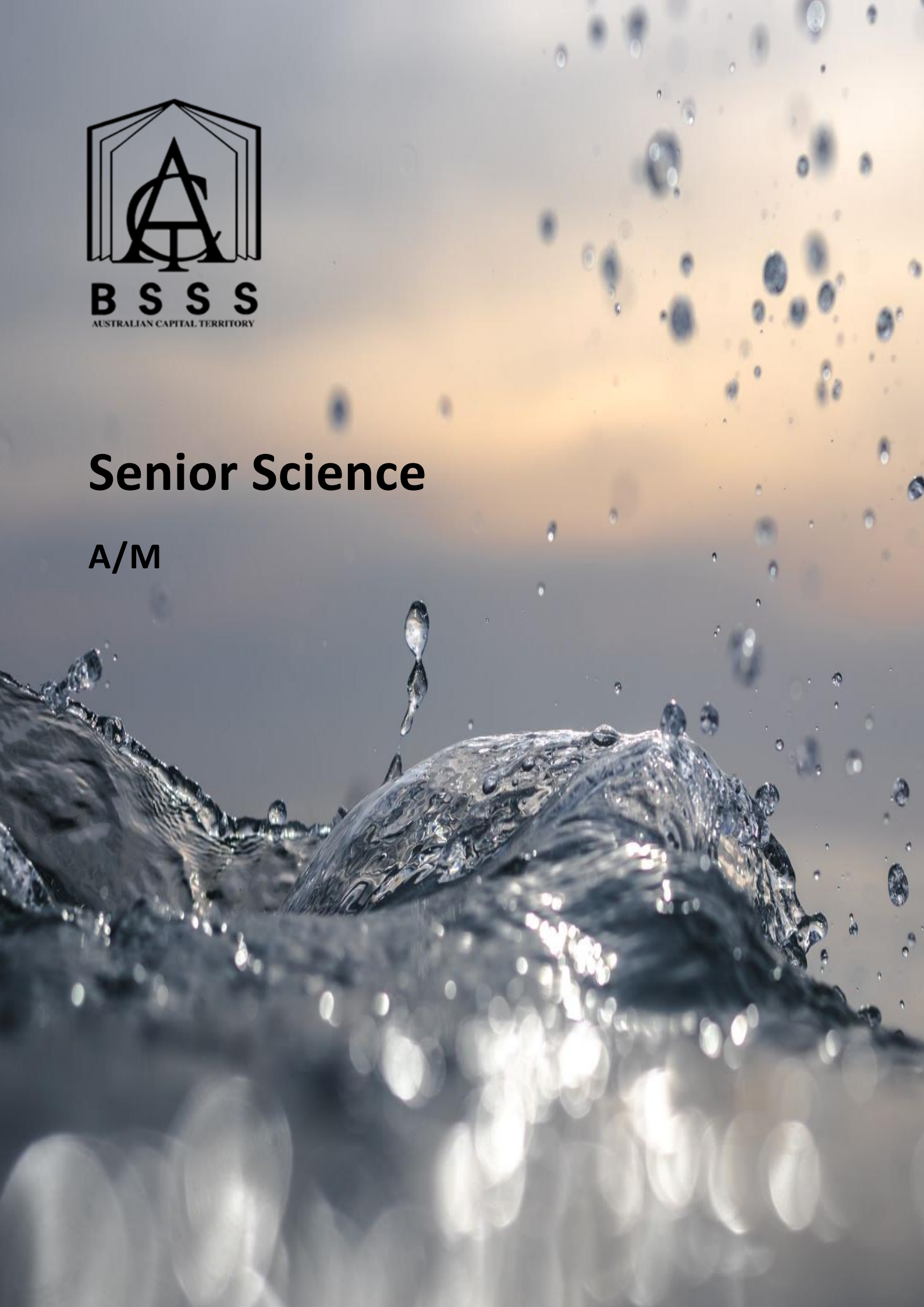
BSSS
AUSTRALIAN CAPITAL TERRITORY

Senior Science

A/M



Cover Art provided by Canberra College student Aidan Giddings

Table of Contents

The ACT Senior Secondary System

The ACT senior secondary system recognises a range of university, vocational or life skills pathways.

The system is based on the premise that teachers are experts in their area: they know their students and community and are thus best placed to develop curriculum and assess students according to their needs and interests. Students have ownership of their learning and are respected as young adults who have a voice.

A defining feature of the system is school-based curriculum and continuous assessment. School-based curriculum provides flexibility for teachers to address students' needs and interests. College teachers have an opportunity to develop courses for implementation across ACT schools. Based on the courses that have been accredited by the BSSS, college teachers are responsible for developing programs of learning. A program of learning is developed by individual colleges to implement the courses and units they are delivering.

Teachers must deliver all content descriptions; however, they do have flexibility to emphasise some content descriptions over others. It is at the discretion of the teacher to select the texts or materials to demonstrate the content descriptions. Teachers can choose to deliver course units in any order and teach additional (not listed) content provided it meets the specific unit goals.

School-based continuous assessment means that students are continually assessed throughout years 11 and 12, with both years contributing equally to senior secondary certification. Teachers and students are positioned to have ownership of senior secondary assessment. The system allows teachers to learn from each other and to refine their judgement and develop expertise.

Senior secondary teachers have the flexibility to assess students in a variety of ways. For example: multimedia presentation, inquiry-based project, test, essay, performance and/or practical demonstration may all have their place. College teachers are responsible for developing assessment instruments with task specific rubrics and providing feedback to students.

The integrity of the ACT Senior Secondary Certificate is upheld by a robust, collaborative and rigorous structured consensus-based peer reviewed moderation process. System moderation involves all year 11 and 12 teachers from public, non-government and international colleges delivering the ACT Senior Secondary Certificate.

Only students who desire a pathway to university are required to sit a general aptitude test, referred to as the ACT Scaling Test (AST), which moderates student scores across courses and colleges. Students are required to use critical and creative thinking skills across a range of disciplines to solve problems. They are also required to interpret a stimulus and write an extended response.

Senior secondary curriculum makes provision for student-centred teaching approaches, integrated and project-based learning inquiry, formative assessment and teacher autonomy. ACT Senior Secondary Curriculum makes provision for diverse learners and students with mild to moderate intellectual disabilities, so that all students can achieve an ACT Senior Secondary Certificate.

The ACT Board of Senior Secondary Studies (BSSS) leads senior secondary education. It is responsible for quality assurance in senior secondary curriculum, assessment and certification. The Board consists of nominees from colleges, professional bodies, universities, industry, parent/carer organisations and unions. The Office of the Board of Senior Secondary Studies (OBSSS) consists of professional and administrative staff who support the Board in achieving its objectives and functions.

ACT Senior Secondary Certificate

Courses of study for the ACT Senior Secondary Certificate:

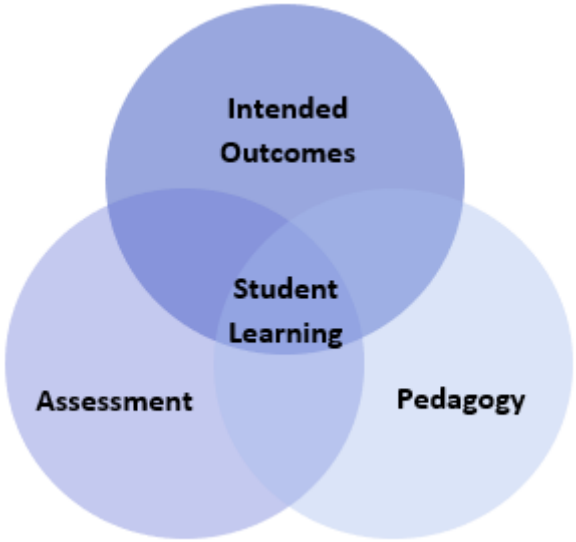
- provide a variety of pathways, to meet different learning needs and encourage students to complete their secondary education
- enable students to develop the essential capabilities for twenty-first century learners
- empower students as active participants in their own learning
- engage students in contemporary issues relevant to their lives
- foster students' intellectual, social and ethical development
- nurture students' wellbeing, and physical and spiritual development
- enable effective and respectful participation in a diverse society.

Each course of study:

- comprises an integrated and interconnected set of knowledge, skills, behaviours and dispositions that students develop and use in their learning across the curriculum
- is based on a model of learning that integrates intended student outcomes, pedagogy and assessment
- outlines teaching strategies which are grounded in learning principles and encompass quality teaching
- promotes intellectual quality, establish a rich learning environment and generate relevant connections between learning and life experiences
- provides formal assessment and certification of students' achievements.

Underpinning beliefs

- All students are able to learn.
- Learning is a partnership between students and teachers.
- Teachers are responsible for advancing student learning.



Learning Principles

1. Learning builds on existing knowledge, understandings and skills.
   (Prior knowledge)
2. When learning is organised around major concepts, principles and significant real world issues, within and across disciplines, it helps students make connections and build knowledge structures.
   (Deep knowledge and connectedness)
3. Learning is facilitated when students actively monitor their own learning and consciously develop ways of organising and applying knowledge within and across contexts.
   (Metacognition)
4. Learners' sense of self and motivation to learn affects learning.
   (Self-concept)
5. Learning needs to take place in a context of high expectations.
   (High expectations)
6. Learners learn in different ways and at different rates.
   (Individual differences)
7. Different cultural environments, including the use of language, shape learners' understandings and the way they learn.
   (Socio-cultural effects)
8. Learning is a social and collaborative function as well as an individual one.
   (Collaborative learning)
9. Learning is strengthened when learning outcomes and criteria for judging learning are made explicit and when students receive frequent feedback on their progress.
   (Explicit expectations and feedback)

General Capabilities

All courses of study for the ACT Senior Secondary Certificate should enable students to develop essential capabilities for twenty-first century learners. These 'capabilities' comprise an integrated and interconnected set of knowledge, skills, behaviours and dispositions that students develop and use in their learning across the curriculum.

