject-matter-specific enhancements may be included, following ACARA's (2021) Development of accessible NAPLAN online items guidelines.

5.4. Science inquiry tasks

5.4.1. Inquiry tasks in previous NAP–SL cycles

In addition to an objective test, the first 3 cycles of the NAP–SL (2006, 2009 and 2012) included a 45-minute practical component. Its purpose was to provide students with an opportunity to experience practical aspects of science within a formal assessment and test the conventions of science literacy in more depth than was possible in the objective test (ACARA 2015, 2017). In NAP–SL 2015, a 45-minute online inquiry task was introduced that targeted similar content to that of the previous NAP–SL practicals.

A limitation of NAP–SL 2015 inquiry tasks is their restricted degree of openness. The degree of openness of a task relates to who defines the problem to be studied, who chooses the method and how many solutions are available. The first 2 considerations can be placed in a continuum from closely defined to not defined, while the last consideration ranges from one solution to many solutions. Students were placed in an observer's role rather than being active participants, followed step-by-step instructions to collect data and were guided with structured questions through the steps of interpreting and evaluating the data. Students were not directly engaged in a practical activity but were tested on a range of relevant science inquiry skills based on their observations from a video stimulus.

For NAP–SL 2018, 4 inquiry tasks were developed for trial at each year level. In the main study, 2 inquiry tasks were administered at each year level – 2 40-minute tasks at Year 6 and 2 50-minute tasks at Year 10. Each student was presented with one of the 2 inquiry tasks. This is consistent with the number and duration of inquiry tasks in previous NAP–SL cycles. The tasks primarily targeted abilities from the Science Inquiry Skills (*Science inquiry* Version 9.0) content sequences. Many of the items targeted the cognitive domains of *Knowing and using procedures* and *Reasoning, analysing and evaluating*, and a few targeted *Synthesising and creating*. The tasks were related to science concepts within the content sub-domain *Science understanding*; however, the inquiry skills rather than the concepts were in the foreground of the assessment. The tasks were in the middle of the content-lean, content-rich continuum. Content-rich tasks require in-depth understanding of subject matter for task execution. Content-lean tasks are not dependent on prior subject-matter knowledge; performance only depends on information given in the assessment situation (Baxter and Glaser 1998). The concepts embedded in the tasks were well within the grasp of most students. Such accessible content was chosen to minimise issues of content-knowledge gaps preventing students demonstrating their inquiry skills.

5.4.2. Inquiry tasks in NAP–SL 2026

The inquiry tasks for NAP–SL 2026 are computer-based and focus on aspects of inquiry that cannot be effectively or efficiently assessed in shorter tasks/items. In addition to planning and carrying out investigations, this includes the overall evaluation of an inquiry in terms of the credibility of the evidence gathered and the solution produced. An overall strategy for the development of the assessment instrument is established upfront. It considers the abilities to be assessed through shorter stimuli and secondary data in the first part of the assessment, and the abilities that are better assessed through inquiry tasks. For example, to enable in-depth assessment of some aspects of the inquiry tasks, time-consuming aspects of data representation (for example, graph drawing) may be assessed in item sets in the first part of the assessment.

As discussed in a section 5.3 Additional technological enhancements, computer-based tasks significantly broaden the type of inquiry with which students can engage, and as a result the content that can be readily assessed and the cognitive complexity of the required responses. These enhancements are incorporated in NAP–SL 2026 where possible, within the capabilities of the online assessment platform and item response types supported by the platform.

For example, students may:

- explore phenomena and processes that are too slow or too fast to observe in the real world, or not visible to the naked eye (for example, decomposition)
- explore phenomena or processes that would be considered hazardous (for example, using hot materials) or messy (for example, using water)
- develop, use and test representations to model the real world (for example, the solar system)
- carry out repetitions/replications of experiments within short assessment times (for example, tabulated data of experimental replicates for analysis).

