Science in Practice 2024 v1.1

Applied senior syllabus

Queensland Government | Queensland Curriculum & Assessment Authority

For all Queensland schools

Contents

1 Queensland syllabuses for senior subjects

In Queensland, a syllabus for a senior subject is an official 'map' of a senior school subject. A syllabus's function is to support schools in delivering the Queensland Certificate of Education (QCE) system through high-quality and high-equity curriculum and assessment.

Syllabuses are based on design principles developed from independent international research about how excellence and equity are promoted in the documents teachers use to develop and enliven the curriculum.

Syllabuses for senior subjects build on student learning in the Prep to Year 10 Australian Curriculum and include General, General (Extension), Senior External Examination (SEE), Applied, Applied (Essential) and Short Course syllabuses.

More information about syllabuses for senior subjects is available at www.qcaa.qld.edu.au/senior/senior-subjects. and in the 'Queensland curriculum' section of the *QCE and QCIA policy and procedures handbook*.

Teaching, learning and assessment resources will support the implementation of a syllabus for a senior subject. More information about professional resources for senior syllabuses is available on the QCAA website and via the QCAA Portal.

2 Course overview

2.1 Rationale

Science in Practice provides opportunities for students to explore, experience and learn concepts and practical skills valued in multidisciplinary science, workplaces and other settings. Learning in Science in Practice involves creative and critical thinking; systematically accessing, capturing and analysing information, including primary and secondary data; and using digital technologies to undertake research, evaluate information and present data.

Science in Practice students apply scientific knowledge and skills in situations to produce practical outcomes. Students build their understanding of expectations for work in scientific settings and develop an understanding of career pathways, jobs and other opportunities available for participating in and contributing to scientific activities.

Projects and investigations are key features of Science in Practice. Projects require the application of a range of cognitive, technical and reasoning skills and practical-based theory to produce real-world outcomes. Investigations follow scientific inquiry methods to develop a deeper understanding of a particular topic or context and the link between theory and practice in real-world and/or lifelike scientific contexts.

By studying Science in Practice, students develop an awareness and understanding of life beyond school through authentic, real-world interactions to become responsible and informed citizens. They develop a strong personal, socially oriented, ethical outlook that assists with managing context, conflict and uncertainty. Students gain the ability to work effectively and respectfully with diverse teams to maximise understanding of concepts, while exercising flexibility, cultural awareness and a willingness to make necessary compromises to accomplish common goals. They learn to communicate effectively and efficiently by manipulating appropriate language, terminology, symbols and diagrams associated with scientific communication.

The objectives of the course ensure that students apply what they understand to explain and execute procedures, plan and implement projects and investigations, analyse and interpret information, and evaluate conclusions and outcomes.

Workplace health and safety practices are embedded across all units and focus on building knowledge and skills in working safely, effectively and efficiently in practical scientific situations.

2.2 Syllabus objectives

The syllabus objectives outline what students have the opportunity to learn.

1. **Describe ideas and phenomena.**

   Students give an account of scientific ideas and phenomena and the skills and processes used to complete a scientific task. They express information in a variety of modes using scientific language, representations and genre conventions.

2. **Execute procedures.**

   Students demonstrate skills and processes to complete a scientific task. They collect and collate information from primary and secondary sources. Students follow workplace health and safety procedures and ethical and environmental considerations.

3. **Analyse information.**

   Students recognise a variety of forms of information produced from experiments and research, e.g. words, symbols, pictures, graphs. They identify the key features and components of information and apply processes to identify patterns, relationships, errors and limitations.

4. **Interpret information.**

   Students draw conclusions from their analysis of information from experiments and research. They identify expectations and requirements in scenarios.

5. **Evaluate conclusions and outcomes.**

   Students make judgments about conclusions and outcomes in terms of criteria such as efficiency, effectiveness, cost, safety, industry standards or social, ethical, cultural or environmental impacts. They make recommendations about future investigations and projects.

6. **Plan investigations and projects.**

   Students make decisions about methodologies, sources and processes to reach conclusions and achieve outcomes. They ensure that workplace health and safety and ethical and environmental considerations are incorporated into planning.

2.3 Designing a course of study in Science in Practice

Syllabuses are designed for teachers to make professional decisions to tailor curriculum and assessment design and delivery to suit their school context and the goals, aspirations and abilities of their students within the parameters of Queensland's senior phase of learning.

The syllabus is used by teachers to develop curriculum for their school context. The term *course of study* describes the unique curriculum and assessment that students engage with in each school context. A course of study is the product of a series of decisions made by a school to select, organise and contextualise subject matter, integrate complementary and important learning, and create assessment tasks in accordance with syllabus specifications.

It is encouraged that, where possible, a course of study is designed such that teaching, learning and assessment activities are integrated and enlivened in an authentic setting.

2.3.1 Course structure

Science in Practice is an Applied senior syllabus. It contains at least four QCAA-developed units from which schools develop their course of study.

Each unit has been developed with a notional time of 55 hours of teaching and learning, including assessment.

Schools select four units from the unit options provided. They decide the order in which the units will be delivered. Once these decisions have been made, the four units selected and their order of implementation determine which units are considered Units 1–4.

Students should complete Unit 1 and Unit 2 before beginning Units 3 and 4. Units 3 and 4 are studied as a pair.

More information about the requirements for administering senior syllabuses is available in the 'Queensland curriculum' section of the *QCE and QCIA policy and procedures handbook*.

2.3.2 Curriculum

Senior syllabuses set out only what is essential while being flexible so teachers can make curriculum decisions to suit their students, school context, resources and expertise.

Within the requirements set out in this syllabus and the *QCE and QCIA policy and procedures handbook*, schools have autonomy to decide:

- how and when subject matter is delivered
- how, when and why learning experiences are developed, and the context in which learning occurs
- how opportunities are provided in the course of study for explicit and integrated teaching and learning of complementary skills.

These decisions allow teachers to develop a course of study that is rich, engaging and relevant for their students.

2.3.3 Assessment

Senior syllabuses set out only what is essential while being flexible so teachers can make assessment decisions to suit their students, school context, resources and expertise.

Applied senior syllabuses contain assessment specifications and conditions for the assessment instruments that must be implemented with Units 3 and 4. These specifications and conditions ensure comparability, equity and validity in assessment.

Within the requirements set out in this syllabus and the *QCE and QCIA policy and procedures handbook*, schools have autonomy to decide:

- specific assessment task details
- assessment contexts to suit available resources
- how the assessment task will be integrated with teaching and learning activities
- how authentic the task will be.

In Unit 1 and Unit 2, schools:

- develop at least two but no more than four assessments
- complete at least one assessment for each unit
- ensure that each unit objective is assessed at least once.

In Units 3 and 4, schools develop four assessments using the assessment specifications and conditions provided in the syllabus.

More information about assessment in senior syllabuses is available in 'The assessment system' section of the *QCE and QCIA policy and procedures handbook*.

2.3.4 Subject matter

Each unit contains a unit description, unit objectives and subject matter. Subject matter is the body of information, mental procedures and psychomotor procedures (see Marzano & Kendall 2007, 2008) that are necessary for students' learning and engagement with the subject. Subject matter itself is not the specification of learning experiences but provides the basis for the design of student learning experiences.

Subject matter has a direct relationship with the unit objectives and provides statements of learning that have been constructed in a similar way to objectives.

2.3.5 Aboriginal perspectives and Torres Strait Islander perspectives

The QCAA is committed to reconciliation. As part of its commitment, the QCAA affirms that:

- Aboriginal peoples and Torres Strait Islander peoples are the first Australians, and have the oldest living cultures in human history
- Aboriginal peoples and Torres Strait Islander peoples have strong cultural traditions and speak diverse languages and dialects, other than Standard Australian English
- teaching and learning in Queensland schools should provide opportunities for students to deepen their knowledge of Australia by engaging with the perspectives of Aboriginal peoples and Torres Strait Islander peoples
- positive outcomes for Aboriginal students and Torres Strait Islander students are supported by successfully embedding Aboriginal perspectives and Torres Strait Islander perspectives across planning, teaching and assessing student achievement.

