MARINE AND MARITIME STUDIES

ATAR 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.

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 ATAR course provides students with the opportunity to understand and explore this relationship and the importance of developing and maintaining a sustainable future for our coastal and marine environments.

The Marine and Maritime Studies ATAR 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 ATAR 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 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 are also introduced to the world of maritime archaeology.

The course will further develop and reinforce the students' foundation skills and knowledge to prepare them for a wide range of vocational or recreational pathways in boating (commercial and recreational), scuba, vessel design and construction (maritime engineering), resource management, and maritime archaeology or marine science.

Course outcomes

The Marine and Maritime Studies ATAR 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 demonstrate an understanding of:

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

Outcome 2 – Marine and maritime skills

Students develop marine and maritime related skills.

In achieving this outcome, students understand and apply:

- water-based skills (swimming/snorkelling/scuba)
- science inquiry 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 investigate:

- management of marine resources
- aspects of maritime archaeology
- 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 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.

Unit 3

This unit explores Western Australian ocean currents and factors which influence the productivity of marine ecosystems, major issues affecting Australia's marine environment, shipwrecks and snorkelling and diving.

Unit 4

This unit focuses on the impacts of climate change, coastal erosion and strategies for managing marine biodiversity. Western Australian historical and archaeological understandings and the skills associated with snorkelling and diving are further developed.

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 ATAR 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 Marine and Maritime Studies ATAR 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.

In science investigations, the collection and analysis of data to provide evidence plays a major role. This can involve collecting or extracting information and reorganising data in the form of tables, graphs, flow charts, diagrams, text, keys, spreadsheets and databases. The analysis of data to identify and select evidence, and the communication of findings, involve the selection, construction and use of specific representations, including mathematical relationships, symbols and diagrams.

Through the Marine and Maritime Studies ATAR course, students will continue to develop their science inquiry skills, building on the skills acquired in the Year 7–10 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

Through science, we seek to improve our understanding and explanations of the natural world. The Science as a Human Endeavour strand highlights the development of science as a unique way of knowing and doing, and explores the use and influence of science in society.

As science involves the construction of explanations based on evidence, the development of science concepts, models and theories is dynamic and involves critique and uncertainty. 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 and can involve the use of international conventions and activities such as peer review.

The use and influence of science are shaped by interactions between science and a wide range of social, economic, ethical and cultural factors. 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 a result, decision-making about socio-scientific issues often involves consideration of multiple lines of evidence and a range of stakeholder needs and values. 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. Models in science can include diagrams, physical replicas, mathematical representations, word-based analogies (including laws and principles) and computer simulations. Development of models involves selection of the aspects of the system(s) to be included in the model, and thus models have inherent approximations, assumptions and limitations.

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 ATAR course

The Marine and Maritime Studies ATAR 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
- 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, $\approx$
- translate information between graphical, numerical and algebraic forms
- distinguish between discrete and continuous data then select appropriate forms, variables and scales for constructing graphs

- construct and interpret frequency tables and diagrams, pie charts and histograms
- describe and compare data sets using mean, median and inter-quartile range
- interpret the slope of a linear graph.

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 ATAR 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 ATAR course. 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 ATAR 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 Australian 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 and 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 ATAR 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 could develop an appreciation for the interconnectedness of the Earth's biosphere, geosphere, hydrosphere and atmosphere. Students appreciate that the Marine and Maritime Studies ATAR course provides the basis for decision making in many areas of society and that these decisions can impact 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

Unit description

This unit explores the importance of plankton and coral communities in the marine environment. Major resource management issues affecting Australia's marine environment, including pollution, water quality and over-fishing, are investigated.

Students also investigate methods of locating shipwrecks, formation and decay processes, excavation and conservation of artefacts.

The concepts, including some scientific principles, behind snorkelling and diving are considered. Students further develop the skills associated with scientific inquiry, and the scientific method is applied to the investigation of real-world problems.

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. This is the examinable content.

Science Inquiry Skills

- identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes

- design investigations, including the procedure(s) to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics, including animal ethics

- conduct investigations, including water sampling, safely, competently and methodically for the collection of valid and reliable data

- represent data in meaningful and useful ways, including the use of mean, median, range and probability; organise and analyse data to identify trends, patterns and relationships; discuss the ways in which measurement error, instrumental accuracy, the nature of the procedure and the sample size may influence uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusions

- interpret a range of scientific and media texts, and evaluate models, processes, claims and conclusions by considering the quality of available evidence, and use reasoning to construct scientific arguments

- select, construct and use appropriate representations, including biomass pyramids and life cycle diagrams to communicate conceptual understanding, solve problems and make predictions

- communicate to specific audiences, and for specific purposes, using appropriate language, nomenclature, genres and modes, including scientific reports