The capabilities include:

- literacy
- numeracy
- information and communication technology (ICT)
- critical and creative thinking
- personal and social
- ethical understanding
- intercultural understanding

Courses of study for the ACT Senior Secondary Certificate should be both relevant to the lives of students and incorporate the contemporary issues they face. Hence, courses address the following three priorities. These priorities are:

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability

Elaboration of these General Capabilities and priorities is available on the ACARA website at www.australiancurriculum.edu.au.

Literacy

Students develop literacy capability as they learn how to build knowledge in relation to economic information, concepts and ideas. Students progressively learn to use a wide range of informational, persuasive and imaginative texts in multiple modes. These texts include stories, narrative recounts, reports, explanations, arguments, debates, timelines, maps, tables, graphs, images, often supported by references from primary and secondary sources.

Students learn to make increasingly sophisticated language and text choices, understanding that language varies according to context, including the nature and stages of their inquiry. They learn to use language features and text structures to comprehend and compose cohesive texts about places, people, events, processes, systems and perspectives of the past, present and future. These include topic-specific vocabulary; appropriate tense verbs; and complex sentences that describe sequential, cause-and-effect and comparative relationships. They recognise how language and images can be used to make and manipulate meaning and evaluate texts for shades of meaning and opinion. Students also participate in debates and discussions, and develop a considered point of view when communicating conclusions and preferred social and environmental futures to a range of audiences.

Numeracy

Students develop numeracy capability as they apply numeracy skills in relation to historical, geographical, civic and economic inquiries. Students count and measure data and information, construct and interpret tables and graphs, and calculate and interpret statistics in their investigations. Students learn to use scaled timelines, including those involving negative and positive numbers, as well as calendars and dates, to recall information on topics of historical significance and to illustrate the passing of time. They collect data through methods such as surveys and field tests, and construct and interpret maps, models, diagrams and remotely sensed and satellite images, working with numerical concepts of grids, scale, distance, area and projections.

Students learn to analyse numerical data to make meaning of the past; to test relationships in patterns and between variables, such as the effects of location and distance; and to draw conclusions. They make predictions and forecast outcomes based on civic, economic and business data and environmental and historical information and represent their findings in numerical and graphical form. Students use numeracy to understand the principles of financial management, and to make informed financial and business decisions. They appreciate the ways numeracy knowledge and skills are used in society and apply these to hypothetical and/or real-life experiences.

Information and Communication Technology (ICT) Capability

Students develop ICT capability when they locate, process, analyse, evaluate and communicate economic information using digital technologies. Students access and use digital technologies, including spatial technologies, as an investigative and creative tool. They seek a range of digital sources of information to resolve inquiry questions or challenges of historical, geographic, civic and economic relevance, being aware of intellectual property. They critically analyse evidence and trends and critique source reliability. Using digital technologies, students present and represent their learning; and collaborate, discuss and debate to co-construct their knowledge. They plan, organise, create, display and communicate data and information digitally using multimodal elements for a variety of reasons and audiences.

Students enhance their understanding of ICT by exploring the increasing use of technology and the effects of technologies on people, places and civic and economic activity over time and place. They learn about and have opportunities to use social media to collaborate, communicate, and share information, and build consensus on issues of social, civic, economic and environmental significance, whilst using an awareness of personal security protocols and ethical responsibilities.

Critical and Creative Thinking

Students develop critical and creative thinking as they investigate economic concepts and ideas through inquiry-based learning. Students develop critical thinking by learning to develop and clarify investigative questions, and to question sources and assess reliability when selecting information from sources. Students learn discipline-specific ways of thinking, including interpreting the past from incomplete documentation, developing an argument using evidence, interpreting and analysing economic data and/or information, and systems thinking to inform predictions and propose solutions. They learn to think logically when evaluating and using evidence, testing explanations, analysing arguments and making decisions, and when thinking deeply about questions that do not have straightforward answers.

Students learn the value and process of developing creative questions and the importance of speculation. They apply concepts and skills to new contexts and learn to develop new interpretations to explain aspects of the past and present that are contested or not well understood. They are encouraged to be curious and imaginative in investigations and fieldwork, and to consider multiple perspectives about issues and events. They imagine alternative futures in response to social, environmental, civic and economic challenges that require problem solving and innovative solutions, proposing appropriate and alternative courses of action and considering the effects on their own lives and the lives of others. In so doing, students develop enterprising behaviours and capabilities and learn to apply decision-making processes including negotiation and conflict resolution.

Personal and Social Capability

Students' personal and social capability is enhanced as they gain understanding about people, places, processes and phenomena. Through economic inquiry, collaboration and reflective practice, students develop an appreciation of the insights and perspectives of others, past and present; and an understanding of what informs their personal identity and sense of belonging, including place and their cultural and national heritage. Inquiry-based learning assists students to develop their capacity for self-management, directing their own learning and providing opportunities to express and reflect on their opinions, beliefs, values and questions appropriately.

As students work independently and collaboratively, they are encouraged to develop personal and interpersonal skills, behaviours and dispositions that enable communication, empathy, teamwork, negotiation and conflict resolution to maintain positive relationships. They learn and apply enterprising behaviours and capabilities such as leadership, resilience, goal-setting and advocacy skills and informed, responsible decision-making. In turn, students develop the capacity to achieve desired outcomes peacefully and to make a contribution to their communities and society more broadly.

Ethical Understanding

Students' capacity for ethical understanding is enhanced by the unique contexts offered through economic inquiry. Students investigate the ways that diverse values and principles have influenced human activity and recognise that examining the nature of evidence deepens their understanding of ethical issues. Students learn about ethical procedures for investigating and working with people and places, including with Aboriginal and Torres Strait Islander Peoples. Students critically explore ethical behaviour of people of different times and places that may be the result of differing standards and expectations and changing societal attitudes. They evaluate their findings about consumer choices, and about current geographical issues against the criteria of environmental protection, economic prosperity and social advancement, raising ethical questions about human rights and citizenship. Students discuss and apply ethical concepts such as equality, respect and fairness, and examine shared beliefs and values which support Australian democracy and citizenship.

As students develop informed, ethical values and attitudes as they explore different perspectives, ambiguities and ethical considerations related to social and environmental issues, they become aware of their own roles, rights and responsibilities as participants in their social, economic and natural world. They consider the consequences of personal and civic decisions, for individuals, society and other forms of life that share the environment.

Intercultural Understanding

Students develop intercultural understanding as they learn about the diversity of the world's places, peoples and their lives, cultural practices, values, beliefs and ways of knowing. Students learn the importance of understanding their own and others' histories, recognising the significance of Aboriginal and Torres Strait Islander peoples' histories and cultures and the contribution of Australian migrants. They have opportunities to learn about the historic benefits and challenges of interacting with other countries and cultural groups over time, and come to understand the nature, causes and consequences of cultural interdependence, dispossession and conflict. They learn of Australia's economic and political relationship with other countries and the role of intercultural understanding for the present and future.

As students investigate the interconnections between people and the significance that places hold, they learn how various cultural identities, including their own, are shaped. Students come to see the critical role of shared beliefs and values in an evolving Australian identity. They reflect on their own intercultural experiences and explore how people interact across cultural boundaries, considering how factors such as group membership, traditions, customs and religious and cultural practices impact on civic life. They recognise similarities as well as differences within and across cultural groups, recognising the importance of practising empathy and learning to challenge stereotypical or prejudiced representations of social and cultural groups where they exist. They demonstrate respect for cultural diversity and the human rights of all people and learn to facilitate dialogue to understand different perspectives.

Cross-Curriculum Priorities

While the significance of the cross-curriculum priorities for Biology varies, there are opportunities for teachers to select contexts that incorporate the key concepts from each priority.

Aboriginal and Torres Strait Islander Histories and Cultures

Through an investigation of contexts that draw on Aboriginal and Torres Strait Islander histories and cultures students could investigate the importance of Aboriginal and Torres Strait Islander Peoples' knowledge in developing a richer understanding of the Australian environment. Students could develop an appreciation of the unique Australian biota and its interactions, the impacts of Aboriginal and Torres Strait Islander Peoples on their environments and the ways in which the Australian landscape has changed over tens of thousands of years. They could examine the ways in which Aboriginal and Torres Strait Islander knowledge of ecosystems has developed over time and the spiritual significance of Country/Place.

Asia and Australia's Engagement with Asia

Contexts that draw on Asian scientific research and development and collaborative endeavours in the Asia Pacific region provide an opportunity for students to investigate Asia and Australia's engagement with Asia. Students could explore the diverse environments of the Asia region and develop an appreciation that interaction between human activity and these environments continues to influence the region, including Australia, and has significance for the rest of the world. By examining developments in biological science, students could appreciate that the Asia region plays an important role in scientific research and development, including through collaboration with Australian scientists, in such areas as medicine, natural resource management, biosecurity and food security.