Guidelines about Aboriginal perspectives and Torres Strait Islander perspectives and resources for teaching are available at www.qcaa.qld.edu.au/k-12-policies/aboriginal-torres-strait-islander-perspectives.

Where appropriate, Aboriginal perspectives and Torres Strait Islander perspectives have been embedded in the subject matter.

2.3.6 Complementary skills

Opportunities for the development of complementary skills have been embedded throughout subject matter. These skills, which overlap and interact with syllabus subject matter, are derived from current education, industry and community expectations and encompass the knowledge, skills, capabilities, behaviours and dispositions that will help students live and work successfully in the 21st century.

These complementary skills are:

- literacy — the knowledge, skills, behaviours and dispositions about language and texts essential for understanding and conveying English language content
- numeracy — the knowledge, skills, behaviours and dispositions that students need to use mathematics in a wide range of situations, to recognise and understand the role of mathematics in the world, and to develop the dispositions and capacities to use mathematical knowledge and skills purposefully
- 21st century skills — the attributes and skills students need to prepare them for higher education, work, and engagement in a complex and rapidly changing world. These skills include critical thinking, creative thinking, communication, collaboration and teamwork, personal and social skills, and digital literacy. The explanations of associated skills are available at www.qcaa.qld.edu.au/senior/senior-subjects/general-subjects/21st-century-skills .

It is expected that aspects of literacy, numeracy and 21st century skills will be developed by engaging in the learning outlined in this syllabus. Teachers may choose to create additional explicit and intentional opportunities for the development of these skills as they design the course of study.

2.3.7 Additional subject-specific information

Additional subject-specific information has been included to support and inform the development of a course of study.

Field work

It is anticipated that approximately five hours of field work will be required for learning and assessment in each unit.

Inquiry and project-management skills

The following list identifies skills that students will typically develop throughout the course of study in Science in Practice. This list is:

- not prescriptive — only skills that are relevant to the investigations and projects that students perform should be taught
- not exhaustive — other skills may be relevant.

Describe ideas and phenomena and execute procedures

- Work with others.
- Implement plans, including risk assessments and protocols for working with Aboriginal communities and Torres Strait Islander communities.
- Use specialised equipment to collect primary data and complete processes.
- Avoid or manage bias in data collection.
- Use research tools (e.g. library resources, search engines) to identify sources of secondary information.
- Record information using appropriate units of measurement.
- Present processed information using appropriate representations, e.g. tables, graphs and diagrams.
- Use technology (e.g. word processors, spreadsheets) to collate and process information.
- Process information from primary sources using descriptive statistics such as
  - percentages
  - measures of central tendency, e.g. mean, median and mode
  - measures of dispersion, e.g. range and standard deviation.
- Use appropriate genre conventions, e.g. report format.
- Acknowledge sources, e.g. using in-text referencing, reference lists, bibliographies.

Analyse and interpret information

- Analyse scenarios to identify components and relationships.
- Identify patterns and relationships in information from
  - primary sources, e.g. direct or inverse correlation, percentage difference
  - secondary sources, e.g. similarities, differences.
- Identify the limitations of information from
  - primary sources, e.g. error, uncertainty
  - secondary sources, e.g. relevance, credibility.
- Interpret texts.
- Interpret scenario requirements to select processes, materials and tools.
- Draw conclusions.

Evaluate and plan investigations and projects

- Identify criteria for the evaluation of
  - methodologies, e.g. efficiency, cost, safety
  - sources, e.g. credibility, relevance, age
  - processes, e.g. efficiency, cost, safety.
- Evaluate methodologies, sources, processes and outcomes against identified criteria
- Make recommendations for future investigations and projects.
- Set goals.
- Conduct background research.
- Identify independent variables and dependent variables.
- Select methodologies for experiments.
- Select sources for research.
- Decide on the type and amount of information to be collected.
- Identify appropriate equipment, materials and sources for investigations.
- Manage time and resources to deliver products and performances.
- Manage risk, including
  - identifying hazards
  - selecting appropriate personal protective equipment (PPE)
  - adapting standard operating procedures (SOPs)
  - proposing suitable modifications
  - planning responses to injuries and accidents.
- Apply ethical principles.
- Plan protocols for working with Aboriginal communities and Torres Strait Islander communities.

2.4 Reporting

General information about determining and reporting results for senior syllabuses is provided in the 'Determining and reporting results' section of the *QCE and QCIA policy and procedures handbook*.

2.4.1 Reporting standards

Reporting standards are summary statements that describe typical performance at each of the five levels (A–E).

A
The student selects sufficient and relevant sources, processes, materials and tools to plan for scientific tasks. They use fluent and concise scientific language to describe ideas, skills and processes. The student demonstrates confident and precise skills and processes to efficiently, effectively and safely execute experimental/research methodology. They efficiently collect and effective collate information and provide recommendations about future investigations and projects, supported with relevant evidence.
B
The student selects relevant sources, processes, materials and tools to plan for scientific tasks. They competently use scientific language to describe ideas, skills and processes. The student demonstrates competent skills and processes to effectively and safely execute experimental/research methodology. They collect and collate information and provide recommendations about future investigations and projects, related to evidence.
C
The student selects sources, processes, materials and tools to plan for scientific tasks. They use scientific language to describe ideas, skills and processes. The student demonstrates skills and processes to safely execute experimental/research methodology. They collect information and provide recommendations about future investigations and projects.
D
The student is guided by the teacher when selecting sources, processes, materials and tools to plan for scientific tasks. They use disjointed language to provide a basic description of ideas, skills and processes. The student is guided by the teacher when executing skills and processes experimental/ research methodology. They provide statements about investigations and projects.
E
The student is directed by the teacher when executing given processes. They provide an incomplete description of ideas, skills or processes and a partial description of investigations and projects.

2.4.2 Determining and reporting results

Unit 1 and Unit 2

Schools make A–E judgments on individual assessment instruments implemented in Unit 1 and Unit 2 using reporting standards.

Schools report results to the QCAA for students who complete Unit 1 and/or Unit 2. Results are reported as satisfactory (S) or unsatisfactory (U). Where appropriate, schools may also report a not rated (NR).

Units 3 and 4

Schools make A–E judgments on each of the four assessment instruments implemented in Units 3 and 4 using instrument-specific standards (ISS).

Schools report instrument results to the QCAA for students enrolled in Units 3 and 4 for each of the four assessments implemented. Where appropriate, schools may also report a not rated (NR).

Schools are also responsible for determining and reporting an A–E final subject result to the QCAA. The subject result is an on-balance judgment about how the pattern of evidence across the four assessments in Units 3 and 4 best matches the characteristics of the reporting standards at one of five levels (A–E).

3 Unit options

3.1 Unit option A: Consumer science

In this unit, students develop an understanding of the role and impact of biology and chemistry in the development, use and disposal of products. They learn about microbes in food, including types of microorganisms and the environmental conditions that affect their growth. Students also analyse the psychology behind different advertisements used to sell products.

Students plan and modify methodology to improve predicted product outcomes and test advertised claims. They plan modifications of environmental conditions to comment on the changes to food preservation and spoilage. They summarise findings from their investigation to determine the effectiveness of microbes for food preservation.

3.1.1 Unit objectives

1. Describe ideas and phenomena in consumer science.
2. Execute procedures in consumer science.
3. Analyse information in consumer science.
4. Interpret information in consumer science.
5. Evaluate conclusions and outcomes in consumer science.
6. Plan investigations and projects in consumer science.

