

Biology

LEVEL 3	15 TCE CREDIT POINTS
COURSE CODE	BIO315116
COURSE SPAN	2016 — 2021
COURSE STATUS	LIVE
READING AND WRITING STANDARD	NO
MATHEMATICS STANDARD	NO
COMPUTERS AND INTERNET STANDARD	NO

Knowledge and understanding of science, scientific literacy and scientific methods are necessary for learners to develop the skills to resolve questions about their natural and constructed world

The purpose of science education is to develop scientific literacy, helping learners: to be interested in, and understand, the world around them; to engage in discourse about the scientific and technological aspects underlying global and local issues; to understand the testable and contestable nature of science, and question the claims made by others about scientific matters; to be able to identify questions, draw evidence-based conclusions and discuss their validity; and to form opinions, that are reasoned and informed, about the environment, about their own health and well-being, and about the role and impact of science on society. Biology is the study of the fascinating diversity of life as it has evolved and as it interacts and functions. Investigation of biological systems and their interactions, from the molecular level to cellular processes to ecosystem dynamics, has led to biological knowledge and understanding that enable us to explore and explain everyday observations, find solutions to biological issues, and understand the processes of biological continuity and change over time.

Rationale

Knowledge and understanding of science, scientific literacy and scientific methods are necessary for learners to develop the skills to resolve questions about their natural and constructed world.

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Aims

Biology aims to develop learners':

- sense of wonder and curiosity about life and respect for all living things and the environment
- understanding of how biological systems interact and are interrelated; the flow of matter and energy through and between these systems; and the processes by which they persist and change
- understanding of major biological concepts, theories and models related to biological systems at all scales, from subcellular processes to ecosystem dynamics
- appreciation of how scientists use biology in a wide range of applications, and how biological knowledge influences society in local, regional and global contexts
- ability to plan and carry out fieldwork, laboratory and other research investigations including the collection and analysis of qualitative and quantitative data and the interpretation of evidence
- ability to use sound, evidence-based arguments creatively and analytically when evaluating claims and applying biological knowledge
- ability to communicate biological understanding, findings, arguments and conclusions using appropriate representations, modes and genres.

Learning Outcomes

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

- plan activities and monitor and evaluate progress; be organised to complete activities and meet deadlines; contribute to completion of group activities in the context of biology
- apply scientific techniques and practical skills using equipment safely and competently to collect data related to biology
- use scientific inquiry to develop, conduct, interpret and evaluate experiments related to biology
- collect and record primary and secondary data from a variety of relevant sources
- apply discriminating research skills and adhere to the principles of academic integrity
- communicate, predict and explain biological phenomena, using qualitative and quantitative representations in appropriate modes and genres, and following accepted conventions and terminology
- make connections between knowledge of biology and ethical, political, cultural, social, economic and scientific considerations in differing contexts
- apply biological concepts to describe processes at all levels of biological organisation: the chemical basis of life; cells; organisms; and continuity of organisms and survival of changes
- interpret information and apply biological concepts and processes to discuss problems and make plausible predictions
- interpret data to draw valid conclusions.

Access

Learners enrolled in this course are required to be able to work responsibly and safely in practical situations.

Pathways

This course is designed for learners who are interested in, and curious about, the science of the living world. The successful completion of Life Sciences Level 2 would provide useful preparation for the study of Biology.

The study of Biology will provide a foundation for learners to critically consider and to make informed decisions about contemporary biological issues in their everyday lives.

It may be studied as part of a pathway to tertiary study and careers in areas such as agriculture, botany, zoology, marine science, biotechnology, health science, pharmacy, medicine, nursing or veterinary science. It is also suitable for learners wishing to study a science as part of a general education.

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 Size And Complexity

This course has a complexity level of 3.

At Level 3, the learner is expected to acquire a combination of theoretical and/or technical and factual knowledge and skills and use judgement when varying procedures to deal with unusual or unexpected aspects that may arise. Some skills in organising self and others are expected. Level 3 is a standard suitable to prepare learners for further study at tertiary level. VET competencies at this level are often those characteristic of an AQF Certificate III.

This course has a size value of 15.

Course Requirements

All content areas of Biology are **compulsory**, however, the order of delivery is not prescribed.

This course has a design time of 150 hours. A **minimum of 45 hours** is to be spent on practical activities, which are an integral part of the course, and are to be used as a means of teaching and consolidating the course content as well as a means of assessment.

Case studies may be used to engage learners and integrate content from different parts of the course.

Course Content

OVERVIEW

For the content areas of Biology, the three (3) interrelated strands – *Science Inquiry Skills*; *Science as a Human Endeavour*; and *Science Understanding* – build on students' learning in F-10 *Australian Curriculum: Science*. In the practice of science, the three strands are closely integrated: the work of scientists reflects the nature and development of science; it is built around scientific inquiry; and it seeks to respond to and influence society. These three strands will be integrated into all areas of study in this course.

Learners will develop an understanding of scientific method and also biology as a human endeavour, throughout the course.

Science understanding will be developed through the study of four (4) sections:

- The chemical basis of life (Criterion 5)
- Cells (Criterion 6)
- Organisms (Criterion 7)
- Continuity of organisms and survival of changes (Criterion 8).

