Biology

LEVEL 3	15 TCE CREDIT POINTS
COURSE CODE	BIO315124
COURSE SPAN	2024 — 2028
READING AND WRITING STANDARD	NO
MATHEMATICS STANDARD	NO
COMPUTERS AND INTERNET STANDARD	NO

This course is current for 2024.

Biology Level 3 builds on learners' interest and prior knowledge of biology.

Course Description

This course will suit learners who have successfully completed Biology Level 2 or achieved above standard in Year 10 Science. They will extend their knowledge by exploring applications of biology in society and the processes behind scientific discovery.

In this course learners will:

- use practical inquiry to observe, measure and represent the biological world
- use established theory to interpret data, analyse findings and propose further study
- explore biochemical and cellular systems
- develop an understanding of the basis of genetics and gene regulation
- investigate the genetic basis for evolution by natural selection
- understand how organisms respond to challenges such as temperature and disease
- understand how biological knowledge explains observations over small and large scales.

Learners are assessed on their biological knowledge and skills through a range of tasks culminating in an external examination. The course content and assessment support those considering a tertiary science pathway. Biology Level 3 provides a foundation to prepare learners for a broad range of fields, including all aspects of health, agriculture and marine science.

Focus Area

Discipline-based study

Courses aligned to the Years 9 to 12 Curriculum Framework belong to one of the five focus areas of Discipline-based study, Transdisciplinary projects, Professional studies, Work-based learning and Personal futures.

Biology Level 3 is a Discipline-based study course.

Discipline-based study

Discipline-based study includes content, core concepts and big ideas; enabling deep knowledge and understanding of the content and the application of what is learned. Learners consider accepted key disciplinary knowledge, apply distinctive ways of thinking and become increasingly independent learners. They use methodologies specific to the discipline to explore and strengthen their understanding of key concepts and develop deep knowledge, skills and understanding.

Discipline-based study courses have three key features that guide teaching and learning:

- specialist knowledge
- theories and concepts
- methodology and terminology.

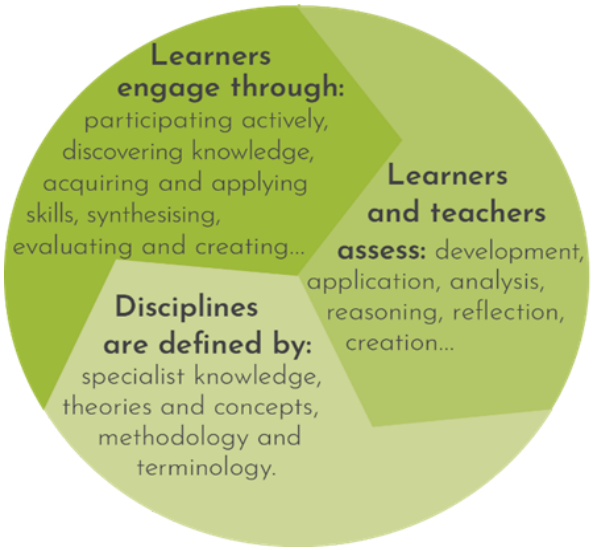


Figure 1: Discipline-based study diagram (developed by Years 9-12 Learning)

In this course learners will do this by engaging with:

- science understanding, science inquiry skills and science as a human endeavour to:
    - gain specialist knowledge
    - explore theories and concepts
    - facilitate the use of methodology and terminology.

Rationale

The purpose of science education is to help learners understand the world around them. This understanding develops and enhances skills in scientific literacy. As a discipline of science, biology is the study of the diversity of life as it has evolved, interacts and functions.

Biology Level 3 builds on the fundamentals learned in Biology Level 2 or Australian Curriculum: Science in Year 10. This course enables learners to consider all living organisms and the processes that contribute to maintaining life. Learners also have opportunities to further develop transferable skills in areas such as literacy, numeracy and critical thinking.

They will do this through the study of biological concepts that include:

- molecular and cellular processes of organisms
- how species adapt, evolve and survive
- how organisms respond to change in internal and external environments
- the mechanisms organisms have that prevent and fight disease.

Biology Level 3 encourages the use of inquiry skills to interrogate evidence. This enables learners to explain connections between science and the world around us. Learners will do this by applying theories and concepts to:

- explain everyday observations
- investigate and find solutions to biological issues
- develop an understanding of the processes of biological continuity and change over time.

Biology Level 3 prepares learners for a range of tertiary science pathways. The course provides opportunities to build knowledge and skills valued by employers in Tasmanian industries. As such, Biology Level 3 complements a range of career pathways. These vary from careers in the Antarctic and Southern Ocean, to those in the cultural and tourism industries, to careers in allied health industries.

The purpose of Years 9 to 12 Education is to enable all learners to achieve their potential through Years 9–12 and beyond in further study, training or employment.

Years 9–12 Education enables personal empowerment, cultural transmission, preparation for citizenship and preparation for work.

This course is built on the principles of access, agency, excellence, balance, support and achievement as part of a range of programs that enables learners to access a diverse and flexible range of learning opportunities suited to their level of readiness, interests and aspirations.

Learning Outcomes

On successful completion of this course, learners will be able to:

1. work independently and with others, planning, monitoring and managing their own learning to interpret and solve problems
2. communicate data and information using standard scientific conventions for qualitative and quantitative representation and evaluate their reliability
3. use science inquiry skills to design, conduct, evaluate and communicate investigations into biological systems
4. discuss how theories and models have developed based on evidence from multiple disciplines and identify the uses and limitations of biological knowledge in a range of contexts
5. discuss the biochemistry and mechanisms that are involved in the regulation of cellular processes
6. discuss the mechanisms by which animals use homeostasis to control their internal environment in a changing external environment
7. discuss how animals respond to the presence of pathogens and the ways in which infection, transmission and spread of disease occur
8. discuss the genetic, cellular and evolutionary processes and mechanisms that explain how the diversity of life on Earth has persisted and changed over time.

Pathways

Biology Level 3 has a pathway from F-10 Australian curriculum: Science and Biology Level 2. It is a complementary pathway from other science courses accredited by the Office of Tasmanian Assessment, Standards and Certification (TASC) that provide foundational science skills. Other TASC-accredited courses in the areas of Humanities and Social Sciences (HASS), Health and Physical Education (HPE), Technologies and Mathematics also support the pathway into this course.

Biology Level 3 provides useful preparation for further study or careers in areas that include agriculture, botany, zoology, marine science, education, biotechnology, health science, pharmacy, medicine, allied health or veterinary science. It is also suitable for learners wishing to study a science as part of a general education.

Biology level 3 is also complementary to many career pathways in industries that include: advanced manufacturing, Antarctic and Southern Ocean, cultural and tourism industry, defence, education and training, food and agribusiness, as well as forestry and related industries.

Integration of General Capabilities and Cross-curriculum Priorities

The general capabilities addressed specifically in this course are:

- Critical and creative thinking
- Ethical understanding
- Literacy
- Numeracy
- Personal and social capability.

The cross-curriculum priorities enabled through this course are:

- Aboriginal and Torres Strait Islander histories and cultures
- Sustainability.

Course Size And Complexity

This course has a complexity level of 3.

For a full description of courses at a complexity level of 3, please refer to the Levels of Complexity - Tasmanian Senior Secondary Education document.

This course has a size value of 15. Upon successful completion of this course (i.e., a Preliminary Achievement (PA) award or higher), a learner will gain 15 credit points at Level 3 towards the Participation Standard of the Tasmanian Certificate of Education (TCE).

Course Structure

This course consists of three 50-hour modules.

Module 1: Science inquiry skills and science as a human endeavour

Module 2: Regulation of cells and systems

Module 3: Continuity and change

Course Delivery

Module 1 must be delivered concurrently with modules 2 and 3. There is no further order of delivery required.

Course Requirements

Access

Learners are required to work as directed in practical situations as potentially dangerous materials and equipment may be used in this course.

Learners are required to apply mathematical skills from F–10 Australian curriculum. See Appendix 2 for full details.

This course requires learners to collaborate with others.