3.1.2 Subject matter

Concepts

- Describe
  - consumer science
  - the life cycle of a consumer product from raw materials to delivery and disposal
  - types of
    - consumer products, e.g. cosmetics, cleansers, moisturisers, fertilisers, nutrient supplements
    - microorganisms, e.g. yeasts, bacteria, fungi, protozoa
  - the function and action of
    - a selected consumer product, e.g. saponification, pH, toxicity, plant or animal hormones
    - microorganisms in food production
  - the basis of a selected consumer product's underlying chemistry, e.g. emollients, thickeners, emulsifiers, pigments, water, preservatives
  - genetic manipulation of food microbes
  - the effect of microbes on nutrition and taste of food
  - environmental conditions for microorganisms' optimal growth or inhibition, e.g. temperature, chemicals, sugar levels, salt
  - psychological concepts involved in advertising consumer products, e.g. halo effect, framing, cognitive dissonance, attribution theory
  - ethics of animal testing
  - workplace health and safety involved in the development and use of a product, e.g. ingredients, labelling, safe handling
  - uses of microbiology in food, e.g. producing food (fermented drinks, bread, cheese); storing food and avoiding spoilage; preserving food (salting, canning, pickling)
  - pathways, relevant qualifications and career opportunities in consumer science.

Information

- Analyse and interpret
  - information from practicals, projects and investigations, e.g. levels of beneficial microbes in food, data about preservation methods
  - product information
  - advertising strategies
  - scales and statistics used to provide information
  - basic legal frameworks and legislation related to consumer products.

Procedures and skills

- Execute
  - risk management plans
  - microscope skills, e.g. set up microscope; prepare microscope slides; sketch specimen; calculate specimen size, gram stain and cell counts
  - methodology to make a consumer product, e.g. soap or moisturiser or food product
  - measurement of
    - materials, ingredients and variables, e.g. percentage composition
    - physical and chemical properties of food products, e.g. pH, volume, mass, calorimetric analysis
  - testing of products, e.g. levels of microbes in commercial or homemade food materials.
- Evaluate
  - use of microbes to produce commercial and homemade food
  - how microbes affect nutrition and taste of food
  - different ways of measuring percentage composition
  - investigations and projects to make recommendations.
- Plan
  - management of risks and hazards
  - investigations into consumer science, e.g. How do two similar consumer products compare?
  - projects in consumer science, e.g. create a consumer product.

3.2 Unit option B: Ecology

In this unit, students examine the ecology of a selected species or group of organisms and their interactions with their environments. Students test and determine factors in the ecosystem through water management and explain concepts such as organisms, ecosystems and their interdependences with Earth systems. They learn how human interactions with the Earth have a profound effect on present and future generations, and how science can inform these complex global problems. Students plan a field trip and collect, analyse and interpret data.

3.2.1 Unit objectives

1. Describe ideas and phenomena in ecology.
2. Execute procedures in ecology.
3. Analyse information in ecology.
4. Interpret information in ecology.
5. Evaluate conclusions and outcomes in ecology.
6. Plan investigations and projects in ecology.

3.2.2 Subject matter

Concepts

- Describe
  - types of ecosystems and the influence, interaction and relationship between abiotic and biotic factors, e.g. different plants grow in different soils, which affects other organisms living there
  - feeding relationships, e.g. consumers, herbivores, omnivores, carnivores, parasites
  - endangered species, e.g. the cause and impact of extinction, referring to Australian fauna and flora examples and considering the Aboriginal perspectives and Torres Strait Islander perspectives of impact
  - reasons for species being introduced and the scope of impacts on native species and environment, e.g. cane toad, mouse plague
  - adaptations, e.g. mechanisms and cause of animals and plant adaptation; reasons some species adapt and others become extinct
  - Aboriginal perspectives and Torres Strait Islander perspectives surrounding the quantity and quality of fauna and flora
  - flow of matter, energy and water through a system
  - the principles of ecologically sustainable development
  - water as a fundamental condition of life; the importance of water quality and quantity; and the causes, effects and consequences of water pollution and water scarcity
  - water quality guidelines for different water types, e.g. trigger values for water quality parameters
  - the main potable water resources for Queensland (surface water, ground water and desalinated water) and how these are affected by changing rainfall patterns
  - examples of monitoring strategies and physical, chemical and biological indicators
  - the role of microbes in water purification e.g. in sewage treatment (trickle filter, anaerobic digestor, sludge ponds)
  - legislation and regulations that protects natural ecosystems, e.g. management strategies of catchment areas are used to prevent dry land salinity, eutrophication and erosion
  - pathways, relevant qualifications and career opportunities in ecology.

Information

- Analyse and interpret
  - information from practicals, projects and investigations
  - biological control
  - the management of numbers for sustainability
  - food pyramids and food webs
  - boom-crash dynamics.

Procedures and skills

- Execute
  - risk management plans
  - protocols for working with Aboriginal communities and Torres Strait Islander communities
  - methodology to investigate species ecology
  - measurement of materials and variables, e.g. pH; light penetration (Secchi discs and turbidity tubes); bio-surveys; biological oxygen demand (BOD); toxins and pollution monitoring; flow rates; salinity
  - completion of food chains and food webs
  - identification and classification of common local organisms
  - contribution to a citizen science project.
- Evaluate
  - water quality monitoring data from different sites, land uses, and/or sources and potential benefits for the community, environment and economy
  - water quality monitoring guidelines — physical, chemical and biological parameters or indicators
  - strategies of water treatment for human or animal use
  - investigations and projects to make recommendations.
- Plan
  - management of risks and hazards
  - protocols for working with Aboriginal communities and Torres Strait Islander communities
  - investigations into ecology, e.g. How does a selected human action (e.g. mining, construction of a housing estate) affect a local ecosystem?
  - projects in ecology, e.g. contribute to a citizen science project.

3.3 Unit option C: Forensic science

In this unit, students explore scientific processes used in the field of forensic science and execute relevant procedures, such as fingerprinting, casting and blood typing. Students identify, explain and organise evidence collected for analysis. They interpret aspects of a simulated crime scene. They plan a methodology for collecting and preserving evidence while conducting further analysis of samples to reach conclusions and communicate findings. Students develop skills in observation, planning, data collection and data analysis of simulated crime scenes.

Note: Some content in this unit may be of a sensitive nature for certain students and school contexts. Teachers are advised to consider this before selecting this unit and, if selected, when they contextualise and develop learning experiences.

3.3.1 Unit objectives

1. Describe ideas and phenomena in forensic science.
2. Execute procedures in forensic science.
3. Analyse information in forensic science.
4. Interpret information in forensic science.
5. Evaluate conclusions and outcomes in forensic science.
6. Plan investigations and projects in forensic science.

3.3.2 Subject matter

Concepts

- Describe
  - forensic science
  - onus of proof and the collection and preservation of evidence
  - the difference between observation and inference
  - types of trace evidence, e.g. tool marks, firearms, foot marks or tread, fibre and hair, substance matching
  - the development of methodology for evidence collection, e.g. the exchange principle, process for controlling crime scenes
  - bodily processes relevant to forensic science, e.g. decomposition and rigor mortis; healing times of fractures
  - factors used in determining the time of death, e.g. blood flow, insects, larvae, bacteria
  - the properties of blood, e.g. types (A, B, AB, O and Rhesus factor); splatter patterns (passive, projected, transfer, contact)
  - DNA structure, e.g. base pairing
  - DNA profile construction and identification, e.g. chromosome pairing
  - pathways, relevant qualifications and career opportunities in forensic science.

Information

- Analyse and interpret
  - information from practicals, projects and investigations
  - crime scene evidence, e.g. fingerprint patterns, handwriting patterns, footwear or tool mark comparison, bone lengths, DNA profiles, blood types, fibre and hair samples, time of death graphs, blood spatter patterns.