Technology gives developers the ability to manipulate the degree of openness of the task and capture process data. Computer-based inquiry tasks provide opportunities to assess a whole investigation, from understanding the problem, planning how to go about the investigation, implementing that plan, collecting the data, drawing conclusions from the data, to evaluating the whole investigation, as one integrated process. Not all inquiry tasks developed have to be experiments. Tasks should also assess other methods of scientific inquiry, such as observation, classifying, pattern seeking and modelling, rather than only fair-test experiments. Technology opens the possibility for different types of inquiry that are, for example, too difficult to carry out in a practical assessment session or require looking at data over time. Such types of inquiry may be carried out by students at the planning and predicting level only, with students presented with secondary data to complete the inquiry. The inquiry task is not an end in itself – it is a means to obtain valid information about the level of student abilities related to important aspects of the content domains.

Approaches other than a single inquiry task, such as the administration of 2 shorter tasks, may also be explored in NAP–SL 2026. A key consideration is whether they lead to less efficient use of assessment time due to the need for students to familiarise themselves with 2 pieces of stimuli and sets of tools rather than one.

NAP–SL 2026 technology-enhanced inquiry tasks are open-ended where possible and include more items targeting the cognitive domain *Synthesising and creating*. This provides students with the opportunity to determine for themselves the procedures that will yield robust evidence that can be used for justifying their conclusions or solutions to a problem.

A key challenge in the design of inquiry tasks is how to provide open-ended environments to tap into difficult-to-assess constructs while giving all students the opportunity to demonstrate what they can do and, at the same time, preserving the independence of the items.

Drawing on the previous analysis and outcomes from NAP–SL 2023, the development of NAP–SL 2026 inquiry tasks:

- explores the advantages and disadvantages of including 2 smaller inquiry tasks vs. one longer task
- develops tasks that relate to or connect 2 or more concepts within different *Science understanding* sub-domains; the concepts selected are typically understood reasonably well by students
- uses a question that is contextualised as authentically as possible to guide the task, regardless of the type (investigation, experiment etc.) and should be contextualised as authentically as possible; the question engages students in solving a problem rather than requiring them to carry out procedures without an end-goal
- uses a well-defined question to guide the task while retaining students' choice(s) of method and solution
- makes available a range of appropriate tools/resources so that students can select appropriate instruments and make appropriate measurements
- provides a range of response formats (see section 5.2.1 Item types and response formats)
- maintains independence of items; that is, a correct or incorrect reply to one item does not lead to a correct or incorrect reply to another item; this may place constraints that impact on assessing authentic inquiry practices (for example, planning and then subsequently conducting experiments according to the proposed plan are, by their nature, dependent).

5.5. Reporting proficiency in science literacy

The approach to reporting used by the NAP–SL has been developed in previous assessment cycles and is based on the definition and description of a number of levels of proficiency in science literacy. In previous cycles, descriptions were developed to characterise typical student performance at each proficiency level. The proficiency levels were used to summarise and report on the performance of Year 6 students (across Australia as well as in individual states and territories), to compare performance across subgroups of students and to report on the performance of students over time. The extension of the assessment scale in 2018 to include Year 10 outcomes resulted in a change to the width and subsequent relabelling of the proficiency levels.

For NAP–SL 2026, the revised assessment framework, and the continuum of student achievement described within the proficiency levels, support the following advances:

- Items are aligned with the proficiency level descriptions updated in NAP–SL 2023 that reflect the refined Australian Curriculum: Science. The assessment items and their descriptions are guided by content and cognitive framework dimensions that reflect the knowledge and capabilities articulated in the Australian Curriculum.
- Anticipated stronger alignment between the NAP–SL assessment and the Australian Curriculum, and use of technology-enhanced response formats in the assessment, mean that the results continue to provide valuable data about Australian students' performance related to the specific knowledge, skills and capabilities included in the Australian Curriculum (including those that are harder to assess with traditional response formats) and support more in-depth feedback on planning and strategies for

future science programs. This includes the identification of opportunities and gaps in how students approach and respond to critical thinking tasks, and how they engage with open-ended scenarios that require a deeper level of planning, analysis and synthesis.

6. References

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7. Appendix A

This mapping is not exhaustive and the ability to incorporate key ideas may depend on the context underpinning assessment items. The grey shaded column heading cells indicate where this is the case, and the context is likely to inform alignment, if any, to the key ideas.