Previously submitted work cannot be used in meeting the requirements of Biology Level 3. Therefore, a learner cannot use work including, but not limited to, an independent study, folio, project or assignment that has already been presented for assessment for a previously or concurrently studied TASC accredited or recognised senior secondary course.

Resource requirements

Providers offering this course will need equipment, materials and a suitable space to carry out the practical component of the course effectively and safely.

Course Content: Module 1

Module 1: Science inquiry skills and science as a human endeavour

This module must be delivered concurrently with the other two course modules. That is, science inquiry skills and science as a human endeavour will be applied to the contexts of regulation of cells and systems and to continuity and change. Learners will therefore use and refer to inquiry skills and human endeavour contexts throughout this course. These are vital for deeper learning in science, as they build understanding, knowledge and skills.

During the course, learners will engage in a range of short and extended practically based inquiry tasks. The topics for inquiry may be chosen by the teacher or the learner. Learners will complete an investigation that highlights the development of science as a unique way of knowing and doing. They document their discoveries, while exploring the use and influence of science in society.

Module 1 learning outcomes

The following learning outcomes are a focus for this module:

1. work independently and with others, planning, monitoring and managing their own learning to interpret and solve problems
2. communicate data and information using standard scientific conventions for qualitative and quantitative representation and evaluate their reliability
3. use science inquiry skills to design, conduct, evaluate and communicate investigations into biological systems
4. discuss how theories and models have developed based on evidence from multiple disciplines and identify the uses and limitations of biological knowledge in a range of contexts.

Module 1 content

Learners explore the ways in which models and theories in modules 2 and 3 have developed over time with advances in technologies. They will explore aspects of science as a human endeavour through social, cultural, economic and ethical contexts relevant to each topic. Learners will also investigate how science contributes to debate in local, regional and international issues. This includes the evaluation of risk and action for sustainability. Through research and investigations, learners will analyse the limitations of science to provide definitive answers.

Learners will use science inquiry skills to:

- design and conduct investigations related to the skills and knowledge in modules 2 and 3
- construct and use models to analyse data gathered
- further develop their skills in constructing plausible predictions, as well as valid and reliable conclusions based on evidence.

Key knowledge – Science as a human endeavour

Development and collaboration within biology:

- models and theories are contested and refined or replaced when new evidence challenges them, or when a new model or theory has greater explanatory power
- international collaboration is often required when investing in large-scale science projects or addressing issues for the Asia-Pacific region.

Science and technology:

- Information and Communication Technologies (ICT) and other technologies have dramatically increased the size, accuracy and geographic and temporal scope of data sets with which scientists work.

Science and the broader community:

- the acceptance of scientific knowledge can be influenced by the social, economic and cultural context in which it is considered
- people can use scientific knowledge to inform the monitoring, assessment and evaluation of risk
- science can be limited in its ability to provide definitive answers to public debate, there may be insufficient reliable data available or interpretation of the data may be open to question
- scientific knowledge can be used to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability
- First Nations Australians' knowledge may be valuable when investigating biological science.

Key skills – Science inquiry skills

Design of inquiry:

- identify, research and construct questions to:
    - investigate
    - propose hypotheses
    - predict possible outcomes
- design investigations that include:
    - the procedures to be followed
    - the materials required
    - the type and amount of primary or secondary data or both to be collected
    - conducting risk assessments
    - consideration of research ethics, including animal ethics and the rights of living organisms.

Implementation of inquiry:

- conduct investigations safely, competently and methodically for the collection of valid and reliable data that include:
    - microscopy
    - the use of probabilities to predict inheritance patterns
    - real or virtual gel electrophoresis
    - population simulations to predict population changes

    - using models of homeostasis and disease transmission
- represent data in meaningful and useful ways by selecting, synthesising and using evidence to make and justify conclusions, including:
    - the use of mean, median, range and probability
    - organising and analysing data to identify trends, patterns and relationships
    - discussing the ways in which measurement error, instrumental accuracy, the nature of the procedure and the sample size may influence uncertainty and limitations in data.

Evaluation of inquiry:

- interpret a range of scientific and media texts, evaluate models, processes, claims and conclusions by considering the quality of available evidence, including:
    - interpreting confidence intervals in secondary data
    - using reasoning to construct scientific arguments
- select, construct and use appropriate representations, including:
    - models of DNA replication
    - transcription and translation
    - Punnett squares
    - probability models of expression of a specific gene in a population, including diagrams and flow charts to:
        - communicate conceptual understanding
        - solve problems
        - make predictions
- communicate to specific audiences and for specific purposes using appropriate language, nomenclature, genres and modes, including scientific reports.

Module 1 work requirements summary

This module includes the following work requirements:

- one folio with evidence of science inquiry skills
- one extended inquiry investigating a question or hypothesis through collection, analysis and synthesis of primary data
- one folio demonstrating understanding of science as a human endeavour.

See Appendix 3 for the full specifications of the work requirement of this course.

Module 1 assessment

This module has a focus on criteria 1, 2, 3 and 4.

Course Content: Module 2

Module 2: Regulation of cells and systems

Learners should be given opportunities to inquire practically into the topics studied. As this module is delivered concurrently with module 1, learners will make connections between key knowledge and, as relevant, science inquiry and science as a human endeavour contexts.

Learners will develop an understanding of:

- the role of enzymes in respiration and photosynthesis
- DNA structure and the process of replication,
- the process of protein synthesis
- the causes and effects of genetic mutations
- homeostatic processes that occur as organisms respond to stimuli from the environment.

Module 2 learning outcomes

The following learning outcomes are a focus for this module:

1. work independently and with others, planning, monitoring and managing their own learning to interpret and solve problems
2. communicate data and information using standard scientific conventions for qualitative and quantitative representation and evaluate their reliability
5. discuss the biochemistry and mechanisms that are involved in the regulation of cellular processes
6. discuss the mechanisms by which animals use homeostasis to control their internal environment in a changing external environment.

Module 2 content

Through the key knowledge and skills, learners will:

- apply the properties and functions of enzymes to explain relevant cellular processes
- investigate the ways in which matter moves and energy is transformed and transferred in the biochemical processes of photosynthesis and respiration
- understand the role of enzymes in controlling biochemical systems
- investigate the transmission of genetic material to the next generation of cells and to offspring through biochemical and cellular systems and processes
- investigate how homeostatic response systems control organisms' responses to external environmental change
- explore how organisms use these responses to survive in a variety of environments while the conditions are within their tolerance limits.

Key knowledge and skills: Science understanding and application

Enzymes:

- structure and function: globular protein, active site, denaturation
- factors affecting rate of reaction: temperature, pH, enzyme concentration, substrate concentration, inhibitors, coenzymes and cofactors
- inhibitors: competitive and non-competitive
- coenzymes and cofactors: vitamins and minerals (only a general understanding, not specific examples).

Photosynthesis:

- role of chloroplasts: thylakoids, stroma and grana (only a general understanding that photosynthesis occurs in stages and where the main inputs and output from the net equation are derived)
- inputs and outputs: balanced net chemical equation required $6CO_2(g) + 6H_2O(g) \rightarrow C_6H_{12}O_6(aq) + 6O_2(g)$
- factors affecting rate of reaction: temperature, carbon dioxide ($CO_2(g)$) concentration and light intensity
- light and dark reactions (only a general understanding that photosynthesis occurs in stages, that is, where water is broken down, oxygen emitted, where carbon dioxide is reduced and only glucose produced. Not photosystem 1 and 2).

Respiration:

- role of mitochondria in aerobic respiration
- main stages, including names, of anaerobic and aerobic respiration: glycolysis and Krebs cycle, excluding individual enzyme pathways and coenzymes
- inputs and outputs: balanced net chemical equation required
  $C_6H_{12}O_6(aq) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g) + 36\text{-}38\ ATP$
- factors affecting rate of reaction: temperature, glucose concentration, oxygen concentration and pH.