Procedures and skills

- Execute
  - risk management plans
  - collection of evidence, e.g. handwriting, fingerprints, marks, hair, fibre, production of casts
  - detailed observations and note-taking at crime scenes
  - crime scene simulations, e.g. tool and foot marks, blood splatter patterns
  - DNA extraction, e.g. liver, strawberries, peas
  - microscopic identification of collected samples.
- Evaluate
  - forensic methodology of television dramas compared to real life
  - impact of artificial intelligence on evidence analysis, e.g. facial recognition software, fingerprint access to phones
  - evidence analysis techniques, e.g. blood splatter analysis, rigor mortis graphs, DNA profiles and collection processes, tool mark and print identification
  - impact of environmental conditions on rate of rigor mortis and decomposition rates
  - investigations and projects to make recommendations.
- Plan
  - management of risks and hazards
  - investigations into forensic science, e.g. What is the blood type of a given sample of blood?
  - projects in forensic science, e.g. demonstrate chosen techniques for collection of physical evidence.

3.4 Unit option D: Disease

In this unit, students explain why the numbers of people being diagnosed with diseases (such as allergies, arthritis, asthma, cancer, cardiovascular disease, diabetes and obesity) are increasing. Students explore disease types and causes. They analyse and evaluate how scientific study has accelerated in the last century and has had major impacts on disease identification, diagnosis and management. Students learn that scientific advances can provide solutions to health and lifestyle challenges.

Note: Some content in this unit may be of a sensitive nature for certain students and school contexts. Teachers are advised to consider this before selecting this unit and, if selected, when they contextualise and develop learning experiences.

3.4.1 Unit objectives

1. Describe ideas and phenomena in disease.
2. Execute procedures in disease.
3. Analyse information in disease.
4. Interpret information in disease.
5. Evaluate conclusions and outcomes in disease.
6. Plan investigations and projects in disease.

3.4.2 Subject matter

Concepts

- Describe
  - the difference between disease, illness and trauma
  - maintenance of homeostasis
  - meanings of endemic and pandemic and the factors that affect the spread of disease
  - types of diseases, e.g. communicable, deficiency, hereditary, infectious, autoimmune, psychological
  - disease-spreading organisms, e.g. protozoa bacteria, parasites, fungi, viruses, vectors
  - the importance of nutrition in a human diet and the role of supplements
  - the relationship between food and physical health
  - signs and symptoms of diseases
  - disease diagnosis, e.g. pathology, DNA analysis, radiology, psychoanalysis
  - the body's lines of defence, e.g. specific adaptive immune responses
  - disease prevention and management, e.g. immunisation; drug therapy; surgical intervention; counselling, psychology and psychiatry; nutrition and lifestyle choices; advancement in medical technology
  - the placebo effect
  - Aboriginal peoples' traditional knowledge and Torres Strait Islander peoples' traditional knowledge about healing and medicine
  - pathways, relevant qualifications and career opportunities in health science.

Information

- Analyse and interpret
  - information from practicals, projects and investigations
  - hypothetical disease cases
  - patterns and relationships in Australian data on diseases
  - information from a variety of sources to identify how the body fights disease and illness depending on its source, e.g. lifestyle, nutrition, parasite, viral
  - the relationship between climate change and disease.

Procedures and skills

- Execute
  - risk management plans
  - protocols for working with Aboriginal communities and Torres Strait Islander communities
  - measurement of materials and variables
  - extraction of DNA
  - modelling of pandemics and disease spread
  - creation of punnet squares to demonstrate heritable diseases
  - methodology to study
    - diseases and illness in the laboratory or field
    - diagnosis of hypothetical disease cases and treatment.
- Evaluate
  - the spread and containment of diseases
  - conclusions made about disease prevalence and reasons for changes in prevalence
  - the drug and immunisation approval process in Australia
  - workplace health and safety standards of the Australian pharmaceutical industry and radiology and cancer treatments compared to rest of the world
  - investigations and projects to make recommendations.
- Plan
  - management of risks and hazards
  - protocols for working with Aboriginal communities and Torres Strait Islander communities
  - investigations into disease, e.g. How might a chosen factor (e.g. climate change) or intervention (e.g. hand-washing, immunisation) affect the spread of a chosen disease?
  - projects in disease, e.g. demonstrate aspects of an activity plan for a person with a particular condition.

3.5 Unit option E: Sustainability

In this unit, students explore the concepts of energy and resources consumption and sustainability. Students demonstrate an understanding of renewable and non-renewable resources, energy efficiency and the four dimensions of sustainability. Students plan and investigate processes for reducing their communities' impacts on the environment at a local, national and global level. Students analyse and interpret primary and secondary data to highlight the efficiency of design for the study of a selected environment. They summarise their findings on their selected topic to the wider community and evaluate how the implementation of sustainable management practices assists in maintaining levels of resources to meet the needs of current and future generations.

3.5.1 Unit objectives

1. Describe ideas and phenomena in sustainability.
2. Execute procedures in sustainability.
3. Analyse information in sustainability.
4. Interpret information in sustainability.
5. Evaluate conclusions and outcomes in sustainability.
6. Plan investigations and projects in sustainability.

3.5.2 Subject matter

Concepts

- Describe
  - forms of energy as either potential (e.g. chemical, elastic, gravitational, nuclear) or kinetic (e.g. mechanical, heat, electrical, sound, light)
  - that work is done when energy is transformed or transferred in a system
  - the law of conservation of energy — how energy is transformed or transferred in a system
  - energy efficiency
  - energy sources, e.g. coal, gas, wind, solar, geothermal
  - differences between non-renewable and renewable resources
  - the generation and transformation of electrical energy into lighting, heating and cooling in the home
  - Aboriginal peoples' and Torres Strait Islander peoples' use of energy resources and sustainable living practices
  - ecological footprint
  - the four dimensions of sustainability — social, environmental, economic and political
  - sustainable interactions among social, global and human systems
  - sustainable practices — maintaining levels of resources to meet needs of the current and future population
  - pathways, relevant qualifications and career opportunities in sustainability.

Information

- Analyse and interpret
  - information from practicals, projects and investigations
  - Australian and worldwide data relevant to greenhouse gas emissions from energy resources and the cost of implementing renewable energy sources, e.g. upgrading current power stations, new renewable energy plants, cost of production, disposal, emissions
  - data from primary and secondary sources, e.g. light bulb energy consumption, solar panels, energy, water ratings of household devices, thermal consumption, change in recycling behaviour
  - energy ratings of materials, e.g. thermal ratings for glazing, insulation, thermal mass or electrical for domestic appliances
  - architectural and cultural features to meet environmental conditions
  - relationships between the four dimensions of sustainability
  - benefits of green spaces in community engagement.

Procedures and skills

- Execute
  - risk management plans
  - protocols for working with Aboriginal communities and Torres Strait Islander communities
  - activities to investigate local energy consumption, e.g. auditing home or school energy use, building a sustainable model house or community, measuring loss of thermal or electrical energy in normal houses or devices
  - constructing diagrams to represent energy transfers and transformations
  - calculations of
    - energy efficiency
    - energy consumption over a chosen period
    - energy and cost savings from efficiency interventions
    - ecological footprint, e.g. individual, school, house.
- Evaluate
  - renewable and non-renewable resources, e.g. comparing environmental impacts, health issues, usage, safety, energy security
  - effectiveness of energy-saving devices, e.g. shower heads, LED lights
  - local levels of sustainability using the four dimensions
  - proposed sustainability strategies, e.g. on a local, state, national or global scale
  - investigations and projects to make recommendations.
- Plan
  - management of risks and hazards
  - protocols for working with Aboriginal communities and Torres Strait Islander communities
  - investigations into sustainability, e.g. Under what conditions do solar panels produce the most energy?
  - projects in sustainability, e.g. construct a model house featuring several energy efficiency strategies.