Sustainability

The sustainability cross-curriculum priority is explicitly addressed in the Biology curriculum. Biology provides authentic contexts for exploring, investigating and understanding the function and interactions of biotic and abiotic systems across a range of spatial and temporal scales. By investigating the relationships between biological systems and system components, and how systems respond to change, students develop an appreciation for the interconnectedness of the biosphere. Students appreciate that biological science provides the basis for decision making in many areas of society and that these decisions can impact the Earth system. They understand the importance of using science to predict possible effects of human and other activity, and to develop management plans or alternative technologies that minimise these effects and provide for a more sustainable future.

Sustainability addresses the ongoing capacity of Earth to maintain all life. Sustainable patterns of living meet the needs of the present without compromising the ability of future generations to meet their needs. Actions to improve sustainability are individual and collective endeavours shared across local and global communities. They necessitate a renewed and balanced approach to the way humans interact with each other and the environment.

Education for sustainability develops the knowledge, skills, values and world views necessary for people to act in ways that contribute to more sustainable patterns of living. It enables individuals and communities to reflect on ways of interpreting and engaging with the world. Sustainability education is futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through informed action. Actions that support more sustainable patterns of living require consideration of environmental, social, cultural and economic systems and their interdependence.

Senior Science

A / M

Rationale

There is an innate human curiosity and desire to understand the universe. The study of Senior Science encourages and enables students to develop an understanding of the universe through observation, questioning, experimentation, discussion, critical analysis and creative thinking.

Students explore key concepts and models through active enquiry into phenomena and through contexts that exemplify the role of Science in society. They learn how an understanding of Science is central to the identification of, and solutions to, some of the key issues facing an increasingly globalised society. The subject explores ways in which scientists work collaboratively and individually in a range of integrated fields to increase understanding of an ever-expanding body of scientific knowledge.

Scientific processes challenge current understanding and are continually re-evaluated. Students are constantly encouraged to examine and reconsider their understanding of scientific concepts, their inquiry methods and phenomena.

The study of Science equips students with the skills to be independent thinkers and life-long learners who are confident to pursue a wide range of study pathways and careers.

Goals

This course should enable students to develop an:

- appreciation of the contribution Science has made to a contemporary society
- appreciation of how scientific knowledge can be used to address contemporary issues
- understanding that scientific knowledge has developed over time, is used in a variety of contexts; and influences, and is influenced by, social, economic, cultural and ethical considerations
- understanding of the theories and models used to describe, explain and make predictions about systems, structures and properties
- understanding that Science is experimental and has developed through independent and collaborative research, and has significant impacts on society and implications for decision making
- ability to communicate scientific understandings, findings, arguments and conclusions using appropriate resources, modes and genres
- ability to conduct a variety of field, research and laboratory investigations involving collection and critical analysis of qualitative and quantitative data, and interpretation of evidence
- ability to critically evaluate and debate scientific arguments and claims in order to solve problems and generate informed, considered and ethical conclusions.

Mathematical skills expected of students studying

The curriculum requires students to use the mathematical skills they have developed through the F-10 Australian Curriculum: Mathematics, in addition to the numeracy skills they have developed through the Science Inquiry Skills strand of the Australian Curriculum: Science.

Within the Science Inquiry Skills strand, students are required to gather, represent and analyse numerical data to identify the evidence that forms the basis of their scientific arguments, claims or conclusions. In gathering and recording numerical data, students are required to make measurements with an appropriate degree of accuracy and to represent measurements using appropriate units.

Students may need to be taught to recognise when it is appropriate to join points on a graph and when it is appropriate to use a line of best fit. They may also need to be taught how to construct a straight line that will serve as the line of best fit for a set of data presented graphically.

Unit Titles

- Biological Senior Science (the electives have a biological focus)
- Environmental Senior Science (the electives have an earth and environmental focus)
- Chemical Senior Science (the electives have a chemistry focus)
- Physical Senior Science (the electives have a physics focus)
- Independent Study

Each unit includes:

- Unit descriptions – short descriptions of the purpose of and rationale for each unit
- Learning outcomes – statements describing the learning expected as a result of studying the unit
- Content descriptions – descriptions of the core content to be taught and learned, organised into three strands:
    - Science Inquiry Skills
    - Science as a Human Endeavour
    - Science Understanding (organised in sub-units)
- Each unit has a selection of electives

Science Strand Descriptions

The Australian Curriculum: Science has three interrelated strands: Science Inquiry Skills, Science as a Human Endeavour and Science Understanding. These strands are used to organise the Science learning area from Foundation to Year 12. In the senior secondary Science subjects, the three strands build on students' learning in the F-10 Australian Curriculum: Science.

In the practice of science, the three strands 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. Students' experiences of school science should mirror this multifaceted view of science. To achieve this, the three strands of the Australian Curriculum: Science should be taught in an integrated way. The content descriptions for Science Inquiry Skills, Science as a Human Endeavour and Science Understanding have been written so that this integration is possible in each unit.

Science Inquiry Skills

- Science inquiry involves identifying and posing questions; planning, conducting and reflecting on investigations; processing, analysing and interpreting data; and communicating findings. This strand is concerned with evaluating claims, investigating ideas, solving problems, reasoning, drawing valid conclusions, and developing evidence-based arguments.
- Science investigations are activities in which ideas, predictions or hypotheses are tested and conclusions are drawn in response to a question or problem. Investigations can involve a range of activities, including experimental testing, field work, locating and using information sources, conducting surveys, and using modelling and simulations. The investigation design will depend on the context and subject of the investigation.
- In science investigations, the collection and analysis of data to provide evidence plays a major role. This can involve collecting or extracting information and reorganising data in the form of tables, graphs, flow charts, diagrams, prose, keys, spreadsheets and databases. The analysis of data to identify and select evidence, and the communication of findings, involve the selection, construction and use of specific representations, including mathematical relationships, symbols and diagrams.
- Through the senior secondary Science subjects, students will continue to develop generic science inquiry skills, building on the skills acquired in the F-10 Australian Curriculum: Science. These generic skills are described below and will be explicitly taught and assessed in each unit. In addition, each unit provides more specific skills to be taught within the generic science inquiry skills; these specific skills align with the Science Understanding and Science as a Human Endeavour content of the unit.

The generic science inquiry skills are:

- Identifying, researching and constructing questions for investigation; proposing hypotheses; and predicting possible outcomes
- Designing investigations, including the procedure/s to be followed, the materials required and the type and amount of primary and/or secondary data to be collected; conducting risk assessments; and considering ethical research
- Conducting investigations, including using equipment and techniques safely, competently and methodically for the collection of valid and reliable data
- Representing data in meaningful and useful ways; organising and analysing data to identify trends, patterns and relationships; recognising error, uncertainty and limitations in data; and selecting, synthesising and using evidence to construct and justify conclusions
- Interpreting scientific and media texts and evaluating processes, claims and conclusions by considering the quality of available evidence; and using reasoning to construct scientific arguments
- Selecting, constructing and using appropriate representations to communicate understanding, solve problems and make predictions
- Communicating to specific audiences and for specific purposes using appropriate language, nomenclature, genres and modes
- The senior secondary Science subjects have been designed to accommodate, if appropriate, an extended scientific investigation within each pair of units.

Science as a Human Endeavour

- Through science, we seek to improve our understanding and explanations of the natural world. The Science as a Human Endeavour strand highlights the development of science as a unique way of knowing and doing and explores the use and influence of science in society.
- As science involves the construction of explanations based on evidence, the development of science concepts, models and theories is dynamic and involves critique and uncertainty. Science concepts, models and theories are reviewed as their predictions and explanations are continually re-assessed through new evidence, often through the application of new technologies. This review process involves a diverse range of scientists working within an increasingly global community of practice and can involve the use of international conventions and activities such as peer review.
- The use and influence of science are shaped by interactions between science and a wide range of social, economic, ethical and cultural factors. The application of science may provide great benefits to individuals, the community and the environment, but may also pose risks and have unintended consequences. As a result, decision making about socio-scientific issues often involves consideration of multiple lines of evidence and a range of stakeholder needs and values. As an ever-evolving body of knowledge, science frequently informs public debate, but is not always able to provide definitive answers.
- Across the senior secondary Science subjects, the same set of Science as a Human Endeavour content descriptions is used for Units 1 and 2 of the subjects; and another set for Units 3 and 4. This consistent approach enables students to develop a rich appreciation of the complex ways in which science interacts with society, through the exploration of Science as a Human Endeavour concepts across the subjects and in multiple contexts.
- 'Examples in context' will be developed to illustrate possible contexts related to Science Understanding content, in which students could explore Science as a Human Endeavour concepts. Each Example in context will be aligned to the relevant sub-unit in Science Understanding and will include links to the relevant Science as a Human Endeavour content descriptions.

Science Understanding

- Science understanding is evident when a person selects and integrates appropriate science concepts, models and theories to explain and predict phenomena, and applies those concepts, models and theories to new situations. Models in science can include diagrams, physical replicas, mathematical representations, word-based analogies (including laws and principles) and computer simulations. Development of models involves selection of the aspects of the system/s to be included in the model, and thus models have inherent approximations, assumptions and limitations.
- The Science Understanding content in each unit develops students' understanding of the key concepts, models and theories that underpin the subject, and of the strengths and limitations of different models and theories for explaining and predicting phenomena.
- Science understanding can be developed through the selection of contexts that have relevance to and are engaging for students.