Table A 1: Mapping of Australian Curriculum: Science content descriptions with key ideas

Year 5			
Science understanding			**Key ideas**
Biological sciences **AC V9.0**	**AC V8.4**	**Core concept**	**Form and function**
examine how particular structural features and behaviours of living things enable their survival in specific habitats AC9S5U01	Living things have structural features and adaptations that help them to survive in their environment ACSSU043	The form and features of living things are related to the functions that their body systems perform.	Sub-structures work together in systems to serve particular functions. Function can be predicted by analysis of form/structure.
Earth and space sciences **AC V9.0**	**AC V8.4**	**Core concept**	**Stability and change**
describe how weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface AC9S5U02	Earth's surface changes over time as a result of natural processes and human activity ACSSU075	The Earth system comprises dynamic and interdependent systems; interactions between these systems cause continuous change over a range of scales.	Stability might be disturbed either by sudden changes or gradual changes over time.
Physical sciences **AC V9.0**	**AC V8.4**	**Core concept**	**Matter and energy**
identify sources of light, recognise that light travels in a straight path and describe how shadows are formed and light can be reflected and refracted AC9S5U03	Light from a source forms shadows and can be absorbed, reflected and refracted ACSSU080	Energy can be transferred and transformed from one form to another and is conserved within systems.	Energy moves through and can cause observable changes to systems.

Chemical sciences AC V9.0	AC V8.4	Core concept	Matter and energy
explain observable properties of solids, liquids and gases by modelling the motion and arrangement of particles AC9S5U04	Solids, liquids and gases have different observable properties and behave in different ways ACSSU077	The chemical and physical properties of substances are determined by their structure at a range of scales.	Energy moves through and can cause observable changes to systems.

Science as a human endeavour			Key ideas
Nature and development of science **AC V9.0**	**AC V8.4**	**Core concept**	
examine why advances in science are often the result of collaboration or build on the work of others AC9S5H01 Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions ACSHE081, ACSHE098	Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures ACSHE223, ACSHE226	Science knowledge is a result of individual and collaborative efforts, and advances reflect historical and global contributions.	
Use and influence of science **AC V9.0**	**AC V8.4**	**Core concept**	
investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions AC9S5H02	Scientific knowledge is used to solve problems and inform personal and community decisions ACSHE083, ACSHE100	Science knowledge, balanced with ethical and social considerations, contributes to understanding complex contemporary issues and identifying responses.	

Science inquiry/ Science Inquiry Skills			Key ideas
Questioning and predicting **AC V9.0**	**AC V8.4**	**Core concept**	**Patterns, order and organisation**
pose investigable questions to identify patterns and test relationships and make reasoned predictions AC9S5I01	With guidance, pose clarifying questions and make predictions about scientific investigations ACSIS231, ACSIS232	Science inquiry involves making observations and predictions, asking questions, and constructing and testing explanations for natural and physical phenomena.	Patterns may be causal or correlational. Some patterns have an underlying cause that cannot be observed at the same spatial or temporal scale.
Planning and conducting **AC V9.0**	**AC V8.4**	**Core concept**	**Scale and measurement**
plan and conduct repeatable investigations to answer questions, including, as appropriate, deciding the variables to be changed, measured and controlled in fair tests; describing potential risks; planning for the safe use of equipment and materials; and identifying required permissions to conduct investigations on Country/Place AC9S5I02 Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks ACSIS086, ACSIS103	Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate ACSIS087, ACSIS104	Science inquiries should be designed to systematically generate or collect valid and reliable primary and secondary data in a safe, ethical and interculturally aware way.	The use of appropriate units of measurement is important.
use equipment to observe, measure and record data with reasonable precision, using digital tools as appropriate AC9S5I03	Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate ACSIS087, ACSIS104		