3.6 Unit option F: Transport

In this unit, students explore transportation and vehicle safety by investigating the scientific concepts of energy, energy conversions, aerodynamics and safety features of selected modern vehicles. Students demonstrate an understanding of the laws of motion, energy efficiency and the effects of aerodynamics. Students apply their understanding of energy to explain concepts such as chain reaction machines. They examine the application of the laws of motion, types of forces, design considerations and environmental conditions that affect motion and the impact of innovative design on vehicle safety.

Students plan and modify a vehicle design to improve safety and aerodynamic features. They plan modifications and identify changes to force and safety of their selected vehicle. Students analyse and data collected from primary and secondary sources to evaluate the effectiveness of vehicle design.

3.6.1 Unit objectives

1. Describe ideas and phenomena in transport.
2. Execute procedures in transport.
3. Analyse information in transport.
4. Interpret information in transport.
5. Evaluate conclusions and outcomes in transport.
6. Plan investigations and projects in transport.

3.6.2 Subject matter

Concepts

- Describe
  - types of energy, e.g. potential and kinetic
  - energy transfers and transformations
  - energy efficiency
  - the laws of motion (i.e. inertia, $F = ma$, action-reaction) and associated concepts, e.g. force, acceleration, speed, momentum, thrust, drag, propulsion
  - examples of transport that use propulsion and aerodynamics
  - the impact of vehicle design on physical factors relating to dynamics, e.g. centre of gravity, gravity, mass, surface area to volume ratio
  - factors that affect braking and stopping distances of vehicles, e.g. reaction time, road conditions
  - angles of impact, e.g. accidental damage
  - technologies used for vehicle safety, e.g. seat belts, air bags, crumple zones
  - behaviour patterns that influence safety, e.g. drink and drug driving, sleep patterns
  - sustainable transport, e.g. public transport, non-motorised transport, sustainable urban models (compact and ‘15-minute' cities)
  - pathways, relevant qualifications and career opportunities in transport.

Information

- Analyse and interpret
  - information from practicals, projects and investigations
  - graphs and diagrams relevant to the transport context, e.g. force diagrams, energy efficiency graphs, distance–time graphs
  - the effect of aerodynamics on aesthetics, resistance, acceleration and speed
  - energy transfers and transformations.

Procedures and skills

- Execute
  - risk management plans
  - application of the laws of motion
  - construction of free-body diagrams
  - calculations, e.g. energy, energy efficiency, force, acceleration, speed, braking and stopping distances.
- Evaluate
  - designs of safety devices in vehicles, e.g. lap belt, three-point vs. five-point harness
  - energy efficiency of comparable objects
  - design of aerodynamic vehicles
  - the impact of crashes on vehicles and people
  - safety regulations and safe driving recommendations, e.g. two-second rule for safe following distance in motor vehicles
  - investigations and projects to make recommendations.
- Plan
  - management of risks and hazards
  - investigations into transport, e.g. What impact does a chosen condition (e.g. mass, centre of gravity, propulsion system) have on the speed of a chosen vehicle (e.g. paper plane, CO2 car, rocket)?
  - projects in transport, e.g. construct an aerodynamic vehicle.

4 Assessment

4.1 Assessment A1: Applied investigation

Students investigate a research question by collecting, analysing and interpreting primary or secondary information.

4.1.1 Assessment objectives

1. Describe ideas and phenomena in consumer science.
2. Execute procedures in consumer science.
3. Analyse information in consumer science.
4. Interpret information in consumer science.
5. Evaluate conclusions in consumer science.
6. Plan investigations in consumer science.

4.1.2 Specifications

This task requires students to:

- investigate a question that
  - is related to consumer science
  - has scope to be refined further
- document the investigation process and conclusion, including
  - selecting a methodology or sources
  - collecting information
  - analysing information
  - drawing a conclusion based on the analysis of information
  - making recommendations for future investigations.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides research questions that students select and investigate.

4.1.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- If students are using primary information, the following aspects of the task may be completed as a group
  - selecting methodology
  - collecting primary information.

4.1.4 Response requirements

One of the following:

- Multimodal (at least two modes delivered at the same time): up to 7 minutes, 10 A4 pages, or equivalent digital media
- Written: up to 1000 words

4.1.5 Instrument-specific standards

Execution	Interpretation	Evaluation	Grade
The student response has the following characteristics:			
• selection of sufficient and relevant methodology/sources • efficient, effective and safe execution of experimental/research methodology • efficient collection and effective collation of information	• thorough and appropriate identification of patterns and relationships in information • thorough and appropriate identification of errors/limitations of information • conclusion supported with relevant evidence	• recommendations for effective future investigations supported with relevant evidence • fluent and concise use of scientific language • effective use of representations and genre conventions	A
• selection of relevant methodology/sources • effective and safe execution of experimental/ research methodology • collection and collation of information	• appropriate identification of patterns or relationships in information • appropriate identification of errors/limitations of information • conclusion related to evidence	• recommendations for appropriate future investigations related to evidence • competent use of scientific language • appropriate use of representations and genre conventions	B
• selection of methodology/sources • safe execution of experimental or research methodology • collection of information	• identification of patterns or relationships in information • identification of errors/limitations of information • conclusion to the research question	• recommendations for future investigations • use of scientific language • use of representations and genre conventions	C
• guided selection of methodology/sources • guided execution of given experimental or research methodology.	• statements about patterns or relationships in information • statements about errors or limitations • statement about the research question.	• statement about investigations • use of language • disjointed use of basic representations and conventions.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.2 Assessment A2: Practical project

Students use practical skills to complete a project in response to a scenario.

4.2.1 Assessment objectives

1. Describe ideas and phenomena in consumer science.
2. Execute procedures in consumer science.
3. Analyse information in consumer science.
4. Interpret information in consumer science.
5. Evaluate outcomes in consumer science.
6. Plan projects in consumer science.

4.2.2 Specifications

This task requires students to:

- complete a project
  - related to a scenario about consumer science
  - with an outcome of either a physical product or the performance of a skill
- document the process used to complete the project, including
  - analysing and interpreting the given scenario
  - describing the relevant concepts and procedures
  - selecting a procedure to follow
  - executing skills and processes to deliver an outcome
  - evaluating the outcome
  - making recommendations for future projects.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides a scenario that students respond to.

4.2.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- The following aspects of the task may be completed as a group
  - analysing and interpreting the scenario
  - selecting a procedure to follow.
  - executing the procedure.

4.2.4 Response requirements

Completed project

One of the following:

- Product: 1
- Performance: up to 4 minutes

Documented process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

4.2.5 Instrument-specific standards

Planning	Execution	Evaluation	Grade
The student response has the following characteristics:			
• identification of components and relationships in scenarios • selection of effective and appropriate processes, materials and tools • justified decisions	• confident and precise execution of skills • integration of skills into effective processes • management of risks and ethical issues	• fluent and concise description of ideas, skills and processes • discerning evaluation of outcome against appropriate criteria • recommendations for future effective projects	A
• identification of relevant information in scenarios • selection of relevant processes, materials and tools • considered decisions	• competent execution of skills • co-ordination of skills in relevant processes • assessment of risks and ethical issues	• competent description of ideas, skills and processes • reasonable evaluation of outcome against identified criteria • recommendations for appropriate future projects	B
• identification of task components • selection of processes, materials and tools • appropriate decisions	• execution of skills • execution of processes • execution of safe and ethical processes	• description of ideas, skills and processes • evaluation of outcome • recommendations for future projects	C
• identification of basic information in scenarios • guided selection of processes, materials and tools • inappropriate decisions.	• guided execution of skills • guided execution of processes • guided execution of safe and ethical processes.	• basic description of ideas, skills or processes • statements about outcome • ideas about future projects.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.3 Assessment B1: Applied investigation

Students investigate a research question by collecting, analysing and interpreting primary or secondary information.