Each section will be studied with reference to relevant underlying concepts and processes from the following:

- structure reflecting function
- materials input/output
- energy input/output
- maintaining equilibrium
- DNA: the code of life
- managing challenges.

All sections of the course will be assessed against Criteria 1, 2, 3 and 4.

The course content structure is summarised in the table below:

Overarching Strands						
Science Inquiry Skills, Science as a Human Endeavour, Science Understanding						
Lines of organisation		The chemical basis of life	Cells	Organisms	Continuity of organisms and survival of changes	
Underlying concepts and processes	Structure reflecting function	P	P	P		
	Material input/output	P	P			
	Energy input/output	P				
	Maintaining equilibrium		P	P		
	DNA: the code of life	P	P			P
	Managing challenges			P		P

SCIENCE INQUIRY SKILLS

- Identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes
- Design experiments, including the procedure(s) to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; observe risk assessments; and consider research ethics, including animal ethics
- Safely, competently and methodically collect valid and reliable data from practical investigations
- Represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error, and uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusions
- Select, construct and use appropriate representations to communicate conceptual understanding, solve problems and make predictions

- Interpret a range of scientific resources, for example, research and media reports, and evaluate processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments
- Communicate to specific audiences for specific purposes using appropriate language, nomenclature, genres and modes, including scientific reports.

SCIENCE AS A HUMAN ENDEAVOUR

- Scientific knowledge can enable scientists to offer valid explanations and make reliable predictions
- ICT and other technologies have dramatically increased the size, accuracy and geographic and temporal scope of data sets with which scientists work
- 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
- 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
- The use of scientific knowledge may have beneficial and/or harmful and/or unintended consequences
- 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.

SCIENCE UNDERSTANDING

Experimental Design (Criterion 2)

- Propose a testable hypothesis that identifies clearly the independent and dependent variable
- Design a controlled experiment:
 - Explain the requirements for only one independent variable and the importance of controlling all other variables (fixed variables)
 - Explain the need for a control treatment for comparison
 - Explain the need for an appropriate sample size and replications and the limitations where this is not possible
 - Explain the economic, ethical and environmental constraints on the design.
- Understand the role of abiotic and biotic factors in influencing the response of organisms as these are generally the independent variables that can be manipulated.
- Analyse and interpret data:
 - Select appropriate analysis and data representations (graphs/tables)
 - Describe patterns/trends in results
 - Provide a reasonable interpretation/explanation of the results
 - Provide a summary conclusion as to whether results support or negate the hypothesis
- Evaluate the method and suggest improvements to experiments.
 - Identify the strengths and weaknesses of an experimental design
 - Identify the limitations and sources of possible errors in the study
 - Suggest possible improvements to the method
 - Suggest further/alternative experiments.

Application and impact of biological science in society (Criterion 4)

- Biological knowledge can enable scientists to offer valid explanations and make reliable predictions. This knowledge, and understanding by society, is relevant to biological issues and informs decision making
- People's values (ethical, political, cultural, social, economic, scientific) are important in decision making
- Pressure groups/stakeholders influence decision making on biological issues
- The use of scientific knowledge may have beneficial and/or harmful and/or unintended consequences
- Current issues demonstrate the complexity and tensions (ethical, political, cultural, social, economic, scientific) surrounding decision making on biological issues.

The chemical basis of life (Criterion 5)

Cells carry out a variety of functions which require nutrients to be able to manufacture material for growth, maintenance and repair. Respiration and photosynthesis are essential for the production of energy of animals and plants. Cells require inputs of suitable forms of energy, including light energy or chemical energy in complex molecules, and matter, including gases, simple nutrients, ions, and removal of wastes, to survive. The activities of cells require a variety of biological molecules for metabolic activities. Enzymes are a catalyst that assist in many reactions.

STRUCTURE REFLECTS FUNCTION

Enzymes have specific structure and functions which can be affected by various factors.

- Structure and function of enzymes
- Role and characteristics of enzymes
- Factors affecting rate of enzyme action
 - temperature
 - pH
 - concentration of substrate
 - concentration of enzyme
- Mechanism of enzyme action (related to protein structure)
 - induced fit model
 - competitive and non-competitive inhibitors.

MATERIALS INPUT / OUTPUT

Organisms need raw materials in the form organic and inorganic nutrients. All organisms need carbohydrates, proteins, lipids and nucleic acids.

- Basic properties and functions of biological compounds
- Differences between organic and inorganic compounds
- Carbohydrates: monosaccharides, disaccharides and polysaccharides
- Lipids: triglycerides only
- Proteins: polymers of amino acids
- Vitamins
- Minerals and water.

(Details of chemical structure not required.)

ENERGY INPUT/OUTPUT

Energy is used by all cells to carry out "work". All activities of organisms are the result of their metabolism. Energy is used to build new molecules and break up old molecules and as a result all activities of cells use chemical energy.

