SCIENCE

Course Framework

From 2014

SCIENCE COURSE FRAMEWORK

INTRODUCTION

All courses of study for the ACT Year 12 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) capability
- Critical and creative thinking
- Personal and social capability
- Ethical behaviour
- Intercultural understanding.

Courses of study for the ACT Year 12 Certificate should be both relevant to the lives of students and incorporate the contemporary issues they face. Hence, courses address the following three priorities are:

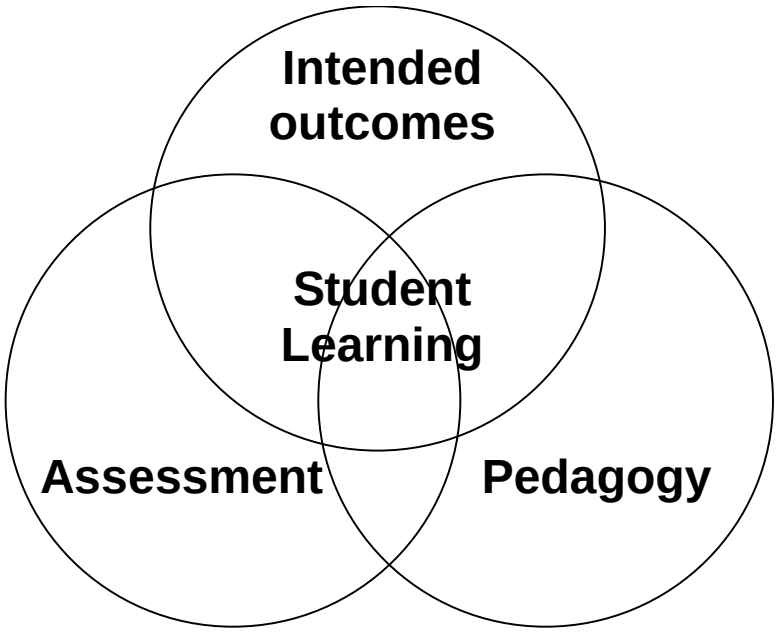
- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability.

Elaboration of these student capabilities and priorities are available on the ACARA website at: www.australiancurriculum.edu.au.

COURSE FRAMEWORKS

Course Frameworks provide the basis for the development and accreditation of any course within a broad subject area and provide a common basis for the assessment, moderation and reporting of student outcomes in courses based on the Framework.

Course Frameworks support a model of learning that integrates intended student outcomes, pedagogy and assessment. This model is underpinned by a set of beliefs and a set of learning principles.



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)

Scope of Science Course Framework

The scope of the Science Course Framework includes, but is not limited to, the following senior secondary Australian Curriculum courses:

- Chemistry
- Physics
- Earth and Environmental Science
- Biology.

This document should be read in conjunction with the senior secondary English Australian Curriculum courses. Copies of these documents are available at www.australiancurriculum.edu.au.

A, T, V and M courses may be developed under this framework. Eligibility to study an M course is determined by BSSS Modified course policy. Modified courses/units are designed for students:

- who satisfy the Education and Training Directorate Disability Criteria accepted as a common definition for census and other system processes by all sectors, public and non-government,
- where the principal has deemed exceptional circumstances due to the students' significant needs and previous levels of support.

Provisions for students with special needs are outlined in the *BSSS Equitable Assessment and Special Consideration in Assessment in Years 11 and 12* guidelines.

RATIONALE

There is an innate human curiosity and desire to understand the universe. The study of 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

All courses based on this Course Framework 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.

Literacy in Science

Literacy is important in students' development of *Science Inquiry Skills* and their understanding of content presented through the *Science Understanding* and *Science as a Human Endeavour* strands. Students gather, interpret, synthesise and critically analyse information presented in a wide range of genres, modes and representations (including text, flow diagrams, symbols, graphs and tables). They evaluate information sources and compare and contrast ideas, information and opinions presented within and between texts. They communicate processes and ideas logically and fluently and structure evidence-based arguments, selecting genres and employing appropriate structures and features to communicate for specific purposes and audiences.[1]

Numeracy in Science

Numeracy is key to students' ability to apply a wide range of *Science Inquiry Skills*, including making and recording observations; ordering, representing and analysing data; and interpreting trends and relationships. They employ numeracy skills to interpret complex spatial and graphic representations, and to appreciate the ways in which systems are structured, interact and change across spatial and temporal scales. They engage in analysis of data, including issues relating to reliability and probability, and they interpret and manipulate mathematical relationships to calculate and predict values.[2]

[1] Senior Secondary Science Australian Curriculum

[2] Senior Secondary Science Australian Curriculum

Concepts, Knowledge and Skills

Courses developed under this Framework provide details of course content through the component units of the course. While this content will differ according to the particular course, all content will be chosen to enable students to work towards the achievement of the common and agreed goals of the Framework.

Overview

Science has three interrelated strands: Science Inquiry Skills, Science as a Human Endeavour and Science Understanding. 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.

Generic inquiry 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.

Courses developed under this Course Framework may incorporate an extended scientific investigation.

Science as a Human Endeavour

The use and influence of science are shaped by interactions between science and a wide range of social, economic, ethical and cultural factors. Scientific knowledge is continually reviewed and 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.

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.

Science Understanding

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 complex phenomena.

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.

Science Understanding should be developed through the selection of contexts that have relevance to and are engaging for students.

Vocational Courses

In addition to the concepts, knowledge and skills, colleges with Registered Training Organisation (RTO) status are eligible to deliver qualifications or statements of attainment from national training packages. In order to do so they must have been granted scope by the Australian Skills Quality Authority (ASQA). Vocational courses may be classified as A/V, T/V, M/V or C. Competencies are embedded into course units and must reflect the packaging rules of the relevant training package for students to achieve the qualification level indicated.

Colleges with Registered Training Organization status (RTO) are eligible to deliver units of competence from Training Packages, or alternatively, they may develop vocational courses, classified as A or T based on the Training Packages, under the relevant Course Framework.

TEACHING STRATEGIES

Course developers are encouraged to outline teaching strategies that are grounded in the Learning Principles and encompass quality teaching. Pedagogical techniques and assessment tasks should promote intellectual quality, establish a rich learning environment and generate relevant connections between learning and life experiences.

Teaching strategies that are particularly relevant and effective in Science include, but are not limited to the following techniques.

Review prior learning

- brainstorming
- individual, pair and group work
- student reflection of relevant concepts and skills

Introduce new material

- exposure to quality visual imagery/materials through a variety of media
- teacher demonstration
- discovery based experimentation
- Provide demonstration, guided practice and application
- teacher demonstration, modelling and peer tutoring
- experimentation
- teacher scaffolding to facilitate analysis of material
- engagement of scientists, including guest speakers, demonstrators and mentors
- establish links with relevant industry individuals and groups
- simulated real life and work scenarios
- online materials
- scientists in schools

Promote independent practice and application

- research strategies and time management
- problem solving strategies
- mentoring
- practice and reinforcement of learning by way of revision, worksheets, tests and demonstrations
- regular and meaningful feedback
- discussions, debates and student presentations
- evaluation and synthesis of data

Link to next task or skill area

- links with the scientific community through excursions, field trips, laboratories , exhibition and industry visits, and engagement with scientists in the classroom

For Modified courses, teaching strategies should be underpinned by the principles of the Disability Discrimination Act and reflect contemporary pedagogical practices in meeting the needs of students with specific learning deficits or disabilities.

ASSESSMENT

The identification of assessment criteria and assessment tasks types and weightings provide 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 of 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 A). It is highly desirable that assessment tasks engage students in demonstrating higher order thinking.

Rubrics use 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.

VET Assessment

In addition, tasks provide evidence required to deem a student competent. Elements of competence for each Unit of Competency indicate the essential concepts and knowledge that underpin each skill or skills set. Some Training Packages have a mandatory structured work learning (SWL) placement where skills may be demonstrated in an industry setting.

Assessment Criteria

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

- knowledge and understanding
- critical thinking
- investigative skills
- communication skills
- effective work practices

Assessment Task Types

Assessment for A Courses

Suggested task types:	Strands			Weighting for 1.0 and 0.5 units	Weighting for Project based units
	Inquiry skills	Human endeavour	Understanding		
log book	✓	*	✓	40-60%	40-100%
practical report	✓	*	✓		
research assignment	*	✓	✓		
presentations	*	✓	✓		
investigative project	✓	✓	✓		
essay	*	✓	✓		
models	✓	*	✓		
test/quizzes	*	✓	✓	40-60%	0-60%
practical skills test	✓	*	✓		

Key:

This table is designed to highlight types of tasks which address different content descriptors and assessment criteria. Teachers are reminded that any single task can incorporate multiple assessment strands.

