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

MARINE AND MARITIME STUDIES

GENERAL COURSE

Year 11 syllabus

IMPORTANT INFORMATION

This syllabus is effective from 1 January 2020.

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.

Content

Rationale

A significant relationship between the marine environment and humans has existed throughout history. Australia is an island nation, with Western Australia's mainland and islands having approximately twenty-one thousand kilometres of coastline. It is therefore relevant to Western Australians to study the sea and how people interact with it. The Marine and Maritime Studies General course provides students with the opportunity to understand and explore this relationship, and the importance of developing and maintaining a sustainable future.

The Marine and Maritime Studies General course draws from a diverse range of disciplines, including science, technology and the humanities. It provides students with opportunities to engage in unique theoretical and practical learning experiences, and to equip them with a broad range of skills and knowledge.

The Marine and Maritime Studies General course provides opportunities for students to apply theoretical knowledge through practical activities with a focus on active learning experiences both within and outside of the classroom.

Students are given the opportunity to develop responsible and competent boat-handling and navigation skills, and in doing so to demonstrate an understanding of nautical concepts. They develop knowledge of the properties inherent in seaworthy craft, and the basics of good boat design, construction and maintenance. Students will also be provided with the opportunity to develop personal water-based skills (swimming/ snorkelling/scuba) to allow them to engage directly with the marine environment.

Students investigate oceanography concepts to develop a strong understanding of the interdependence between elements of the marine environment; conduct research into the safe and sustainable management of the oceans' resources for conservation and commercialism; and also are introduced to the world of maritime archaeology.

The course will provide students with a solid foundation of skills and knowledge suitable for a wide range of vocational or recreational pathways in boating (commercial and recreational), scuba, vessel design and construction (maritime engineering), resource management, maritime archaeology or marine science.

Course outcomes

The Marine and Maritime Studies General course is designed to facilitate achievement of the following outcomes.

Outcome 1 – Marine and maritime knowledge

Students develop an understanding of marine and maritime related knowledge.

In achieving this outcome, students develop an understanding of:

- oceanographic concepts
- aspects of marine life and the relationships between components of the underwater world
- maritime engineering concepts
- nautical concepts
- Western Australian maritime history.

Outcome 2 – Marine and maritime skills

Students develop marine and maritime related skills.

In achieving this outcome, students demonstrate:

- seamanship skills
- nautical skills
- water–based skills: swimming/snorkelling/scuba
- scientific investigation and research skills.

Outcome 3 – Marine and maritime application

Students apply knowledge and skills to interact with and investigate elements of the marine and maritime environment.

In achieving this outcome, students apply their understandings to:

- management of marine resources
- interrelationships within the marine environment.

Organisation

This course is organised into a Year 11 syllabus and a Year 12 syllabus. The cognitive complexity of the syllabus content increases from Year 11 to Year 12.

Structure of the syllabus

The Year 11 syllabus is divided into two units, each of one semester duration, which are typically delivered as a pair. The notional time for each unit is 55 class contact hours.

Unit 1

This unit introduces students to marine science through the examination of water properties and methods used to conduct water testing. In oceanography, students learn about wind formation, tides, waves and currents, including Western Australian ocean currents. Students examine Western Australian recreational and commercial fishing issues and how they are managed through rules and regulations.

Students gain an understanding of maritime studies, including the properties, purposes and uses of maritime construction materials in relation to the challenges of a marine environment. Nautical terminology, including the basic parts of boats, will be introduced and students gain an understanding of aspects of small craft, such as buoyancy and design of pulley systems.

Through a practical approach, students gain an understanding of the concepts and safe practices of either snorkelling or sailing. Science inquiry skills will be developed through the design process of investigate, devise and evaluate, in relation to marine construction materials. Students will also be involved in practical activities to collect and analyse data related to water properties, winds, tides, waves and currents.

Unit 2

This unit introduces students to the marine ecosystem, with a focus on the four main zones and the adaptations of marine life to survive in each zone. Western Australian examples of marine life will be identified and classified into the major groups. Food webs for each ocean zone will be studied. Students examine the importance of marine protected areas, marine parks, reserves and sanctuary zones, and the role of Western Australian agencies and organisations in the protection and management of marine life.

Students gain an understanding of maritime studies, including the design features of marine or maritime equipment and methods of maritime construction. Features of small craft propulsion systems are studied, and students gain an understanding of aspects of small craft, such as steering and gear systems.