DNA structure and replication:

- deoxyribonucleic acid (DNA) is a double-stranded molecule that occurs in the nucleus of eukaryotic cells
- the structure of DNA, including:
  - nucleotide composition
  - complementary base pairing of Adenine to Thymine (A-T) and Cytosine to Guanine (C-G) only (understanding of purines and pyrimidines not needed)
- the process of DNA replication, including the enzymes involved: helicase, primase, DNA polymerase and ligase only (not continuous and discontinuous replication)
- the significance of semi-conservative theory
- demonstrate and apply the use of enzymes to manipulate DNA, including polymerase to synthesise DNA, ligase to join DNA and endonucleases to cut DNA
- investigate genome sequencing.

Protein synthesis:

- proteins are a diverse group of molecules, including enzymes as catalysts in biochemical pathways
- genes include 'coding' (exons) and 'noncoding' (introns and regulatory genes) components of DNA
- the process of protein synthesis in terms of:
  - transcription of a gene into messenger RNA in the nucleus

    - translation of messenger ribonucleic acid (mRNA) into an amino acid sequence at the ribosome, refer to transfer ribonucleic acid (RNA), codons and anticodons
    - gene expression and regulation: only prokaryotic cells, specifically use the lac-operon example
- analyse how the phenotypic expression of genes depends on factors controlling transcription and translation during protein synthesis, the products of other genes and the environment
- understand differential gene expression controls cell differentiation for tissue formation, as well as the structural changes that occur during growth.

Mutations:

- identify, understand and apply models of how mutations in genes and chromosomes can result from errors in:
    - DNA, point and block mutations including substitutions, deletions, additions and inversions
    - cell division, general understanding of types of chromosomal mutations
    - damage by mutagens, including: physical, UV radiation, ionising radiation, heat and chemical damage.
- impact of mutation on the final gene product and function of the product, specifically protein.

Homeostasis:

- involves a stimulus-response model in which change in external or internal environmental conditions is detected and appropriate responses occur via negative feedback:
    - in vertebrates, receptors and effectors are linked via a control centre in nervous or hormonal, or both pathways
- neural pathways consist of cells that transport nerve impulses from sensory receptors to neurons and on to effectors:
    - the passage of nerve impulses involves transmission of an action potential along a nerve axon
    - synaptic transmission by neurotransmitters and signal transduction
- hormones alter the metabolism of target cells, tissues or organs by increasing or decreasing their activity:
    - in animals, most hormones are produced in endocrine glands as a result of nervous or chemical stimulation and travel via the circulatory or lymph system to the target cells, tissues or organs
- investigate changes in an organism's metabolic activity, in addition to structural features and changes in physiological processes and behaviour, to enable the organism to maintain its internal environment within tolerance limits (glucose regulation only)
- analyse different metabolic processes, including where endothermic animals have varying thermoregulatory mechanisms that involve structural features, behavioural responses and physiological and homeostatic mechanisms to control heat exchange and metabolic activity
- evaluate various mechanisms animals and plants use to maintain water balance that involve structural features and behavioural, physiological and homeostatic responses.

Module 2 work requirements

This module includes the following work requirements:

- two extended responses: regulation of cells and systems case studies
- two short responses: applying regulation of cells and systems ideas and problem solving.

See Appendix 3 for the full specifications of the work requirement of this course.

Module 2 assessment

This module has a focus on criteria 1, 2, 5 and 6.

Course Content: Module 3

Module 3: Continuity and change

Learners should be given opportunities to inquire practically into what is being studied. As this module is delivered concurrently with module 1, learners will make connections between key knowledge and, as relevant, science inquiry and science as a human endeavour contexts.

Learners will:

- investigate body system change and continuity in response to pathogens
- investigate the transmission and impact of infectious diseases at cellular and organism levels
- consider the factors that encourage or reduce the spread of infectious disease at the population level
- explain, model and predict patterns in inheritance by investigating mechanisms of heredity
- connect inheritance patterns to population dynamics
- apply the theory of evolution by natural selection to examine changes in populations.

Module 3 learning outcomes

The following learning outcomes are a focus for this module:

1. work independently and with others, planning, monitoring and managing their own learning to interpret and solve problems
2. communicate data and information using standard scientific conventions for qualitative and quantitative representation and evaluate their reliability
7. discuss how animals respond to the presence of pathogens and the ways in which infection, transmission and spread of disease occur
8. discuss the genetic, cellular and evolutionary processes and mechanisms that explain how the diversity of life on Earth has persisted and changed over time.

Module 3 content

Through the key knowledge and skills, learners will explore:

- how the invasion of an organism's internal environment by pathogens challenges effective biological functioning
- how organism function is maintained during invasion by pathogens and triggers a series of responses or events in the short- and long-term
- factors that contribute to the spread of infectious disease and how it can be predicted, monitored and contained
- heredity as an important biological principle to explain why offspring resemble their parent cell or organism
- how to apply their observations to explanatory models that describe patterns of inheritance and predictive models of inheritance
- how to construct, use and evaluate explanatory and predictive models of gene pool diversity of populations
- the genetic basis for the theory of evolution by natural selection
- the underlying processes that drive speciation and population dynamics.

Key knowledge and skills: Science understanding and application

Immunology

Pathogens:

- biological pathogens include prions, viruses, bacteria, fungi, protists and parasites
- infectious disease is caused by invasion of a pathogen which can be transmitted from one host to another
- investigate and model adaptations that pathogens have to enter cells or tissues and that facilitate transmission between hosts:
    - transmission occurs by various mechanisms, including through direct contact, contact with body fluids and via contaminated food, water or specific vectors
- analyse the physical or chemical changes that occur to stimulate immune responses when a pathogen enters a host.

Immune response:

- cell specialisation: phagocytic cells
- cell membrane role in endocytosis, including phagocytosis
- vertebrates have innate (non-specific) and adaptive (specific) immune responses:
    - there are three lines (levels) of immune defence:
        - first line of defence is innate, non-specific: physical and chemical barriers
        - second line of defence is innate, non-specific: cellular, chemical and inflammatory responses
        - third line of defence is adaptive, specific: cellular responses
- innate responses in animals that target pathogens, including through the inflammatory response, which involves the actions of phagocytes
- represent and analyse the processes of persistent adaptive responses to specific antigens:
    - including the production of humoral immunity through the production of antibodies by B lymphocytes and the provision of cell-mediated immunity by T lymphocytes
    - in both cases memory cells are produced that confirm long-term immunity to the specific antigen
- investigate the role and function of cells, including: antigen presenting cells such as dendritic cells and macrophages, mast cells, neutrophils, B lymphocytes, Memory B cells, T lymphocytes, Helper T cells, Cytotoxic T cells, Repressor T cells and Memory T cells
- vaccination and concept of herd immunity:
    - analyse the similarities and differences between where immunity may be:
        - passive; for example, antibodies acquired via the placenta or via antibody serum injection
        - active; for example, acquired through actions of the immune system as a result of natural exposure to a pathogen or through the use of vaccines.

Reproduction and cell division:

- the role of chromosomes as structures that package DNA
- all eukaryotic cells come from pre-existing cells through completion of the cell cycle
- the key events in the phases G1, S, G2, M and C of the eukaryotic cell cycle:
    - including the characteristics of the sub-phases of mitosis (prophase, metaphase, anaphase and telophase) and cytokinesis in animal cells
- within the process of meiosis I and II recognise the role of homologous chromosomes in independent assortment and crossing over of non-sister chromatids

- analyse the processes of crossing over and recombination to demonstrate how they contribute to genetic variation
- demonstrate how the process of independent assortment and random fertilisation alter the variations in the genotype of offspring
- understand the significance of genetic variation.

Genetics:

- monohybrid and dihybrid crosses (not linkage)
- use models such as Punnett squares to predict frequencies of genotypes and phenotypes and by taking into consideration patterns of inheritance for the following types of alleles and modes of inheritance:
    - autosomal dominant or recessive
    - sex linked dominant or recessive
    - incomplete dominance
    - codominance
    - multiple alleles (only A,B,O Blood Groups and associated alleles i, IA, IB)
- use pedigree charts to describe and analyse inheritance of genetic disorders and disease.