✓ highly relevant - These tasks will have a clear link to the content descriptors and assessment strands.

*** some relevance - These tasks have some links to the content descriptors and assessment strands.**

Additional Assessment Advice for A Courses

- For a standard 1.0 unit, a minimum of **three** and a maximum of **five** assessment items.
- For a half-standard 0.5 unit, minimum of **two** and a maximum of **three** assessment items.
- Each unit (standard 1.0 or half standard 0.5) should include at least 2 different types of tasks. It is recommended that, in standard units, no assessment item should carry a weighting of less than 10% or greater than 45% of the unit assessment.
- A variety of task types and modes of presentations should be used during the course.
- It is recommended that an open-ended 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.

Assessment Task Types

Assessment for T Courses

Suggested task types:	Strands			Weighting for 1.0 and 0.5 units	Weighting for Project based units
	Inquiry skills	Human endeavour	Understanding		
log book	✓	*	✓	40-60%	40-100%
practical report	✓	*	✓		
research assignment	*	✓	✓		
presentations	*	✓	✓		
investigative project	✓	✓	✓		
essay	*	✓	✓		
models	✓	*	✓		
test/quizzes	*	✓	✓	40-60%	0-60%
practical skills test	✓	*	✓		

Key:

This table is designed to highlight types of tasks which address different content descriptors and assessment criteria. Teachers are reminded that any single task can incorporate multiple assessment strands.

✓ highly relevant - These tasks will have a clear link to the content descriptors and assessment strands.

*** some relevance - These tasks have some links to the content descriptors and assessment strands.**

Additional Assessment Advice for T Courses

- For a standard 1.0 unit, a minimum of **three** and a maximum of **five** assessment items.
- For a half-standard 0.5 unit, minimum of **two** and a maximum of **three** assessment items.
- Each unit (standard 1.0 or half standard 0.5) should include at least 2 different types of tasks. It is recommended that, in standard units, no assessment item should carry a weighting of less than 10% or greater than 45% of the unit assessment.
- A variety of task types and modes of presentations should be used during the course.
- It is recommended that an open-ended 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.

Assessment Task Types

Assessment for M Courses

Suggested task types	Strands			Weighting for 1.0 and 0.5 units
	Inquiry skills	Human endeavour	Understanding	
log book	✓	*	✓	10-90%
practical report	✓	*	✓	
research assignment	*	✓	✓	
presentations	*	✓	✓	
investigative project	✓	✓	✓	
essay	*	✓	✓	
models	✓	*	✓	
test/quizzes	*	✓	✓	10-90%
practical skills test	✓	*	✓	

Key:

This table is designed to highlight types of tasks which address different content descriptors and assessment criteria. Teachers are reminded that any single task can incorporate multiple assessment strands.

✓ highly relevant - These tasks will have a clear link to the content descriptors and assessment strands.

*** some relevance - These tasks have some links to the content descriptors and assessment strands.**

Additional Assessment Advice for M Courses

- For a standard 1.0 unit, a minimum of **three** and a maximum of **five** assessment items.
- For a half-standard 0.5 unit, minimum of **two** and a maximum of **three** assessment items.
- Each unit (standard 1.0 or half standard 0.5) should include at least 2 different types of tasks. It is recommended that, in standard units, no assessment item should carry a weighting of less than 10% or greater than 45% of the unit assessment.
- A variety of task types and modes of presentations should be used during the course.
- It is recommended that an open-ended 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.

Achievement Standards

Grade descriptors provide a guide for teacher judgement of students' achievement, based on the assessment criteria, over a unit of work in this subject. Grades are organized on an A - E basis and represent standards of achievement.

Grades are awarded on the proviso that the assessment requirements have been met. Teachers will consider, when allocating grades, the degree to which students demonstrate their ability to complete and submit tasks within a specified time frame.

The following descriptors are consistent with the **system grade descriptors** which describe generic standards of student achievement across all courses.

All students, regardless of **A or T course** enrolment, have the goal of improving their learning and should all strive to achieve higher order thinking and investigative skills. Both **A and T courses** should extend students in all aspects of their learning.

In interpreting the following grade descriptors for A and T courses, the key differences to consider are the context of the course, the depth of understanding and application of concepts and the weighting of assessment tasks.

VET

Students must demonstrate competency according to training package and industry requirements. Achievement benchmarks are documented as elements of competence under each Unit of Competency.

Science Unit Grade Descriptors for A courses

	*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*
Knowledge and understanding	• demonstrates thorough knowledge and understanding of scientific concepts presented • selects and applies knowledge to solve challenging problems in a wide range of contexts, distinguishes ideas and assesses the significance of the scientific evidence presented	• demonstrates broad knowledge and understanding of scientific concepts presented • applies knowledge to solve problems in a range of contexts, identifies ideas and explains the significance of the scientific evidence presented	• demonstrates general knowledge and understanding of scientific concepts presented • applies knowledge to solve general problems in a narrow range of contexts, identifies ideas and describes the scientific evidence presented	• demonstrates basic knowledge of scientific ideas • applies knowledge to solve basic problems, identifies ideas and describes the scientific evidence presented	• demonstrates little knowledge of scientific ideas • demonstrates limited ability to solve basic problems, identifies scientific evidence presented
Critical thinking	• recognises complex patterns and trends in data, observations and investigations to develop valid inferences • interprets and explains data/information collected	• recognises patterns and trends in data, observations and investigations to develop inferences • interprets and describes data/information collected	• recognises most patterns and trends in data, observations and investigations • identifies and describes data/information collected	• recognises simple patterns and trends in data, observations and investigations • identifies &/or describes some data/information collected	• recognises little or no patterns and trends in data and observations • shows limited understanding of data/information
Investigative skills	• performs scientific investigations with proficiency and effectiveness • selects and uses appropriate resources and equipment efficiently and in a safe and correct manner	• performs scientific investigations with proficiency • selects and uses appropriate resources and equipment in a safe and correct manner	• performs scientific investigations adequately • demonstrates general awareness of appropriate resources and safety requirements	• performs scientific investigations with inconsistencies • shows some understanding of using appropriate resources and equipment safely	• performs scientific investigations with limited understanding • uses equipment and resources with little awareness of safety
Communication	• presents and communicates scientific concepts in detail using scientific terminology accurately and documents all information correctly using a recognised referencing system	• presents and communicates scientific concepts in some detail using appropriate scientific terminology and documents information correctly using a recognised referencing system	• presents and communicates scientific concepts with some detail, using scientific terminology and a recognised referencing system inconsistently	• presents and communicates scientific concepts with little attention to detail, occasionally using scientific terminology and a recognised referencing system	• presents and communicates scientific concepts with limited or no attention to details including scientific terminology and a recognised referencing system
Work practices	• works highly effectively in both individual and collaborative contexts and understands risks and acts safely in all investigations	• works effectively in collaborative and individual contexts and understands risks and acts safely in all investigations	• works with a degree of effectiveness in individual and collaborative contexts, identifies risks and mostly acts safely in investigations	• works with limited effectiveness in individual and collaborative contexts & inconsistently identifies risks and acts safely in investigations	• works in individual and collaborative contexts under direct supervision with minimal awareness of risks and appropriate safe behaviours in investigations