Through a practical approach, students gain an understanding of the concepts and safe practices of either snorkelling or sailing. Science inquiry skills will be developed through the design process in relation to design features of marine or maritime equipment and methods of maritime construction. Students use ecosystem surveying techniques to collect and analyse data related to marine ecosystems, and classification keys to identify marine organisms found there.

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 Marine and Maritime Studies General course has three interrelated strands: Science Inquiry Skills, Science as a Human Endeavour and Science Understanding, which build on students' learning in the P–10 Science curriculum. The three strands of the Marine and Maritime Studies 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.

Through the Marine and Maritime Studies General course, students will continue to develop their science inquiry skills, building on the skills acquired in the P–10 Science curriculum. Each unit provides specific skills to be taught. These specific skills align with the Science Understanding and Science as a Human Endeavour content of the unit.

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.

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 Marine and Maritime Studies General course

The Marine and Maritime Studies General course requires students to use the mathematical skills they have developed through P–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
- transform decimal notation to power of ten notation
- substitute physical quantities into an equation using consistent units so as to calculate one quantity and check the dimensional consistency of such calculations

- solve simple algebraic equations
- comprehend and use the symbols/notations <, >, Δ, ≈
- translate information between graphical, numerical and algebraic forms
- distinguish between discrete and continuous data then select appropriate forms, variables and scales for constructing graphs
- construct and interpret frequency tables and diagrams, pie charts and histograms
- describe and compare data sets using mean
- interpret the slope of a linear graph.

Progression from the Year 7–10 curriculum

This syllabus continues to develop student understanding and skills from across the three strands of the Year 7–10 Science curriculum. In the Science Understanding strand, this syllabus draws on knowledge and understanding from across the four sub-strands of Biological, Physical, Chemical and Earth and Space Sciences.

In particular, this syllabus continues to develop the key concepts introduced in the Biological Sciences sub-strand, that is, that a diverse range of living things have evolved on Earth over hundreds of millions of years, that living things are interdependent and interact with each other and their environment, and that the form and features of living things are related to the functions their systems perform.

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 Marine and Maritime Studies 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 Understanding and Science as a Human Endeavour strands. Students gather, interpret, synthesise and critically analyse information presented in a wide range of formats 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 marine 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 Marine and Maritime Studies 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 understanding 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 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 Marine and Maritime Studies 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 richer understandings of the marine environment. Students could develop an appreciation of historical craft types; the sustainable management strategies used in the local marine environment; and impacts of legislation designed to protect marine environments on Aboriginal and Torres Strait Islander Peoples' traditional use of the marine environment.

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 consider collaborative projects between Australian and Asian scientists in such areas as ocean acidification, adaptability to climate change, the identification of new technologies to aid in marine science research, and the contribution these make to scientific knowledge.

Sustainability

In the Marine and Maritime Studies General course, the Sustainability cross-curriculum priority 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 marine biological systems and system components, and how systems respond to change, students develop an appreciation for the interconnectedness of the Earth's biosphere, geosphere, hydrosphere and atmosphere. Students appreciate that the Marine and Maritime Studies General course 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 1

Unit description

This unit introduces students to marine science through the examination of water properties and methods used to conduct water testing. In oceanography, students learn about wind formation, tides, waves and currents, including Western Australian ocean currents. Students examine Western Australian recreational and commercial fishing issues, and how they are managed through rules and regulations.

Students gain an understanding of maritime studies, including the properties, purposes and uses of maritime construction materials in relation to the challenges of a marine environment. Nautical terminology, including the basic parts of boats, will be introduced, and students gain an understanding of aspects of small craft, such as buoyancy and design of pulley systems.

Through a practical approach, students gain an understanding of the concepts and safe practices of either snorkelling and diving or sailing. Science inquiry skills will be developed through the design process of investigate, devise and evaluate, in relation to marine construction materials. Students will also be involved in practical activities to collect and analyse data related to water properties, winds, tides, waves and currents.