Science as a Human Endeavour

- ocean warming and increasing stratification will result in major changes in phytoplankton abundance, distribution and seasonal fluctuations. The Australian Continuous Plankton Recorder (AusCPR) survey observes plankton along several routes on board ships of opportunity and collects a wide variety of data. Data from the AusCPR survey and other CPR surveys, is contributing to global databases. This data is being used to inform research, conservation and marine environmental management strategies

- biosecurity is increasingly an issue of state and national concern. Introduced marine species (pests) and diseases pose a huge threat to Australia's marine environment. Biosecurity initiatives, including the National System for the Prevention and Management of Marine Pest Incursions (the National System), aims to prevent new pests arriving, guide responses when a new pest does arrive, and minimise the spread and impact of pests already established

- in recent decades advances in science have provided new ways to locate and conserve the artefacts that are found in maritime archaeological sites

- maritime communication systems, including underwater hand signals, are based on international conventions and are subject to change through debate and resolution

Science Understanding

Marine

Oceanography

- Western Australian ocean currents, including Leeuwin, West Australian and South Equatorial, and their influence on Western Australian marine ecosystems

- comparisons of the production of biomass and transfer of energy in Western Australian marine ecosystems

- phytoplankton and zooplankton: identification, life cycles, interactions, seasonal patterns, importance to fish stocks, and measurement

- characteristics of coral communities, including:
  - role and importance to the marine environment
  - coral bleaching process

Environmental and resource management

- major issues affecting Australia's marine environment, including:
  - declining water quality
  - loss of habitat
  - over-fishing
  - introduced species
  - ocean acidification

- types of marine pollutants, including:
  - human and domestic wastes
  - petroleum oil
  - eutrophication
  - heavy metals

- processes used to manage and control marine pollutant problems

Maritime

History and archaeology

- methods of locating shipwrecks:
  - historical records
  - aerial survey
  - magnetometer
  - sonar

- formation and decay processes associated with wreck sites (including metal corrosion)

- underwater wreck site excavation: techniques, processing and recording, recovery of artefacts, lift bags (purpose, use and calculations)

- conservation techniques (on-site and laboratory), including:
  - safe retrieval
  - de-concretion
  - stabilisation

Concepts and skills

Snorkelling and diving

- snorkelling equipment: types, preparation, fitting and removing

- pre- and post-dive care and maintenance of equipment

- buddy responsibilities: pre-dive safety check, monitoring

- hand signals

- entry and exit techniques relevant to a natural environment

- underwater swimming in a natural environment

- finning: technique, direction control in a natural environment

- mask defogging

- clearing a partially flooded mask

- snorkel breathing

- snorkel clearing blast and displacement method

- duck diving, safe descending

- descending and ascending technique

Unit 4

Unit description

This unit focuses on the impacts of climate change, the process of coastal erosion and coastal engineering structures. Environmental and resource management is considered, including strategies for managing marine biodiversity.

Students further explore the maritime history of Western Australia through the example of the Batavia shipwreck.

Students have the opportunity to develop additional skills relating to snorkelling and diving. Students further develop the skills associated with scientific inquiry.

Unit content

This unit builds on the content covered in Unit 3.

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

Science Inquiry Skills

- identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes

- design investigations, including the procedure(s) to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics, including animal ethics

- conduct investigations, including longitudinal studies, safely, competently and methodically for the collection of valid and reliable data

- represent data in meaningful and useful ways, including the use of mean, median, range and probability; organise and analyse data to identify trends, patterns and relationships; discuss the ways in which measurement error, instrumental accuracy, the nature of the procedure and the sample size may influence uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusions

- interpret a range of scientific and media texts, and evaluate models, processes, claims and conclusions by considering the quality of available evidence, and use reasoning to construct scientific arguments

- select, construct and use appropriate representations, including models of the enhanced greenhouse effect, to communicate conceptual understanding, solve problems and make predictions

- communicate to specific audiences, and for specific purposes, using appropriate language, nomenclature, genres and modes, including scientific reports

Science as a Human Endeavour

- 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. The demographics of whale sharks can serve as an indication of ocean health and bio-productivity. The technology, which was developed collaboratively by a multidisciplinary team of scientists, can also potentially be used to identify other marine species

- artificial reefs may be designed to assist in coastal protection and can also provide benefits to a number of different groups within the community. The benefits need to be offset against detrimental impacts to local marine ecology when the artificial reef is first introduced. Their potential to become havens for marine life in the future, resulting in increased abundance and diversity in the region, is also considered

- snorkelling and diving requires knowledge of the behaviour of gases, with reference to volume and pressure. In particular, divers should understand how the volume of a gas varies with the surrounding pressure in order to prevent barotraumas. Diving equipment is designed to enhance the safety and comfort of the user and reduce the risk of dealing with gases. Materials are chosen, and equipment designed, to improve efficiency and safety.