Safety

- Science learning experiences may involve the use of potentially hazardous substances and/or hazardous equipment. It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students and that school practices meet the requirements of the Work Health and Safety Act 2011, in addition to relevant state or territory health and safety guidelines.
- For further information about relevant guidelines, contact your state or territory curriculum authority.

Animal Ethics

- Through a consideration of research ethics as part of Science Inquiry Skills, students will examine their own ethical position, draw on ethical perspectives when designing investigation methods, and ensure that any activities that impact on living organisms comply with the Australian code of practice for the care and use of animals for scientific purposes 7th edition (2004) (http://www.nhmrc.gov.au/guidelines/publications/ea16).
- Any teaching activities that involve the care and use of, or interaction with, animals must comply with the Australian code of practice for the care and use of animals for scientific purposes 7th edition, in addition to relevant state or territory guidelines.
- For further information about relevant guidelines or to access your local Animal Ethics Committee, contact your state or territory curriculum authority.

Independent Study

An Independent Study unit has an important place in senior secondary courses. It is a valuable pedagogical approach that empowers students to make decisions about their own learning. An Independent Study unit can be proposed by an individual student for their own independent study and negotiated with their teacher. The program of learning for an Independent Study unit must meet the unit goals and content descriptions as they appear in the course.

Independent Study units are only available to individual students in Year 12. A student can only study a maximum of one Independent Study unit in each course. Students must have studied at least three standard 1.0 units from this course. An Independent Study unit requires the principal's written approval. Principal approval can also be sought by a student in Year 12 to enrol concurrently in an Independent Study unit and their third 1.0 unit in this course of study.

Assessment

The identification of criteria within the achievement standards and assessment task types and weightings provides a common and agreed basis for the collection of evidence of student achievement.

Assessment Criteria (the dimensions of quality that teachers look for in evaluating student work) provide a common and agreed basis for judgement of performance against unit and course goals, within and across colleges. Over a course, teachers must use all these criteria to assess students' performance but are not required to use all criteria on each task. Assessment criteria are to be used holistically on a given task and in determining the unit grade.

Assessment Tasks elicit responses that demonstrate the degree to which students have achieved the goals of a unit based on the assessment criteria. The Common Curriculum Elements (CCE) is a guide to developing assessment tasks that promote a range of thinking skills (see Appendix C). It is highly desirable that assessment tasks engage students in demonstrating higher order thinking.

Rubrics are constructed for individual tasks, informing the assessment criteria relevant for a particular task and can be used to assess a continuum that indicates levels of student performance against each criterion.

Assessment Criteria

Students will be assessed on the degree to which they demonstrate:

- concepts, models and application
- contexts
- inquiry skills.

Assessment Task Types

Suggested tasks

Individual tasks may incorporate one or more of the following:

- models
- commentary
- debate
- portfolio/journal
- field work
- investigation
- document/source analysis
- practical report
- role play
- research report
- test/quiz
- seminar/workshop/lecture
- poster
- response to stimulus
- essay
- multimedia presentation
- creative response
- interview
- discussion forum
- rationale/validation
- practical skills

It is recommended that a student conceived investigation be undertaken at least once during a minor and twice during a major. This investigation may either be theoretical or practical, or a combination of both.

Weightings in A/T/M 1.0 and 0.5 Units:

No task to be weighted more than 45% for a standard 1.0 unit.

Additional Assessment Information

- For a standard unit (1.0), students must complete a minimum of three assessment tasks and a maximum of five.
- For a half standard unit (0.5), students must complete a minimum of two and a maximum of three assessment tasks.
- Students must experience a variety of task types and different modes of communication to demonstrate the Achievement Standards in both theoretical and practical tasks.
- All Achievement Standards must be demonstrated in standard (1.0) or half-standard (0.5) units.
- Task types need to be selected to address all Achievement Standards within the Concepts, Models and Applications, Contexts and Inquiry Skills strands across a standard (1.0) or half-standard (0.5) unit.
- For tasks completed in unsupervised conditions, schools need to have mechanisms to uphold academic integrity, for example: student declaration, plagiarism software, oral defence, interview, or other validation tasks.

Achievement Standards

Years 11 and 12 Achievement Standards are written for A/T courses. A single achievement standard is written for M courses.

A Year 12 student in any unit is assessed using the Year 12 achievement standards. A Year 11 student in any unit is assessed using the Year 11 achievement standards. Year 12 achievement standards reflect higher expectations of student achievement compared to the Year 11 achievement standards. Years 11 and 12 achievement standards are differentiated by cognitive demand, the number of dimensions and the depth of inquiry.

An achievement standard cannot be used as a rubric for an individual assessment task. Assessment is the responsibility of the college. Student tasks may be assessed using rubrics or marking schemes devised by the college. A teacher may use the achievement standards to inform development of rubrics. The verbs used in achievement standards may be reflected in the rubric. In the context of combined Years 11 and 12 classes, it is best practice to have a distinct rubric for Years 11 and 12. These rubrics should be available for students prior to completion of an assessment task so that success criteria are clear.

BSSS Achievement Standards for Science A Course – Year 11

	*A student who achieves an **A** grade typically*	*A student who achieves a **B** grade typically*	*A student who achieves a **C** grade typically*	*A student who achieves a **D** grade typically*	*A student who achieves an **E** grade typically*
Concepts, Models and Applications	• analyses the fundamental properties and functions of system components, processes and interactions, and how they are affected by factors across a range of temporal and spatial scales • analyses the nature, functions, limitations and applications of theories and models using evidence, in unfamiliar contexts • assesses evidence with reference to models and/or theories, and develops evidence-based conclusions and assesses limitations	• explains the fundamental properties and functions of system components, processes and interactions, and how they are affected by factors across a range of temporal and spatial scales • explains the nature, functions, limitations and applications of theories and models using evidence, in familiar contexts • explains evidence with reference to models and/or theories, and develops evidence-based conclusions and explains limitations	• describes the fundamental properties and functions of system components, processes and interactions, and how they are affected by factors across a range of temporal and spatial scales • describes the nature, functions, limitations and applications of theories and models with supporting evidence • describes evidence with reference to models and/or theories, and develops evidence-based conclusions and describes limitations	• identifies the fundamental properties and functions with some identification of system components and factors that affect processes across a range of temporal and spatial scales • identifies the nature, functions, applications, and some possible limitations of theories and models, with some evidence • identifies evidence, and develops conclusions with some reference to models and/or theories	• identifies the fundamental properties and functions with little or no identification of system components, processes, interactions and contextual scales • identifies the nature, function of theories and models, with an assertion of a few possible limitations • identifies evidence, and asserts conclusions with little or no reference to models and/or theories
Contexts	• analyses how the practice and applications of science meet needs, make decisions; and is influenced by social, economic, technological, and ethical factors	• explains how the practice and applications of science meet needs, make decisions, and is influenced by social, economic, technological, and ethical factors	• describes how the applications of science meet needs, make decisions, and is influenced by social, economic, technological, and ethical factors	• identifies ways in the applications of science meet needs, and is influenced by some factors	• identifies ways in which the application of science has been used in society to meet needs
Inquiry Skills	• designs, conducts and improves safe, ethical and original inquiries individually and collaboratively, that efficiently collect valid and reliable data in response to a complex question • analyses causal and correlational relationships, anomalies, reliability and validity of data and representations, and analyses errors • assesses processes and claims, provides a critique based on evidence, and discusses alternatives • reflects with insight on their own thinking and learning and evaluates planning, time management and use of appropriate strategies to work independently and collaboratively • communicates concisely, effectively and accurately, demonstrating scientific literacy in a range of modes, styles, representations, and genres for specific audiences and purposes, with appropriate evidence and accurate referencing	• designs, conducts and improves safe, ethical inquiries individually and collaboratively, that collect valid data in response to a complex question • explains causal and correlational relationships, anomalies, reliability and validity of data and representations, and explains errors • explains processes and claims, provides a critique with reference to evidence, and identifies alternatives • reflects on their own thinking and analyses planning, time management, use of appropriate strategies to work independently and collaboratively • communicates clearly and accurately, demonstrating scientific literacy in a range of modes, styles, representations and genres for specific audiences and purposes, with appropriate evidence and accurate referencing	• plans and conducts safe, ethical inquiries individually and collaboratively, that collect valid data in response to a question • describes relationships in data sets, reliability and validity of data and representations, and describes common errors • describes processes and claims, and identifies alternatives with some reference to evidence • reflects on their own thinking and explains planning, time management, use of appropriate strategies to work independently and collaboratively • communicates accurately demonstrating scientific literacy, in a range of modes, styles, representations, and genres for specific purposes, with appropriate evidence and mostly consistent referencing	• follows a procedure to conduct safe, ethical inquiries individually and collaboratively, to collect data in response to a question with varying success • identifies trends and anomalies in data and representations, with general comments about errors • identifies processes and claims, and identifies the need for improvements with some reference to evidence • reflects on their own thinking with some reference to planning, time management, use of appropriate strategies to work independently and collaboratively • communicates demonstrating some scientific literacy, in a range of modes, representations, and genres with some evidence and inconsistent referencing	• follows a procedure to conduct safe, ethical inquiries individually and collaboratively, to collect data with little or no connection to a question • identifies trends in data and representations, with little or no reference to anomalies and errors • identifies processes and the need for some improvements, with little or no reference to evidence • reflects on their own thinking with little or no reference to planning, time management, use of appropriate strategies to work independently and collaboratively • communicates demonstrating limited scientific literacy, in a range of modes and representations, with inconsistent and inaccurate referencing

