



Government of **Western Australia**
School Curriculum and Standards Authority

BIOLOGY

GENERAL COURSE

Year 12 syllabus

IMPORTANT INFORMATION

This syllabus is effective from 1 January 2017.

Users of this syllabus are responsible for checking its currency.

Syllabuses are formally reviewed by the School Curriculum and Standards Authority on a cyclical basis, typically every five years.

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Rationale

Through biology we investigate and answer questions about the living world. Biology contributes to our understanding of the world from genes and DNA to the theory of natural selection. Biological knowledge is continually refined in the light of new evidence.

In the Biology General Year 12 course, students investigate asexual and sexual reproduction in a diverse range of organisms, life cycles of selected plants and animals, the role of deoxyribonucleic acid (DNA) in inheritance, how changes in DNA occur and the effects on populations in the face of environmental change.

The Biology General course provides opportunities for students to develop an understanding of important science concepts and processes, the practices used to develop scientific knowledge, of science's contribution to our culture and society, and its applications in our lives. The course supports students to develop the scientific knowledge, understandings and skills to make informed decisions about local, national and global issues.

Through this course, students can become questioning, reflective and critical thinkers about biological issues. Biology highlights the importance of reasoning and respect for evidence. Students consider different perspectives on ethical, environmental and sustainability issues. This process enables students to use evidence to make informed judgements and decisions about controversial biological issues that directly affect their lives and the lives of others.

Biological sciences introduce students to a variety of skills in biological investigations. Students learn to develop and test hypotheses, plan and conduct ethical investigations, and begin to appreciate the critical importance of evidence in forming conclusions. This course enables students to communicate their understandings to different audiences for a range of purposes.

In addition to its practical applications, learning science is a valuable pursuit in its own right. Students can experience the joy of scientific discovery and nurture their natural curiosity about the world around them. In doing this, they develop critical and creative thinking skills, challenge themselves to identify questions, and draw evidence-based conclusions using scientific methods. In order to develop their students' scientific literacy, teachers should use an inquiry-based contextual approach wherever possible.

Aims

The Biology General course aims to develop students':

- 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 biological knowledge has developed over time and continues to develop; 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.

Organisation

The Year 12 syllabus is divided into two units which are delivered as a pair. The notional time for the pair of units is 110 class contact hours.

Structure of the syllabus

The Year 12 syllabus is divided into two units each of one semester duration which are delivered as a pair. The notional time for each unit is 55 class contact hours.

Unit 3 – Reproduction and heredity

This unit explores the transition of genetic material to the next generation. Through practical activities, students will study reproductive structures and processes in a range of plants and animals. Students will study the life cycles of selected organisms, and how the environment can change species over time.

Unit 4 – Ecosystems and eco-issues

This unit explores the biotic and abiotic components to understand the dynamics, diversity and underlying unity of ecosystems. In this unit, students investigate and describe a number of diverse ecosystems, including the human impact on the biodiversity of the Western Australian environment. Students will be actively engaged in collecting scientific information in a local environment.

Each unit includes:

- a unit description – a short description of the focus of the unit
- unit content – the content to be taught and learned.

Organisation of content

Science strand descriptions

The Biology General course has three interrelated strands: Science Inquiry Skills, Science as a Human Endeavour and Science Understanding which build on students' learning in the Year 7–10 Science curriculum. The three strands of the Biology General course should be taught in an integrated way. The content descriptions for Science Inquiry Skills, Science as a Human Endeavour and Science Understanding have been written so that this integration is possible in each unit.

Science Inquiry Skills

Science inquiry involves identifying and posing questions; planning, conducting and reflecting on investigations; processing, analysing and interpreting data; and communicating findings. This strand is concerned with evaluating claims, investigating ideas, solving problems, reasoning, drawing valid conclusions, and developing evidence-based arguments.

Science investigations are activities in which ideas, predictions or hypotheses are tested, and conclusions are drawn in response to a question or problem. Investigations can involve a range of activities, including experimental testing, field work, locating and using information sources, conducting surveys, and using modelling and simulations. The investigation design will depend on the context and subject of the investigation.