Science Unit Grade Descriptors for T courses

	*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*
Knowledge and Understanding	• demonstrates thorough and extensive knowledge and understanding of scientific concepts • justifies and applies knowledge to familiar and unfamiliar contexts and across different concept areas and experiences, displays originality and lateral thinking in problem solving	• demonstrates broad and in-depth knowledge and understanding of scientific concepts • applies knowledge to familiar and unfamiliar contexts and across different concept areas and experiences, displaying originality and effective thinking in problem solving	• demonstrates broad and general knowledge and understanding of scientific concepts • is able to apply knowledge in a variety of contexts and different concept areas to solve problems	• demonstrates general and basic knowledge and understanding of scientific concepts • is able to use knowledge in different areas to solve problems	• demonstrates a limited knowledge of scientific concepts • displays emerging awareness of strategies to solve problems
Critical Thinking	• evaluates, synthesises and analyses patterns and trends in data, observations and investigations and makes valid and perceptive inferences • applies highly effective analytical and evaluative skills, makes perceptive connections between scientific concepts, draws accurate conclusions and proposes appropriate improvements	• analyses and synthesises patterns and trends in data, observations and investigations and makes valid inferences • applies effective analytical skills, makes insightful connections between scientific concepts, draws mostly accurate conclusions and proposes appropriate improvements	• describes and explains patterns and trends in data, observations and investigations and makes general inferences • describes and explains general connections between scientific concepts, draws conclusions and proposes improvements	• identifies and describes patterns in data, observations and investigations and makes simple inferences • describes connections between scientific concepts, draws conclusions and proposes improvements	• identifies patterns in data, observations and investigations • identifies connections between scientific concepts
Investigative Skills	• demonstrates logical and coherent investigations, acknowledges information using referencing conventions and operates equipment highly effectively and safely	• demonstrates well considered investigations, acknowledges information using referencing conventions and operates equipment effectively and safely	• demonstrates considered investigations, acknowledges information using referencing conventions and operates equipment safely with some general effectiveness	• outlines investigations, inconsistently acknowledges information using referencing conventions and mostly operates equipment effectively and safely	• displays emerging skills in investigations, attempts to acknowledge information and operates equipment with limited awareness of safety procedures
Communication	• presents highly complex concepts accurately and coherently in a wide range of written and non written formats using appropriate terminology with flair	• presents concepts clearly and logically in a range of written and non written formats using appropriate terminology with confidence	• presents general concepts clearly in a range of written and non written formats using appropriate terminology generally using terminology appropriately	• presents basic concepts in a narrow range of written and non written formats using terminology inconsistently	• presents some basic concepts in a limited range of written & non written formats using minimal terminology
Work practices	• organises time and resources to work in a highly productive and safe manner both independently and in a team • evaluates and analyses risks, acts highly appropriately in all investigations	• organises time and resources to work in a productive and safe manner both independently and in a team • analyses and explains risks and acts appropriately in all investigations	• organises time and resources to work in a generally productive and safe manner both independently and in a team • identifies and describes risks and acts appropriately in all investigations	• demonstrates inconsistent organisation of time & resources, works with occasional productivity & some awareness of safety independently or in a group • identifies risks and acts mostly appropriately in investigations	• demonstrates limited organisation of time & resources to work with an emerging awareness of safety • demonstrates an emerging awareness of risks, developing approaches to investigations

Science Unit Grade Descriptors for M courses

	*A student who achieves an **A** grade typically, independently*	*A student who achieves a **B** grade typically, with some assistance*	*A student who achieves a **C** grade typically, with occasional assistance*	*A student who achieves a **D** grade typically, with continuous guidance*	*A student who achieves an **E** grade typically, with direct instruction*
Knowledge and understanding	• demonstrates knowledge and understanding of scientific concepts	• demonstrates knowledge and understanding of scientific concepts	• demonstrates knowledge and understanding of scientific concepts	• demonstrates basic knowledge of scientific ideas	• demonstrates knowledge of scientific ideas
Critical thinking	• interprets data/information collected	• describes data/information collected	• identifies data/information collected	• identifies some data/information collected	• shows basic understanding of data/information
Investigative skills	• selects and uses appropriate resources and equipment efficiently and in a safe and correct manner	• selects and uses appropriate resources and equipment in a safe and correct manner	• uses appropriate resources and equipment in a safe and correct manner	• uses resources and equipment in a safe and correct manner	• uses equipment and resources with little awareness of safety
Communication	• communicates basic scientific concepts with accurate use of scientific terminology	• communicates basic scientific concepts with some accurate use of scientific terminology	• communicates simple scientific concepts with some use of scientific terminology	• communicates simple scientific concepts with some use of scientific terminology	• communicates simple scientific concepts with limited use of scientific terminology
Work practices	• works effectively in both individual and collaborative contexts	• works effectively in collaborative and individual contexts	• works with a degree of effectiveness in individual and collaborative contexts	• works with limited effectiveness in individual and collaborative contexts	• works in individual and collaborative contexts

MODERATION

Moderation is a system designed and implemented to:

- provide comparability in the system of school-based assessment
- form the basis for valid and reliable assessment in senior secondary schools
- involve the ACT Board of Senior Secondary Studies and colleges in cooperation and partnership
- maintain the quality of school-based assessment and the credibility, validity and acceptability of Board certificates.

Moderation commences within individual colleges. Teachers develop assessment programs and instruments, apply assessment criteria, and allocate Unit Grades, according to the relevant Course Framework. Teachers within course teaching groups conduct consensus discussions to moderate marking or grading of individual assessment instruments and unit grade decisions.

The Moderation Model

Moderation within the ACT encompasses structured, consensus-based peer review of Unit Grades for all accredited courses, as well as statistical moderation of course scores, including small group procedures, for 'T' courses.

Moderation by Structured, Consensus-based Peer Review

Review is a subcategory of moderation, comprising the review of standards and the validation of Unit Grades. In the review process, Unit Grades, determined for Year 11 and Year 12 student assessment portfolios that have been assessed in schools by teachers under accredited courses, are moderated by peer review against system wide criteria and standards. This is done by matching student performance with the criteria and standards outlined in the unit grade descriptors as stated in the Course Framework. Advice is then given to colleges to assist teachers with, and/or reassure them on, their judgements.

Preparation for Structured, Consensus-based Peer Review

Each year, teachers teaching a Year 11 class are asked to retain originals or copies of student work completed in Semester 2. Similarly, teachers teaching a Year 12 class should retain originals or copies of student work completed in Semester 1. Assessment and other documentation required by the Office of the Board of Senior Secondary Studies should also be kept. Year 11 work from Semester 2 of the previous year is presented for review at Moderation Day 1 in March, and Year 12 work from Semester 1 is presented for review at Moderation Day 2 in August.

In the lead up to Moderation Day, a College Course Presentation (comprised of a document folder and a set of student portfolios) is prepared for each A and T course and any M units offered by the school, and is sent in to the Office of the Board of Senior Secondary Studies.

Teachers of C courses are required to present portfolios of student work for verification that units are taught and assessed as documented and validation that assessments meet industry standards. The Moderation Officer will report any concerns to the Board.

The College Course Presentation

The package of materials (College Course Presentation) presented by a college for review on moderation days in each course area will comprise the following:

- a folder containing supporting documentation as requested by the Office of the Board through memoranda to colleges
- a set of student portfolios containing marked and/or graded written and non-written assessment responses on which the unit grade decision has been made is to be included in the student review portfolios.

Specific requirements for subject areas and types of evidence to be presented for each moderation day will be outlined by the Board Secretariat through memoranda and Information Papers.

COURSE FRAMEWORK GROUP

Name	College
Jane O'Brien	Canberra Girls Grammar School
Inderpal Singh	Daramalan College
Ian Stace-Winkles	St Francis Xavier College

Appendix A – 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 A – Common Curriculum Elements
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
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	Plan, inquire into and draw conclusions about
Justify	Show how argument or conclusion is right or reasonable
Manipulate	Adapt or change
Plan	Strategies,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 B– Australian Curriculum Achievement Standards