BSSS Achievement Standards for Science A Course – Year 12

	*A student who achieves an **A** grade typically*	*A student who achieves a **B** grade typically*	*A student who achieves a **C** grade typically*	*A student who achieves a **D** grade typically*	*A student who achieves an **E** grade typically*
Concepts, Models and Applications	• analyses the fundamental properties and functions of system components, processes and interactions, and the effects of factors across a range of scales • analyse the nature, functions, limitations and applications of theories and models using evidence, in unfamiliar contexts • assesses evidence with reference to models and/or theories, and develops evidence-based conclusions and evaluates limitations	• explains the fundamental properties and functions of system components, processes and interactions, and the effects of factors across a range of scales • explains the nature, functions, limitations and applications of theories and models using evidence, in familiar contexts • explains evidence with reference to models and/or theories, and develops evidence-based conclusions and discusses limitations	• describes the fundamental properties and functions of system components, processes and interactions, and the effects of factors across a range of scales • describes the nature, functions, limitations and applications of theories and models using evidence, in familiar contexts • describes evidence with reference to models and/or theories, and develops evidence-based conclusions and identifies limitations	• describes the fundamental properties and functions of system components, processes and interactions, and the effects of one or more factors • describes the nature, functions, limitations and applications of theories and models with supporting evidence • describes evidence, and develops conclusions with some reference to models and/or theories	• identifies the fundamental properties and functions of system components, processes and interactions, and the effects of factors • identifies the nature, functions, applications, and some limitations of theories and models with some evidence • identifies evidence, and asserts conclusions with little or no reference to models and/or theories
Contexts	• analyses epistemology, role of peer review, collaboration and technology in developing knowledge • analyses the influence of social, economic, ethical and cultural factors on Science	• explains epistemology, role of peer review and technology in developing knowledge • explains the influence of social, economic, ethical and cultural factors on Science	• describes epistemology, role of peer review and technology in developing knowledge • describes the influence of social, economic, ethical and cultural factors on Science	• describes role of peer review and technology in developing knowledge • describes the influence of social, economic, ethical and cultural factors on Science	• identifies that scientific knowledge has changed over time • identifies the influence of social, economic, ethical and cultural factors on Science
Inquiry Skills	• designs, conducts and improves safe, ethical and original inquiries individually and collaboratively, that collect valid, reliable data in response to a complex question • analyses causal and correlational relationships, anomalies, reliability and validity of data and representations, and analyses errors • analyses processes and claims, and provides a critique based on evidence, and analyses alternatives • reflects with insight on own thinking and that of others and, evaluates planning, time management and use of appropriate independent and collaborative work strategies • communicates concisely, effectively and accurately, demonstrating scientific literacy in a range of modes, styles, representations, and genres for specific audiences and purposes, with appropriate evidence and accurate referencing	• designs, conducts and improves safe, ethical inquiries individually and collaboratively, that collect valid, reliable data in response to a question • analyses causal and correlational relationships, anomalies, reliability and validity of data and representations, and discusses errors • explains processes and claims, and provides a critique with reference to evidence, and proposes alternatives • reflects on their own thinking and analyses planning, time management, and use of appropriate independent and collaborative work strategies • communicates clearly and accurately, demonstrating scientific literacy in a range of modes, styles, representations and genres for specific audiences and purposes, with appropriate evidence and accurate referencing	• plans and conducts safe, ethical inquiries individually and collaboratively, that collect valid data in response to a familiar question • describes causal and correlational relationships, anomalies, reliability and validity of data and representations, and cites common errors • describes processes and claims, and identifies alternatives with reference to reliable evidence • reflects on their own thinking and explains planning, time management, and use of appropriate independent and collaborative work strategies • communicates accurately demonstrating scientific literacy, in a range of modes, styles, representations, and genres for specific purposes, with appropriate evidence and mostly consistent referencing	• follows a procedure to conduct safe, ethical inquiries individually and collaboratively, to collect data in response to a simple question with varying success • describes trends, relationships and anomalies in data, identifies anomalies, and some possible sources of error • describes processes and claims, and identifies the need for improvements with some reference to evidence • reflects on their own thinking, with reference to planning and the use of appropriate independent and collaborative work strategies • communicates demonstrating some scientific literacy, in a range of modes, representations, and genres with some evidence and inconsistent referencing	• follows a procedure to conduct safe, ethical inquiries individually and collaboratively, to collect data with little or no connection to a question • identifies trends and relationships in data, with little or no reference to sources of error • identifies processes and the need for some improvements, with little or no reference to evidence • reflects on their own thinking with little or no reference to planning, time management, and use of appropriate independent and collaborative work strategies • communicates demonstrating limited scientific literacy, in a range of modes and representations, with inconsistent and inaccurate referencing

Achievement Standards for Science M Course – Years 11 and 12

	*A student who achieves an **A** grade typically*	*A student who achieves a **B** grade typically*	*A student who achieves a **C** grade typically*	*A student who achieves a **D** grade typically*	*A student who achieves an **E** grade typically*
Concepts, Models and Applications	• describes the properties and functions of system components and processes with independence • describes system components and processes with some reference to how they are affected by factors with independence	• describes the properties and functions of system components, processes, and interactions with assistance • describes system components, processes, and interactions with some reference to how they are affected by factors with assistance	• identifies the properties and functions of system components, processes, and interactions with independence • identifies system components, processes, and interactions with independence	• identifies the properties and functions of system components, processes, and interactions with assistance • identifies system components, processes, and interactions with assistance	• identifies the properties and functions of system components, processes, and interactions with direct instruction • identifies system components, processes, and interactions with direct instruction
Contexts	• describes the impact of science on an aspect of society with independence	• describes the impact of science on an aspect of society with some independence	• identifies the impact of science on an aspect of society with independence	• identifies the impact of science on an aspect of society with assistance	• identifies the impact of science on an aspect of society with direct instruction
Inquiry Skills	• plans and conducts investigations in response to a question or problem with independence • draws evidence-based conclusions from investigations with independence • reflects on own thinking and learning in science with independence • communicates findings effectively with independence	• plans and conducts investigations in response to a question or problem with some independence • draws evidence-based conclusions from investigations with some independence • reflects on own thinking and learning in science with some independence • communicates findings effectively with some independence	• plans and conducts investigations in response to a question or problem with assistance • draws evidence-based conclusions from investigations with assistance • reflects on own thinking and learning in science with assistance • communicates findings with assistance	• plans and conducts investigations in response to a question or problem with repeated cueing • draws evidence-based conclusions from investigations with repeated cueing • reflects on own thinking and learning in science with repeated cueing • communicates findings with repeated cueing	• follows a procedure to conduct investigations to collect data with direct instruction • draws evidence-based conclusions from investigations with direct instruction • reflects on own thinking and learning in science with direct instruction • communicates findings with direct instruction

Biological Senior Science — Value: 1.0

Biological Senior Science a — **Value: 0.5**

Biological Senior Science b — **Value: 0.5**

Specific Unit Goals

This unit should enable students to:

A Course	M Course
• analyse the concepts underpinning the topic	• identify key concepts in the topic
• apply concepts to solve problems in real world situations	• use concepts to solve simple problems in real world situations
• use science inquiry skills to design, conduct, evaluate and communicate investigations	• use science inquiry skills
• analyse the impact of social and cultural influences on and within science	
• communicate scientific concepts in range of contexts using appropriate scientific terminology	• communicate scientific concepts in range of contexts using appropriate scientific terminology
• apply workplace health and safety skills	• apply workplace health and safety skills
• work independently and collaboratively	

Content Descriptions

All knowledge, understanding and skills below must be delivered:

A Course	M Course
Science Inquiry Skills	
• identify, research and construct questions for investigation within a concept	• research questions within a concept
• design investigations including the materials required, the type and amount of primary and secondary data required and conduct risk assessments and consider research ethics	
• conduct experiments including the use of techniques and collect valid data	• conduct experiments and collect data
• represent data in meaningful and useful ways, organise and describe trends, patterns and relationships, errors and limitations in data, use evidence to construct and justify conclusions	• identify trends and patterns from data
• interpret a range of scientific texts, explain claims and conclusions by considering the quality of the evidence presented	• identify key concepts
• communicate to specific audiences for specific purposes using appropriate language, nomenclature, genres and modes including scientific reports	• communicate to an audience
• construct and use models for scientific concepts	• use models to demonstrate a scientific concept

A Course	M Course
Science as a Human Endeavour	
• science is a global enterprise that relies on clear communication, international conventions, peer review and reproducibility • development of models and/or theories often requires a wide range of evidence from multiple individuals and across disciplines • advances in science understanding in one field can influence other areas of science, technology and engineering • the use of scientific knowledge will have beneficial and/or harmful and/or unintended consequences • scientific knowledge can be used to develop and explain projected economic, social and environmental impacts and to design action for sustainability	• science is fundamentally a communication • advances in science understanding in one field can influence other areas of science, technology and engineering • the use of scientific knowledge will have consequences • scientific knowledge is the basis of civilisation
Science Understanding	
• demonstrates knowledge and understanding of scientific concepts • explores models and theories that underpins the topic • examines the strength and limitations of models for explain and predicting complex phenomena • applies models and theories to new situations	• demonstrates knowledge and understanding of scientific concepts • understand that models are used to represent concepts • understand that models have limitations • match models to new situations

Electives

For a standard 1.0 unit, a student must study a minimum of TWO electives from below.