Science as a Human Endeavour

Science concepts, models and theories are reviewed as their predictions and explanations are continually re-assessed through new evidence, often through the application of new technologies. This review process involves a diverse range of scientists working within an increasingly global community of practice.

The application of science may provide great benefits to individuals, the community and the environment, but may also pose risks and have unintended consequences. As an ever-evolving body of knowledge, science frequently informs public debate, but is not always able to provide definitive answers.

Science Understanding

Science understanding is evident when a person selects and integrates appropriate science concepts, models and theories to explain and predict phenomena, and applies those concepts, models and theories to new situations.

The Science Understanding content in each unit develops students' understanding of the key concepts, models and theories that underpin the subject, and of the strengths and limitations of different models and theories for explaining and predicting complex phenomena.

Science Understanding can be developed through the selection of contexts that have relevance to, and are engaging for, students. The science curriculum has been designed to provide jurisdictions, schools and teachers with the flexibility to select contexts that meet the social, geographic and learning needs of their students.

Safety

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

Animal ethics

Through a consideration of research ethics as part of Science Inquiry Skills, students will examine their own ethical position, draw on ethical perspectives when designing investigation methods, and ensure that any activities that impact on living organisms comply with the *Australian code of practice for the care and use of animals for scientific purposes 8th edition 2013* (www.nhmrc.gov.au/guidelines/publications/ea28).

Any teaching activities that involve the care and use of, or interaction with, animals must comply with the *Australian code of practice for the care and use of animals for scientific purposes 8th edition 2013*, in addition to relevant state or territory guidelines.

The *Animal Welfare Act 2002* can be found at www.slp.wa.gov.au. The related animal welfare regulations, along with the licences required for the use and supply of animals, can be downloaded from www.dlg.wa.gov.au.

Information regarding the care and use of animals in Western Australian schools and agricultural colleges can be viewed at www.det.wa.edu.au/curriculumsupport/animalethics/detcms/portal/.

Mathematical skills expected of students studying the Biology General course

The Biology General course requires students to use the mathematical skills they have developed through the Year 7–10 Mathematics curriculum, in addition to the numeracy skills they have developed through the Science Inquiry Skills strand of the Science curriculum.

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

It is assumed that students will be able to:

- 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
- translate information between graphical and numerical 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
- interpret the slope of a linear graph.

Representation of the general capabilities

The general capabilities encompass the knowledge, skills, behaviours and dispositions that will assist students to live and work successfully in the twenty-first century. Teachers may find opportunities to incorporate the capabilities into the teaching and learning program for the Biology General course. The general capabilities are not assessed unless they are identified within the specified unit content.

Literacy

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

Numeracy

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

Information and communication technology capability

Information and communication technology (ICT) capability is a key part of Science Inquiry Skills. Students use a range of strategies to locate, access and evaluate information from multiple digital sources; to collect, analyse and represent data; to model and interpret concepts and relationships; and to communicate and share science ideas, processes and information. Through exploration of Science as a Human Endeavour concepts, students assess the impact of ICT on the development of science and the application of science in society, particularly with regard to collating, storing, managing and analysing large data sets.

Critical and creative thinking

Critical and creative thinking is particularly important in the science inquiry process. Science inquiry requires the ability to construct, review and revise questions and hypotheses about increasingly complex and abstract scenarios and to design related investigation methods. Students interpret and evaluate data; interrogate, select and cross-reference evidence; and analyse processes, interpretations, conclusions and claims for validity and reliability, including reflecting on their own processes and conclusions. Science is a creative endeavour and students devise innovative solutions to problems, predict possibilities, envisage consequences and speculate on possible outcomes as they develop Science Understanding and Science Inquiry Skills. They also appreciate the role of critical and creative individuals and the central importance of critique and review in the development and innovative application of science.