Unit content

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

Science Inquiry Skills

- construct questions for investigation; propose hypotheses; and predict possible outcomes
- plan investigations, including the procedure/s to be followed, the materials required, and the type and amount of data to be collected; assess risk and address ethical issues associated with these methods
- conduct investigations, including using ecosystem surveying techniques, including line transects, safely, competently and methodically for the collection of reliable data
- represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error and inconsistencies in data; 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
- construct and use appropriate representations, including classification keys to communicate conceptual understanding, solve problems and make predictions
- communicate scientific ideas and information for a specific purpose, using appropriate language, nomenclature and formats, including scientific reports

Science as a Human Endeavour

- maritime communication systems, including underwater hand signals, are based on international conventions, and are subject to change through debate and resolution
- an increase in the number of recreational fishers, together with an increased use of technology, (global positioning system [GPS], colour echo sounders) have impacted on the stocks of offshore demersal scalefish. Regulatory measures are used to protect stocks, and long-term sampling programs are undertaken so that predictions can be made about fish numbers in the future

Science Understanding

Marine

Oceanography

- definition of oceanography – biological, chemical, geological, physical
- properties of seawater – salinity, solvent properties, density, effect on light and sound, viscosity
- methods of water testing – pH, salinity, temperature, turbidity
- wind formation, including land and sea breezes
- ocean tides – cause and effects, cycles, charts
- waves – types, formation, shape, characteristics
- factors that create ocean currents – wind, Earth's rotation (Coriolis force), water temperature differences, water density
- features of Western Australian ocean currents and identification on maps, including:
  - Leeuwin current
  - West Australian current
  - South Equatorial current
- methods used to measure surface current speed and direction and tides

Environmental and resource management

- issues related to Western Australian fisheries – management, control of fishing efforts, sustainable yields
- rules and regulations relating to Western Australian recreational fishing and commercial fisheries

Maritime

Design

- basic design process – investigate, devise, evaluate
- marine construction materials – properties, purpose and uses of:
  - natural materials, such as wood, animal skins, plant fibres
  - synthetic materials, such as steel, aluminium, fibreglass
- effects of sunlight, water, salt, oxygen and living organisms on construction materials

Small craft

- nautical terminology – basic parts of a boat
- factors affecting buoyancy and stability, such as
  - free surface effect
  - passengers and equipment
  - freeboard
  - listing
  - moving loads
  - stowage systems
- design, construction and use of pulley systems

Concepts and skills

Note: select either snorkelling and diving or sailing

Snorkelling and diving

- snorkelling equipment – types, preparation, fitting and removing
- pre- and post-dive care of and maintenance of equipment
- buddy responsibilities – pre-dive safety check, monitoring
- hand signals
- entry and exit techniques relevant to the environment
- underwater swimming
- finning – technique, direction control
- mask defogging
- clearing a partially flooded mask
- snorkel breathing
- snorkel clearing – blast and displacement method
- duck diving, safe descending
- descending and ascending technique

Sailing

- the history of sail and its significance
- types of sailing craft: square rigged, gaff rigged, Bermudian
- parts of a sailing dinghy
- sail design
  - developed for different races
  - different sail shapes and sailing rigs

- simple machines in sailing boats
- the forces acting on a sail boat
- Bernoulli's principle and sails
- forces acting on a boat or board through its sail
- points of sail

Unit 2

Unit description

This unit introduces students to the marine ecosystem, with a focus on the four main zones, and the adaptations of marine life to survive in each zone. Western Australian examples of marine life will be identified and classified into the major groups. Food webs for each ocean zone will be studied. Students examine the importance of marine protected areas, marine parks, reserves and sanctuary zones, and the role of Western Australian agencies and organisations in the protection and management of marine life.

Students gain an understanding of maritime studies, including the design features of marine or maritime equipment and methods of maritime construction. Features of small craft propulsion systems are studied and students gain an understanding of aspects of small craft, such as steering and gear systems.

Through a practical approach, students gain an understanding of the concepts and safe practices of either snorkelling and diving or sailing. Science inquiry skills will be developed through the design process in relation to design features of marine or maritime equipment and methods of maritime construction. Students use ecosystem surveying techniques to collect and analyse data related to marine ecosystems, and classification keys to identify marine organisms found there.

Unit content

This unit builds on the content covered in Unit 1.

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

Science Inquiry Skills

- construct questions for investigation; propose hypotheses; and predict possible outcomes
- plan investigations, including the procedure/s to be followed, the materials required, and the type and amount of data to be collected; assess risk and address ethical issues associated with these methods
- conduct investigations, including using ecosystem surveying techniques, including line transects, safely, competently and methodically for the collection of reliable data
- represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error and inconsistencies in data; 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
- construct and use appropriate representations, including classification keys to communicate conceptual understanding, solve problems and make predictions
- communicate scientific ideas and information for a specific purpose, using appropriate language, nomenclature and formats, including scientific reports