Evolution:

- life has existed on Earth and has changed and diversified over time
- mutation is the ultimate source of genetic variation as it introduces new alleles into a population
- natural selection occurs when the pressures of environmental selection confer a selective advantage on a specific phenotype to enhance its survival and reproductive capabilities
- concepts of natural selection, mutation, gene flow and genetic drift
- analyse differing selection pressures between examples of geographically isolated populations to demonstrate the process of speciation
- investigate how sample populations with reduced genetic diversity, that is those affected by population bottlenecks, have an increased risk of extinction
- represent and analyse accumulation of micro-evolutionary changes over time and macro-evolutionary changes resulting in speciation
- understand that micro-evolutionary change and macro-evolutionary change leading to speciation occur through the main processes of natural selection, mutation, gene flow and genetic drift.

Module 3 work requirements

This module includes the following work requirements:

- two extended responses: continuity and change case studies
- two short responses: applying continuity and change ideas and problem solving.

See Appendix 3 for the full specifications of the work requirements of this course.

Module 3 assessment

This module has a focus on criteria 1, 2, 7 and 8.

Assessment

Criterion-based assessment is a form of outcomes assessment that identifies the extent of learner achievement at an appropriate endpoint of study. Although assessment as part of the learning program is continuous, much of it is formative and is done to help learners identify what they need to do to attain the maximum benefit from their study of the course. Therefore, assessment for summative reporting to the Office of TASC will focus on what both teacher and learner understand to reflect endpoint achievement.

The standard of achievement each learner attains on each criterion is recorded as a rating 'A', 'B', or 'C', according to the outcomes specified in the standards section of the course.

A 't' notation must be used where a learner demonstrates any achievement against a criterion less than the standard specified for the 'C' rating.

A 'z' notation is to be used where a learner provides no evidence of achievement at all.

Internal assessment of all criteria will be made by the provider. Providers will report the learner's rating for each criterion to the Office of TASC.

The Office of TASC will supervise the external assessment of designated criteria which will be indicated by an asterisk (*). The ratings obtained from the external assessments will be used in addition to internal ratings from the provider to determine the final award.

Quality Assurance Process

The following processes will be facilitated by the Office of TASC to ensure there is:

- a match between the standards of achievement specified in the course and the skills and knowledge demonstrated by learners
- community confidence in the integrity and meaning of the qualification.

Process

The Office of TASC gives course providers feedback about any systematic differences in the relationship of their internal and external assessments and, where appropriate, seeks further evidence through audit and requires corrective action in the future.

Additionally, the Office of TASC may select to undertake scheduled audits of this course (Provider Standards 1, 2, 3 & 4) and work requirements.

External Assessment Requirements

The external assessment for this course will comprise:

- a three (3) hour external written examination assessing criteria 3, 5, 6, 7 and 8.

For further information, see the current external assessment specifications and guidelines for this course available in the Supporting documents below.

Criteria

The assessment for Biology Level 3 will be based on the degree to which the learner can:

1. plan, work independently and collaboratively, solve problems and achieve goals
2. analyse and communicate scientific data and information
3. undertake biological inquiry to generate and evaluate data*
4. analyse the role of biological contexts
5. analyse the processes and mechanisms by which biological systems are regulated*
6. analyse homeostatic concepts, processes and interrelationships*
7. analyse concepts, processes and interrelationships as organisms respond to pathogens*
8. analyse cell division, genetics and evolution to explain biological persistence and diversity*.

*denotes criteria that are both internally and externally assessed.

	Module 1	**Module 2**	**Module 3**
Criteria focus	1, 2, 3, 4	1, 2, 5, 6	1, 2, 7, 8

Standards

Criterion 1: plan, work independently and collaboratively, solve problems and achieve goals

This criterion is only internally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Complete work within timeframes	uses a range of planning and self-management strategies to ensure the successful completion of tasks within agreed time frames	uses planning and self-management strategies to ensure the completion of tasks within agreed time frames	uses planning strategies to enable the completion of tasks within agreed time frames
E02 - Assessing outcomes	analyses how modifications made improved outcomes and contributed to the completion of tasks	explains how modifications made improved outcomes and contributed to the completion of tasks	discusses how modifications made improved outcomes to complete tasks
E03 - Contribute to collaborative activities	analyses own and others' contributions to a product in collaborative activities	explains own and others' contributions to a product in collaborative activities	discusses own and others' contributions to a product in collaborative activities
E04 - Interprets problems and makes predictions	analyses complex problems and makes valid predictions in unfamiliar contexts.	explains problems and makes valid predictions in unfamiliar contexts.	interprets problems and makes valid predictions in familiar contexts.

Criterion 2: analyse and communicate scientific data and information

This criterion is only internally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Represents data and information	represents data and information to effectively, accurately and concisely communicate concepts and ideas selected from a variety of sources to evaluate relevance	represents data and information to accurately communicate concepts and ideas selected from a variety of sources to analyse relevance	represents data and information to clearly communicate concepts and ideas selected from a variety of sources identified as relevant
E02 - Reliability of data and information	analyses data and information to determine validity and reliability	explains data and information to identify validity and reliability	discusses data and information to identify limited aspects of validity and reliability
E03 - Format, units and terminology	selects and uses appropriate scientific formats and units and terminology to effectively, accurately and concisely communicate data and information	selects and uses appropriate scientific formats, units and terminology to clearly and accurately communicate data and information	uses appropriate scientific formats, units and terminology to communicate data and information
E04 - Referencing	clearly differentiates the work of others from the learner's own[†]. Referencing conventions and methodologies are followed including a high degree of accuracy in individual entries[‡] and well-structured reference lists and bibliographies[§].	clearly differentiates the work of others from the learner's own[†]. Referencing conventions and methodologies are followed accurately[‡], including appropriate, structured reference lists and bibliographies[§].	differentiates the work of others from the learner's own[†]. Referencing conventions and methodologies are followed[‡], including the use of reference lists and bibliographies[§].

[†]This includes, but is not limited to, ideas, images, information, data or words
[‡] This includes, but is not limited to, alphabetising the surnames of authors and use of an abbreviation key for journal titles
[§] This includes but is not limited to, grouping by publication dates, source types (books, internet, personal communications).

Criterion 3: undertake biological inquiry to generate and evaluate data

This criterion is both internally and externally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Risks	analyses how safety and ethics have been considered when designing and conducting investigations	explains how safety and ethics have been considered when designing and conducting investigations	discusses how safety and ethics have been considered when designing and conducting investigations
E02 - Hypotheses	analyses observations to express and justify a valid hypothesis as a precise and testable statement	explains observations to express and justify a valid hypothesis as a precise and testable statement	discusses observations to express a hypothesis as a testable statement
E03 - Investigations	designs, conducts and improves investigations to effectively generate and collect valid, reliable data in response to a complex question or problem	designs, conducts and improves investigations to generate and collect valid, reliable data in response to a question or problem	designs and conducts investigations to generate and collect valid data that answers a question or problem
E04 - Conclusions from data	analyses data to explain causal and correlational relationships, anomalies, the	explains data to identify causal and correlational relationships, anomalies and	selects and represents data to demonstrate relationships, anomalies

	reliability of the data and sources of error to make justified conclusions	sources of error to make justified conclusions	and sources of error to present evidence-based conclusions
E05 - Limitations and improvements	evaluates processes and conclusions to provide a critique with reference to relevant evidence that discusses limitations, improvements or alternatives.	evaluates processes and conclusions to provide a critique with reference to evidence that identifies possible limitations, improvements or alternatives.	evaluates processes and conclusions to suggest improvements or alternatives.