Personal and social capability

Personal and social capability is integral to a wide range of activities in the Biology General course, as students develop and practise skills of communication, teamwork, decision making, initiative taking and self-discipline with increasing confidence and sophistication. In particular, students develop skills in both independent and collaborative investigation; they employ self-management skills to plan effectively, follow procedures efficiently and work safely; and they use collaboration skills to conduct investigations, share research and discuss ideas. In considering aspects of Science as a Human Endeavour, students also recognise the role of their own beliefs and attitudes in their response to science issues and applications, consider the perspectives of others, and gauge how science can affect people's lives.

Ethical understanding

Ethical behaviour is a vital part of science inquiry. Students evaluate the ethics of experimental science, codes of practice, and the use of scientific information and science applications. They explore what integrity means in science, and they understand, critically analyse and apply ethical guidelines in their investigations. They consider the implications of their investigations on others, the environment and living organisms.

They use scientific information to evaluate the claims and actions of others and to inform ethical decisions about a range of social, environmental and personal issues and applications of science.

Intercultural understanding

Intercultural understanding is fundamental to understanding aspects of Science as a Human Endeavour, as students appreciate the contributions of diverse cultures to developing science understanding and the challenges of working in culturally diverse collaborations. They develop awareness that raising some debates within culturally diverse groups requires cultural sensitivity, and they demonstrate open-mindedness to the positions of others. Students also develop an understanding that cultural factors affect the ways in which science influences and is influenced by society.

Representation of the cross-curriculum priorities

The cross-curriculum priorities address the contemporary issues which students face in a globalised world. Teachers may find opportunities to incorporate the priorities into the teaching and learning program for the Biology General course. The cross-curriculum priorities are not assessed unless they are identified within the specified unit content.

Aboriginal and Torres Strait Islander histories and cultures

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

Asia and Australia's engagement with Asia

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

Sustainability

The Sustainability cross-curriculum priority is explicitly addressed in the Biology curriculum. The Biology General course provides authentic contexts for exploring, investigating and understanding the function and interactions of biotic and abiotic systems across a range of spatial and temporal scales. By investigating the relationships between biological systems and system components, and how systems respond to change, students develop an appreciation for the interconnectedness of the biosphere.

Students appreciate that biological science provides the basis for decision making in many areas of society and that these decisions can affect the Earth system. They understand the importance of using science to predict possible effects of human and other activity, and to develop management plans, or alternative technologies, that minimise these effects and provide for a more sustainable future.

Unit 3 – Reproduction and inheritance

Unit description

Organisms exhibit a diverse and interesting range of reproductive structures and behaviours to ensure reproductive success. This unit explores the genetic basis for variation and inheritance of characteristics by the next generation. Environmental conditions can also influence observable traits, including the sex of the offspring, and the timing and behaviours of reproduction. Life cycles of living organisms involve different modes of reproduction, methods of fertilisation, gestation, and distribution to maximise survival. Natural selection occurs when changing environments cause differential survival of organisms with adaptive characteristics.

Scientists use knowledge of reproduction and inheritance to inform practice in animal husbandry, horticulture and pest control. Understanding of reproduction and life cycles helps with the successful implementation of fire regimes, and rehabilitation of natural communities devastated by bushfires.

This unit will use practical and investigative skills involving fieldwork, dissections and microscope work to explore reproductive behaviours and structures. It may also include propagation of plants by different methods and keeping animals to research life cycles.

Unit 3 and Unit 4 can be integrated to provide a year-long course. A student's choice of Unit 4 citizen science longitudinal study may influence, or be influenced by, the selection of organisms covered for Unit 3.

Unit content

An understanding of the Year 11 content is assumed knowledge for students in Year 12. It is recommended that students studying Unit 3 and Unit 4 have completed Unit 1 and Unit 2.

This unit includes the knowledge, understandings and skills described below.