For a half-standard 0.5 unit, a student must study a minimum of ONE elective from below.

Health, Lifestyle and Diseases

In this elective, students will study:

- Lifestyle disease
- Health optimisation
- Diagnosis and treatment of diseases
- Exercise systems and physical fitness
- Basic body systems
- Immunity
- Genetic and infectious disease

Animal Science

In this elective, students will study:

- Breeding of domestic animals
- Common animal diseases and their treatment
- Animal care and maintenance
- Nutritional requirements for different animals
- Impact of feral animals on native species
- Biological control of feral populations
- Animal rights and welfare policies
- Animal living conditions
- Requirements for keeping native animals

Gardening Science

In this elective, students will study:

- Structure and function of plants. Seeds and fruit
- Plant reproduction – asexual and sexual
- Pest and weed control
- Propagation of plants
- Soil fertility
- Composting
- Growing vegetables
- Planning seasonal gardens
- Native and exotic plants
- Garden tool use and maintenance

Forensic Science

In this elective, students will study:

- crime scene and evidence
- fingerprint characteristics
- Blood composition and splatter patterns
- DNA profiling
- Entomology
- Hair and fibres
- Castings
- Ballistics
- Soil composition
- Chromatography
- Drug analysis and poisons

A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

Assessment

Refer to pages 13-15.

Environmental Senior Science — Value: 1.0

Environmental Senior Science a — **Value: 0.5**

Environmental Senior Science b — **Value: 0.5**

Specific Unit Goals

This unit should enable students to:

A Course	M Course
• analyse the concepts underpinning the topic	• identify key concepts in the topic
• apply concepts to solve problems in real world situations	• use concepts to solve simple problems in real world situations
• use science inquiry skills to design, conduct, evaluate and communicate investigations	• use science inquiry skills
• analyse the impact of social and cultural influences on and within science	
• communicate scientific concepts in range of contexts using appropriate scientific terminology	• communicate scientific concepts in range of contexts using appropriate scientific terminology
• apply workplace health and safety skills	• apply workplace health and safety skills
• work independently and collaboratively	

Content Descriptions

All knowledge, understanding and skills below must be delivered:

A Course	M Course
Science Inquiry Skills	
• identify, research and construct questions for investigation within a concept	• research questions within a concept
• design investigations including the materials required, the type and amount of primary and secondary data required and conduct risk assessments and consider research ethics	
• conduct experiments including the use of techniques and collect valid data	• conduct experiments and collect data
• represent data in meaningful and useful ways, organise and describe trends, patterns and relationships, errors and limitations in data, use evidence to construct and justify conclusions	• identify trends and patterns from data
• interpret a range of scientific texts, explain claims and conclusions by considering the quality of the evidence presented	• identify key concepts
• communicate to specific audiences for specific purposes using appropriate language, nomenclature, genres and modes including scientific reports	• communicate to an audience
• construct and use models for scientific concepts	• use models to demonstrate a scientific concept

A Course	M Course
Science as a Human Endeavour	
• science is a global enterprise that relies on clear communication, international conventions, peer review and reproducibility • development of models and/or theories often requires a wide range of evidence from multiple individuals and across disciplines • advances in science understanding in one field can influence other areas of science, technology and engineering • the use of scientific knowledge will have beneficial and/or harmful and/or unintended consequences • scientific knowledge can be used to develop and explain projected economic, social and environmental impacts and to design action for sustainability	• science is fundamentally a communication • advances in science understanding in one field can influence other areas of science, technology and engineering • the use of scientific knowledge will have consequences • scientific knowledge is the basis of civilisation
Science Understanding	
• demonstrates knowledge and understanding of scientific concepts • explores models and theories that underpins the topic • examines the strength and limitations of models for explain and predicting complex phenomena • applies models and theories to new situations	• demonstrates knowledge and understanding of scientific concepts • understand that models are used to represent concepts • understand that models have limitations • match models to new situations

Electives

For a standard 1.0 unit, a student must study a minimum of TWO electives from below.

For a half-standard 0.5 unit, a student must study a minimum of ONE elective from below.

Gardening Science

In this elective, students will study:

- Structure and function of plants. Seeds and fruit
- Plant reproduction – asexual and sexual
- Pest and weed control
- Propagation of plants
- Soil fertility
- Composting
- Growing vegetables
- Planning seasonal gardens
- Native and exotic plants
- Garden tool use and maintenance

Disaster Management

In this elective, students will study:

- Individual and community disaster management
- Disaster management plans
- Emergency responses
- Nature of disasters
- Types of disasters
- Man-made disasters
- Predicting disasters

Urban Sustainability

In this elective, students will study:

- Defining sustainability
- Recycling
- Water
- Organic waste
- Reduce, reuse
- Community systems
- Energy efficiency in the home
- Building design
- Energy systems
- Community systems
- Waste disposal
- Sewage
- Water

Astronomy

In this elective, students will study:

- The night skies
- Astronomy vs astrology
- Telescopes and tools
- Star navigations
- Satellites and emerging technologies
- Origin of the universe
- Galaxies and their formation
- Star lifecycles
- The solar system and its formation
- Earth moon system

Forensic Science

In this elective, students will study:

- Crime scene and evidence
- Fingerprint characteristics
- Blood composition and splatter patterns
- DNA profiling
- Entomology
- Hair and fibres
- Castings
- Ballistics
- Soil composition
- Chromatography
- Drug analysis and poisons

A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

Assessment

Refer to pages 13-15.

Chemical Senior Science — Value: 1.0

Chemical Senior Science a — **Value: 0.5**

Chemical Senior Science b — **Value: 0.5**

Specific Unit Goals

This unit should enable students to:

A Course	M Course
• analyse the concepts underpinning the topic	• identify key concepts in the topic
• apply concepts to solve problems in real world situations	• use concepts to solve simple problems in real world situations
• use science inquiry skills to design, conduct, evaluate and communicate investigations	• use science inquiry skills
• analyse the impact of social and cultural influences on and within science	
• communicate scientific concepts in range of contexts using appropriate scientific terminology	• communicate scientific concepts in range of contexts using appropriate scientific terminology
• apply workplace health and safety skills	• apply workplace health and safety skills
• work independently and collaboratively	

Content Descriptions

All knowledge, understanding and skills below must be delivered:

A Course	M Course
Science Inquiry Skills	
• identify, research and construct questions for investigation within a concept	• research questions within a concept
• design investigations including the materials required, the type and amount of primary and secondary data required and conduct risk assessments and consider research ethics	
• conduct experiments including the use of techniques and collect valid data	• conduct experiments and collect data
• represent data in meaningful and useful ways, organise and describe trends, patterns and relationships, errors and limitations in data, use evidence to construct and justify conclusions	• identify trends and patterns from data
• interpret a range of scientific texts, explain claims and conclusions by considering the quality of the evidence presented	• identify key concepts
• communicate to specific audiences for specific purposes using appropriate language, nomenclature, genres and modes including scientific reports	• communicate to an audience
• construct and use models for scientific concepts	• use models to demonstrate a scientific concept

A Course	M Course
Science as a Human Endeavour	
• science is a global enterprise that relies on clear communication, international conventions, peer review and reproducibility • development of models and/or theories often requires a wide range of evidence from multiple individuals and across disciplines • advances in science understanding in one field can influence other areas of science, technology and engineering • the use of scientific knowledge will have beneficial and/or harmful and/or unintended consequences • scientific knowledge can be used to develop and explain projected economic, social and environmental impacts and to design action for sustainability	• science is fundamentally a communication • advances in science understanding in one field can influence other areas of science, technology and engineering • the use of scientific knowledge will have consequences • scientific knowledge is the basis of civilisation
Science Understanding	
• demonstrates knowledge and understanding of scientific concepts • explores models and theories that underpins the topic • examines the strength and limitations of models for explain and predicting complex phenomena • applies models and theories to new situations	• demonstrates knowledge and understanding of scientific concepts • understand that models are used to represent concepts • understand that models have limitations • match models to new

Electives

For a standard 1.0 unit, a student must study a minimum of TWO electives from below.

For a half-standard 0.5 unit, a student must study a minimum of ONE elective from below.

Household Chemistry

In this elective, students will study:

- Acids, bases and salts and their role in the house
- Detergents soaps and their nature
- Dyes, bleaches and paints
- Baking soda and yeast
- Fermentation
- Storage and handling of household chemicals
- Medicines
- Disposal of household chemicals and waste
- Chemical reactions and the cooking process
- Food storage and hygiene

Hair Care and Cosmetics

In this elective, students will study:

- Structure and properties of hair
- Requirements for healthy hair
- Chemical composition of shampoos and conditioners
- Structure and properties of the skin
- Requirements for healthy skin
- Allergies and disorders of the skin
- Skin care products
- Perfumes and essential oils
- Make up and its application
- Animal testing ethics
- Nail care

Forensic Science

In this elective, students will study:

- crime scene and evidence
- fingerprint characteristics
- Blood composition and splatter patterns
- DNA profiling
- Entomology
- Hair and fibres
- Castings
- Ballistics
- Soil composition
- Chromatography
- Drug analysis and poisons

A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

Assessment

Refer to pages 13-15.