4.3.1 Assessment objectives

1. Describe ideas and phenomena in ecology.
2. Execute procedures in ecology.
3. Analyse information in ecology.
4. Interpret information in ecology.
5. Evaluate conclusions in ecology.
6. Plan investigations in ecology.

4.3.2 Specifications

This task requires students to:

- investigate a question that
  - is related to ecology and environment
  - has scope to be refined further
- document the investigation process and conclusion, including
  - selecting a methodology or sources
  - collecting information
  - analysing information
  - drawing a conclusion based on the analysis of information
  - making recommendations for future investigations.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides research questions that students select and investigate.

4.3.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- If students are using primary information, the following aspects of the task may be completed as a group
  - selecting methodology
  - collecting primary information.

4.3.4 Response requirements

One of the following:

- Multimodal (at least two modes delivered at the same time): up to 7 minutes, 10 A4 pages, or equivalent digital media
- Written: up to 1000 words

4.3.5 Instrument-specific standards

Execution	Interpretation	Evaluation	Grade
The student response has the following characteristics:			
• selection of sufficient and relevant methodology/sources • efficient, effective and safe execution of experimental/research methodology • efficient collection and effective collation of information	• thorough and appropriate identification of patterns and relationships in information • thorough and appropriate identification of errors/limitations of information • conclusion supported with relevant evidence	• recommendations for effective future investigations supported with relevant evidence • fluent and concise use of scientific language • effective use of representations and genre conventions	A
• selection of relevant methodology/sources • effective and safe execution of experimental/ research methodology • collection and collation of information	• appropriate identification of patterns or relationships in information • appropriate identification of errors/limitations of information • conclusion related to evidence	• recommendations for appropriate future investigations related to evidence • competent use of scientific language • appropriate use of representations and genre conventions	B
• selection of methodology/sources • safe execution of experimental or research methodology • collection of information	• identification of patterns or relationships in information • identification of errors/limitations of information • conclusion to the research question	• recommendations for future investigations • use of scientific language • use of representations and genre conventions	C
• guided selection of methodology/sources • guided execution of given experimental or research methodology.	• statements about patterns or relationships in information • statements about errors or limitations • statement about the research question.	• statement about investigations • use of language • disjointed use of basic representations and conventions.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.4 Assessment B2: Practical project

Students use practical skills to complete a project in response to a scenario.

4.4.1 Assessment objectives

1. Describe ideas and phenomena in ecology.
2. Execute procedures in ecology.
3. Analyse information in ecology.
4. Interpret information in ecology.
5. Evaluate outcomes in ecology.
6. Plan projects in ecology.

4.4.2 Specifications

This task requires students to:

- complete a project
  - related to a scenario about ecology
  - with an outcome of either a physical product or the performance of a skill
- document the process used to complete the project, including
  - analysing and interpreting the given scenario
  - describing the relevant concepts and procedures
  - selecting a procedure to follow
  - executing skills and processes to deliver an outcome
  - evaluating the outcome
  - making recommendations for future projects.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides a scenario that students respond to.

4.4.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- The following aspects of the task may be completed as a group
  - analysing and interpreting the scenario
  - selecting a procedure to follow.
  - executing the procedure.

4.4.4 Response requirements

Completed project

One of the following:

- Product: 1
- Performance: up to 4 minutes

Documented process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

4.4.5 Instrument-specific standards

Planning	Execution	Evaluation	Grade
The student response has the following characteristics:			
• identification of components and relationships in scenarios • selection of effective and appropriate processes, materials and tools • justified decisions	• confident and precise execution of skills • integration of skills into effective processes • management of risks and ethical issues	• fluent and concise description of ideas, skills and processes • discerning evaluation of outcome against appropriate criteria • recommendations for future effective projects	A
• identification of relevant information in scenarios • selection of relevant processes, materials and tools • considered decisions	• competent execution of skills • co-ordination of skills in relevant processes • assessment of risks and ethical issues	• competent description of ideas, skills and processes • reasonable evaluation of outcome against identified criteria • recommendations for appropriate future projects	B
• identification of task components • selection of processes, materials and tools • appropriate decisions	• execution of skills • execution of processes • execution of safe and ethical processes	• description of ideas, skills and processes • evaluation of outcome • recommendations for future projects	C
• identification of basic information in scenarios • guided selection of processes, materials and tools • inappropriate decisions.	• guided execution of skills • guided execution of processes • guided execution of safe and ethical processes.	• basic description of ideas, skills or processes • statements about outcome • ideas about future projects.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.5 Assessment C1: Applied investigation

Students investigate a research question by collecting, analysing and interpreting primary or secondary information.

4.5.1 Assessment objectives

1. Describe ideas and phenomena in forensic science.
2. Execute procedures in forensic science.
3. Analyse information in forensic science.
4. Interpret information in forensic science.
5. Evaluate conclusions in forensic science.
6. Plan investigations in forensic science.

4.5.2 Specifications

This task requires students to:

- investigate a question that
  - is related to forensic science
  - has scope to be refined further
- document the investigation process and conclusion, including
  - selecting a methodology or sources
  - collecting information
  - analysing information
  - drawing a conclusion based on the analysis of information
  - making recommendations for future investigations.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides research questions that students select and investigate.

4.5.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- If students are using primary information, the following aspects of the task may be completed as a group
  - selecting methodology
  - collecting primary information.

4.5.4 Response requirements

One of the following:

- Multimodal (at least two modes delivered at the same time): up to 7 minutes, 10 A4 pages, or equivalent digital media
- Written: up to 1000 words

4.5.5 Instrument-specific standards

Execution	Interpretation	Evaluation	Grade
The student response has the following characteristics:			
• selection of sufficient and relevant methodology/sources • efficient, effective and safe execution of experimental/research methodology • efficient collection and effective collation of information	• thorough and appropriate identification of patterns and relationships in information • thorough and appropriate identification of errors/limitations of information • conclusion supported with relevant evidence	• recommendations for effective future investigations supported with relevant evidence • fluent and concise use of scientific language • effective use of representations and genre conventions	A
• selection of relevant methodology/ sources • effective and safe execution of experimental/research methodology • collection and collation of information	• appropriate identification of patterns or relationships in information • appropriate identification of errors/ limitations of information • conclusion related to evidence	• recommendations for appropriate future investigations related to evidence • competent use of scientific language • appropriate use of representations and genre conventions	B
• selection of methodology/sources • safe execution of experimental or research methodology • collection of information	• identification of patterns or relationships in information • identification of errors/limitations of information • conclusion to the research question	• recommendations for future investigations • use of scientific language • use of representations and genre conventions	C
• guided selection of methodology/ sources • guided execution of given experimental or research methodology.	• statements about patterns or relationships in information • statements about errors or limitations • statement about the research question.	• statement about investigations • use of language • disjointed use of basic representations and conventions.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.6 Assessment C2: Practical project

Students use practical skills to complete a project in response to a scenario.

4.6.1 Assessment objectives

1. Describe ideas and phenomena in forensic science.
2. Execute procedures in forensic science.
3. Analyse information in forensic science.
4. Interpret information in forensic science.
5. Evaluate outcomes in forensic science.
6. Plan projects in forensic science.

4.6.2 Specifications

This task requires students to:

- complete a project
  - related to a scenario about forensic science
  - with an outcome of either a physical product or the performance of a skill
- document the process used to complete the project, including
  - analysing and interpreting the given scenario
  - describing the relevant concepts and procedures
  - selecting a procedure to follow
  - executing skills and processes to deliver an outcome
  - evaluating the outcome
  - making recommendations for future projects.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides a scenario that students respond to.

4.6.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- The following aspects of the task may be completed as a group
  - analysing and interpreting the scenario
  - selecting a procedure to follow.
  - executing the procedure.