Science Inquiry Skills

- construct questions for investigation; propose hypotheses; and predict possible outcomes
- plan, select and use appropriate investigation methods, including laboratory experimentation, real or virtual dissections and microscopy techniques, to collect reliable data; assess risk and address ethical issues associated with these methods
- represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error; and use evidence to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate the conclusions by considering the quality of available evidence
- use appropriate representations, including DNA models, diagrams, flow charts and graphs to communicate conceptual understanding, solve problems and make predictions
- communicate scientific ideas and information for a particular purpose using appropriate scientific language, conventions and representations

Science as a Human Endeavour

- banksias, eucalypts and many other Australian plants are adapted to regular burning of their habitat for seed dispersal and recolonisation
- since the discovery that smoke promotes germination of many native Australian plants, smoke-water is now widely used in nursery production, bushland management and mine-site restoration
- apiarists facilitate pollination of native plants through the movement of beehives
- selective breeding is used in animal husbandry; for example, agriculture, horticulture and domestic pets
- knowledge of the life cycles of organisms is important in the control of pests; for example, dung beetles to control flies, spraying wet areas to interrupt mosquitoes' life cycle

Science Understanding

Reproduction

Living things use a variety of methods to reproduce and support their offspring.

- there are a number of asexual methods of reproduction in plants and animals, including:
 - binary fission
 - budding
 - vegetative propagation
 - cuttings
 - bulbs and tubers
 - spores
 - parthenogenesis
- cell division has a critical role in reproduction and growth:
 - mitosis (description of the main events)
 - meiosis (description of the main events)
 - comparison of mitosis and meiosis, including:
 - haploid and diploid cells
 - number of divisions
 - variability of daughter cells produced
 - number of daughter cells produced
- sexual reproduction involves the production and union of gametes:
 - types of gametes (haploid)
 - fertilisation (restoring the diploid number)
- flowering plants differ in their methods of reproduction:
 - main reproductive structures and their functions
 - mechanisms of pollination
 - seed dispersal
 - requirements for germination

- animals differ in their methods of reproduction:
 - reproductive structures for external and internal fertilisation
 - timing of reproduction
 - strategies for the survival of offspring, including parental care and number of offspring
- animals and plants have a range of life cycles:
 - insects or amphibians
 - flowering plants
 - Australian marsupials.

Inheritance and change

Variation is the result of genetics and the environment. Genetic information is transferred to offspring by DNA to produce specific traits.

- the DNA of an organism determines its characteristics:
 - structure and function of DNA (double helix, nucleotides, complementary base pairing)
 - genes (sequence of bases that codes for traits)
- the external environment influences observable traits of an organism; for example, fur colour in Himalayan rabbits, flower colour in hydrangeas
- sex determination is influenced by genetics and environmental conditions; for example, temperature, day length
- mutations, the ultimate source of genetic variation, introduce new alleles into a population:
 - gene
 - chromosome (structure and number)
- variations in the genotype of offspring arise as a result of the processes of meiosis, sexual reproduction and mutations
- natural selection occurs when selection pressures in the environment confer a selective advantage on a specific phenotype to enhance its survival and reproduction

Unit 4 – Ecosystems and eco-issues

Unit description

In ecosystems, there is a dynamic interaction between organisms in a community and their abiotic environment. Varying environmental conditions in different geographical and physical situations have resulted in a wide diversity of ecosystems. Models of the flow of energy and matter help biologists understand interactions and how they might be applied in conservation. Human activity has impacted on the biodiversity in Western Australia.

Fieldwork is important for collection of first-hand data and to experience local ecosystem interactions. The interconnectedness of organisms, the physical environment and human activity is investigated through the analysis and interpretation of data collected through long-term investigations of a local environment and from sources relating to other Australian environments.

Citizen science is a growing phenomenon across the world and is gaining traction in Australia, particularly in the coastal and marine environment. Citizen science, in this context, includes community and students in data collecting, ecological monitoring, and being involved in scientific research. A 'citizen science' approach is encouraged for this unit.

Unit content

This unit builds on the content covered in Unit 3.

This unit includes the knowledge, understandings and skills described below.