Processing, modelling and analysing **AC V9.0**	Processing and analysing data and information **AC V8.4**	Core concept	Patterns, order and organisation Scale and measurement Systems
construct and use appropriate representations, including tables, graphs and visual or physical models, to organise and process data and information and describe patterns, trends and relationships AC9S5I04	Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate ACSIS090, ACSIS107	Mathematical thinking underpins science practices of representing objects and events, analysing data and modelling relationships.	Classification helps us to organise objects and events; some objects/events can be difficult to fit within existing classification systems. Patterns may be causal or correlational. Models can be used to investigate systems that are too large or small, or occur over timescales that are too fast or slow, to observe directly. Generalisations about relationships within systems can be made. Some relationships can impact on other relationships.
Evaluating **AC V9.0**	**AC V8.4**	**Core concept**	**Patterns, order and organisation**
compare methods and findings with those of others, recognise possible sources of error, pose questions for further investigation and select evidence to draw reasoned conclusions AC9S5I05	Compare data with predictions and use as evidence in developing explanations ACSIS218, ACSIS221 Reflect on and suggest improvements to scientific investigations ACSIS091, ACSIS108	Evaluating evidence enables development of explanations, decision-making and designed solutions.	Patterns and relationships can be identified within and between scientific findings.
Communicating **AC V9.0**	**AC V8.4**	**Core concept**	
Write and create texts to communicate ideas and findings for specific purposes and audiences, including selection of language features, using digital tools as appropriate AC9S5I06	Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts ACSIS093, ACSIS110	Critiquing and communicating science ideas effectively is critical to advancing science and influencing environmental, social and economic futures.	

Year 9			
Science understanding			**Key ideas**
Biological sciences **AC V9.0**	**AC V8.4**	**Core concept**	**Form and function** **Stability and change** **Systems**
compare the role of body systems in regulating and coordinating the body's response to a stimulus, and describe the operation of a negative feedback mechanism AC9S9U01	Multi-cellular organisms rely on coordinated and interdependent internal systems to respond to changes to their environment ACSSU175	The form and features of living things are related to the functions that their body systems perform.	Structures and systems can be analysed to determine how they function. Microscopic form determines macroscopic properties and functions. Systems in dynamic equilibrium are stable due to feedback mechanisms. Models can be used to predict the behaviour of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. Systems may interact with other systems; have sub-systems, and be part of larger complex systems.
describe the form and function of reproductive cells and organs in animals and plants, and analyse how the processes of sexual and asexual reproduction enable survival of the species AC9S9U02		The form and features of living things are related to the functions that their body systems perform.	The form and function of a system is determined by the form, functions and interconnections of its parts.

Earth and space sciences AC V9.0	 AC V8.4	Core concept	Stability and change Patterns, order and organisation Systems
represent the carbon cycle and examine how key processes including combustion, photosynthesis and respiration rely on interactions between Earth's spheres (the geosphere, biosphere, hydrosphere and atmosphere) AC9S9U03	Global systems, including the carbon cycle, rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere ACSSU189 Chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer ACSSU179	The Earth system comprises dynamic and interdependent systems; interactions between these systems cause continuous change over a range of scales. All living things are connected through Earth's systems and depend on sustainability of the Earth system.	Systems in dynamic equilibrium are stable due to feedback mechanisms. Change and rates of change can be quantified and modelled at different scales. Patterns in systems can be observed at different scales and can be related. Energy drives cycling of matter within and between systems. Changes of energy and matter in a system can be described in terms of energy transfer. Matter flows into, out of and within a system.
Physical sciences **AC V9.0**	 **AC V8.4**	**Core concept**	**Matter and energy** **Patterns, order and organisation** **Form and function**
use wave and particle models to describe energy transfer through different mediums and examine the usefulness of each model for explaining phenomena AC9S9U04	Energy transfer through different mediums can be explained using wave and particle models ACSSU182	Energy can be transferred and transformed from one form to another and is conserved within systems.	Changes of energy and matter in a system can be described in terms of energy transfer. Matter flows into, out of and within a system The relationships that underpin patterns, including cause and effect, can be identified and described. Patterns in systems can be observed at different scales and can be related. Structures and systems can be analysed to determine how they function.
apply the law of conservation of energy to analyse system efficiency in terms of energy inputs, outputs, transfers and transformations AC9S9U05	Energy conservation in a system can be explained by describing energy transfers and transformations ACSSU190	Energy can be transferred and transformed from one form to another and is conserved within systems.	The total amount of energy and matter in closed systems is conserved.