Criterion 4: analyse the role of biological contexts

This criterion is only internally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Biological connections	analyses connections between biological knowledge and social, economic and ethical decision making	explains connections between biological knowledge and social, economic and ethical decision making	discusses connections between biological knowledge and social, economic and ethical decision making
E02 - Technologies	analyses the role of technologies in the development of biological knowledge	explains the role of technologies in the development of biological knowledge	discusses the role of technologies in the development of biological knowledge
E03 - Collaboration and evidence	analyses the role of collaboration and evolving evidence in the development of biological knowledge	explains the role of collaboration and evolving evidence in the development of biological knowledge	discusses the role of collaboration and evolving evidence in the development of biological knowledge
E04 - Applications	analyses how biological sciences are applied to meet specific needs in society and explains the implications of these applications.	explains how biological sciences are applied to meet specific needs in society and discusses the implications of these applications.	discusses how biological sciences are applied to meet specific needs in society and identifies the implications of these applications.

Criterion 5: analyse the processes and mechanisms by which biological systems are regulated

This criterion is both internally and externally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Enzymes	analyses how enzymes regulate chemical pathways in living things	explains how enzymes regulate chemical pathways in living things	discusses how enzymes regulate chemical pathways in living things
E02 - Biochemical pathways	analyses inputs, outputs and factors affecting rates of reaction for photosynthesis and respiration reactions	explains inputs, outputs and factors affecting rates of reaction for photosynthesis and respiration reactions	discusses inputs, outputs and factors affecting rates of reaction for photosynthesis and respiration reactions
E03 - DNA structure and replication	analyses how DNA structure and replication enables continuity of organisms	explains how DNA structure and replication enables continuity of organisms	discusses how DNA structure and replication enables continuity of organisms
E04 - Gene expression and regulation	analyses how gene expression enables regulation of cell and organism functions	explains how gene expression enables regulation of cells and organism functions	discusses how gene expression enables regulation of cell and organism functions
E05 - Causes and impacts of mutation	analyses the causes and impacts of genetic mutations and explains the impacts on the product.	explains the causes and impacts of genetic mutations and discusses the impact on the product.	discusses the causes and impacts of genetic mutations and identifies the impact on the product.

Criterion 6: analyse homeostatic concepts, processes and interrelationships

This criterion is both internally and externally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Responses to the external environment	applies and analyses elements of the stimulus-response model in a variety of familiar and unfamiliar contexts	applies and explains elements of the stimulus-response model in a variety of familiar contexts	applies and discusses elements of the stimulus-response model in familiar contexts
E02 - Homeostatic pathways	analyses system processes to explain homeostatic pathways between receptors and effectors	explains system processes to discuss homeostatic pathways between receptors and effectors	discusses system processes to identify homeostatic pathways between receptors and effectors
E03 - Glucose regulation in animals	analyses changes in the function and interrelationships of metabolic system components in response to changing external factors	explains changes in the function and interrelationships of metabolic system components in response to changing external factors	discusses changes in the metabolic system components or processes in response to changing external factors

E04 - Thermoregulation in animals	analyses changes in the function and interrelationships of thermoregulation system components in response to changing external factors	explains changes in the function and interrelationships of thermoregulation system components in response to changing external factors	discusses changes in the thermoregulation system components or processes in response to changing external factors
E05 - Osmoregulation in animals and plants	analyses changes in the function and interrelationships of water balance system components, in response to changing external factors.	explains changes in the function and interrelationships of water balance system components, in response to changing external factors.	discusses changes in the water balance system components or processes, in response to changing external factors.

Criterion 7: analyse concepts, processes and interrelationships as organisms respond to pathogens

This criterion is both internally and externally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Nature and transmission of pathogens	analyses relevant types and explains features of pathogens and how they are transmitted	explains relevant types and discusses features of pathogens and how they are transmitted	discusses relevant types of pathogens and identifies how they are transmitted
E02 - Innate immune responses	analyses the function and relationships between innate immune system responses of organisms	explains the function and relationships between innate immune system responses of organisms	discusses the function and relationships between innate immune system components and processes of organisms
E03 - Adaptive immune responses	analyses the function and relationships between adaptive immune system responses	explains the function and relationships between adaptive immune system responses	discusses the function and relationships between adaptive immune system components and processes
E04 - Types of immunity	analyses the function and relationships between types of immunity and explains how they arise in organisms.	explains the function and relationships between types of immunity and describes how they arise in organisms.	discusses the function and relationships between types of immunity and identifies how they arise in organisms.

Criterion 8: analyse cell division, genetics and evolution to explain biological persistence and diversity

This criterion is both internally and externally assessed.

Standard Element	Rating A	Rating B	Rating C
E01 - Processes of reproduction	analyses how processes of reproduction enable continuity of organisms and populations	explains how processes of reproduction enable continuity of organisms and populations	discusses how processes of reproduction enable continuity of organisms and populations
E02 - Processes of cell division	analyses the mechanisms, processes and outcomes of cell division	explains the mechanisms, processes and outcomes of cell division	discusses the mechanisms and processes of cell division
E03 - Patterns of inheritance	analyses how patterns of inheritance enable continuity of individuals and populations	explains how patterns of inheritance enable continuity of individuals and populations	discusses how patterns of inheritance enable continuity of individuals and populations
E04 - Pedigree analysis	analyses patterns in pedigrees to explain the most likely mode of inheritance of traits	explains patterns in pedigrees to discuss the most likely mode of inheritance traits	discusses patterns in pedigrees to identify the most likely mode of inheritance traits
E05 - Mechanisms of evolution	analyses how the mechanisms of micro and macro evolution enable continuity of populations.	explains how the mechanisms of micro and macro evolution enable continuity of populations.	discusses how the mechanisms of micro and macro evolution enable continuity of populations.

Qualifications Available

Biology Level 3 (with the award of):

EXCEPTIONAL ACHIEVEMENT

HIGH ACHIEVEMENT

COMMENDABLE ACHIEVEMENT

SATISFACTORY ACHIEVEMENT

PRELIMINARY ACHIEVEMENT

Award Requirements

The final award will be determined by the Office of TASC from 13 ratings (8 from the internal assessment, 5 from external assessment).
The minimum requirements for an award in this course are as follows:

EXCEPTIONAL ACHIEVEMENT (EA)
10 'A' ratings, 3 'B' ratings (3 'A' ratings, 2 'B' rating from external assessment)

HIGH ACHIEVEMENT (HA)
5 'A' ratings, 5 'B' ratings, 3 'C' ratings (1 'A' ratings, 3 'B' ratings, 1 'C' rating from external assessment)

COMMENDABLE ACHIEVEMENT (CA)
6 'B' ratings, 6 'C' ratings (2 'B' ratings, 3 'C' ratings from external assessment)

SATISFACTORY ACHIEVEMENT (SA)
11 'C' ratings (3 'C' ratings from external assessment)

PRELIMINARY ACHIEVEMENT (PA)
6 'C' ratings

A learner who otherwise achieves the ratings for a CA (Commendable Achievement) or SA (Satisfactory Achievement) award but who fails to show any evidence of achievement in one or more criteria ('z' notation) will be issued with a PA (Preliminary Achievement) award.

Course Evaluation

Years 9-12 Learning will develop and regularly review and revise the curriculum. Course evaluation is informed by the experience of the course's implementation, delivery and assessment. More information about course evaluation can be found on the Years 9-12 website.

Course Developer

This course has been developed by the Department for Education Children, Young People's Years 9-12 Learning Unit in collaboration with Catholic Education Tasmania and Independent Schools Tasmania.