- Capture release and transfer of energy
- Photosynthesis is a biochemical process that occurs in the chloroplasts of plant cells using light energy to synthesise organic compounds; the overall process can be represented by a balanced chemical reaction:
 - initial reactants and final products (individual biochemical reactions not required)
 - factors affecting the rate of photosynthesis including: temperature, concentration of carbon dioxide, light intensity and light quality
- Cellular respiration is a biochemical process that occurs in different locations in the cytosol and mitochondria and metabolises organic compounds, aerobically or anaerobically, to release useable energy in the form of ATP; the overall process can be represented as a balanced chemical equation:
 - initial reactants and final products including energy release for aerobic respiration and anaerobic respiration
 - anaerobic respiration in bacteria, yeast and plants (producing alcohol)
 - anaerobic respiration in animals (producing lactic acid)
 - sites of anaerobic and aerobic respiration
 - ATP as energy currency
 - carbohydrates and lipids as energy storage molecules.

(Individual biochemical reactions not required.)

DNA: THE CODE OF LIFE

All living organisms contain the genetic material deoxyribonucleic acid (DNA).

- The structure and role of DNA
- Structure and replication of DNA (*details of enzymes not required*)
- Protein synthesis: a basic understanding of transcription and translation (*details of enzymes involved not required*)
- Gene (or point) mutations as the source of genetic variation.

Cells (Criterion 6)

Cells are the basic functional unit of all living organisms, their structure varies according to their function. They contain DNA which 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.

STRUCTURE REFLECTS FUNCTION

- Structure reflects function in cells and cell organelles
- Differences between plant and animal cells
- In eukaryotic cells, specialised organelles facilitate biochemical processes of photosynthesis, cellular respiration, the synthesis of complex molecules, and the removal of cellular products and wastes
- Identification and function of organelles:
 - nucleus, nucleolus, nuclear membrane
 - mitochondrion
 - chloroplast
 - Golgi apparatus
 - ribosome
 - endoplasmic reticulum (rough and smooth)
 - vacuole, lysosome, vesicle
 - centrioles
 - cell membrane, cell wall, including the fluid mosaic model
 - contractile vacuole
 - cilium, flagellum.
- Differences between prokaryotic and eukaryotic cells. Prokaryotic and eukaryotic cells have many features in common, which is a reflection of their common evolutionary past, but prokaryotes lack internal membrane bound organelles, do not have a nucleus, are significantly smaller than eukaryotes, usually existing as single cells
- Characteristics and differences of viruses, prions and plasmids
- Cell differentiation of plant and animal cell specialisation
- Organisation of cells into tissues, organs and organ systems
- Use of light and electron microscopes for studying cells, including estimation of cell size.

MATERIALS INPUT/OUTPUT

Movement of materials across membranes occurs via diffusion, osmosis, active transport and/or endocytosis.

- Cells need materials and remove waste
- Passive processes: diffusion, facilitated diffusion and osmosis
- Active processes: active transport, exocytosis and endocytosis
- Significance of surface area to volume ratio.

MAINTAINING EQUILIBRIUM

- Maintaining equilibrium in cells
- Substances are kept in balance in cells – salts, water
- The mechanism of the contractile vacuole as an example of maintaining equilibrium in some single-celled organisms.

DNA: THE CODE OF LIFE

- Cell division
- Significance of mitosis and meiosis in asexual and sexual reproduction as a source of genetic variation (*details of processes not required*).

Organisms (Criterion 7)

STRUCTURE REFLECTS FUNCTION AND MATERIALS INPUT / OUTPUT

- Structure reflect function in organisms – examples to be studied in the context of input, breakdown, transfer and output of material in selected organisms
- The principles involved in the following processes in vertebrates and plants (*dicots only*), with reference to the relationship between structure and function:
 - Digestion and absorption
 - the need for digestion in herbivores, carnivores and omnivores
 - physical and chemical digestion (including a variety of diets)
 - Gas exchange
 - characteristics of efficient gas exchange (surfaces in animals and plants)
 - Transport
 - blood as a transport medium
 - the heart as a pump (*not including foetal circulation*)
 - arteries, veins and capillary structures
 - transport of water and food in plants (*dicots only*)
 - transpiration (*including mechanisms*) and translocation (*not the mechanism*)
 - Excretion
 - nitrogenous wastes as products produced in the liver from excess amino acids (ammonia, urea and uric acid)
 - ultrafiltration and reabsorption in the kidney.
- Advantages and demands of multi-cellularity.
- The significance of surface area to volume ratio.

MANAGING CHALLENGES

Adaptations

- Adaptations of plants and animals (including structural, physiological and behavioural) to environmental variations in:
 - temperature
 - water availability (osmoregulation).

MAINTAINING EQUILIBRIUM

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.

- Basic feedback mechanisms in vertebrates (homeostasis)
- The concept of negative feedback mechanisms in the regulation of:
 - temperature
 - blood glucose
 - water balance.

Continuity of organisms and survival of changes (Criterion 8)

DNA: THE CODE OF LIFE

- Asexual and sexual reproduction: genetics
- Significances of sexual and asexual reproduction
- Variations in the genotype of offspring arise as a result of the processes of meiosis and fertilisation, as well as a result of mutations. Monohybrid crosses, including incomplete dominance and co-dominance, multiple alleles (only for ABO bloods).
- 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 (only for ABO bloods)
- Sex linkage
- Pedigrees.