Science Inquiry Skills

- construct questions for investigation; propose hypotheses; and predict possible outcomes
- plan, select and use appropriate investigation methods, including using ecosystem surveying techniques, to collect reliable data in a long term study; assess risk and address ethical issues associated with these methods
- represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error; and use evidence to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate the conclusions by considering the quality of available evidence
- use appropriate representations, including models, flowcharts, tables and graphs to communicate conceptual understanding, solve problems and make predictions
- communicate scientific ideas and information for a particular purpose using appropriate scientific language, conventions and representations

Science as a Human Endeavour

- the unique biodiversity in Western Australia has come about through natural selection due to poor fertility in soils, climate, and the length of time Australia has been isolated from other land masses
- the southwest of Western Australia has been identified as a biodiversity hotspot with a high degree of niche specialisation
- significant threats to migratory species, such as birds, sharks, mammals and turtles, due to climate change, habitat degradation and over-harvesting affect ecosystems worldwide
- long-term studies and on-going monitoring of ecosystems allow for the establishment of baseline data and a record of changes in an ecosystem over time
- advances in technology enable scientists to collect scientific data online from a variety of sources, including agencies, community groups and individuals, and provides extensive and widespread records

Science Understanding

Local ecosystem study

- there is a dynamic interaction between organisms and their environment
- differences in geographical and physical conditions result in a wide diversity of ecosystems
- abiotic factors, such as climate, pH, salinity and soil strata, impact on the survival of organisms within the environment
- the biotic components of an ecosystem transfer and transform energy originating primarily from the sun into biomass
- biotic components interact with abiotic components to facilitate biogeochemical cycling
- producers, consumers, decomposers and detritivores have a role in the transfer of energy in an ecosystem
- food chains and food webs show the feeding relationships between organisms within a community
- the amount of energy transferred between trophic levels in food chains and food webs diminishes as the trophic level increases
- interactions between species in ecosystems include competition, predation and symbiosis (mutualism, commensalism and parasitism)
- species interactions affect population densities and are important in determining community structure and composition
- ecosystems have carrying capacities that limit the number of organisms (within populations) they can support, and can be affected by changes to abiotic and biotic factors, including climatic events

Biodiversity

- only the species that belong naturally to an area add to the functional biodiversity of an ecosystem; weeds and introduced species detract from the functioning of the ecosystem
- keystone species play a critical role in maintaining the structure of a community
- bioindicator species demonstrate the condition of the environment
- threats to biodiversity include:
 - loss, fragmentation and degradation of habitat
 - the spread of invasive species
 - unsustainable use of natural resources
 - climate change
 - inappropriate fire regimes
 - changes to the aquatic environment and water flows

School-based assessment

The Western Australian Certificate of Education (WACE) Manual contains essential information on principles, policies and procedures for school-based assessment that needs to be read in conjunction with this syllabus.

Teachers design school-based assessment tasks to meet the needs of students. The table below provides details of the assessment types for the Biology General Year 12 syllabus and the weighting for each assessment type.

Assessment table – Year 12

Type of assessment	Weighting
<p>Science inquiry Science inquiry involves posing questions; planning, conducting and reflecting on investigations; processing, analysing and interpreting data; and communicating findings. Assessment can take the form of practical work or investigation.</p> <p>Science inquiry: practical Practical work can involve a range of activities, such as practical tests; modelling and simulations; observation checklists; and brief summaries of practical activities.</p> <p>Science inquiry: investigation Investigations are more extensive activities, which can include experimental testing; environmental and field work; conducting surveys; and scientific reports. Field work or an environmental investigation must be conducted in Year 12.</p>	30%
<p>Extended response Extended response consists of tasks that can involve integrating appropriate science concepts, models and theories to explain and predict phenomena, and applying those concepts, models and theories to new situations; interpreting scientific and media texts and evaluating processes, claims and conclusions by considering the quality of available evidence. Assessment can take the form of answers to specific questions based on individual research; exercises requiring analysis; and interpretation and evaluation of biological information in scientific and media texts. Research completed out of class can be authenticated using an assessment task conducted under supervised conditions.</p>	20%
<p>Test Tests typically consist of multiple choice questions, and questions requiring short and extended answers.</p>	35%
<p>Externally set task Externally set task consists of a written task or item or set of items of 50 minutes duration developed by the School Curriculum and Standards Authority and administered by the school.</p>	15%

Teachers are required to use the assessment table to develop an assessment outline for the pair of units.