<table>
<tr><th colspan="3">Biology Units 1 & 2 (T)</th></tr>
<tr><th></th><th>Biology concepts, models and applications</th><th>Biology inquiry skills</th></tr>
<tr><td rowspan="2">A</td><td>For the biological systems studied, the student:
analyses how system components function and are interrelated at micro and macro levels
analyses how flows of matter and transfers and transformations of energy are related in system processes
explains the theories and model/s used to explain the system and the aspects of the system they include
applies theories and models of systems and processes to explain phenomena, interpret complex problems and make reasoned, plausible predictions in unfamiliar contexts</td><td rowspan="2">For the biological contexts studied, the student:
designs, conducts and improves safe, ethical investigations that efficiently collect valid, reliable data in response to a complex question or problem
analyses data sets to explain causal and correlational relationships, the reliability of the data, and sources of error
justifies their selection of data as evidence, analyses evidence with reference to models and/or theories, and develops evidence-based conclusions that identify limitations
evaluates processes and claims, and provides an evidence-based critique and discussion of improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and to solve complex and unfamiliar problems
communicates effectively and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the biological contexts studied, the student:
analyses the roles of collaboration, debate and review, and technologies, in the development of biological theories and models
evaluates how biological science has been used in concert with other sciences to meet diverse needs and to inform decision making; and how these applications are influenced by interacting social, economic and ethical factors</td></tr>
<tr><td rowspan="2">B</td><td>For the biological systems studied, the student:
explains how system components are interrelated and how they function
explains the role of system components in processes involving flows of matter and transfers and transformations of energy
describes the theories and model/s used to explain the system
applies theories and models of systems and processes to explain phenomena, interpret problems and make plausible predictions in unfamiliar contexts</td><td rowspan="2">For the biological contexts studied, the student:
designs, conducts and improves safe, ethical investigations that collect valid, reliable data in response to a question or problem
analyses data sets to identify causal and correlational relationships, anomalies, and sources of error
selects appropriate data as evidence, interprets evidence with reference to models and/or theories, and provides evidence for conclusions
evaluates processes and claims, provides a critique with reference to evidence, and identifies possible improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and to solve unfamiliar problems
communicates clearly and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the biological contexts studied, the student:
explains the role of collaboration, debate and review, and technologies, in the development of biological theories and models
explains how biological science has been used to meet diverse needs and to inform decision making; and how these applications are influenced by social, economic and ethical factors</td></tr>
</table>

Biology Units 1 & 2 *(continued)* (T)		
	Biology concepts, models and applications	**Biology inquiry skills**
C	*For the biological systems studied, the student:* • describes the system components and their function • describes the ways in which matter and energy move through the system • describes a theory or model used to explain the system • applies theories or models of systems and processes to explain phenomena, interpret problems and make plausible predictions in familiar contexts *For the biological contexts studied, the student:* • describes the role of collaboration and review, and technologies, in the development of biological theories or models • discusses how biological science has been used to meet needs and inform decision making, and some social, economic or ethical implications of these applications	*For the biological contexts studied, the student:* • designs and conducts safe, ethical investigations that collect valid data in response to a question or problem • analyses data to identify relationships, anomalies, and sources of error • selects data to demonstrate relationships linked to biological knowledge, and provides conclusions based on data • evaluates processes and claims, and suggests improvements or alternatives • selects, constructs and uses appropriate representations to describe relationships and solve problems • communicates clearly in a range of modes, styles and genres for specific purposes
D	*For the biological systems studied, the student:* • identifies the system components • describes observable processes and phenomena • identifies aspects of a theory or model related to the system • describes phenomena, interprets simple problems and makes simple predictions in familiar contexts *For the biological contexts studied, the student:* • describes the roles of communication and new evidence in developing biological knowledge • describes ways in which biological science has been used in society to meet needs, and identifies some implications of these applications	*For the biological contexts studied, the student:* • plans and conducts safe, ethical investigations to collect data in response to a question or problem • analyses data to identify trends and anomalies • selects data to demonstrate trends, and presents simple conclusions based on data • considers processes and claims from a personal perspective • constructs and uses simple representations to describe relationships and solve simple problems • communicates in a range of modes and genres
E	*For the biological systems studied, the student:* • identifies some parts of the system • describes some observable phenomena • identifies aspects of a theory or model related to parts of the system • describes phenomena and makes simple predictions in familiar, simple contexts *For the biological contexts studied, the student:* • identifies that biological knowledge has changed over time • identifies ways in which biological science has been used in society to meet needs	*For the biological contexts studied, the student:* • follows a procedure to conduct safe, ethical investigations to collect data • identifies trends in data • selects data to demonstrate trends • considers claims from a personal perspective • constructs and uses simple representations to describe phenomena • communicates in a range of modes

Appendix B– Australian Curriculum Achievement Standards

<table>
<tr><th colspan="3">Biology Units 3 and 4 (T)</th></tr>
<tr><th></th><th>Biology concepts, models and applications</th><th>Biology inquiry skills</th></tr>
<tr><td rowspan="2">A</td><td>For the biological systems studied, the student:
analyses how system components function and are interrelated across a range of scales to enable continuity of individuals, populations and species
analyses how the function and interrelationships of system components are affected by external factors across a range of scales, and how the system responds over time
explains the theories and model/s used to explain the system, the supporting evidence, and their limitations and assumption
applies theories and models of systems and processes to explain phenomena, critically analyse complex problems, and make reasoned, plausible predictions in unfamiliar contexts</td><td rowspan="2">For the biological contexts studied, the student:
designs, conducts and improves safe, ethical investigations that efficiently collect valid, reliable data in response to a complex question or problem
analyses data sets to explain causal and correlational relationships, the reliability of the data, and sources of error
justifies their selection of data as evidence, analyses evidence with reference to models and/or theories, and develops evidence-based conclusions that identify limitations
evaluates processes and claims, and provides an evidence-based critique and discussion of improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and to solve complex and unfamiliar problems
communicates effectively and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the biological contexts studied, the student:
analyses the roles of collaboration, debate and review, and technologies, in the development of biological theories and models
evaluates how biological science has been used in concert with other sciences to meet diverse needs and to inform decision making; and how these applications are influenced by interacting social, economic and ethical factors</td></tr>
<tr><td rowspan="2">B</td><td>For the biological systems studied, the student:
explains how system components are interrelated and how they function to enable continuity of individuals, populations and species
explains how the function and interrelationships of system components are affected by external factors, and how the system responds
describes the theories and model/s used to explain the system, some supporting evidence, and their limitations
applies theories and models of systems and processes to explain phenomena, analyse problems, and make plausible predictions in unfamiliar contexts</td><td rowspan="2">For the biological contexts studied, the student:
designs, conducts and improves safe, ethical investigations that collect valid, reliable data in response to a question or problem
analyses data sets to identify causal and correlational relationships, anomalies, and sources of error
selects appropriate data as evidence, interprets evidence with reference to models and/or theories, and provides evidence for conclusions
evaluates processes and claims, provides a critique with reference to evidence, and identifies possible improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and to solve unfamiliar problems
communicates clearly and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the biological contexts studied, the student:
explains the role of collaboration, debate and review, and technologies, in the development of biological theories and models
explains how biological science has been used to meet diverse needs and to inform decision making; and how these applications are influenced by social, economic and ethical factors</td></tr>
</table>

Biology Units 3 and 4 *(continued)* (T)		
	Biology concepts, models and applications	**Biology inquiry skills**
C	*For the biological systems studied, the student:* • describes how system components function and the processes that enable continuity of the individual, population and species • describes how system components or processes are affected by external factors, and how the system responds • describes key aspects of a theory or model used to explain system processes, and the phenomena to which they can be applied • applies theories or models of systems and processes to explain phenomena, interpret problems, and make plausible predictions in some unfamiliar contexts *For the biological contexts studied, the student:* • describes the role of collaboration and review, and technologies, in the development of biological theories or models • discusses how biological science has been used to meet needs and to inform decision making, and some social, economic or ethical implications of these applications	*For the biological contexts studied, the student:* • designs and conducts safe, ethical investigations that collect valid data in response to a question or problem • analyses data to identify relationships, anomalies, and sources of error • selects data to demonstrate relationships linked to biological knowledge, and provides conclusions based on data • evaluates processes and claims, and suggests improvements or alternatives • selects, constructs and uses appropriate representations to describe relationships and solve problems • communicates clearly in a range of modes, styles and genres for specific purposes
D	*For the biological systems studied, the student:* • identifies system components that contribute to the survival of an organism, population or species • describes changes to the system, the external factors that caused those changes, and some system responses • describes key aspects of a theory or model used to explain a system process • describes phenomena, interprets simple problems, and makes predictions in familiar contexts *For the biological contexts studied, the student:* • describes the roles of communication and new evidence in developing biological knowledge • describes ways in which biological science has been used in society to meet needs, and identifies some implications of these applications	*For the biological contexts studied, the student:* • plans and conducts safe, ethical investigations to collect data in response to a question or problem • analyses data to identify trends and anomalies • selects data to demonstrate trends, and presents simple conclusions based on data • considers processes and claims from a personal perspective • constructs and uses simple representations to describe relationships and solve simple problems • communicates in a range of modes and genres
E	*For the biological systems studied, the student:* • identifies some parts of the system that contribute to the survival of an organism, population or species • describes a change to the system, and an external factor that caused that change • identifies aspects of a theory or model related to a system process • describes phenomena and makes simple predictions in familiar contexts *For the biological contexts studied, the student:* • identifies that biological knowledge has changed over time • identifies ways in which biological science has been used in society to meet needs	*For the biological contexts studied, the student:* • follows a procedure to conduct safe, ethical investigations to collect data • identifies trends in data • selects data to demonstrate trends • considers claims from a personal perspective • constructs and uses simple representations to describe phenomena • communicates in a range of modes