Accreditation

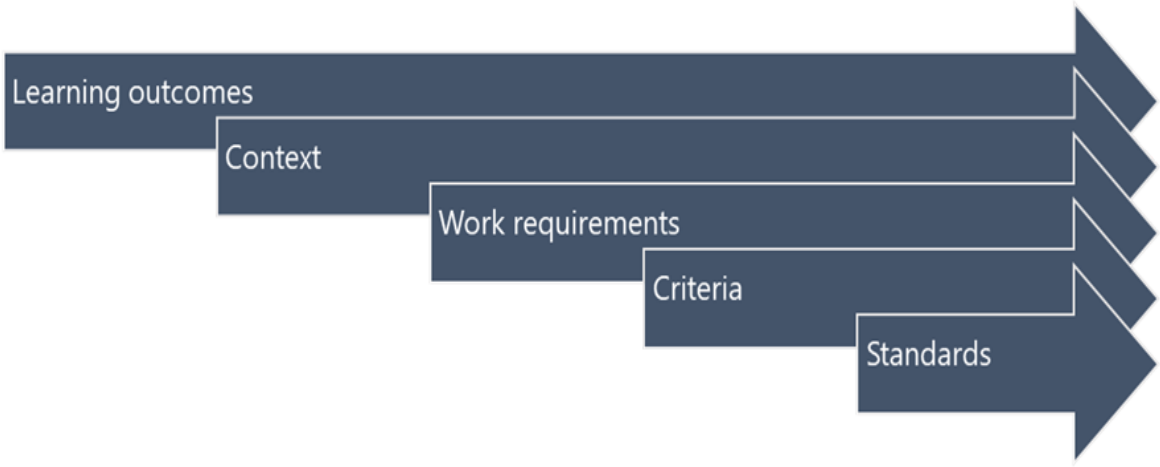
Accredited on 20 February 2023 for use from 1 January 2024 to 31 December 2028.

Version History

Version 1

Accredited on 20 February 2023 for use from 1 January 2024 to 31 December 2028. This course replaces Biology Level 3 (BIO315116) which expires on 31 December 2023.

Appendix 1 – Line of sight



Learning outcomes	Course content: module	Work requirements: module	Criterion	Criterion elements	General capabilities
1. **work independently and with others, planning, monitoring and managing their own learning to interpret and solve problems**	1, 2, 3	1, 2, 3	1	1, 2, 3, 4	Critical and creative thinking; Literacy
2. **communicate data and information using standard scientific conventions for qualitative and quantitative representation and evaluate their reliability**	1, 2, 3	1, 2, 3	2	1, 2, 3, 4	Critical and creative thinking; Literacy; Numeracy
3. **use science inquiry skills to design, conduct, evaluate and communicate investigations into biological systems**	1	1	3	1, 2, 3, 4, 5	Critical and creative thinking; Ethical understanding; Literacy; Numeracy
4. **discuss how theories and models have developed based on evidence from multiple disciplines and identify the uses and limitations of biological knowledge in a range of contexts**	1	1	4	1, 2, 3, 4	Critical and creative thinking; Literacy
5. **discuss the biochemistry and mechanisms that are involved in the regulation of cellular processes**	2	2	5	1, 2, 3, 4, 5	Critical and creative thinking; Literacy; Numeracy
6. **discuss the mechanisms by which animals use homeostasis to control their internal environment in a changing external environment**	2	2	6	1, 2, 3, 4. 5	Critical and creative thinking; Literacy; Numeracy
7. **discuss how animals respond to the presence of pathogens and the ways in which infection, transmission and spread of disease occur**	3	3	7	1, 2, 3, 4	Critical and creative thinking; Literacy; Numeracy
8. **discuss the genetic, cellular and evolutionary processes and mechanisms that explain how the diversity of life on Earth has persisted and changed over time**	3	3	8	1, 2, 3, 4, 5	Critical and creative thinking; Literacy; Numeracy

Appendix 2 – Alignment to curriculum frameworks

Links to Foundation to Year 10

Progression from the F-10 Australian Curriculum: Science

Biology Level 3 continues to develop learner understanding and skills from across the three strands of the F-10 Australian Curriculum: Science. In the Science understanding strand, Biology Level 3 draws on knowledge and understanding from across the four sub-strands:

- biological
- physical
- chemical
- Earth and space sciences.

The following key concepts introduced in the Biological science sub-strand are further developed in this course:

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

Mathematical skills expected of students studying biology

Biology Level 3 requires learners to use the mathematical skills they have developed through the F-10 Australian Curriculum: Mathematics. This is in addition to the numeracy skills they have developed through the Science inquiry skills strand of the F-10 Australian Curriculum: Science.

Within the Science inquiry skills strand learners are required to gather, represent and analyse numerical data to identify the evidence that forms the basis of scientific arguments, claims or conclusions. In gathering and recording numerical data, learners are required to make measurements using appropriate units to an appropriate degree of accuracy.
Learners may need to be taught when it is appropriate to join points on a graph and when it is appropriate to use a line of best fit. They may also need to be taught how to construct a straight line that will serve as the line of best fit for a set of data presented graphically.

It is assumed that learners will be able to competently:

- perform calculations involving addition, subtraction, multiplication and division of quantities
- perform approximate evaluations of numerical expressions
- express fractions as percentages and percentages as fractions
- calculate percentages
- recognise and use ratios
- transform decimal notation to power of ten notation
- substitute physical quantities into an equation using consistent units so as to calculate one quantity and check the dimensional consistency of such calculations
- solve simple algebraic equations
- comprehend and use the symbols and notations $<$, $>$, Δ, $\approx$
- translate information between graphical, numerical and algebraic forms
- distinguish between discrete and continuous data then select appropriate forms, variables and scales for constructing graphs
- construct and interpret frequency tables and diagrams, pie charts and histograms
- describe and compare data sets using mean, median and inter-quartile range
- interpret the slope of a linear graph.

Senior Secondary Australian Curriculum: Biology

Biology Level 3 is aligned to Senior Secondary Australian Curriculum: Biology Units 2, 3 and 4 as follows:

Unit 2 – Science understanding

Cells as the basis of life:

- the cell membrane separates the cell from its surroundings and controls the exchange of materials, including gases, nutrients and wastes, between the cell and its environment (ACSBL045)
- movement of materials across membranes occurs via diffusion, osmosis, active transport and/or endocytosis (ACSBL046)
- biochemical processes in the cell are controlled by the nature and arrangement of internal membranes, the presence of specific enzymes and environmental factors (ACSBL050)
- enzymes have specific functions, which can be affected by factors, including temperature, pH, the presence of inhibitors and the concentrations of reactants and products (ACSBL051)
- photosynthesis is a biochemical process that in plant cells occurs in the chloroplast and that uses light energy to synthesise organic compounds; the overall process can be represented as a balanced chemical equation (ACSBL052)
- cellular respiration is a biochemical process that occurs in different locations in the cytosol and mitochondria and metabolises organic compounds, aerobically [...], to release useable energy in the form of ATP; the overall process can be represented as a balanced chemical equation (ACSBL053).

Units 3 and 4 - Science as a human endeavour

Development and collaboration within biology:

- ICT and other technologies have dramatically increased the size, accuracy and geographic and temporal scope of data sets with which scientists work (ACSBL068 and ACSBL103)
- models and theories are contested and refined or replaced when new evidence challenges them, or when a new model or theory has greater explanatory power (ACSBL069 and ACSBL104)
- the acceptance of scientific knowledge can be influenced by the social, economic and cultural context in which it is considered (ACSBL070 and ACBL105)
- people can use scientific knowledge to inform the monitoring, assessment and evaluation of risk (ACSBL071 and ACBL106)
- science can be limited in its ability to provide definitive answers to public debate, there may be insufficient reliable data available, or interpretation of the data may be open to question (ACSBL072 and ACSBL107)

- international collaboration is often required when investing in large-scale science projects or addressing issues for the Asia-Pacific region (ACSBL073 and ACSBL108)
- scientific knowledge can be used to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability (ACSBL074 and ACBL109).