4.6.4 Response requirements

Completed project

One of the following:

- Product: 1
- Performance: up to 4 minutes

Documented process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

4.6.5 Instrument-specific standards

Planning	Execution	Evaluation	Grade
The student response has the following characteristics:			
• identification of components and relationships in scenarios • selection of effective and appropriate processes, materials and tools • justified decisions	• confident and precise execution of skills • integration of skills into effective processes • management of risks and ethical issues	• fluent and concise description of ideas, skills and processes • discerning evaluation of outcome against appropriate criteria • recommendations for future effective projects	A
• identification of relevant information in scenarios • selection of relevant processes, materials and tools • considered decisions	• competent execution of skills • co-ordination of skills in relevant processes • assessment of risks and ethical issues	• competent description of ideas, skills and processes • reasonable evaluation of outcome against identified criteria • recommendations for appropriate future projects	B
• identification of task components • selection of processes, materials and tools • appropriate decisions	• execution of skills • execution of processes • execution of safe and ethical processes	• description of ideas, skills and processes • evaluation of outcome • recommendations for future projects	C
• identification of basic information in scenarios • guided selection of processes, materials and tools • inappropriate decisions.	• guided execution of skills • guided execution of processes • guided execution of safe and ethical processes.	• basic description of ideas, skills or processes • statements about outcome • ideas about future projects.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.7 Assessment D1: Applied investigation

Students investigate a research question by collecting, analysing and interpreting primary or secondary information.

4.7.1 Assessment objectives

1. Describe ideas and phenomena in disease.
2. Execute procedures in disease.
3. Analyse information in disease.
4. Interpret information in disease.
5. Evaluate conclusions in disease.
6. Plan investigations in disease.

4.7.2 Specifications

This task requires students to:

- investigate a question that
  - is related to disease
  - has scope to be refined further
- document the investigation process and conclusion, including
  - selecting a methodology or sources
  - collecting information
  - analysing information
  - drawing a conclusion based on the analysis of information
  - making recommendations for future investigations.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides research questions that students select and investigate.

4.7.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- If students are using primary information, the following aspects of the task may be completed as a group
  - selecting methodology
  - collecting primary information.

4.7.4 Response requirements

One of the following:

- Multimodal (at least two modes delivered at the same time): up to 7 minutes, 10 A4 pages, or equivalent digital media
- Written: up to 1000 words

4.7.5 Instrument-specific standards

Execution	Interpretation	Evaluation	Grade
The student response has the following characteristics:			
• selection of sufficient and relevant methodology/sources • efficient, effective and safe execution of experimental/research methodology • efficient collection and effective collation of information	• thorough and appropriate identification of patterns and relationships in information • thorough and appropriate identification of errors/limitations of information • conclusion supported with relevant evidence	• recommendations for effective future investigations supported with relevant evidence • fluent and concise use of scientific language • effective use of representations and genre conventions	A
• selection of relevant methodology/sources • effective and safe execution of experimental/ research methodology • collection and collation of information	• appropriate identification of patterns or relationships in information • appropriate identification of errors/limitations of information • conclusion related to evidence	• recommendations for appropriate future investigations related to evidence • competent use of scientific language • appropriate use of representations and genre conventions	B
• selection of methodology/sources • safe execution of experimental or research methodology • collection of information	• identification of patterns or relationships in information • identification of errors/limitations of information • conclusion to the research question	• recommendations for future investigations • use of scientific language • use of representations and genre conventions	C
• guided selection of methodology/sources • guided execution of given experimental or research methodology.	• statements about patterns or relationships in information • statements about errors or limitations • statement about the research question.	• statement about investigations • use of language • disjointed use of basic representations and conventions.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.8 Assessment D2: Practical project

Students use practical skills to complete a project in response to a scenario.

4.8.1 Assessment objectives

1. Describe ideas and phenomena in disease.
2. Execute procedures in disease.
3. Analyse information in disease.
4. Interpret information in disease.
5. Evaluate outcomes in disease.
6. Plan projects in disease.

4.8.2 Specifications

This task requires students to:

- complete a project
  - related to a scenario about disease
  - with an outcome of either a physical product or the performance of a skill
- document the process used to complete the project, including
  - analysing and interpreting the given scenario
  - describing the relevant concepts and procedures
  - selecting a procedure to follow
  - executing skills and processes to deliver an outcome
  - evaluating the outcome
  - making recommendations for future projects.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides a scenario that students respond to.

4.8.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- The following aspects of the task may be completed as a group
  - analysing and interpreting the scenario
  - selecting a procedure to follow.
  - executing the procedure.

4.8.4 Response requirements

Completed project

One of the following:

- Product: 1
- Performance: up to 4 minutes

Documented process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

4.8.5 Instrument-specific standards

Planning	Execution	Evaluation	Grade
The student response has the following characteristics:			
• identification of components and relationships in scenarios • selection of effective and appropriate processes, materials and tools • justified decisions	• confident and precise execution of skills • integration of skills into effective processes • management of risks and ethical issues	• fluent and concise description of ideas, skills and processes • discerning evaluation of outcome against appropriate criteria • recommendations for future effective projects	A
• identification of relevant information in scenarios • selection of relevant processes, materials and tools • considered decisions	• competent execution of skills • co-ordination of skills in relevant processes • assessment of risks and ethical issues	• competent description of ideas, skills and processes • reasonable evaluation of outcome against identified criteria • recommendations for appropriate future projects	B
• identification of task components • selection of processes, materials and tools • appropriate decisions	• execution of skills • execution of processes • execution of safe and ethical processes	• description of ideas, skills and processes • evaluation of outcome • recommendations for future projects	C
• identification of basic information in scenarios • guided selection of processes, materials and tools • inappropriate decisions.	• guided execution of skills • guided execution of processes • guided execution of safe and ethical processes.	• basic description of ideas, skills or processes • statements about outcome • ideas about future projects.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.9 Assessment E1: Applied investigation

Students investigate a research question by collecting, analysing and interpreting primary or secondary information.

4.9.1 Assessment objectives

1. Describe ideas and phenomena in sustainability.
2. Execute procedures in sustainability.
3. Analyse information in sustainability.
4. Interpret information in sustainability.
5. Evaluate conclusions in sustainability.
6. Plan investigations in sustainability.

4.9.2 Specifications

This task requires students to:

- investigate a question that
  - is related to sustainability
  - has scope to be refined further
- document the investigation process and conclusion, including
  - selecting a methodology or sources
  - collecting information
  - analysing information
  - drawing a conclusion based on the analysis of information
  - making recommendations for future investigations.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides research questions that students select and investigate.

4.9.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- If students are using primary information, the following aspects of the task may be completed as a group
  - selecting methodology
  - collecting primary information.

4.9.4 Response requirements

One of the following:

- Multimodal (at least two modes delivered at the same time): up to 7 minutes, 10 A4 pages, or equivalent digital media
- Written: up to 1000 words

4.9.5 Instrument-specific standards

Execution	Interpretation	Evaluation	Grade
The student response has the following characteristics:			
• selection of sufficient and relevant methodology/sources • efficient, effective and safe execution of experimental/research methodology • efficient collection and effective collation of information	• thorough and appropriate identification of patterns and relationships in information • thorough and appropriate identification of errors/limitations of information • conclusion supported with relevant evidence	• recommendations for effective future investigations supported with relevant evidence • fluent and concise use of scientific language • effective use of representations and genre conventions	A
• selection of relevant methodology/sources • effective and safe execution of experimental/ research methodology • collection and collation of information	• appropriate identification of patterns or relationships in information • appropriate identification of errors/limitations of information • conclusion related to evidence	• recommendations for appropriate future investigations related to evidence • competent use of scientific language • appropriate use of representations and genre conventions	B
• selection of methodology/sources • safe execution of experimental or research methodology • collection of information	• identification of patterns or relationships in information • identification of errors/limitations of information • conclusion to the research question	• recommendations for future investigations • use of scientific language • use of representations and genre conventions	C
• guided selection of methodology/sources • guided execution of given experimental or research methodology.	• statements about patterns or relationships in information • statements about errors or limitations • statement about the research question.	• statement about investigations • use of language • disjointed use of basic representations and conventions.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.10 Assessment E2: Practical project

Students use practical skills to complete a project in response to a scenario.