Physical Senior Science — Value: 1.0

Physical Senior Science a — **Value: 0.5**

Physical Senior Science b — **Value: 0.5**

Specific Unit Goals

This unit should enable students to:

A Course	M Course
• analyse the concepts underpinning the topic	• identify key concepts in the topic
• apply concepts to solve problems in real world situations	• use concepts to solve simple problems in real world situations
• use science inquiry skills to design, conduct, evaluate and communicate investigations	• use science inquiry skills
• analyse the impact of social and cultural influences on and within science	
• communicate scientific concepts in range of contexts using appropriate scientific terminology	• communicate scientific concepts in range of contexts using appropriate scientific terminology
• apply workplace health and safety skills	• apply workplace health and safety skills
• work independently and collaboratively	

Content Descriptions

All knowledge, understanding and skills below must be delivered:

A Course	M Course
Science Inquiry Skills	
• identify, research and construct questions for investigation within a concept	• research questions within a concept
• design investigations including the materials required, the type and amount of primary and secondary data required and conduct risk assessments and consider research ethics	
• conduct experiments including the use of techniques and collect valid data	• conduct experiments and collect data
• represent data in meaningful and useful ways, organise and describe trends, patterns and relationships, errors and limitations in data, use evidence to construct and justify conclusions	• identify trends and patterns from data
• interpret a range of scientific texts, explain claims and conclusions by considering the quality of the evidence presented	• identify key concepts
• communicate to specific audiences for specific purposes using appropriate language, nomenclature, genres and modes including scientific reports	• communicate to an audience
• construct and use models for scientific concepts	• use models to demonstrate a scientific concept

A Course	M Course
Science as a Human Endeavour	
• science is a global enterprise that relies on clear communication, international conventions, peer review and reproducibility • development of models and/or theories often requires a wide range of evidence from multiple individuals and across disciplines • advances in science understanding in one field can influence other areas of science, technology and engineering • the use of scientific knowledge will have beneficial and/or harmful and/or unintended consequences • scientific knowledge can be used to develop and explain projected economic, social and environmental impacts and to design action for sustainability	• science is fundamentally a communication • advances in science understanding in one field can influence other areas of science, technology and engineering • the use of scientific knowledge will have consequences • scientific knowledge is the basis of civilisation
Science Understanding	
• demonstrates knowledge and understanding of scientific concepts • explores models and theories that underpins the topic • examines the strength and limitations of models for explain and predicting complex phenomena • applies models and theories to new situations	• demonstrates knowledge and understanding of scientific concepts • understand that models are used to represent concepts • understand that models have limitations • match models to new situations

Electives

For a standard 1.0 unit, a student must study a minimum of TWO electives from below.

For a half-standard 0.5 unit, a student must study a minimum of ONE elective from below.

Transport

In this elective, students will study:

- Fuel types and combustion
- Internal combustion engine
- Rockets and ramjets
- Newton's three laws of motion, speed and acceleration
- Aerodynamics and design
- Consequences of collision, braking distances
- Environmental impact
- Vehicle design features for safety and fuel efficiency
- Biological impact of weightlessness and space travel
- Emerging transport technologies

Light and Sound

In this elective, students will study:

- Wave physics
- Sound waves and their properties
- Musical instruments
- The structure and function of ears
- The nature of light waves
- The electromagnetic spectrum and its applications
- Reflections, refractions and dispersion
- Optical instruments and cameras
- Structure and function of eyes
- Lasers and their applications
- Fibre optics

Electricity

In this elective, students will study:

- Electrical currents and fields
- Electric circuits
- Alternating and direct currents
- Voltage, current and resistance
- Energy usage in the home
- Electrical safety in the home
- Conductors and insulators
- Generation of electricity
- Alternative energy sources and generators
- Distribution of electricity

Forensic Science

In this elective, students will study:

- crime scene and evidence
- fingerprint characteristics
- Blood composition and splatter patterns
- DNA profiling
- Entomology
- Hair and fibres
- Castings
- Ballistics
- Soil composition
- Chromatography
- Drug analysis and poisons

A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

Assessment

Refer to pages 13-15.

Independent Study — Value: 1.0

Independent Study a — **Value: 0.5**

Independent Study b — **Value: 0.5**

Prerequisites

Independent Study units are only available to individual students in Year 12. A student can only study a maximum of one Independent Study unit in each course. Students must have studied at least three standard 1.0 units from this course. An Independent Study unit requires the principal's written approval. Principal approval can also be sought by a student in Year 12 to enrol concurrently in an Independent Study unit and their third 1.0 unit in this course of study.

Unit Description

An Independent Study unit has an important place in senior secondary courses. It is a valuable pedagogical approach that empowers students to make decisions about their own learning. An Independent Study unit can be proposed by an individual student for their own independent study and negotiated with their teacher. The program of learning for an Independent Study unit must meet the unit goals and content descriptions as they appear in the course.

Specific Unit Goals

This unit should enable students to:

A course	M course
• analyse the concepts underpinning the topic	• identify key concepts in the topic
• apply concepts to solve problems in real world situations	• use concepts to solve simple problems in real world situations
• use science inquiry skills to design, conduct, evaluate and communicate investigations	• use science inquiry skills
• analyse the impact of social and cultural influences on and within science	
• communicate scientific concepts in range of contexts using appropriate scientific terminology	• communicate scientific concepts in range of contexts using appropriate scientific terminology
• apply workplace health and safety skills	• apply workplace health and safety skills
• work independently and collaboratively	• identify key concepts in the topic

Content Descriptions

All knowledge, understanding and skills below must be delivered:

A Course	M Course
Science Inquiry Skills	
• identify, research and construct questions for investigation within a concept	• research questions within a concept
• design investigations including the materials required, the type and amount of primary and secondary data required and conduct risk assessments and consider research ethics	
• conduct experiments including the use of techniques and collect valid data	• conduct experiments and collect data

A Course	M Course
• represent data in meaningful and useful ways, organise and describe trends, patterns and relationships, errors and limitations in data, use evidence to construct and justify conclusions	• identify trends and patterns from data
• interpret a range of scientific texts, explain claims and conclusions by considering the quality of the evidence presented	• identify key concepts
• communicate to specific audiences for specific purposes using appropriate language, nomenclature, genres and modes including scientific reports	• communicate to an audience
• construct and use models for scientific concepts	• use models to demonstrate a scientific concept
Science as a Human Endeavour	
• science is a global enterprise that relies on clear communication, international conventions, peer review and reproducibility	• science is fundamentally a communication
• development of models and/or theories often requires a wide range of evidence from multiple individuals and across disciplines	
• advances in science understanding in one field can influence other areas of science, technology and engineering	• advances in science understanding in one field can influence other areas of science, technology and engineering
• the use of scientific knowledge will have beneficial and/or harmful and/or unintended consequences	• the use of scientific knowledge will have consequences
• scientific knowledge can be used to develop and explain projected economic, social and environmental impacts and to design action for sustainability	• scientific knowledge is the basis of civilisation
Science Understanding	
• demonstrates knowledge and understanding of scientific concepts	• demonstrates knowledge and understanding of scientific concepts
• explores models and theories that underpins the topic	• understand that models are used to represent concepts
• examines the strength and limitations of models for explain and predicting complex phenomena	• understand that models have limitations
• applies models and theories to new situations	• match models to new situations

A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

Assessment

Refer to pages 13-15.

Appendix A – Implementation Guidelines

Available course patterns

A standard 1.0 value unit is delivered over at least 55 hours. To be awarded a course, students must complete at least the minimum units over the whole minor, major, major/minor or double major course.

Course	Number of standard units to meet course requirements
Minor	Minimum of 2 units
Major	Minimum of 3.5 units

Units in this course can be delivered in any order.

Prerequisites for the course or units within the course

Students must have studied at least three standard 1.0 units from this course in order to access the Independent Study unit. An Independent Study unit requires the principal's written approval. Principal approval can also be sought by a student in Year 12 to enrol concurrently in an Independent Study unit and their third 1.0 unit in this course of study.

Arrangements for students continuing study in this course

Students who studied the previous course may undertake any units in this course provided there is no duplication of content.

Implementation Guidelines

The following table outlines the standard 1.0 units and electives in each unit.

	Biological Senior Science	Environmental Senior Science	Chemical Senior Science	Physical Senior Science
Electives	• Health, Lifestyle and Disease • Animal Science • Gardening Science • Forensic science	• Gardening Science • Disaster Management • Urban Sustainability • Astronomy • Forensic Science	• Household Chemistry • Hair Care and Cosmetics • Forensic Science	• Transport • Light and Sound • Electricity • Forensic Science

Duplication of Content Rules

Students cannot be given credit towards the requirements for a Senior Secondary Certificate for a unit that significantly duplicates content in a unit studied in another course. The responsibility for preventing undesirable overlap of content studied by a student rests with the principal and the teacher delivering the course. Students will only be given credit for covering the content once.

Guidelines for Delivery

Program of Learning

A program of learning is what a school provides to implement the course for a subject. This meets the requirements for context, scope and sequence set out in the Board endorsed course. Students follow programs of learning in a college as part of their senior secondary studies. The detail, design and layout of a program of learning are a college decision.

The program of learning must be documented to show the planned learning activities and experiences that meet the needs of particular groups of students, taking into account their interests, prior knowledge, abilities and backgrounds. The program of learning is a record of the learning experiences that enable students to achieve the knowledge, understanding and skills of the content descriptions. There is no requirement to submit a program of learning to the OBSSS for approval. The Principal will need to sign off at the end of Year 12 that courses have been delivered as accredited.