Natural Selection

- The species concept and the binomial system of nomenclature
- Speciation including isolating mechanisms
- Darwin's theory of evolution by natural selection
- The concepts of a gene pool, genetic drift, gene flow and changes in gene/allele frequency.

Lymphatic system

- Functions in relation to defence against disease
- Lymph nodes, lymph vessels, lymph, spleen, thymus, appendix and tonsils.

MANAGING CHALLENGES

Organisms that cause disease

- Difference between infectious and non-infectious diseases: Infectious disease differs from other disease (for example, genetic and lifestyle diseases) in that it is caused by invasion by a pathogen and can be transmitted from one host to another
- Conditions under which an organism is described as a pathogen
- Difference between the following pathogens; prions, viruses, bacteria, fungi, protists and parasites
- Transmission of diseases: 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.

Lines of defence inside the body

Immunity

Immunity is the human body's ability to resist almost all types of organisms and toxins that tend to damage the tissues or organs.

Non-specific (innate) immune responses

1st line of defence

- Barriers to prevent entry of pathogens to humans:
 - Structural
 - skin, mucous membranes, cilia
 - Chemical barriers
 - pH
 - Biological
 - Competition from non-pathogenic organisms.

2nd line of defence

- Body's defence mechanisms: 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.
- 2nd Line of defence mechanisms:
 - Inflammatory – histamine release, increased blood flow and permeability of blood vessels
 - Phagocytic – phagocytic cells and NK cells
 - Physiological – fever
 - Chemical – cytokines, complement proteins.

Specific (adaptive) immune responses

3rd line of defence

In humans, 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.

- Humoral response:
 - Production and function of antibodies
 - Complement proteins.
- Cell mediated responses:
 - Cytotoxic T cells, helper T cells, suppressor T cells
 - Activated phagocytes
 - Antigen presenting cells – macrophages, dendritic cells, B cells
 - Graft rejection.
- Immune memory by T and B cells.

Passive or active immunity

In humans, immunity may be passive (for example, antibodies gained via the placenta or via antibody or T lymphocyte 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).

- Difference between passive and active immunity
- Immunisation
- Primary and secondary response to antigen.

Assessment

Criterion-based assessment is a form of outcomes assessment that identifies the extent of learner achievement at an appropriate end-point 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 TASC will focus on what both teacher and learner understand to reflect end-point 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.

Providers offering this course must participate in quality assurance processes specified by TASC to ensure provider validity and comparability of standards across all awards. To learn more, see TASC's [quality assurance](#) processes and [assessment](#) information.

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

TASC will supervise the external assessment of designated criteria which will be indicated by an asterisk (*). The ratings obtained from the external assessment 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 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 – 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.

External Assessment Requirements

The external assessment for this course will comprise:

- a 3 hour written examination assessing criteria: 2, 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. apply personal skills to plan, organise and complete activities
2. develop, interpret and evaluate biological experiments*
3. collect, record, process and communicate information
4. discuss the application and impact of biology in society
5. describe and apply concepts and processes of the chemical basis of life*
6. describe and apply concepts and processes involving cells*
7. describe and apply concepts and processes within organisms*
8. describe and apply concepts and processes related to continuity of organisms and survival of changes*

* = denotes criteria that are both internally and externally assessed

Standards

Criterion 1: apply personal skills to plan, organise and complete activities

The learner:

Rating A	Rating B	Rating C
selects and uses techniques and equipment safely, competently and methodically, applying them to unfamiliar contexts	selects and uses techniques and equipment safely, competently and methodically	uses familiar techniques and equipment safely and competently
follows instructions accurately and methodically, adapting to new circumstances	follows instructions accurately and methodically to complete activities	follows instructions accurately to complete activities
monitors and critically evaluates progress towards meeting goals and timelines, and plans realistic future actions	monitors and evaluates progress towards meeting goals and timelines, and plans/negotiates realistic future actions	monitors progress towards meeting goals and timelines and plans/negotiates future actions
meets planned timelines and addresses all aspects of the activity with a high degree of accuracy	meets planned timelines and addresses all aspects of the activity	meets planned timelines and addresses most aspects of the activity
performs and monitors own contribution, and guides others in their contribution to successful completion of group activities.	performs tasks and monitors own contribution to successful completion of group activities.	performs tasks to contribute to successful completion of group activities.

Criterion 2: develop, interpret and evaluate biological experiments

This criterion is both internally and externally assessed.

The learner:

Rating A	Rating B	Rating C
expresses a hypothesis to explain observations, as a precise and testable statement that can be supported or refuted by an experiment	expresses a hypothesis to explain observations, as a precise and testable statement	expresses a hypothesis to explain observations, meeting most of the criteria of a testable hypothesis
designs a controlled, safe and ethical experiment, identifying all variables and including all accepted elements of experimental design, to efficiently collect valid, reliable data	designs a controlled, safe and ethical experiment, identifying the main variables, to collect valid, reliable data	designs a controlled experiment, identifying the main variables and considering safety and ethics, to collect valid data
critically analyses, interprets and explains data to draw a valid conclusion that relates to a hypothesis	analyses, interprets and explains data to draw a valid conclusion that relates to a hypothesis	based on data, provides some explanation and draws a conclusion that relates to a hypothesis that has some validity
discusses significant limitations and sources of error in experimental design, with reference to evidence	identifies significant limitations and sources of error in experimental design	identifies some limitations and sources of error in experimental design
critically analyses an experimental design and provides an evidence-based critique and discussion on valid improvements and alternatives.	evaluates an experimental design and describes a number of possible valid improvements.	identifies a valid improvement in an experimental design.