Appendix B– Australian Curriculum Achievement Standards

<table>
<tr><th colspan="3">Chemistry Units 1 and 2 (T)</th></tr>
<tr><th></th><th>Chemistry concepts, models and applications</th><th>Chemistry inquiry skills</th></tr>
<tr><td rowspan="2">A</td><td>For the chemical systems studied, the student:
analyses how structure, bond strength and energy transfers and transformations are interrelated in chemical systems
analyses how a range of factors affect atomic or molecular interactions and change the structure and properties of systems
explains the theories and model/s used to explain the system and the aspects of the system they include
applies theories and models of systems and processes to explain phenomena, interpret complex problems, and make reasoned, plausible predictions in unfamiliar contexts</td><td rowspan="2">For the chemical science contexts studied, the student:
designs, conducts and improves safe, ethical investigations that efficiently collect valid, reliable data in response to a complex question or problem
analyses data sets to explain causal and correlational relationships, the reliability of the data, and sources of error
justifies their selection of data as evidence, analyses evidence with reference to models and/or theories, and develops evidence-based conclusions that identify limitations
evaluates processes and claims, and provides an evidence-based critique and discussion of improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve complex and unfamiliar problems
communicates effectively and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the chemical science contexts studied, the student:
analyses the roles of collaboration, debate and review, and technologies, in the development of chemical science theories and models
evaluates how chemical science has been used in concert with other sciences to meet diverse needs and inform decision making, and how these applications are influenced by interacting social, economic and ethical factors</td></tr>
<tr><td rowspan="2">B</td><td>For the chemical systems studied, the student
explains how structure, bonding and energy transfers and transformations are interrelated in chemical systems
explains how a range of factors change the structure and properties of chemical systems
describes the theories and model/s used to explain the system
applies theories and models of systems and processes to explain phenomena, interpret problems, and make plausible predictions in unfamiliar contexts</td><td rowspan="2">For the chemical science contexts studied, the student:
designs, conducts and improves safe, ethical investigations that collect valid, reliable data in response to a question or problem
analyses data sets to identify causal and correlational relationships, anomalies, and sources of error
selects appropriate data as evidence, interprets evidence with reference to models and/or theories, and provides evidence for conclusions
evaluates processes and claims, provides a critique with reference to evidence, and identifies possible improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve unfamiliar problems
communicates clearly and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the chemical science contexts studied, the student:
explains the role of collaboration, debate and review, and technologies, in the development of chemical science theories and models
explains how chemical science has been used to meet diverse needs and inform decision making, and how these applications are influenced by social, economic and ethical factors</td></tr>
</table>

Chemistry Units 1 and 2 *(continued)* (T)		
	Chemistry concepts, models and applications	**Chemistry inquiry skills**
C	*For the chemical systems studied, the student:* • describes how structure, bonding and energy transfers are related in chemical systems • describes how some factors change the structure and properties of chemical systems • describes a theory or model used to explain the system • applies theories or models of systems and processes to explain phenomena, interpret problems, and make plausible predictions in familiar contexts *For the chemical science contexts studied, the student:* • describes the role of collaboration and review, and technologies, in the development of chemical science theories or models • discusses how chemical science has been used to meet needs and inform decision making, and some social, economic or ethical implications of these applications	*For the chemical science contexts studied, the student:* • designs and conducts safe, ethical investigations that collect valid data in response to a question or problem • analyses data to identify relationships, anomalies, and sources of error • selects data to demonstrate relationships linked to chemical science knowledge, and provides conclusions based on data • evaluates processes and claims, and suggests improvements or alternatives • selects, constructs and uses appropriate representations to describe relationships and solve problems • communicates clearly in a range of modes, styles and genres for specific purposes •
D	*For the chemical systems studied, the student:* • describes structure and bonding in substances • describes how some factors affect chemical systems • identifies aspects of a theory or model related to the system • describes phenomena, interprets simple problems, and makes simple predictions in familiar contexts *For the chemical science contexts studied, the student:* • describes the role of communication and new evidence in developing chemical science knowledge • describes ways in which chemical science has been used in society to meet needs, and identifies some implications of these applications	*For the chemical science contexts studied, the student:* • plans and conducts safe, ethical investigations to collect data in response to a question or problem • analyses data to identify trends and anomalies • selects data to demonstrate trends, and presents simple conclusions based on data • considers processes and claims from a personal perspective • constructs and uses simple representations to describe relationships and solve simple problems • communicates in a range of modes and genres •
E	*For the chemical systems studied, the student:* • identifies observable properties of substances • identifies observable changes to chemical systems • identifies aspects of a theory or model related to parts of the system • describes phenomena and makes simple predictions in familiar, simple contexts *For the chemical science contexts studied, the student:* • identifies that chemical science knowledge has changed over time • identifies ways in which chemical science has been used in society to meet needs	*For the chemical science contexts studied, the student:* • follows a procedure to conduct safe, ethical investigations to collect data • identifies trends in data • selects data to demonstrate trends • considers claims from a personal perspective • constructs and uses simple representations to describe phenomena • communicates in a range of modes •

Appendix B– Australian Curriculum Achievement Standards

<table>
<tr><th colspan="3">Chemistry Units 3 and 4 (T)</th></tr>
<tr><th></th><th>Chemistry concepts, models and applications</th><th>Chemistry inquiry skills</th></tr>
<tr><td rowspan="2">A</td><td>For the chemical systems studied, the student:
analyses how a range of interrelated factors affect atomic and molecular interactions and change the structure, properties and dynamics of chemical systems
analyses how interactions between matter and energy in complex chemical systems can be designed, monitored and controlled to produce desired outcomes
explains the theories and model/s used to explain the system, the supporting evidence, and their limitations and assumptions
applies theories and models of systems and processes to explain phenomena, critically analyse complex problems, and make reasoned, plausible predictions in unfamiliar contexts</td><td rowspan="2">For the chemical science contexts studied, the student:
designs, conducts and improves safe, ethical investigations that efficiently collect valid, reliable data in response to a complex question or problem
analyses data sets to explain causal and correlational relationships, the reliability of the data, and sources of error
justifies their selection of data as evidence, analyses evidence with reference to models and/or theories, and develops evidence-based conclusions that identify limitations
evaluates processes and claims, and provides an evidence-based critique and discussion of improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve complex and unfamiliar problems
communicates effectively and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the chemical science contexts studied, the student:
analyses the roles of collaboration, debate and review, and technologies, in the development of chemical science theories and models
evaluates how chemical science has been used in concert with other sciences to meet diverse needs and inform decision making, and how these applications are influenced by interacting social, economic and ethical factors</td></tr>
<tr><td rowspan="2">B</td><td>For the chemical systems studied, the student:
explains how a range of interrelated factors change the structure, properties and dynamics of chemical systems
explains how interactions between matter and energy in chemical systems can be designed, monitored and controlled to produce desired outcomes
describes the theories and model/s used to explain the system, some supporting evidence, and their limitations
applies theories and models of systems and processes to explain phenomena, analyse problems, and make plausible predictions in unfamiliar contexts</td><td rowspan="2">For the chemical science contexts studied, the student:
designs, conducts and improves safe, ethical investigations that collect valid, reliable data in response to a question or problem
analyses data sets to identify causal and correlational relationships, anomalies, and sources of error
selects appropriate data as evidence, interprets evidence with reference to models and/or theories, and provides evidence for conclusions
evaluates processes and claims, provides a critique with reference to evidence, and identifies possible improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve unfamiliar problems
communicates clearly and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the chemical science contexts studied, the student:
explains the roles of collaboration, debate and review, and technologies, in the development of chemical science theories and models
explains how chemical science has been used to meet diverse needs and inform decision making, and how these applications are influenced by social, economic and ethical factors</td></tr>
</table>