The assessment outline must:

- include a set of assessment tasks
- include a general description of each task
- indicate the unit content to be assessed
- indicate a weighting for each task and each assessment type
- include the approximate timing of each task (for example, the week the task is conducted, or the issue and submission dates for an extended task).

All assessment types must be included in the assessment outline at least twice with the exception of the externally set task which only occurs once.

The set of assessment tasks must provide a representative sampling of the content for Unit 3 and Unit 4.

Assessment tasks not administered under test/controlled conditions require appropriate validation/authentication processes.

Externally set task

All students enrolled in the Biology General Year 12 course will complete the externally set task developed by the Authority. Schools are required to administer this task in Term 2 at a time prescribed by the Authority.

Externally set task design brief – Year 12

Time	50 minutes
Format	Written
	Conducted under invigilated conditions
	Typically between two and five questions
Content	The Authority informs schools during Term 3 of the previous year of the Unit 3 syllabus content on which the task will be based

Refer to the WACE Manual for further information.

Grading

Schools report student achievement in terms of the following grades:

Grade	Interpretation
A	Excellent achievement
B	High achievement
C	Satisfactory achievement
D	Limited achievement
E	Very low achievement

The teacher prepares a ranked list and assigns the student a grade for the pair of units. The grade is based on the student's overall performance as judged by reference to a set of pre-determined standards. These standards are defined by grade descriptions and annotated work samples. The grade descriptions for the Biology General Year 12 syllabus are provided in Appendix 1. They can also be accessed, together with annotated work samples, through the Guide to Grades link on the course page of the Authority website at www.scsa.wa.edu.au.

To be assigned a grade, a student must have had the opportunity to complete the education program, including the assessment program (unless the school accepts that there are exceptional and justifiable circumstances).

Refer to the WACE Manual for further information about the use of a ranked list in the process of assigning grades.

Appendix 1 – Grade descriptions Year 12

A

Understanding and applying concepts

Applies concepts to describe biological structures and systems, and explains processes, in detail.
Describes relationships within and between biological systems and processes.
Uses appropriate language, conventions and clearly labelled diagrams.
Selects and assesses the relevance of scientific information from a variety of sources to explain concepts or a point of view.
Analyses issues, organises information and presents clear and logical arguments which are supported by evidence.

Science inquiry

Formulates a testable hypothesis that states the relationship between dependent and independent variables.
Identifies appropriate variables with specific detail on how they are controlled.
Provides a clear and logical experimental procedure with sufficient detail to allow the investigation to be repeated by others.
Organises data logically and presents it in a range of forms, including appropriate graphs and tables, to reveal patterns and relationships.
Accurately performs simple calculations.
Analyses experimental data to describe trends, and explains these using relevant scientific concepts.
Uses evidence to make and justify conclusions that relate to the hypothesis.
Evaluates experimental method and makes specific relevant suggestions to improve the design of the investigation.
Communicates information and concepts logically, using correct scientific language, conventions and representations.

B

Understanding and applying concepts

Applies concepts to describe biological structures and briefly explain systems and processes.
Uses scientific language, conventions and supporting diagrams where appropriate.
Selects scientific information from a variety of sources to explain concepts or a point of view.
Organises information and presents arguments or statements that are not always well supported by evidence.

Science inquiry

Formulates a testable hypothesis that states the relationship between dependent and independent variables.
Identifies appropriate variables without detail on how they are controlled.
Provides a clear experimental procedure that lacks some detail.
Presents data in a range of forms, including appropriate graphs and tables, and identifies relationships.
Performs calculations with minor errors.
Generally uses correct units.
Describes trends and briefly explains these using relevant scientific concepts.
Uses evidence to make conclusions that relate to the hypothesis.
Evaluates experimental method and makes relevant suggestions to improve the design of the investigation.
Communicates information and concepts logically, generally using scientific language and representations.
Makes some errors in the use of conventions.