Science as a Human Endeavour

- classification systems have been developed to allow scientists to identify and communicate information about organisms. Classification systems are reviewed based on new information and evidence
- techniques, including transects and video surveying, in conjunction with measurement of abiotic factors, can be used so that a complete picture of the health of an ecosystem and its resilience to change may be obtained
- snorkelling and diving requires knowledge of the effect of pressure on the body at depth in order to prevent barotraumas. Diving equipment is designed to enhance the safety and comfort of the user. Materials are chosen, and equipment designed, to improve efficiency and safety
- a world-wide sighting and photo-identification system has been created which enables people to act as citizen scientists, assisting in the conservation of whale sharks and enhancing knowledge of the demographics of this species

Science Understanding

Marine

Oceanography

- location and characteristics of ocean zones, including:
  - inter-tidal
  - continental shelf
  - pelagic
  - deep sea
- adaptations of marine organisms living within these zones
- classification of marine organisms based on habitat and motility
  - plankton
  - nekton
  - benthos
- identification and classification of Western Australian examples of marine life, such as protozoa, angiosperms, porifera, cnidaria, platyhelminths, nematodes, annelids, molluscs, echinoderms, arthropods and chordates
- food chains and webs relevant to the ocean zones studied

Environmental and resource management

- marine protected areas, marine parks, reserves and sanctuary zones: importance and examples
- roles and responsibilities of Western Australian marine resource management organisations: for example, Parks and Wildlife Service – Department of Biodiversity, Conservation and Attractions, Department of Water and Environmental Regulations, Fisheries – Department of Primary Industries and Regional Development, Recfishwest, Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Maritime

Design

- design features of marine or maritime equipment, such as
  - boat hulls
  - anchors
  - paddles/oars
  - marker buoys
  - scientific testing/collecting equipment
  - fishing lures
  - moorings
- methods of maritime construction – model design and construction to compare various designs

Small craft

- features of small craft propulsion systems, including:
  - wind
  - outboard motor
  - inboard motor or jet
- steering and gear systems

Concepts and skills

Note: select either snorkelling and diving or sailing

Snorkelling and diving

- underwater vision – the eyes, refraction, light and colour
- underwater hearing – the ear, effects of water on sound
- methods to manage heat loss underwater
- positive, negative and neutral buoyancy
- pressure – effect of depth on body
- barotraumas
- Archimedes' principle
- methods of equalising ear pressure
- tired buddy tow
- cramp release
- ditch and recovery of an object – weight belt
- establish neutral buoyancy at the surface

Sailing

- knots – clove hitch, round turn and two half-hitches, bowline, figure of eight, sheet bend, reef knot, stopper
- coiling, stowing and heaving of line
- boat preparation – rigging and de-rigging
- launching a sail boat
- centre board position
- capsize and recovery
- leave and return to beach/launching facility
- heave-to position
- primary boat control
- balance and trim
- set sails associated with specific points of sail
- sailing on a beam reach
- tacking and jibing
- controlling boat speed
- sailing a basic Olympic triangle
- disabled sail craft
- diagnose and repair common equipment problems and breakages
- skipper's responsibilities
- IALA buoyage – lateral, cardinal, special, isolated danger, safe water, wreck, marine safety signs, leads (sector light)

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 Marine and Maritime Studies General Year 11 syllabus and the weighting for each assessment type.

Assessment table – Year 11

Type of assessment	Weighting
Science inquiry Science inquiry involves identifying and posing questions; planning, conducting and reflecting on investigations; processing, analysing and interpreting data; and communicating findings. **Scientific skills** Scientific skills can include: classification exercises, design and construction of scientific testing/collecting equipment or models, and microscope work. **Investigation** Investigations are more extensive activities which can include: experimental testing; environmental and field work; conducting surveys; scientific research into specific marine and maritime issues; and/or comprehensive scientific reports.	25%
Practical Practical tasks assess how students perform in a practical activity where they demonstrate specific skills or strategies. Practical tasks can include: snorkelling, sailing, knot tying, completing a pre-dive safety check. Assessment can take the form of direct observation and judgement of student's performance as they demonstrate a skill.	50%
Extended response Tasks requiring an extended response may involve selecting and 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; and using reasoning to construct scientific arguments. Assessment may take the form of answers to specific questions based on individual research; exercises requiring analysis; and interpretation and evaluation of information in scientific journals, fisheries reports and/or media texts.	5%
Test Tests typically consist of multiple-choice questions and questions requiring short and extended answers. They should be designed so that students may apply their understanding and skills in the Marine and Maritime Studies General course to analyse, interpret, solve problems and construct scientific arguments.	20%

Teachers are required to use the assessment table to develop an assessment outline for the pair of units (or for a single unit where only one is being studied).