<table>
<tr><th colspan="3">Chemistry Units 3 and 4 (continued) (T)</th></tr>
<tr><th></th><th>Chemistry concepts, models and applications</th><th>Chemistry inquiry skills</th></tr>
<tr><td rowspan="2">C</td><td>For the chemical systems studied, the student:
explains how a range of factors change the structure, properties and dynamics of chemical systems
describes how chemical systems are controlled and monitored to produce desired outcomes
describes key aspects of a theory or model used to explain system processes, and the phenomena to which those processes can be applied
applies theories or models of systems and processes to explain phenomena, interpret problems, and make plausible predictions in some unfamiliar contexts</td><td rowspan="2">For the chemical science contexts studied, the student:
designs and conducts safe, ethical investigations that collect valid data in response to a question or problem
analyses data to identify relationships, anomalies, and sources of error
selects data to demonstrate relationships linked to chemical science knowledge, and provides conclusions based on data
evaluates processes and claims, and suggests improvements or alternatives
selects , constructs and uses appropriate representations to describe relationships and solve problems
communicates clearly in a range of modes, styles and genres for specific purposes</td></tr>
<tr><td>For the chemical science contexts studied, the student:
describes the roles of collaboration and review, and technologies, in the development of chemical science theories or models
discusses how chemical science has been used to meet needs and inform decision making, and some social, economic or ethical implications of these applications</td></tr>
<tr><td rowspan="2">D</td><td>For the chemical systems studied, the student:
describes how some factors affect the properties of chemical systems
describes how chemical systems are manipulated to produce desired outcomes
describes key aspects of a theory or model used to explain a system process
describes phenomena, interprets simple problems, and makes predictions in familiar contexts</td><td rowspan="2">For the chemical science contexts studied, the student:
plans and conducts safe, ethical investigations to collect data in response to a question or problem
analyses data to identify trends and anomalies
selects data to demonstrate trends, and presents simple conclusions based on data
considers processes and claims from a personal perspective
constructs and uses simple representations to describe relationships and solve simple problems
communicates in a range of modes and genres</td></tr>
<tr><td>For the chemical science contexts studied, the student:
describes the roles of communication and new evidence in developing chemical science knowledge
describes ways in which chemical science has been used in society to meet needs, and identifies some implications of these applications</td></tr>
<tr><td rowspan="2">E</td><td>For the chemical systems studied, the student:
describes changes to chemical systems
describes how chemical systems are used to produce desired outcomes
identifies aspects of a theory or model related to a system process
describes phenomena and makes simple predictions in familiar contexts</td><td rowspan="2">For the chemical science contexts studied, the student:
follows a procedure to conduct safe, ethical investigations to collect data
identifies trends in data
selects data to demonstrate trends
considers claims from a personal perspective
constructs and uses simple representations to describe phenomena
communicates in a range of modes</td></tr>
<tr><td>For the chemical science contexts studied, the student:
identifies that chemical science knowledge has changed over time
identifies ways in which chemical science has been used in society to meet needs</td></tr>
</table>

Appendix B– Australian Curriculum Achievement Standards

<table>
<tr><th colspan="3">Physics Units 1 and 2 (T)</th></tr>
<tr><th></th><th>Physics concepts, models and applications</th><th>Physics inquiry skills</th></tr>
<tr><td rowspan="2">A</td><td>For the physical systems studied, the student:
analyses physical phenomena in complex scenarios qualitatively and quantitatively
analyses the relationships between components and properties of physical systems qualitatively and quantitatively
explains the theories and model/s used to explain the system and the aspects of the system they include
applies theories and models of systems and processes to explain phenomena, interpret complex problems, and make reasoned, plausible predictions in unfamiliar contexts</td><td rowspan="2">For the physical science contexts studied, the student:
designs, conducts and improves safe, ethical investigations that efficiently collect valid, reliable data in response to a complex question or problem
analyses data sets to explain causal and correlational relationships, the reliability of the data and sources of error
justifies their selection of data as evidence, analyses evidence with reference to models and/or theories, and develops evidence-based conclusions that identify limitations
evaluates processes and claims, and provides an evidence-based critique and discussion of improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve complex and unfamiliar problems
communicates effectively and accurately in a range of modes, styles and genres for specific audiencesand purposes</td></tr>
<tr><td>For the physical science contexts studied, the student:
analyses the roles of collaboration, debate and review, and technologies, in the development of physical science theories and models
evaluates how physical science has been used in concert with other sciences to meet diverse needs and to inform decision making, and how these applications are influenced by interacting social, economic and ethical factors</td></tr>
<tr><td rowspan="2">B</td><td>For the physical systems studied, the student:
explains physical phenomena qualitatively and quantitatively
explains the relationships between components and properties of physical systems qualitatively and quantitatively
describes the theories and model/s used to explain the system
applies theories and models of systems and processes to explain phenomena, interpret problems, and make plausible predictions in unfamiliar contexts</td><td rowspan="2">For the physical science contexts studied, the student:
designs, conducts and improves safe, ethical investigations that collect valid, reliable data in response to a question or problem
analyses data sets to identify causal and correlational relationships, anomalies, and sources of error
selects appropriate data as evidence, interprets evidence with reference to models and/or theories, and provides evidence for conclusions
evaluates processes and claims, provides a critique with reference to evidence, and identifies possible improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve unfamiliar problems
communicates clearly and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the physical science contexts studied, the student:
explains the roles of collaboration, debate and review, and technologies, in the development of physical science theories and models
explains how physical science has been used to meet diverse needs and to inform decision making, and how these applications are influenced by social, economic and ethical factors</td></tr>
</table>

Appendix B– Australian Curriculum Achievement Standards

<table>
<tr><th colspan="3">Physics Units 1 and 2 (continued) (T)</th></tr>
<tr><th></th><th>Physics concepts, models and applications</th><th>Physics inquiry skills</th></tr>
<tr><td>C</td><td>For the physical systems studied, the student:
describes physical phenomena in simple scenarios qualitatively and quantitatively
describes the relationships between components and properties of physical systems qualitatively
describes a theory or model used to explain the system
applies theories or models of systems and processes to explain phenomena, interpret problems, and make plausible predictions in familiar contexts
For the physical science contexts studied, the student:
describes the roles of collaboration, review, and technologies, in the development of physical science theories or models
discusses how physical science has been used to meet needs and to inform decision making, and discusses some social, economic or ethical implications of these applications</td><td>For the physical science contexts studied, the student:
designs and conducts safe, ethical investigations that collect valid data in response to a question or problem
analyses data to identify relationships, anomalies, and sources of error
selects data to demonstrate relationships linked to physical science knowledge, and provides conclusions based on data
evaluates processes and claims, and suggests improvements or alternatives
selects, constructs and uses appropriate representations to describe relationships and solve problems
communicates clearly in a range of modes, styles and genres for specific purposes</td></tr>
<tr><td>D</td><td>For the physical systems studied, the student:
describes physical phenomena in simple scenarios qualitatively
describes how components of physical systems are related
identifies aspects of a theory or model related to the system
describes phenomena, interprets simple problems, and makes simple predictions in familiar contexts
For the physical science contexts studied, the student:
describes the roles of communication and new evidence in developing physical science knowledge
describes ways in which physical science has been used in society to meet needs, and identifies some implications of these applications</td><td>For the physical science contexts studied, the student:
plans and conducts safe, ethical investigations to collect data in response to a question or problem
analyses data to identify trends and anomalies
selects data to demonstrate trends, and presents simple conclusions based on data
considers processes and claims from a personal perspective
constructs and uses simple representations to describe relationships and solve simple problems
communicates in a range of modes and genres</td></tr>
<tr><td>E</td><td>For the physical systems studied, the student:
Identifies properties of physical phenomena
identifies components of physical systems
identifies aspects of a theory or model related to parts of the system
describes phenomena and makes simple predictions in familiar, simple contexts
For the physical science contexts studied, the student:
identifies that physical science knowledge has changed over time
identifies ways in which physical science has been used in society to meet needs</td><td>For the physical science contexts studied, the student:
follows a procedure to conduct safe, ethical investigations to collect data
identifies trends in data
selects data to demonstrate trends
considers claims from a personal perspective
constructs and uses simple representations to describe phenomena
communicates in a range of modes</td></tr>
</table>