Units 3 and 4 - Science inquiry skills:

- identify, research and construct questions for investigation, propose hypotheses and predict possible outcomes (ACSBL061 and ACSBL096)
- design 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; conduct risk assessments; and consider research ethics, including animal ethics (ACSBL062)
- design 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; conduct risk assessments; and consider research ethics, including the rights of living organisms (ACSBL097)
- conduct investigations, including the use of probabilities to predict inheritance patterns, real or virtual gel electrophoresis and population simulations to predict population changes, safely, competently and methodically for the collection of valid and reliable data (ACSBL063)
- conduct investigations, including using models of homeostasis and disease transmission, safely, competently and methodically for valid and reliable collection of data (ACSBL098)
- represent data in meaningful and useful ways, including the use of mean, median, range and probability, organise and analyse data to identify trends, patterns and relationships, discuss the ways in which measurement error, instrumental accuracy, the nature of the procedure and the sample size may influence uncertainty and limitations in data and select, synthesise and use evidence to make and justify conclusions (ACSBL064 and ACSBL099)
- interpret a range of scientific and media texts and evaluate models, processes, claims and conclusions by considering the quality of available evidence, including interpreting confidence intervals in secondary data and use reasoning to construct scientific arguments (ACSBL065 and ACBL099)
- select, construct and use appropriate representations, including models of DNA replication, transcription and translation, Punnett squares and probability models of expression of a specific gene in a population, to communicate conceptual understanding, solve problems and make predictions (ACSBL066)
- select, construct and use appropriate representations, including diagrams and flow charts, to communicate conceptual understanding, solve problems and make predictions (ACSBL101)
- communicate to specific audiences and for specific purposes using appropriate language, nomenclature, genres and modes, including scientific reports (ACSBL067 and ACSBL102).

Unit 3 – Science understanding

DNA, genes and the continuity of life:

- continuity of life requires the replication of genetic material and its transfer to the next generation through processes, including binary fission, mitosis, meiosis and fertilisation (ACSBL075)
- DNA is a helical double-stranded molecule that occurs bound to proteins in chromosomes in the nucleus and as unbound circular DNA in the cytosol of prokaryotes and in the mitochondria and chloroplasts of eukaryotic cells (ACSBL076)
- the structural properties of the DNA molecule, including nucleotide composition and pairing and the weak bonds between strands of DNA, allow for replication (ACSBL077)
- genes include ‘coding’ and ‘non-coding’ DNA and many genes contain information for protein production (ACSBL078)
- protein synthesis involves transcription of a gene into messenger RNA in the nucleus and translation into an amino acid sequence at the ribosome (ACSBL079)
- proteins, including enzymes, are essential to cell structure and functioning (ACSBL080)
- the phenotypic expression of genes depends on factors controlling transcription and translation during protein synthesis, the products of other genes and the environment (ACSBL081)
- mutations in genes and chromosomes can result from errors in DNA replication or cell division, or from damage by physical or chemical factors in the environment (ACSBL082)
- differential gene expression controls cell differentiation for tissue formation, as well as the structural changes that occur during growth (ACSBL083)
- variations in the genotype of offspring arise as a result of the processes of meiosis and fertilisation, as well as a result of mutations (ACSBL084)
- frequencies of genotypes and phenotypes of offspring can be predicted using probability models, including Punnett squares and by taking into consideration patterns of inheritance, including the effects of dominant, autosomal and sex-linked alleles and multiple alleles and polygenic inheritance (ACSBL085)
- DNA sequencing enables mapping of species genomes [...] (ACSBL086).

Continuity of life on Earth:

- life has existed on Earth for approximately 3.5 billion years and has changed and diversified over time (ACSBL088)
- natural selection occurs when selection pressures in the environment confer a selective advantage on a specific phenotype to enhance its survival and reproduction [...] (ACSBL090)
- in additional to environmental selection pressures, mutation, gene flow and genetic drift can contribute to changes in allele frequency in a population gene pool and results in micro-evolutionary change (ACSBL091)
- mutation is the ultimate source of genetic variation as it introduces new alleles into a population (ACSBL092)
- speciation and macro-evolutionary changes result from an accumulation of micro-evolutionary changes over time (ACSBL093)
- differing selection pressures between geographically isolated populations may lead to allopatric speciation (ACSBL094)
- populations with reduced genetic diversity face increased risk of extinction (ACSBL095).

Unit 4 – Science understanding

Homeostasis:

- homeostasis involves a stimulus-response model in which change in external or internal environmental conditions is detected and appropriate responses occur via negative feedback; in vertebrates, receptors and effectors are linked via a control centre by nervous and/or hormonal pathways (ACSBL110)
- changes in an organism’s metabolic activity, in addition to structural features and changes in physiological processes and behaviour, enable the organism to maintain its internal environment within tolerance limits (ACSBL111)
- neural pathways consist of cells that transport nerve impulses from sensory receptors to neurons and on to effectors; the passage of nerve impulses involves transmission of an action potential along a nerve axon and synaptic transmission by neurotransmitters and signal transduction (ACSBL112)
- hormones alter the metabolism of target cells, tissues or organs by increasing or decreasing their activity; in animals, most hormones are produced in endocrine glands as a result of nervous or chemical stimulation and travel via the circulatory or lymph system to the target cells, tissues or organs (ACSBL113)
- endothermic animals have varying thermoregulatory mechanisms that involve structural features, behavioural responses and physiological and homeostatic mechanisms to control heat exchange and metabolic activity (ACSBL114)
- animals, [...] osmoregulators [...] and plants, have various mechanisms to maintain water balance that involve structural features and behavioural, physiological and homeostatic responses (ACSBL115).

Infectious disease:

- infectious disease [...] is caused by invasion by a pathogen and can be transmitted from one host to another (ACSBL116)
- pathogens include prions, viruses, bacteria, fungi, protists and parasites (ACSBL117)
- pathogens have adaptations that facilitate their entry into cells and tissues and their transmission between hosts; transmission occurs by various mechanisms, including through direct contact, contact with body fluids and via contaminated food, water or disease-specific vectors (ACSBL118)
- when a pathogen enters a host, it causes physical or chemical changes (for example, the introduction of foreign chemicals via the surface of the pathogen, or the production of toxins) in the cells or tissues; these changes stimulate the host immune responses (ACSBL119)
- all [...] animals have innate (general) immune responses to the presence of pathogens; vertebrates also have adaptive immune responses (ACSBL120)
- innate responses in animals target pathogens, including through the inflammation response, which involves the actions of phagocytes, defensins and the complement system (ACSBL121)
- in vertebrates, adaptive responses to specific antigens include the production of humoral immunity through the production of antibodies by B lymphocytes and the provision of cell-mediated immunity by T lymphocytes; in both cases memory cells are produced that confirm long-term immunity to the specific antigen (ACSBL122)
- in vertebrates, immunity may be passive (for example, antibodies gained via the placenta or via antibody serum injection) or active (for example, acquired through actions of the immune system as a result of natural exposure to a pathogen or through the use of vaccines) (ACSBL123)
- the spread of a specific disease involves a wide range of interrelated factors (for example, persistence of the pathogen within hosts, the transmission mechanism, the proportion of the population that are immune or have been immunised and the mobility of individuals of the affected population); analysis of these factors can enable prediction of the potential for an outbreak, as well as evaluation of strategies to control the spread of disease (ACSBL125).

Appendix 3 – Work requirements

The work requirements of a course are processes, products or performances that provide a significant demonstration of achievement that is measurable against the course's standards. Work requirements need not be the sole form of assessment for a module.

Module 1 Work requirements specifications

Work requirement 1 of 3

Title of work requirement: Science inquiry skills

Mode or format: folio

Description: This work requirement has two short inquiries. To support this and the extended inquiry in work requirement two short practical activities or fieldwork will be used. These are designed to support the depth of understanding and engagement for a number of purposes, including:

- learning and practising scientific techniques
- developing safe practices to avoid health and safety issues to be used independently throughout the year
- illustration of concepts
- exploring components of experimental practice
- meeting the requirements of experimental practice whilst addressing criterion 3.

A digital or physical record of the above and other inquiry-based tasks in this work requirement may include but is not limited to a laboratory manual or journal, reports, compiled data; for example, images, tables, graphs, or other observations.

Learners will undertake two 5-hour minor inquiries to address all elements in criterion 3 to produce a practical record in a form that will include:

- development of a hypothesis and prediction of outcomes
- risk and ethical assessment
- experimental design and method
- analysis of data and evidence-based conclusions
- evaluation of processes and conclusions and recommendations for improvement.

Size: 10 hours in total.

Timing: concurrent with modules 2 and 3.

Relevant criteria: 1, 2 and 3

Work requirement 2 of 3

Title of work requirement: Extended inquiry

Mode or format: inquiry

Description: This assessment requires learners to research a question or hypothesis through experimentation, collection, analysis and synthesis of primary data. This assessment occurs over an extended period of time.