Criterion 3: collect, record, process and communicate information

The learner:

Rating A	Rating B	Rating C
uses a variety of relevant sources to collect information and critically evaluates their reliability	uses a variety of relevant sources to collect information and evaluates their reliability	uses differing relevant sources to collect information
collects a wide range of relevant and accurate qualitative and quantitative experimental data, and records it methodically in a format that allows analysis	collects relevant and accurate qualitative and quantitative experimental data and records it in a format that allows analysis	collects and records relevant qualitative and quantitative experimental data, with some degree of accuracy
accurately follows accepted complex conventions and terminology in written responses	accurately follows accepted conventions and terminology in written responses	follows accepted conventions and terminology to achieve clarity in written responses
clearly identifies the information, images, ideas and words of others used in the learner's work	clearly identifies the information, images, ideas and words of others used in the learner's work	differentiates the information, images, ideas and words of others from the learner's own
clearly identifies sources of the information, images, ideas and words that are not the learner's own. Referencing conventions and methodologies are followed with a high degree of accuracy.	clearly identifies sources of the information, images, ideas and words that are not the learner's own. Referencing conventions and methodologies are followed correctly.	identifies the sources of information, images, ideas and words that are not the learner's own. Referencing conventions and methodologies are generally followed correctly.
creates appropriate, well-structured reference lists/bibliographies	creates appropriate, structured reference lists/bibliographies	creates appropriate reference lists/bibliographies
selects and uses appropriate scientific formats for effective and accurate communication of information for specific audiences and purposes.	uses an appropriate scientific format for clear and accurate communication of information for specific audiences and purposes.	uses an appropriate scientific format for communication of information.

Criterion 4: discuss the application and impact of biology in society

The learner:

Rating A	Rating B	Rating C
explains relevance of identified science background to an issue	describes relevant science background to an issue	identifies relevant science background to an issue
evaluates aspects and explains significant components of an issue to present a detailed and balanced discussion with reference to evidence	evaluates aspects and describes components of an issue to present a balanced discussion	identifies key components of an issue and presents a discussion
critically evaluates the tensions and connections between all significant relevant influences (ethical, political, cultural, social, economic, scientific) in a range of contexts	discusses the connections between an issue and most of the relevant influences (ethical, political, cultural, social, economic, scientific) in a range of contexts	outlines connections between an issue and some of the relevant influences (ethical, political, cultural, social, economic, scientific) in more than one context
analyses and evaluates to present a complex argument related to benefits of the use of scientific knowledge, and any harmful or unintended consequences	discusses benefits of the use of scientific knowledge, and any harmful or unintended consequences	describes benefits of the use of scientific knowledge, and any harmful or unintended consequences
argues a reasoned conclusion, linking it to relevant evidence, and assesses the relative	argues a reasoned conclusion, linking it to relevant evidence.	presents a reasoned conclusion, using some relevant evidence.

impact of influences on their decision making.		
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Criterion 5: describe and apply concepts and processes of the chemical basis of life

This criterion is both internally and externally assessed.

Related to the study of the chemical basis of life, the learner:

Rating A	Rating B	Rating C
correctly explains concepts and processes	correctly describes concepts and processes	correctly identifies fundamental concepts and processes
applies concepts and processes to explain the chemical basis of life, analyses and interprets complex problems, and makes reasoned, plausible predictions in familiar and unfamiliar contexts	applies concepts and processes to explain the chemical basis of life, analyse and interpret problems, and makes plausible predictions in familiar and some unfamiliar contexts	applies fundamental concepts and processes to describe the chemical basis of life, interprets problems, and makes plausible predictions in familiar contexts
justifies the selection of data as evidence, critically analyses and interprets evidence with reference to concepts, and draws evidence-based conclusions that identify any limitations.	selects appropriate data as evidence, analyses and interprets evidence with reference to concepts, and draws valid conclusions based on data.	uses data to demonstrate links to fundamental concepts, and presents simple valid conclusions based on data.

Criterion 6: describe and apply concepts and processes involving cells

This criterion is both internally and externally assessed.

Related to the study of cells, the learner:

Rating A	Rating B	Rating C
correctly explains concepts and processes	correctly describes concepts and processes	correctly identifies fundamental concepts and processes
applies concepts and processes to explain cells, analyses and interprets complex problems, and makes reasoned, plausible predictions in familiar and unfamiliar contexts	applies concepts and processes to explain cells, analyses and interprets problems, and makes plausible predictions in familiar and some unfamiliar contexts	applies fundamental concepts and processes to describe cells, interprets problems, and makes plausible predictions in familiar contexts
justifies the selection of data as evidence, critically analyses and interprets evidence with reference to concepts, and draws evidence-based conclusions that identify any limitations.	selects appropriate data as evidence, analyses and interprets evidence with reference to concepts, and draws valid conclusions based on data.	uses data to demonstrate links to fundamental concepts, and presents simple valid conclusions based on data.