Appendix B– Australian Curriculum Achievement Standards

<table>
<tr><th colspan="3">Physics Units 3 and 4 (T)</th></tr>
<tr><th></th><th>Physics concepts, models and applications</th><th>Physics inquiry skills</th></tr>
<tr><td>A</td><td>For the physical systems studied, the student:
analyses physical phenomena in complex scenarios at a range of scales qualitatively and quantitatively
analyses the relationships between mass, energy and properties of physical systems qualitatively and quantitatively
explains the theories and model/s used to explain the system, the supporting evidence, and their limitations and assumptions
applies theories and models of systems and processes to explain phenomena, critically analyse complex problems, and make reasoned, plausible predictions in unfamiliar contexts
For the physical science contexts studied, the student:
analyses the roles of collaboration, debate and review, and technologies, in the development of physical science theories and models
evaluates how physical science has been used in concert with other sciences to meet diverse needs and to inform decision making; and how these applications are influenced by interacting social, economic and ethical factors</td><td>For the physical science contexts studied, the student:
designs, conducts and improves safe, ethical investigations that efficiently collect valid, reliable data in response to a complex question or problem
analyses data sets to explain causal and correlational relationships, the reliability of the data, and sources of error
justifies their selection of data as evidence, analyses evidence with reference to models and/or theories, and develops evidence-based conclusions that identify limitations
evaluates processes and claims, and provides an evidence-based critique and discussion of improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve complex and unfamiliar problems
communicates effectively and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>B</td><td>For the physical systems studied, the student:
explains physical phenomena at a range of scales qualitatively and quantitatively
explains the relationships between mass, energy and properties of physical systems qualitatively and quantitatively
describes the theories and model/s used to explain the system, some supporting evidence, and their limitations
applies theories and models of systems and processes to explain phenomena, analyse problems, and make plausible predictions in unfamiliar contexts
For the physical science contexts studied, the student:
explains the roles of collaboration, debate and review, and technologies, in the development of physical science theories and models
explains how physical science has been used to meet diverse needs and to inform decision making; and how these applications are influenced by social, economic and ethical factors</td><td>For the physical science contexts studied, the student:
designs, conducts and improves safe, ethical investigations that collect valid, reliable data in response to a question or problem
analyses data sets to identify causal and correlational relationships, anomalies, and sources of error
selects appropriate data as evidence, interprets evidence with reference to models and/or theories, and provides evidence for conclusions
evaluates processes and claims, provides a critique with reference to evidence, and identifies possible improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve unfamiliar problems
communicates clearly and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
</table>

<table>
<tr><th colspan="3">Physics Units 3 and 4 (continued) (T)</th></tr>
<tr><th></th><th>Physics concepts, models and applications</th><th>Physics inquiry skills</th></tr>
<tr><td>C</td><td>For the physical systems studied, the student:
explains physical phenomena qualitatively and quantitatively
explains the relationships between mass, energy and properties of physical systems qualitatively
describes key aspects of a theory or model used to explain system processes, and the phenomena to which they can be applied
applies theories or models of systems and processes to explain phenomena, interpret problems, and make plausible predictions in some unfamiliar contexts
For the physical science contexts studied, the student:
describes the roles of collaboration and review, and technologies, in the development of physical science theories or models
discusses how physical science has been used to meet needs and to inform decision making, and some social, economic or ethical implications of these applications</td><td>For the physical science contexts studied, the student:
designs and conducts safe, ethical investigations that collect valid data in response to a question or problem
analyses data to identify relationships, anomalies, and sources of error
selects data to demonstrate relationships linked to physical science knowledge, and provides conclusions based on data
evaluates processes and claims, and suggests improvements or alternatives
selects, constructs and uses appropriate representations to describe relationships and solve problems
communicates clearly in a range of modes, styles and genres for specific purposes</td></tr>
<tr><td>D</td><td>For the physical systems studied, the student:
describes physical phenomena qualitatively
describes how components and properties of physical systems are related
describes key aspects of a theory or model used to explain a system process
describes phenomena, interprets simple problems, and makes predictions in familiar contexts
For the physical science contexts studied, the student:
describes the roles of communication and new evidence in developing physical science knowledge
describes ways in which physical science has been used in society to meet needs, and identifies some implications of these applications</td><td>For the physical science contexts studied, the student:
plans and conducts safe, ethical investigations to collect data in response to a question or problem
analyses data to identify trends and anomalies
selects data to demonstrate trends, and presents simple conclusions based on data
considers processes and claims from a personal perspective
constructs and uses simple representations to describe relationships and solve simple problems
communicates in a range of modes and genres</td></tr>
<tr><td>E</td><td>For the physical systems studied, the student:
describes properties of physical phenomena
describes components of physical systems
identifies aspects of a theory or model related to a system process
describes phenomena and makes simple predictions in familiar contexts
For the physical science contexts studied, the student:
identifies that physical science knowledge has changed over time
identifies ways in which physical science has been used in society to meet needs</td><td>For the physical science contexts studied, the student:
follows a procedure to conduct safe, ethical investigations to collect data
identifies trends in data
selects data to demonstrate trends
considers claims from a personal perspective
constructs and uses simple representations to describe phenomena
communicates in a range of modes</td></tr>
</table>

Appendix B– Australian Curriculum Achievement Standards

<table>
<tr><th colspan="3">Earth and Environmental Science Units 1 and 2 (T)</th></tr>
<tr><th></th><th>Earth and Environmental Science concepts, models and applications</th><th>Earth and Environmental Science inquiry skills</th></tr>
<tr><td rowspan="2">A</td><td>For the Earth systems studied, the student:
analyses how Earth systems and their components are inter-related across a range of spatial scales, and how they have changed over time
analyses how cycling of matter and transfers and transformations of energy are interrelated within and between Earth systems across a range of temporal and spatial scales
explains the theories and model/s used to explain the system and the aspects of the system they include
applies theories and models of systems and processes to explain phenomena, interpret complex problems and make reasoned, plausible predictions in unfamiliar contexts</td><td rowspan="2">For the Earth and environmental contexts studied, the student:
designs, conducts and improves safe, ethical investigations that efficiently collect valid, reliable data in response to a complex question or problem
analyses data sets to explain causal and correlational relationships, the reliability of the data and sources of error
justifies their selection of data as evidence, analyses evidence with reference to models and/or theories and develops evidence-based conclusions that identify limitations
evaluates processes and claims; provides an evidence-based critique and discussion of improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve complex and unfamiliar problems
communicates effectively and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the Earth and environmental contexts studied, the student:
analyses the role of collaboration, debate and review, and technologies, in the development of Earth and environmental theories and models
evaluates how Earth and environmental science has been used in concert with other sciences to meet diverse needs and inform decision making; and how these applications are influenced by interacting social, economic and ethical factors</td></tr>
<tr><td rowspan="2">B</td><td>For the Earth systems studied, the student:
explains how Earth system components are inter-related and how they have changed over time
explains how cycling of matter and transfers and transformations of energy occur between and within Earth systems
describes the theories and model/s used to explain the system
applies theories and models of systems and processes to explain phenomena, interpret problems and make plausible predictions in unfamiliar contexts</td><td rowspan="2">For the Earth and environmental contexts studied, the student:
designs, conducts and improves safe, ethical investigations that collect valid, reliable data in response to a question or problem
analyses data sets to identify causal and correlational relationships, anomalies and sources of error
selects appropriate data as evidence, interprets evidence with reference to models and/or theories and provides evidence for conclusions
evaluates processes and claims; provides a critique with reference to evidence and identifies possible improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve unfamiliar problems
communicates clearly and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the Earth and environmental contexts studied, the student:
explains the role of collaboration, debate and review, and technologies, in the development of Earth and environmental theories and models
explains how Earth and environmental science has been used to meet diverse needs and inform decision making; and how these applications are influenced by social, economic and ethical factors</td></tr>
</table>