In the experiment, learners design, or refine, extend, modify or redirect an experiment in order to address their own related hypothesis or question. It is sufficient that learners use a practical or fieldwork performed in class as the basis for their choice of methodology and research question.

Learners will document:

- an introduction with relevant biological concepts and a hypothesis and variables and a prediction of outcomes
- the materials and equipment used
- the method that was implemented
- the identification and management of safety and ethical risks
- the results, including tables and/or graphs to demonstrate trends, patterns and relationships
- an analysis of results, including identifying trends, linking results to concepts and limitations of data
- an evaluation of procedures and their effect on data and identifying sources of uncertainty
- an evidence based and justified conclusion identifying possible improvements.

Size: 10 hours.

Timing: concurrent with modules 2 and 3.

Relevant criteria: 1, 2 and 3

Work requirement 3 of 3

Title of work requirement: Science as a human endeavour folio

Mode or format: folio

Description: Learners will complete an investigation that will represent at least 10 hours of design time.

Learners will collect examples from the media covering recent discoveries, innovations and issues, linked to topics across module 2 and module 3. On four occasions within this task they will analyse information to show its connections to science as a human endeavour.

On the four separate occasions within this task learners will document for an example they have chosen in any appropriate format or formats analysis of:

- the context and implications
- any collaboration involved
- the technologies used
- how needs are being met and the impact in society.

The folio will include a bibliography citing sources for all examples collected.

Size: 10 hours.

Timing: concurrent with modules 2 or 3.

Relevant criteria: 1, 2 and 4

Module 2 Work requirements specifications

Work requirement 1 of 2

Title of work requirement: Regulation of cells and systems case studies

Mode or format: extended response

Description: Learners will demonstrate their scientific knowledge of cellular and system processes through investigation of two minor case studies. It is recommended that learners use topics from their folio from module 1 work requirement 3.

In addition to criteria 1 and 2:

- one case study is to be assessed against criterion 5
- one case study is to be assessed against criterion 6.

Each case study should be of no more than 400 words or equivalent in any appropriate format or formats.

Examples of case study topics include but are not limited to

- discovery and development of the model of the structure of DNA
- proteomic research applications
- transgenic organism use in agriculture
- use, research and regulation of gene technologies, including CRISPR-Cas9
- outcomes and unexpected consequences of the use of enzyme inhibitors such as pesticides and drugs
- research into increasing efficiency of photosynthesis or cellular respiration or impact of poisons on the cellular respiration pathway
- the application of biotechnologies to biochemical pathways leading to improvements in agricultural practices
- cell therapy and latest biotechnology such as development of a bioartificial pancreas to treat diabetes.

Size: 400 words or equivalent for each of the two extended response assessments.

Timing: There is no specified timing for this requirement.

Relevant criteria: 1, 2, 5 and 6

Work requirement 2 of 2

Title of work requirement: Regulation of cells and systems: ideas and problem solving

Mode or format: short response

Description: Learners are required to demonstrate that they have achieved an understanding of enzymes, DNA structure, protein synthesis, gene regulation and mutations and/or homeostasis. Learners will undertake at least two separate assessment tasks each requiring a range of short responses. Each assessment task will require no more than 700 words, or equivalent representations, including diagrammatic, data, graphical, statistical or algebraic modelling, to complete all answers.

It is expected that at least one of these assessments be under conditions similar to the external examination.

It is expected that at least one of these short responses will be designed to be addressed in a range of ways, such as:

- solve a simple problem
- express a single or discrete group of ideas
- answer closed questions
- provide brief descriptions
- convey specific information.

The focuses for this work requirement are enzymes, DNA structure, protein synthesis, gene regulation and mutations and/or homeostasis.

Note: often the use of other scientific representations, in conjunction with concise and precise language, demonstrates a greater level of understanding than a paragraph.

Size: 700 words or equivalent for each of the two short response assessments.

Timing: There is no specified timing for this requirement.

Relevant criteria: 1, 2, 5 and 6

Module 3 Work requirements specifications

Work requirement 1 of 2

Title of work requirement: Continuity and change case studies

Mode or format: extended response

Description: Learners will demonstrate their scientific knowledge of immunology, cell division and genetics and evolution through investigation of two minor case studies. It is recommended that learner use topics from their folio from module 1 work requirement 3.

In addition to criteria 1 and 2:

- one case study is to be assessed against criterion 7
- one case study is to be assessed against criterion 8.

Each case study should be of no more than 400 words or equivalent in any appropriate format or formats.

Examples of case study topics include but are not limited to:

- deviant cell behaviour and links to disease
- autoimmune diseases
- allergic reactions
- development of immunotherapy strategies
- antibiotic resistance
- use and application of bacteriophage therapy
- prevention and eradication of disease
- vaccinations
- bioprospecting for new medical treatments
- trends, patterns and evidence for evolutionary relationships
- population and species changes over time in non-animal communities such as forests and microbiota
- monitoring of gene pools for conservation planning
- role of selective breeding programs in conservation of endangered species
- impact of new technologies on the study of evolutionary biology.

Size: 400 words or equivalent for each of the two extended response assessments.

Timing: There is no specified timing for this requirement.

Relevant criteria: 1, 2, 7 and 8

Work requirement 2 of 2

Title of work requirement: Continuity and change: ideas and problem solving

Mode or format: short response

Description: Learners are required to demonstrate that they have achieved an understanding of immunology, cell division and genetics and/or evolution. Learners will undertake at least two separate assessment tasks each requiring a range of short responses. Each assessment task will require no more than 700 words, or equivalent representations, including diagrammatic, data, graphical, statistical or algebraic modelling, to complete all answers.

It is expected that at least one of these short responses will be designed to be addressed in a range of ways, such as:

- solve a simple problem
- express a single or discrete group of ideas
- answer closed questions
- provide brief descriptions
- convey specific information.

The focuses for this work requirement are immunology and/or cell division and genetics and evolution.

Note: often the use of other scientific representations, in conjunction with concise and precise language, demonstrates a greater level of understanding than a paragraph.

Size: 700 words or equivalent for each of the two short response assessments.

Timing: There is no specified timing for this requirement.

Relevant criteria: 1, 2, 7 and 8

Appendix 4 – General capabilities and cross-curriculum priorities

Learning across the curriculum content, including the cross-curriculum priorities and general capabilities, assists students to achieve the broad learning outcomes defined in the *Alice Springs (Mparntwe) Education Declaration (December 2019)*.

General capabilities

The general capabilities play a significant role in the Australian Curriculum in equipping young Australians to live and work successfully in the twenty-first century.

In the Australian Curriculum, capability encompasses knowledge, skills, behaviours and dispositions. Students develop capability when they apply knowledge and skills confidently, effectively and appropriately in complex and changing circumstances, in their learning at school and in their lives outside school.

The general capabilities include:

- Critical and creative thinking
- Digital literacy
- Ethical understanding
- Intercultural understanding
- Literacy
- Numeracy
- Personal and social capability.

Cross-curriculum priorities

Cross-curriculum priorities enable students to develop understanding about and address the contemporary issues they face, for their own benefit and for the benefit of Australia as a whole. The priorities provide national, regional and global dimensions which will enrich the curriculum through development of considered and focused content that fits naturally within learning areas. Incorporation of the priorities will encourage conversations between students, teachers and the wider community.

The cross-curriculum priorities include:

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

Appendix 5 – Glossary

See Glossary for Senior Secondary Australian Curriculum Science (Version 8.4).

Supporting documents including external assessment material

- BIO315124 Biology External Assessment Specifications and Content Mapping.pdf (2024-01-04 02:58pm AEDT)
- BIO315124 Biology Exemplar Exam Paper.pdf (2024-01-04 02:58pm AEDT)
- BIO315124 - Information sheet - 2024.docx (2024-06-04 02:33pm AEST)
- BIO315124 Biology Exemplar Exam Marking Tool.pdf (2024-03-12 08:23am AEDT)

Tasmanian Government