Content Descriptions

Are all content descriptions of equal importance? No. It depends on the focus of study. Teachers can customise their program of learning to meet their own students' needs, adding additional content descriptions if desired or emphasising some over others. A teacher must balance student needs with their responsibility to teach all content descriptions. It is mandatory that teachers address all content descriptions and that students engage with all content descriptions.

Half standard 0.5 units

Half standard units appear on the course adoption form but are not explicitly documented in courses. It is at the discretion of the college principal to split a standard 1.0 unit into two half standard 0.5 units. Colleges are required to adopt the half standard 0.5 units. However, colleges are not required to submit explicit documentation outlining their half standard 0.5 units to the BSSS. Colleges must assess students using the half standard 0.5 assessment task weightings outlined in the framework. It is the responsibility of the college principal to ensure that all content is delivered in units approved by the Board.

System Moderation

System moderation begins in schools whereby teachers cooperate to develop assessment, and grade and score student assessment according to the relevant curriculum.

Moderation Day is an essential component of the ACT senior secondary system which empowers school autonomy in curriculum and assessment. Moderation Day is a collaborative and professional event whereby schools undertake system quality assurance activities on behalf of their current and future students. Moderation Day fosters and enriches the development of quality assessment and validates student achievement. Continued best practice in teaching and learning is ensured through the formation of valid, constructive, and detailed feedback.

System Moderation:

- provides comparability of school-based assessment
- forms the basis for valid and reliable assessment in senior secondary schools
- involves the ACT Board of Senior Secondary Studies (BSSS) and schools in cooperation and partnership
- maintains the integrity of the ACT Senior Secondary Certificate.

The Moderation Model

Moderation within the ACT senior secondary system encompasses structured, consensus-based peer review of Unit Grades and quality of assessment for all BSSS courses twice per year. In addition to System Moderation, there is statistical moderation of course scores.

Moderation by Structured, Consensus-based Peer Moderation

Consensus-based peer moderation involves the review of student assessment against system wide criteria and standards and the validation of Unit Grades. This is done by matching student performance with the Framework Achievement Standards. In addition, feedback will be provided on the quality of the task.

Preparation for Structured, Consensus-based Peer Review

Schools retain originals or copies of student assessment evidence completed in the delivery of the unit and all unit documentation. Student assessment evidence must be sufficient to allow reviewing teachers to make an accurate judgment of grade standard. Schools will use ACS to present this information for System Moderation. Criteria for each Moderation Day will be communicated to schools in the proceeding calendar year.

Feedback from System Moderation

Feedback is provided to schools to affirm good practice and inform continuous improvement. This feedback is based on the BSSS Quality Assessment Guidelines and relevant course documents. It is expected that schools engage with feedback and address any longitudinal trends as outlined in the *BSSS Policy and Procedures Manual*.

Appendix B – Course Developers

Name	College
Judy Bolton	Canberra College
Trudy Cheesman	Gungahlin College

Appendix C – Common Curriculum Elements

Common curriculum elements assist in the development of high-quality assessment tasks by encouraging breadth and depth and discrimination in levels of achievement.

Organisers	Elements	Examples
create, compose and apply	apply	ideas and procedures in unfamiliar situations, content and processes in non-routine settings
	compose	oral, written and multimodal texts, music, visual images, responses to complex topics, new outcomes
	represent	images, symbols or signs
	create	creative thinking to identify areas for change, growth and innovation, recognise opportunities, experiment to achieve innovative solutions, construct objects, imagine alternatives
	manipulate	images, text, data, points of view
analyse, synthesise and evaluate	justify	arguments, points of view, phenomena, choices
	hypothesise	statement/theory that can be tested by data
	extrapolate	trends, cause/effect, impact of a decision
	predict	data, trends, inferences
	evaluate	text, images, points of view, solutions, phenomenon, graphics
	test	validity of assumptions, ideas, procedures, strategies
	argue	trends, cause/effect, strengths and weaknesses
	reflect	on strengths and weaknesses
	synthesise	data and knowledge, points of view from several sources
	analyse	text, images, graphs, data, points of view
	examine	data, visual images, arguments, points of view
	investigate	issues, problems
organise, sequence and explain	sequence	text, data, relationships, arguments, patterns
	visualise	trends, futures, patterns, cause and effect
	compare/contrast	data, visual images, arguments, points of view
	discuss	issues, data, relationships, choices/options
	interpret	symbols, text, images, graphs
	explain	explicit/implicit assumptions, bias, themes/arguments, cause/effect, strengths/weaknesses
	translate	data, visual images, arguments, points of view
	assess	probabilities, choices/options
	select	main points, words, ideas in text
identify, summarise and plan	reproduce	information, data, words, images, graphics
	respond	data, visual images, arguments, points of view
	relate	events, processes, situations
	demonstrate	probabilities, choices/options
	describe	data, visual images, arguments, points of view
	plan	strategies, ideas in text, arguments
	classify	information, data, words, images
	identify	spatial relationships, patterns, interrelationships
	summarise	main points, words, ideas in text, review, draft and edit

Appendix D – Glossary of Verbs

Verbs	Definition
Analyse	Consider in detail for the purpose of finding meaning or relationships, and identifying patterns, similarities and differences
Apply	Use, utilise or employ in a particular situation
Argue	Give reasons for or against something
Assess	Make a Judgement about the value of
Classify	Arrange into named categories in order to sort, group or identify
Compare	Estimate, measure or note how things are similar or dissimilar
Compose	The activity that occurs when students produce written, spoken, or visual texts
Contrast	Compare in such a way as to emphasise differences
Create	Bring into existence, to originate
Critically analyse	Analysis that engages with criticism and existing debate on the issue
Demonstrate	Give a practical exhibition an explanation
Describe	Give an account of characteristics or features
Discuss	Talk or write about a topic, taking into account different issues or ideas
Evaluate	Examine and judge the merit or significance of something
Examine	Determine the nature or condition of
Explain	Provide additional information that demonstrates understanding of reasoning and /or application
Extrapolate	Infer from what is known
Hypothesise	Put forward a supposition or conjecture to account for certain facts and used as a basis for further investigation by which it may be proved or disproved
Identify	Recognise and name
Interpret	Draw meaning from
Investigate	Planning, inquiry into and drawing conclusions about
Justify	Show how argument or conclusion is right or reasonable
Manipulate	Adapt or change
Plan	Strategize, develop a series of steps, processes
Predict	Suggest what might happen in the future or as a consequence of something
Reflect	The thought process by which students develop an understanding and appreciation of their own learning. This process draws on both cognitive and affective experience
Relate	Tell or report about happenings, events or circumstances
Represent	Use words, images, symbols or signs to convey meaning
Reproduce	Copy or make close imitation
Respond	React to a person or text
Select	Choose in preference to another or others
Sequence	Arrange in order
Summarise	Give a brief statement of the main points
Synthesise	Combine elements (information/ideas/components) into a coherent whole
Test	Examine qualities or abilities
Translate	Express in another language or form, or in simpler terms
Visualise	The ability to decode, interpret, create, question, challenge and evaluate texts that communicate with visual images as well as, or rather than, words

Appendix E – Glossary for ACT Senior Secondary Curriculum

Courses will detail what teachers are expected to teach and students are expected to learn for year 11 and 12. They will describe the knowledge, understanding and skills that students will be expected to develop for each learning area across the years of schooling.

Learning areas are broad areas of the curriculum, including English, mathematics, science, the arts, languages, health and physical education.

A **subject** is a discrete area of study that is part of a learning area. There may be one or more subjects in a single learning area.

Frameworks are system documents for Years 11 and 12 which provide the basis for the development and accreditation of any course within a designated learning area. In addition, frameworks provide a common basis for assessment, moderation and reporting of student outcomes in courses based on the framework.

The **course** sets out the requirements for the implementation of a subject. Key elements of a course include the rationale, goals, content descriptions, assessment, and achievement standards as designated by the framework.

BSSS courses will be organised into units. A unit is a distinct focus of study within a course. A standard 1.0 unit is delivered for a minimum of 55 hours generally over one semester.

Core units are foundational units that provide students with the breadth of the subject.

Additional units are avenues of learning that cannot be provided for within the four core 1.0 standard units by an adjustment to the program of learning.

An **Independent Study unit** is a pedagogical approach that empowers students to make decisions about their own learning. Independent Study units can be proposed by a student and negotiated with their teacher but must meet the specific unit goals and content descriptions as they appear in the course.

An **elective** is a lens for demonstrating the content descriptions within a standard 1.0 or half standard 0.5 unit.

A **lens** is a particular focus or viewpoint within a broader study.

Content descriptions refer to the subject-based knowledge, understanding and skills to be taught and learned.

A **program of learning** is what a college develops to implement the course for a subject and to ensure that the content descriptions are taught and learned.

Achievement standards provide an indication of typical performance at five different levels (corresponding to grades A to E) following completion of study of senior secondary course content for units in a subject.

ACT senior secondary system **curriculum** comprises all BSSS approved courses of study.

Appendix F – Course Adoption

Conditions of Adoption

The course and units of this course are consistent with the philosophy and goals of the college and the adopting college has the human and physical resources to implement the course.

Adoption Process

Course adoption must be initiated electronically by an email from the principal or their nominated delegate to bssscertification@ed.act.edu.au. A nominated delegate must CC the principal.

The email will include the **Conditions of Adoption** statement above, and the table below adding the **College** name, and circling the **Classification/s** required.

College:	
Course Title:	Senior Science
Classification/s:	A M
Accredited from:	2017
Framework:	Science