C	<p>Understanding and applying concepts</p> <p>Describes some biological structures, systems and processes in a general way. Uses some scientific language, conventions and supporting diagrams. Uses some scientific information to explain concepts or a point of view. Presents general statements supported by some evidence including some irrelevant or incorrect information.</p>
	<p>Science inquiry</p> <p>Formulates a hypothesis, that includes dependent and independent variables, within a context that has been provided. Identifies and controls some variables. Outlines the main steps in the experimental procedure. Presents data using basic tables and graphs. Generally completes calculations which may contain errors. Describes trends in data and draws general conclusions that may not be linked to the hypothesis. Describes difficulties experienced in conducting the investigation and suggests general improvements. Communicates information and concepts, without detail, using some scientific language and conventions. Provides responses which are often not supported by appropriate examples and diagrams lack detail.</p>
D	<p>Understanding and applying concepts</p> <p>Identifies biological structures, systems and processes. Describes some biological concepts using everyday language and provides simple diagrams. Uses inappropriate scientific information or makes little use of evidence to explain concepts or a point of view. Provides responses which are incomplete and include irrelevant or incorrect information.</p>
	<p>Science inquiry</p> <p>Makes a simple prediction for an investigation. Does not distinguish between dependent, independent and controlled variables. Lists general factors that may or may not affect the investigation. Follows a provided experimental procedure to collect data. Presents data that is disorganised and lacks appropriate processing. Provides incomplete or incorrect tables and graphs. Attempts calculations which may contain errors and omissions and lack appropriate conventions. Identifies trends in the data incorrectly or overlooks trends. Offers conclusions that are not supported by the data. Identifies difficulties experienced in conducting the investigation. Communicates information using everyday language with frequent errors in the use of conventions. Provides responses which are often incomplete or irrelevant.</p>
E	<p>Does not meet the requirements of a D grade and/or has completed insufficient assessment tasks to be assigned a higher grade.</p>

Appendix 2 – Glossary

This glossary is provided to enable a common understanding of the key terms in this syllabus.

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.
Animal ethics	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).
Biosecurity	Policy and regulatory frameworks designed to safeguard against biological threats to environments, organisms and human health; biosecurity measures aim to restrict entry of disease causing agents, genetically modified species, or invasive alien species or genotypes.
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.
Comparative genomics	The study and comparison of the genome sequences of different species; comparative genomics enables identification of genes that are conserved or common among species, as well as genes that give each organism its unique characteristics.
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.
Ecological survey techniques	Techniques used to survey, measure, quantify, assess and monitor biodiversity and ecosystems in the field; techniques used depend on the subject and purpose of the study. Techniques may include random quadrats, transects, capture – recapture, nest survey, netting, trapping, flight interception, beating trays, dry extraction from leaf litter samples, 3-minute habitat-proportional sampling of aquatic habitats, aerial surveys and soil, air and water sampling.
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.
Field work	Observational research undertaken in the normal environment of the subject of the study.
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 scientific statement based on the available information that can be tested by experimentation. When appropriate, the statement expresses an expected relationship between the independent and dependent variables for observed phenomena.

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.
Law	A statement describing invariable relationships between phenomena in specified conditions, frequently expressed mathematically.
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.
Primary source	Report of data created by the person or persons directly involved in observations of one or more events, experiments, investigations or projects.
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.
Reliability	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.
Research ethics	Norms of conduct that determine ethical research behaviour; research ethics are governed by principles such as honesty, objectivity, integrity, openness and respect for intellectual property and include consideration of animal ethics.
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.
Secondary source	Information that has been compiled from records of primary sources by a person or persons not directly involved in the primary event.
Simulation	A representation of a process, event or system which imitates a real or idealised situation.
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.