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).

In the assessment outline for the pair of units, each assessment type must be included at least twice. In the assessment outline where a single unit is being studied, each assessment type must be included at least once.

The set of assessment tasks must provide a representative sampling of the content for Unit 1 and Unit 2.

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

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 (or for a unit where only one unit is being studied). 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 Marine and Maritime Studies General Year 11 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 11

A	**Understanding and applying concepts** Applies models and principles to explain the behaviours of systems and processes in detail. Presents information which generally includes supporting evidence. Explains concepts and processes consistently using appropriate scientific language and representations.
	Science Inquiry Skills With guidance formulates a testable hypothesis that states the relationship between dependent and independent variables. Plans an investigation to collect appropriate data. Identifies controlled variables with specific detail. Organises data logically and presents it in a range of forms to reveal patterns and relationships. Accurately applies simple mathematical processes to numerical data. Analyses experimental data to describe and explain observed trends. Uses evidence to make and justify conclusions that relate to the hypothesis. Explains any inconsistencies in data and suggests ways to improve the design of an investigation. Communicates information and concepts logically, using correct scientific language, conventions and representations.
	Practical Uses resources and achieves results that meet simple design or performance requirements. Manages basic aspects of the work and/or leisure environment through hazard recognition, demonstration of safety and selection of appropriate operational procedures for working with selected equipment. Performs tasks competently with minor skill faults which are self-corrected within the allocated time.

B	**Understanding and applying concepts** Describes and briefly explains the behaviours of systems and processes using models. Presents information which sometimes includes supporting evidence. Explains concepts and processes mostly using scientific language and representations.
	Science Inquiry Skills With guidance formulates a testable hypothesis that states the relationship between dependent and independent variables. Plans an investigation to collect appropriate data. Identifies some controlled variables without detail. Presents data in a range of forms to reveal patterns and relationships. Performs some simple mathematical processes to numerical data. Describes and briefly explains observed trends. Uses evidence to make conclusions that relate to the hypothesis. Describes inconsistencies in data and makes general suggestions to improve the design of an investigation. Communicates information and concepts logically, generally using scientific language and representations. Makes some errors in the use of conventions.
	Practical Uses resources and achieves results that meet simple design or performance requirements. With minimal direction meets safety standards, including the management of the work and/or leisure environment. Performs tasks with a small number of skill faults which are not always self-corrected within the allocated time.

C	**Understanding and applying concepts** Describes the behaviours of some systems and processes. Briefly presents information which generally lacks supporting evidence. Recognises and describes concepts and processes, with limited detail, using representations and some scientific language.
	Science Inquiry Skills Predicts a general outcome for an investigation. Plans an investigation to collect appropriate data. Inconsistently identifies controlled variables. Presents data using basic tables and graphs. Describes trends in the data and draws simple conclusions that may not be linked back to the hypothesis. Recognises difficulties experienced in conducting the investigation and suggests general improvements. Communicates information and concepts, without detail, using some scientific language and conventions. Representations lack detail.
	Practical With supervision and direction achieves results that meet simple design or performance requirements. With some direction, meets safety standards, including the management of the work and/or leisure environment. Performs tasks with a substantial number of obvious skills, faults, and requires additional guidance and time to reach minimum standards.

D	**Understanding and applying concepts** Recognises systems and processes. Explanations are incomplete and contain errors. Presents incomplete information which contains errors and lacks supporting evidence. Recognises some concepts and processes. Responses are often incomplete.
	Science Inquiry Skills Identifies the dependent variable without linking it to the independent variable. Follows a provided experimental procedure to collect data. Confuses variables. Presents data that is unclear, insufficient and lacks appropriate processing. Identifies trends in the data incorrectly or overlooks trends. Offers simple conclusions that are not supported by the data or are not related to the hypothesis. Recognises difficulties experienced in conducting the investigation. Communicates information using everyday language with frequent errors in the use of conventions. Responses are often incomplete.
	Practical With supervision and direction, makes limited use of resources and achieves limited results that meet simple design or performance requirements. With frequent direction, meets safety standards, including the management of the work and/or leisure environment. Performs tasks with high levels of indecisiveness, leading to a substantial number of obvious skills faults, unsafe practices and substandard performance, even with additional guidance and time.

E	Does not meet the requirements of a D grade and/or has completed insufficient assessment tasks to be assigned a higher grade.

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.
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.
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.
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 scentific 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.
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.
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.