Criterion 7: describe and apply concepts and processes within organisms

This criterion is both internally and externally assessed.

Related to the study of organisms, the learner:

Rating A	Rating B	Rating C
correctly explains concepts and processes	correctly describes concepts and processes	correctly identifies fundamental concepts and processes

applies concepts and processes to explain organisms, analyses and interprets complex problems, and makes reasoned, plausible predictions in familiar and unfamiliar contexts	applies concepts and processes to explain organisms, analyses and interprets problems, and makes plausible predictions in familiar and some unfamiliar contexts	applies fundamental concepts to describe organisms, interprets problems, and makes plausible predictions in familiar contexts
justifies the selection of data as evidence, critically analyses and interprets evidence with reference to concepts, and draws evidence-based conclusions that identify any limitations.	selects appropriate data as evidence, analyses and interprets evidence with reference to concepts, and draws valid conclusions based on data.	uses data to demonstrate links to fundamental concepts, and presents simple valid conclusions based on data.

Criterion 8: describe and apply concepts and processes related to continuity of organisms and survival of changes

This criterion is both internally and externally assessed.

Related to the study of continuity of organisms and survival of changes, the learner:

Rating A	Rating B	Rating C
correctly explains concepts and processes	correctly describes concepts and processes	correctly identifies fundamental concepts and processes
applies concepts and processes to explain, continuity of organisms and survival of changes, analyses and interpret complex problems, and makes reasoned, plausible predictions in familiar and unfamiliar contexts	applies concepts and processes to explain, continuity of organisms and survival of changes, analyses and interprets problems, and makes plausible predictions in familiar and some unfamiliar contexts	applies fundamental concepts and processes to describe continuity of organisms and survival of changes, interprets problems, and makes plausible predictions in familiar contexts
justifies the selection of data as evidence, critically analyses and interprets evidence with reference to concepts, and draws evidence-based conclusions that identify any limitations.	selects appropriate data as evidence, analyses and interprets evidence with reference to concepts, and draws valid conclusions based on data.	uses data to demonstrate links to fundamental concepts, and presents simple valid conclusions based on data.

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 Tasmanian Assessment, Standards and Certification from 13 ratings (8 from the internal assessment, 5 from the external assessment).

The minimum requirements for an award in Biology Level 3 are as follows:

EXCEPTIONAL ACHIEVEMENT (EA)

11 'A' ratings, 2 'B' ratings (4 'A' ratings, 1 'B' rating from external assessment)

HIGH ACHIEVEMENT (HA)

5 'A' ratings, 5 'B' ratings, 3 'C' ratings (2 'A' ratings, 2 'B' ratings, 1 'C' rating from external assessment)

COMMENDABLE ACHIEVEMENT (CA)

7 'B' ratings, 5 'C' ratings (2 'B' ratings, 2 '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

The Department of Education's Curriculum Services will develop and regularly revise the curriculum. This evaluation will be informed by the experience of the course's implementation, delivery and assessment.

In addition, stakeholders may request Curriculum Services to review a particular aspect of an accredited course.

Requests for amendments to an accredited course will be forwarded by Curriculum Services to the Office of TASC for formal consideration.

Such requests for amendment will be considered in terms of the likely improvements to the outcomes for learners, possible consequences for delivery and assessment of the course, and alignment with Australian Curriculum materials.

A course is formally analysed prior to the expiry of its accreditation as part of the process to develop specifications to guide the development of any replacement course.

Course Developer

The Department of Education.

Expectations Defined By National Standards In Content Statements Developed by ACARA

The statements in this section, taken from documents endorsed by Education Ministers as the agreed and common base for course development, are to be used to define expectations for the meaning (nature, scope and level of demand) of relevant aspects of the sections in this document setting out course requirements, learning outcomes, the course content and standards in the assessment.

SCIENCE INQUIRY SKILLS (UNIT 3 AND 4)

- Identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes (ACSBL061)
- 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)
- Conduct investigations (.....) safely, competently and methodically for the collection of valid and reliable data (ACSBL063)
- Represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error, and uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusions (ACSBL064)
- Interpret a range of scientific and media texts, and evaluate processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments (ACSBL065)
- Select, construct and use appropriate representations (.....) to communicate conceptual understanding, solve problems and make predictions (ACSBL066)
- Communicate to specific audiences and for specific purposes using appropriate language, nomenclature, genres and modes, including scientific reports (ACSBL067)

SCIENCE AS A HUMAN ENDEAVOUR (UNITS 1 AND 2)

- The use of scientific knowledge may have beneficial and/or harmful and/or unintended consequences (ACSBL012)
- Scientific knowledge can enable scientists to offer reliable explanations and make reliable predictions (ACSBL042)

SCIENCE AS A HUMAN ENDEAVOUR (UNITS 3 AND 4)

- ICT and other technologies have dramatically increased the size, accuracy and geographic and temporal scope of data sets with which scientists work (ACSBL068)
- 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)
- The acceptance of scientific knowledge can be influenced by the social, economic and cultural context in which it is considered (ACSBL070)
- People can use scientific knowledge to inform the monitoring, assessment and evaluation of risk (ACSBL071)
- 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)
- Scientific knowledge can be used to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability (ACSBL074)