Chemical sciences AC V9.0	 AC V8.4	Core concept	Form and function Matter and energy Patterns, order and organisation
explain how the model of the atom changed following the discovery of electrons, protons and neutrons and describe how natural radioactive decay results in stable atoms AC9S9U06	All matter is made of atoms that are composed of protons, neutrons and electrons; natural radioactivity arises from the decay of nuclei in atoms ACSSU177	The chemical and physical properties of substances are determined by their structure at a range of scales.	The form and function of a system is determined by the form, functions and interconnections of its parts. Changes of energy and matter in a system can be described in terms of energy transfer. Matter flows into, out of and within a system
model the rearrangement of atoms in chemical reactions using a range of representations, including word and simple balanced chemical equations, and use these to demonstrate the law of conservation of mass AC9S9U07	Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed ACSSU178	Substances change and new substances are produced by rearranging atoms; these changes involve energy transfer and transformation.	The total amount of energy and matter in closed systems is conserved. The relationships that underpin patterns, including cause and effect, can be identified and described.
Science as a human endeavour			
Nature and development of science **AC V9.0**	 **AC V8.4**	**Core concept**	
explain how scientific knowledge is validated and refined, including the role of publication and peer review AC9S9H01	Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community ACSHE157, ACSHE191	Science knowledge is built on empirical evidence; however, all science knowledge can be changed in light of new or reinterpreted evidence.	
investigate how advances in technologies enable advances in science, and how science has contributed to developments in technologies and engineering AC9S9H02	Advances in scientific understanding often rely on technological advances and are often linked to scientific discoveries ACSHE158, ACSHE192	Science knowledge is a result of individual and collaborative efforts, and advances reflect historical and global contributions.	

Use and influence of science AC V9.0	AC V8.4	Core concept	
analyse the key factors that contribute to science knowledge and practices being adopted more broadly by society AC9S9H03	People use scientific knowledge to evaluate whether they accept claims, explanations or predictions, and advances in science can affect people's lives, including generating new career opportunities ACSHE160, ACSHE194	Science knowledge, balanced with ethical and social considerations, contributes to understanding complex contemporary issues and identifying responses.	
examine how the values and needs of society influence the focus of scientific research AC9S9H04	Values and needs of contemporary society can influence the focus of scientific research ACSHE228, ACSHE230	Scientific knowledge, practices and products are influenced by ethical, environmental, social and economic factors.	
Science inquiry			
Questioning and predicting AC V9.0	**AC V8.4**	**Core concept**	**Patterns, order and organisation**
develop investigable questions, reasoned predictions and hypotheses to test relationships and develop explanatory models AC9S9I01	Formulate questions or hypotheses that can be investigated scientifically ACSIS164, ACSIS198	Science inquiry involves making observations and predictions, asking questions, and constructing and testing explanations for natural and physical phenomena.	Patterns may be causal or correlational. Some patterns have an underlying cause that cannot be observed at the same spatial or temporal scale.
Planning and conducting AC V9.0	**AC V8.4**	**Core concept**	**Scale and measurement**
plan and conduct valid, reproducible investigations to answer questions and test hypotheses, including identifying and controlling for possible sources of error and, as appropriate, developing and following risk assessments, considering ethical issues, and addressing key considerations regarding heritage sites and artefacts on Country/Place AC9S9I02	Plan, select and use appropriate investigation types, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods ACSIS165, ACSIS199	Science inquiries should be designed to systematically generate or collect valid and reliable primary and secondary data in a safe, ethical and interculturally aware way.	