4.10.1 Assessment objectives

1. Describe ideas and phenomena in sustainability.
2. Execute procedures in sustainability.
3. Analyse information in sustainability.
4. Interpret information in sustainability.
5. Evaluate outcomes in sustainability.
6. Plan projects in sustainability.

4.10.2 Specifications

This task requires students to:

- complete a project
  - related to a scenario about sustainability
  - with an outcome of either a physical product or the performance of a skill
- document the process used to complete the project, including
  - analysing and interpreting the given scenario
  - describing the relevant concepts and procedures
  - selecting a procedure to follow
  - executing skills and processes to deliver an outcome
  - evaluating the outcome
  - making recommendations for future projects.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides a scenario that students respond to.

4.10.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- The following aspects of the task may be completed as a group
  - analysing and interpreting the scenario
  - selecting a procedure to follow.
  - executing the procedure.

4.10.4 Response requirements

Completed project

One of the following:

- Product: 1
- Performance: up to 4 minutes

Documented process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

4.10.5 Instrument-specific standards

Planning	Execution	Evaluation	Grade
The student response has the following characteristics:			
• identification of components and relationships in scenarios • selection of effective and appropriate processes, materials and tools • justified decisions	• confident and precise execution of skills • integration of skills into effective processes • management of risks and ethical issues	• fluent and concise description of ideas, skills and processes • discerning evaluation of outcome against appropriate criteria • recommendations for future effective projects	A
• identification of relevant information in scenarios • selection of relevant processes, materials and tools • considered decisions	• competent execution of skills • co-ordination of skills in relevant processes • assessment of risks and ethical issues	• competent description of ideas, skills and processes • reasonable evaluation of outcome against identified criteria • recommendations for appropriate future projects	B
• identification of task components • selection of processes, materials and tools • appropriate decisions	• execution of skills • execution of processes • execution of safe and ethical processes	• description of ideas, skills and processes • evaluation of outcome • recommendations for future projects	C
• identification of basic information in scenarios • guided selection of processes, materials and tools • inappropriate decisions.	• guided execution of skills • guided execution of processes • guided execution of safe and ethical processes.	• basic description of ideas, skills or processes • statements about outcome • ideas about future projects.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.11 Assessment F1: Applied investigation

Students investigate a research question by collecting, analysing and interpreting primary or secondary information.

4.11.1 Assessment objectives

1. Describe ideas and phenomena in transport.
2. Execute procedures in transport.
3. Analyse information in transport.
4. Interpret information in transport.
5. Evaluate conclusions in transport.
6. Plan investigations in transport.

4.11.2 Specifications

This task requires students to:

- investigate a question that
  - is related to transport
  - has scope to be refined further
- document the investigation process and conclusion, including
  - selecting a methodology or sources
  - collecting information
  - analysing information
  - drawing a conclusion based on the analysis of information
  - making recommendations for future investigations.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides research questions that students select and investigate.

4.11.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- If students are using primary information, the following aspects of the task may be completed as a group
  - selecting methodology
  - collecting primary information.

4.11.4 Response requirements

One of the following:

- Multimodal (at least two modes delivered at the same time): up to 7 minutes, 10 A4 pages, or equivalent digital media
- Written: up to 1000 words

4.11.5 Instrument-specific standards

Execution	Interpretation	Evaluation	Grade
The student response has the following characteristics:			
• selection of sufficient and relevant methodology/sources • efficient, effective and safe execution of experimental/research methodology • efficient collection and effective collation of information	• thorough and appropriate identification of patterns and relationships in information • thorough and appropriate identification of errors/limitations of information • conclusion supported with relevant evidence	• recommendations for effective future investigations supported with relevant evidence • fluent and concise use of scientific language • effective use of representations and genre conventions	A
• selection of relevant methodology/sources • effective and safe execution of experimental/ research methodology • collection and collation of information	• appropriate identification of patterns or relationships in information • appropriate identification of errors/limitations of information • conclusion related to evidence	• recommendations for appropriate future investigations related to evidence • competent use of scientific language • appropriate use of representations and genre conventions	B
• selection of methodology/sources • safe execution of experimental or research methodology • collection of information	• identification of patterns or relationships in information • identification of errors/limitations of information • conclusion to the research question	• recommendations for future investigations • use of scientific language • use of representations and genre conventions	C
• guided selection of methodology/sources • guided execution of given experimental or research methodology.	• statements about patterns or relationships in information • statements about errors or limitations • statement about the research question.	• statement about investigations • use of language • disjointed use of basic representations and conventions.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

4.12 Assessment F2: Practical project

Students use practical skills to complete a project in response to a scenario.

4.12.1 Assessment objectives

1. Describe ideas and phenomena in transport.
2. Execute procedures in transport.
3. Analyse information in transport.
4. Interpret information in transport.
5. Evaluate outcomes in transport.
6. Plan projects in transport.

4.12.2 Specifications

This task requires students to:

- complete a project
  - related to a scenario about transport
  - with an outcome of either a physical product or the performance of a skill
- document the process used to complete the project, including
  - analysing and interpreting the given scenario
  - describing the relevant concepts and procedures
  - selecting a procedure to follow
  - executing skills and processes to deliver an outcome
  - evaluating the outcome
  - making recommendations for future projects.

It is recommended that this task is designed so that students can develop a response in approximately 10–15 hours of class time.

Stimulus specifications

The teacher provides a scenario that students respond to.

4.12.3 Conditions

- Students can develop their responses in class time and their own time.
- This is an individual task.
- The following aspects of the task may be completed as a group
  - analysing and interpreting the scenario
  - selecting a procedure to follow.
  - executing the procedure.

4.12.4 Response requirements

Completed project

One of the following:

- Product: 1
- Performance: up to 4 minutes

Documented process

Multimodal (at least two modes delivered at the same time): up to 5 minutes, 8 A4 pages, or equivalent digital media

4.12.5 Instrument-specific standards

Planning	Execution	Evaluation	Grade
The student response has the following characteristics:			
• identification of components and relationships in scenarios • selection of effective and appropriate processes, materials and tools • justified decisions	• confident and precise execution of skills • integration of skills into effective processes • management of risks and ethical issues	• fluent and concise description of ideas, skills and processes • discerning evaluation of outcome against appropriate criteria • recommendations for future effective projects	A
• identification of relevant information in scenarios • selection of relevant processes, materials and tools • considered decisions	• competent execution of skills • co-ordination of skills in relevant processes • assessment of risks and ethical issues	• competent description of ideas, skills and processes • reasonable evaluation of outcome against identified criteria • recommendations for appropriate future projects	B
• identification of task components • selection of processes, materials and tools • appropriate decisions	• execution of skills • execution of processes • execution of safe and ethical processes	• description of ideas, skills and processes • evaluation of outcome • recommendations for future projects	C
• identification of basic information in scenarios • guided selection of processes, materials and tools • inappropriate decisions.	• guided execution of skills • guided execution of processes • guided execution of safe and ethical processes.	• basic description of ideas, skills or processes • statements about outcome • ideas about future projects.	D
The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	The student response does not match any of the descriptors above.	E

5 Glossary

The syllabus glossary is available at www.qcaa.qld.edu.au/downloads/senior-qce/common/snr_glossary_cognitive_verbs.pdf.

6 References

Marzano, RJ & Kendall, JS 2007, *The New Taxonomy of Educational Objectives*, 2nd edition, Corwin Press, USA.

——2008, Designing and Assessing Educational Objectives: Applying the new taxonomy, Corwin Press, USA.

7 Version history

Version	Date of change	Update
1.1	August 2023	Released for implementation with minor updates

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