Appendix B– Australian Curriculum Achievement Standards

<table>
<tr><th colspan="3">Earth and Environmental Science Units 1 and 2 (continued) (T)</th></tr>
<tr><th></th><th>Earth and Environmental Science concepts, models and applications</th><th>Earth and Environmental Science inquiry skills</th></tr>
<tr><td rowspan="2">C</td><td>For the Earth systems studied, the student:
describes Earth system components and how they have changed over time
describes the ways in which matter and energy move within and between Earth systems
describes a theory or model used to explain the system
applies theories or models of systems and processes to explain phenomena, interpret problems and make plausible predictions in familiar contexts</td><td rowspan="2">For the Earth and environmental contexts studied, the student:
designs and conducts safe, ethical investigations that collect valid data in response to a question or problem
analyses data to identify relationships, anomalies and sources of error
selects data to demonstrate relationships linked to Earth and environmental knowledge and provides conclusions based on data
evaluates processes and claims and suggests improvements or alternatives
selects, constructs and uses appropriate representations to describe relationships and solve problems
communicates clearly in a range of modes, styles and genres for specific purposes</td></tr>
<tr><td>For the Earth and environmental contexts studied, the student:
describes the role of collaboration and review, and technologies, in the development of Earth and environmental theories or models
discusses how Earth and environmental science has been used to meet needs and inform decision making, and some social, economic or ethical implications of these applications</td></tr>
<tr><td rowspan="2">D</td><td>For the Earth systems studied, the student:
identifies Earth system components
identifies processes that cause change in Earth systems
identifies aspects of a theory or model related to the system
describes phenomena, interprets simple problems and makes simple predictions in familiar contexts</td><td rowspan="2">For the Earth and environmental contexts studied, the student:
plans and conducts safe, ethical investigations to collect data in response to a question or problem
analyses data to identify trends and anomalies
selects data to demonstrate trends and presents simple conclusions based on data
considers processes and claims from a personal perspective
constructs and uses simple representations to describe relationships and solve simple problems
communicates in a range of modes and genres</td></tr>
<tr><td>For the Earth and environmental contexts studied, the student:
describes the role of communication and new evidence in the development of Earth and environmental knowledge
describes ways in which Earth and environmental science has been used in society to meet needs and identifies some implications of these applications</td></tr>
<tr><td rowspan="2">E</td><td>For the Earth systems studied, the student:
identifies some parts of the Earth system
describes some observable Earth processes
identifies aspects of a theory or model related to parts of the system
describes phenomena and makes simple predictions in familiar, simple contexts</td><td rowspan="2">For the Earth and environmental contexts studied, the student:
follows a procedure to conduct safe, ethical investigations to collect data
identifies trends in data
selects data to demonstrate trends
considers claims from a personal perspective
constructs and uses simple representations to describe phenomena
communicates in a range of modes</td></tr>
<tr><td>For the Earth and environmental contexts studied, the student:
identifies that Earth and environmental knowledge has changed over time
identifies ways in which Earth and environmental science has been used in society to meet needs</td></tr>
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Appendix B– Australian Curriculum Achievement Standards

<table>
<tr><th colspan="3">Earth and Environmental Science Units 3 and 4 (T)</th></tr>
<tr><th></th><th>Earth and Environmental Science concepts, models and applications</th><th>Earth and Environmental inquiry skills</th></tr>
<tr><td rowspan="2">A</td><td>For the Earth systems studied, the student:
analyses how human activities and Earth processes affect components of, and interactions between, Earth systems across a range of temporal and spatial scales
analyses how interactions between Earth systems change, and how these changes are monitored and managed across a range of temporal and spatial scales
explains the theories and model/s used to explain the systems, the supporting evidence and their limitations and assumptions
applies theories and models of systems and processes to explain phenomena and critically analyse complex problems and make reasoned, plausible predictions in unfamiliar contexts</td><td rowspan="2">For the Earth and environmental contexts studied, the student:
designs, conducts and improves safe, ethical investigations that efficiently collect valid, reliable data in response to a complex question or problem
analyses data sets to explain causal and correlational relationships, the reliability of the data and sources of error
justifies their selection of data as evidence, analyses evidence with reference to models and/or theories and develops evidence-based conclusions that identify limitations
evaluates processes and claims; provides an evidence-based critique and discussion of improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve complex and unfamiliar problems
communicates effectively and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the Earth and environmental contexts studied, the student:
analyses the role of collaboration, debate and review, and technologies, in the development of Earth and environmental theories and models
evaluates how Earth and environmental science has been used in concert with other sciences to meet diverse needs and inform decision making; and how these applications are influenced by interacting social, economic and ethical factors</td></tr>
<tr><td rowspan="2">B</td><td>For the Earth systems studied, the student:
explains how human activities and Earth processes affect components of, and interactions between, Earth systems
explains how interactions between Earth systems change, and how these changes are monitored and managed
describes the theories and model/s used to explain the systems, some supporting evidence, and their limitations
applies theories and models of systems and processes to explain phenomena, analyse problems and make plausible predictions in unfamiliar contexts</td><td rowspan="2">For the Earth and environmental contexts studied, the student:
designs, conducts and improves safe, ethical investigations that collect valid, reliable data in response to a question or problem
analyses data sets to identify causal and correlational relationships, anomalies and sources of error
selects appropriate data as evidence, interprets evidence with reference to models and/or theories and provides evidence for conclusions
evaluates processes and claims; provides a critique with reference to evidence and identifies possible improvements or alternatives
selects, constructs and uses appropriate representations to describe complex relationships and solve unfamiliar problems
communicates clearly and accurately in a range of modes, styles and genres for specific audiences and purposes</td></tr>
<tr><td>For the Earth and environmental contexts studied, the student:
explains the role of collaboration, debate and review, and technologies, in the development of Earth and environmental theories and models
explains how Earth and environmental science has been used to meet diverse needs and inform decision making; and how these applications are influenced by social, economic and ethical factors</td></tr>
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<table>
<tr><th colspan="3">Earth and Environmental Science Units 3 and 4 (continued) (T)</th></tr>
<tr><th></th><th>Earth and Environmental Science concepts, models and applications</th><th>Earth and Environmental inquiry skills</th></tr>
<tr><td rowspan="2">C</td><td>For the Earth systems studied, the student:
explains how human activities and Earth processes affect components of Earth systems
explains how components of Earth systems change, and how these changes are managed
describes key aspects of a theory or model used to explain system processes and the phenomena to which they can be applied
applies theories or models of systems and processes to explain phenomena, interpret problems and make plausible predictions in some unfamiliar contexts</td><td rowspan="2">For the Earth and environmental contexts studied, the student:
designs and conducts safe, ethical investigations that collect valid data in response to a question or problem
analyses data to identify relationships, anomalies and sources of error
selects data to demonstrate relationships linked to Earth and environmental knowledge and provides conclusions based on data
evaluates processes and claims and suggests improvements or alternatives
selects, constructs and uses appropriate representations to describe relationships and solve problems
communicates clearly in a range of modes, styles and genres for specific purposes</td></tr>
<tr><td>For the Earth and environmental contexts studied, the student:
describes the role of collaboration and review, and technologies, in the development of Earth and environmental theories or models
discusses how Earth and environmental science has been used to meet needs and inform decision making, and some social, economic or ethical implications of these applications</td></tr>
<tr><td rowspan="2">D</td><td>For the Earth systems studied, the student:
describes how human activities and Earth processes affect components of Earth systems
describes changes to components of Earth systems and some management responses
describes key aspects of a theory or model used to explain a system process
describes phenomena, interprets simple problems and makes predictions in familiar contexts</td><td rowspan="2">For the Earth and environmental contexts studied, the student:
plans and conducts safe, ethical investigations to collect data in response to a question or problem
analyses data to identify trends and anomalies
selects data to demonstrate trends and presents simple conclusions based on data
considers processes and claims from a personal perspective
constructs and uses simple representations to describe relationships and solve simple problems
communicates in a range of modes and genres</td></tr>
<tr><td>For the Earth and environmental contexts studied, the student:
describes the role of communication and new evidence in developing Earth and environmental knowledge
describes ways in which Earth and environmental science has been used in society to meet needs and identifies some implications of these applications</td></tr>
<tr><td rowspan="2">E</td><td>For the Earth systems studied, the student:
identifies some human activities and Earth processes that impact components of Earth systems
describes some changes to components of Earth systems, and a related management response
identifies aspects of a theory or model related to a system process
describes phenomena and makes simple predictions in familiar context</td><td rowspan="2">For the Earth and environmental contexts studied, the student:
follows a procedure to conduct safe, ethical investigations to collect data
identifies trends in data
selects data to demonstrate trends
considers claims from a personal perspective
constructs and uses simple representations to describe phenomena
communicates in a range of modes</td></tr>
<tr><td>For the Earth and environmental contexts studied, the student:
identifies that Earth and environmental knowledge has changed over time
identifies ways in which Earth and environmental science has been used in society to meet needs</td></tr>
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