select and use equipment to generate and record data with precision to obtain useful sample sizes and replicable data, using digital tools as appropriate AC9S9I03	Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately ACSIS166, ACSIS200	Science inquiries should be designed to systematically generate or collect valid and reliable primary and secondary data in a safe, ethical and interculturally aware way.	The use of appropriate units of measurement is important.
Processing, modelling and analysing **AC V9.0**	**Processing and analysing data and information** **AC V8.4**	**Core concept**	**Patterns, order and organisation** **Scale and measurement** **Systems**
select and construct appropriate representations, including tables, graphs, descriptive statistics, models and mathematical relationships, to organise and process data and information AC9S9I04		Mathematical thinking underpins science practices of representing objects and events, analysing data and modelling relationships.	Classification helps us to organise objects and events; some objects/events can be difficult to fit within existing classification systems. Models can be used to investigate systems that are too large or small, or occur over timescales that are too fast or slow, to observe directly. Generalisations about relationships within systems can be made.
analyse and connect a variety of data and information to identify and explain patterns, trends, relationships and anomalies AC9S9I05	Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies ACSIS169, ACSIS203		Patterns may be causal or correlational. Some relationships can impact on other relationships.
Evaluating **AC V9.0**	**AC V8.4**	**Core concept**	**Patterns, order and organisation**
assess the validity and reproducibility of methods and evaluate the validity of conclusions and claims, including by identifying assumptions, conflicting evidence and areas of uncertainty AC9S9I06	Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data ACSIS171, ACSIS205 Critically analyse the validity of information in primary and secondary sources and evaluate the approaches used to solve problems ACSIS172, ACSIS206	Evaluating evidence enables development of explanations, decision-making and designed solutions.	

construct arguments based on analysis of a variety of evidence to support conclusions or evaluate claims, and consider any ethical issues and cultural protocols associated with accessing, using or citing secondary data or information AC9S9I07	Critically analyse the validity of information in primary and secondary sources and evaluate the approaches used to solve problems ACSIS172, ACSIS206		Patterns and relationships can be identified within and between scientific findings.
Communicating **AC V9.0**	**AC V8.4**	**Core concept**	
write and create texts to communicate ideas, findings and arguments effectively for identified purposes and audiences, including selection of appropriate content, language and text features, using digital tools as appropriate AC9S9I08	Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations ACSIS174, ACSIS208	Critiquing and communicating science ideas effectively is critical to advancing science and influencing environmental, social and economic futures.	

8. Appendix B

Knowing and using procedures

Knowing and using procedures			
Cognitive area	**Description**	**CCT element**	**CCT sub-element**
Recognise	Make or identify accurate statements about science phenomena, concepts, relationships, procedures or the scientific endeavour; recognise an instance of a concept/entity/generalisation (e.g. producers or decomposers in a food web).	Inquiring[9]	Identify, process and evaluate information[10]
Define	Identify statements that define particular concepts and content.	Inquiring	Identify, process and evaluate information
Describe	Make straightforward observations of features/objects; identify and extract information from simple data sources or diagrams; describe factual information, processes and relationships about science or the scientific endeavour.	Inquiring	Identify, process and evaluate information
Illustrate with examples	Identify or provide examples that support or clarify statements about the scientific endeavour or statements about particular science concepts, relationships and theories.	Inquiring	Identify, process and evaluate information
Relate	Relate science concepts to phenomena and observations.	Inquiring	Identify, process and evaluate information
Use tools and procedures	Demonstrate skills in the use of science equipment, tools, measurement devices/scales, mechanical aspects of constructing and reading graphs and tables.	Inquiring	Identify, process and evaluate information

[9] Inquiring – identifying, exploring and organising information and ideas, AC Version 8.4
[10] Identify and clarify information and ideas and Organise and process information, AC Version 8.4

Reasoning, analysing and evaluating

Reasoning, analysing and evaluating			
Cognitive area	**Description**	**CCT element**	**CCT sub-element**
Compare/ Contrast/ Classify	Identify similarities and differences between objects, processes or ideas; organise and process information; classify objects or processes based on characteristics/properties.	Inquiring	Identify, process and evaluate information
		Inquiring	Identify, process and evaluate information
Represent	Make representations (e.g. diagrams) to describe and illustrate aspects of concepts, structures, relationships, processes; make or use representations to communicate or find solutions to problems.	Inquiring	Identify, process and evaluate information
		Reflecting[11]	Transfer knowledge[12]
Collect, analyse and interpret data	Make decisions about variables to be investigated and controlled, measurements to conduct; represent data in tables and graphs using appropriate labelling and scales; identify and summarise patterns in the data; interpolate/extrapolate from data.	Inquiring	Identify, process and evaluate information
		Analysing[13]	Interpret concepts and problems[14]
		Analysing	Evaluate actions and outcomes[15]
Make inferences	Make inferences from data, information given and/or own knowledge; give reasons/evidence to support an inference.	Analysing	Interpret concepts and problems Draw conclusions and provide reasons[16]
		Reflecting	Transfer knowledge