SCIENCE UNDERSTANDING (UNIT 1)

Describing Biodiversity

- Most common definitions of species rely on (.....) the ability to interbreed to produce fertile offspring in natural conditions – but, in all cases, exceptions are found (ACSBL018)

SCIENCE UNDERSTANDING (UNIT 2)

Cells as the Basis of Life

- Cells require inputs of suitable forms of energy, including light energy or chemical energy in complex molecules, and matter, including gases, simple nutrients, ions, and removal of wastes, to survive (ACSBL044)

- 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)
- Factors that affect exchange of materials across membranes include the surface-area-to-volume ratio of the cell, concentration gradients, and the physical and chemical nature of the materials being exchanged (ACSBL047)
- Prokaryotic and eukaryotic cells have many features in common, which is a reflection of their common evolutionary past, but prokaryotes lack internal membrane bound organelles, do not have a nucleus, are significantly smaller than eukaryotes, usually have a single circular chromosome, and exist as single cells (ACSBL048)
- In eukaryotic cells, specialised organelles facilitate biochemical processes of photosynthesis, cellular respiration, the synthesis of complex molecules (including carbohydrates, proteins, lipids and other biomacromolecules), and the removal of cellular products and wastes (ACSBL049)
- 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 or anaerobically, to release useable energy in the form of ATP; the overall process can be represented as an (...) equation (ACSBL053)

Multicellular Organisms

- Multicellular organisms have a hierarchical structural organisation of cells, tissues, organs and systems (ACSBL054)
- The specialised structure and function of tissues, organs and systems can be related to cell differentiation and cell specialisation (ACSBL055)
- In animals, the exchange of gases between the internal and external environments of the organism is facilitated by the structure and function of the respiratory system at cell and tissue levels (ACSBL056)
- In animals, the exchange of nutrients and wastes between the internal and external environments of the organism is facilitated by the structure and function of the cells and tissues of the digestive system (for example, villi structure and function), and the excretory system (for example, nephron structure and function) (ACSBL057)
- In animals, the transport of materials within the internal environment for exchange with cells is facilitated by the structure and function of the circulatory system at cell and tissue levels (for example, the structure and function of capillaries) (ACSBL058)
- In plants, gases are exchanged via stomata and the plant surface; their movement within the plant by diffusion does not involve the plant transport system (ACSBL059)
- In plants, transport of water and mineral nutrients from the roots occurs via xylem involving root pressure, transpiration and (cohesion) of water molecules; transport of the products of photosynthesis and some mineral nutrients occurs by translocation in the phloem (ACSBL060)

SCIENCE UNDERSTANDING (UNIT 3)

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 (.....) in the cytosol of prokaryotes (.....) (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)
- (.....) 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)
- 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 (.....) (ACSBL085)

Continuity of Life on Earth

- 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 addition 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)
- Differing selection pressures between geographically isolated populations may lead to (....) speciation (ACSBL094)
- Populations with reduced genetic diversity face increased risk of extinction (ACSBL095)

SCIENCE UNDERSTANDING (UNIT 4)

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 (.....) 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)
- 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 (.....) and travel via the circulatory (.....) 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, whether 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 differs from other disease (for example, genetic and lifestyle diseases) in that it 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 plants and 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)

Accreditation

The accreditation period for this course is from 1 January 2016 to 31 December 2020.

Version History

Version 1 – Accredited on 1 June 2015 for use from 1 January 2016 to 31 December 2020. This course replaces Biology (BIO315114) that expired on 31 December 2015.

Version 1.a – Approved 20 December 2016 by Executive Officer. Clarification of Course Content on pages 5, 6 and 9.

Version 1.b - Accreditation renewed on 22 July 2020 for the period 1 January 2021 to 31 December 2021, with the following amendments: refinement of Learning Outcomes.

Appendix

GLOSSARY

Accuracy

The extent to which a measurement result represents the quantity it purports to measure; an accurate measurement result includes an estimate of the true value and an estimate of the uncertainty.

Analyse

To examine, scrutinise, explore, review, consider in detail for the purpose of finding meaning or relationships, and identifying patterns, similarities and differences.

Animal ethics

Animal ethics involves consideration of respectful, fair and just treatment of animals. The use of animals in science involves consideration of replacement (substitution of insentient materials for conscious living animals), reduction (using only the minimum number of animals to satisfy research statistical requirements) and refinement (decrease in the incidence or severity of 'inhumane' procedures applied to those animals that still have to be used).

Apply

Use, utilise or employ in a particular situation.

Assess

Determine the value, significance or extent of (something).

Biotechnology

The application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for human purposes.

Communicates

Conveys knowledge and/or understandings to others.

Complex

Consisting of multiple interconnected parts or factors.

Critically analyse

Examine the component parts of an issue or information, for example identifying the premise of an argument and its plausibility, illogical reasoning or faulty conclusions.

Critically evaluate

Evaluation of an issue or information that includes considering important factors and available evidence in making critical judgement that can be justified.

Data

The plural of datum; the measurement of an attribute, for example, the volume of gas or the type of rubber. This does not necessarily mean a single measurement: it may be the result of averaging several repeated measurements. Data may be quantitative or qualitative and be from primary or secondary sources.

Demonstrate

Give a practical exhibition as an explanation.

Describe

Give an account of characteristics or features.

Design (verb)

Plan and evaluate the construction of a product or process.

Discuss

Talk or write about a topic, taking into account different issues and ideas.

Evaluate

Provide a detailed examination and substantiated judgement concerning the merit, significance or value of something.

Evidence

In science, evidence is data that is considered reliable and valid and which can be used to support a particular idea, conclusion or

decision. Evidence gives weight or value to data by considering its credibility, acceptance, bias, status, appropriateness and reasonableness.

Explain

Provide additional information that demonstrates understanding of reasoning and/or application.

Familiar

Previously encountered in prior learning activities.

Genre

The categories into which texts are grouped; genre distinguishes texts on the basis of their subject matter, form and structure (for example, scientific reports, field guides, explanations, procedures, biographies, media articles, persuasive texts, narratives).

Hypothesis

A tentative explanation for an observed phenomenon, expressed as a precise and unambiguous statement that can be supported or refuted by experiment.

Identify

Establish or indicate who or what someone or something is.

Investigation

A scientific process of answering a question, exploring an idea or solving a problem that requires activities such as planning a course of action, collecting data, interpreting data, reaching a conclusion and communicating these activities. Investigations can include observation, research, field work, laboratory experimentation and manipulation of simulations.

Justify

Show how an argument or conclusion is right or reasonable.

Measurement error

The difference between the measurement result and a currently accepted or standard value of a quantity.

Media texts

Spoken, print, graphic or electronic communications with a public audience. Media texts can be found in newspapers, magazines and on television, film, radio, computer software and the internet.

Mode

The various processes of communication – listening, speaking, reading/viewing and writing/creating.

Model

A representation that describes, simplifies, clarifies or provides an explanation of the workings, structure or relationships within an object, system or idea.

Primary data

Data collected directly by a person or group.

Reasoned

Reasoned argument/conclusion: one that is sound, well-grounded, considered and thought out.

Reliability

The degree to which an assessment instrument or protocol consistently and repeatedly measures an attribute achieving similar results for the same population.

Reliable data

Data that has been judged to have a high level of reliability; reliability is the degree to which an assessment instrument or protocol consistently and repeatedly measures an attribute achieving similar results for the same population.

Representation

A verbal, visual, physical or mathematical demonstration of understanding of a science concept or concepts. A concept can be represented in a range of ways and using multiple modes.

Research

To locate, gather, record, attribute and analyse information in order to develop understanding.

Risk assessment

Evaluations performed to identify, assess and control hazards in a systematic way that is consistent, relevant and applicable to all school

activities. Requirements for risk assessments related to particular activities will be determined by jurisdictions, schools or teachers as appropriate.

Secondary data

Data collected by a person or group other than the person or group using the data.

Select

Choose in preference to another or others.

Solve

Work out a correct solution to a problem.

Synthesise

Combine elements (information/ideas/components) into a coherent whole.

System

A group of interacting objects, materials or processes that form an integrated whole. Systems can be open or closed.

Theory

A set of concepts, claims and/or laws that can be used to explain and predict a wide range of related observed or observable phenomena. Theories are typically founded on clearly identified assumptions, are testable, produce reproducible results and have explanatory power.

Uncertainty

Range of values for a measurement result, taking account of the likely values that could be attributed to the measurement result given the measurement equipment, procedure and environment.

Understand

Perceive what is meant, grasp an idea, and to be thoroughly familiar with.













Unfamiliar

Not previously encountered in prior learning activities.

Validity

The extent to which tests measure what was intended; the extent to which data, inferences and actions produced from tests and other processes are accurate.

Supporting documents including external assessment material

-  [BIO315116 Exam Paper 2016.pdf](#) (2017-07-21 01:05pm AEST)
-  [BIO315116 Assessment Report 2016.pdf](#) (2017-07-25 04:11pm AEST)
-  [BIO315114 External Assessment Specifications 2016-2020.pdf](#) (2017-07-25 04:12pm AEST)
-  [BIO315116 Exam Paper 2017.pdf](#) (2017-11-21 03:50pm AEDT)
-  [BIO315116 Assessment Report 2017.pdf](#) (2018-03-02 09:45am AEDT)
-  [BIO315116 TASC Exam Paper 2018.pdf](#) (2018-11-22 12:30pm AEDT)
-  [BIO315116 - Assessment Panel Report 2018.pdf](#) (2019-01-30 01:29pm AEDT)
-  [BIO315116 External Information Sheet - Last Updated September 2019 - Current Version.pdf](#) (2019-09-24 12:18pm AEST)
-  [BIO315116 Biology TASC Exam Paper 2019.pdf](#) (2019-11-20 04:51pm AEDT)
-  [BIO315116 Assessment Report 2019.pdf](#) (2020-01-24 02:43pm AEDT)
-  [BIO315116 Biology TASC Exam Paper 2020.pdf](#) (2020-11-18 07:15pm AEDT)
-  [BIO315116 Assessment Report 2020.pdf](#) (2021-01-27 10:44am AEDT)