11 Reflecting on thinking and processes, AC Version 8.4
12 Transfer knowledge into new contexts, AC Version 8.4
13 Analysing, synthesising and evaluating reasoning and procedures, AC Version 8.4
14 Draw conclusions and design a course of action, AC Version 8.4
15 Evaluate procedures and outcomes, AC Version 8.4
16 Apply logic and reasoning and Draw conclusions and design a course of action, AC Version 8.4

Predict/Explain	Make predictions based on evidence and concepts; give reasons to support predictions; construct and defend explanations based on evidence and/or concepts; transfer knowledge into new contexts by making predictions and constructing explanations in new situations.	Generating[17] Reflecting	Put ideas into action[18] Transfer knowledge
Analyse information, evidence and arguments	Pose questions to probe assumptions, to identify gaps in information, evidence or arguments, or to investigate ideas or issues; prioritise information/evidence required to draw a conclusion or to make a decision; identify facts, observations or data that can be used as evidence to support an explanation, conclusion or argument; identify whether there is sufficient evidence to justify a claim, explanation or conclusion; identify evidence needed to decide among competing claims, explanations or solutions; integrate new information or evidence into ideas.	Inquiring	Develop questions[19]
		Analysing	Interpret concepts and problems Draw conclusions and provide reasons
Evaluate information, evidence, procedures and arguments	Evaluate information and evidence according to criteria such as relevance, bias, validity and/or reliability; evaluate claims, conclusions and arguments with respect to quality of evidence and reasoning supporting them; recognise flaws (e.g. gaps) in reasoning; consider and evaluate alternative explanations, processes and solutions; evaluate steps of investigations.	Inquiring Inquiring Generating	Identify, process and evaluate information Identify, process and evaluate information Consider alternatives

[17] Generating ideas, possibilities and actions, AC Version8.4
[18] Seek solutions and put ideas into action, AC Version 8.4
[19] Pose questions, AC Version 8.4

Synthesising and creating

Synthesising and creating			
Cognitive area	**Description**	**CCT element**	**CCT sub-element**
Generate hypotheses	Generate hypotheses based on background knowledge, preliminary observations, and logic; generate and test alternative hypotheses; identify and justify the thinking processes behind such hypotheses.	Generating	Put ideas into action
Construct arguments and draw conclusions	Construct sound and valid arguments supported by evidence and logical reasoning; draw conclusions that address questions/hypotheses and are supported with evidence; draw or support conclusions using evidence and scientific understanding; adapt conclusions as new evidence becomes available; draw general conclusions that go beyond the experimental or given conditions.	Analysing	Interpret concepts and problems Draw conclusions and provide reasons
		Reflecting	Transfer knowledge
Create and use models	Create models to explain a phenomenon or make a prediction (using imagery or analogies, as relevant); adapt models as new evidence becomes available; use computer simulations to test models under different conditions.	Generating	Put ideas into action
Plan and design investigations	Plan and design whole investigations appropriate for answering scientific questions or solving problems.	Analysing	Draw conclusions and
Make connections	Make connections between different concepts and areas of science; make decisions considering both scientific and social factors and trade-offs; synthesise complex information to inform a course of action.	Analysing Generating	Draw conclusions and provide reasons Create possibilities[20]
Solve problems	Seek and provide solutions to problems that require consideration of different factors and/or concepts; identify, assess and test options, implications and consequences when seeking solutions; propose alternative solutions to problems; justify the reasons behind choosing particular options/solutions; design solutions to problems of social significance, using science knowledge, considering a range of perspectives and trade-offs, and assessing risks	Analysing	Evaluate actions and outcomes
		Generating	Consider alternatives

[20] Imagine possibilities and connect ideas, AC Version 8.4