Science Understanding

Marine

Oceanography

- impact of the enhanced greenhouse effect on:
  - marine habitats and coastal communities
  - coral bleaching
  - global sea levels
  - thermohaline current

- cause, effect and measurement of coastal erosion, including longshore currents, accreting and eroding beaches, deposition and sand budgets

- features, role and impact of coastal engineering structures, including
  - physical barriers
  - sand bypass systems
  - artificial reefs
  - ports
  - canals

Environmental and resource management

- strategies for managing marine biodiversity, including:
  - role of marine protected areas and zones
  - global protection of cetaceans
  - role of scientific research in marine environmental management

- ecotourism, reasons for rules and the ethical management of human interactions with whale sharks, dolphins and whales

Maritime

History and archaeology

- the Batavia shipwreck, including:
  - historical background
  - location process
  - survey
  - excavation
  - recovery
  - conservation and interpretation of artefacts.

Concepts and skills

Nautical concepts and skills

Snorkelling and diving

- underwater vision: the eyes, refraction, light and colour

- underwater hearing: the ear, effects of water on sound

- heat loss underwater: ways to reduce

- positive, negative and neutral buoyancy

- pressure: effect of depth on body

- Boyle's Law

- barotraumas

- carbon dioxide poisoning

- 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

- making observations while snorkelling in a natural environment
  - slates
  - photography

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 ATAR Year 12 syllabus and the weighting for each assessment type.

Assessment table – Year 12

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. Science inquiry can involve scientific skills or investigations which are more extensive activities. **Scientific skills** Scientific skills can include: classification exercises, design and construction of scientific testing/collecting equipment or models and microscope work. **Investigation** Investigations can include experimental testing; environmental and field work; conducting surveys; scientific research into specific marine and maritime issues and/or comprehensive scientific reports.	10%
Practical Practical tasks assess how students perform in a practical activity where they demonstrate specific skills or strategies. Types of practical tasks can include: snorkelling completing, a pre-dive safety check and performance of care and maintenance on equipment. Assessment can take the form of direct observation and judgement of student's performance as they demonstrate a skill.	10%
Extended response Tasks requiring an extended response can 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 can 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.	10%
Test Tests typically consist of multiple choice questions and questions requiring short and extended answers. They should be designed so that students can apply their understanding and skills in the Marine and Maritime Studies ATAR course to analyse, interpret, solve problems and construct scientific arguments.	25%
Examination Typically conducted at the end of each semester and/or unit and reflecting the examination design brief for this syllabus.	45%

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).

In the assessment outline for the pair of units, each assessment type must be included at least twice.

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.

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 Marine and Maritime Studies ATAR 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.

ATAR course examination

All students enrolled in the Marine and Maritime Studies ATAR Year 12 course are required to sit the ATAR course examination. The examination is based on a representative sampling of the content for Unit 3 and Unit 4. Details of the ATAR course examination are prescribed in the examination design brief on the following page.

Refer to the WACE Manual for further information.

Examination design brief – Year 12

Time allowed

Reading time before commencing work: ten minutes

Working time for paper: three hours

Permissible items

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: up to three calculators, which do not have the capacity to create or store programmes or text, are permitted in this ATAR course examination

Additional information

Appendices containing charts, diagrams and/or stimulus pictures can be used for some sections.

SECTION	SUPPORTING INFORMATION
Section One **Multiple-choice** 20% of the total examination 20 questions Suggested working time: 20 minutes	Nil
Section Two **Short answer** 50% of the total examination 6–8 short answer questions Suggested working time: 90 minutes	The candidate can be required to respond to stimuli, such as short extracts from articles, tables, graphs, charts, diagrams and pictures. They can give answers to these questions in the form of dot points, short paragraphs, diagrams, tables, graphs or charts. At least one question should test the candidate's knowledge and understanding of the process of science. The questions can be scaffolded or sectionalised.
Section Three **Extended answer** 30% of the total examination Two questions from a choice of four Suggested working time: 70 minutes	Questions in this section can require the candidate to interpret, analyse or evaluate diagrams, nautical charts, graphs, scenarios or case studies, excerpts from articles, numerical data, photographs, and draw on their understanding of specific learning contexts or experiences. The questions can be scaffolded or sectionalised.

Appendix 1 – Grade descriptions Year 12

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<td rowspan="3">A</td>
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Understanding and applying concepts
Applies models and scientific principles to comprehensively explain complex systems and processes.
Supports responses with a range of appropriate examples and accurate diagrams.
Clearly links multiple concepts to explain relationships in detail.
Accurately applies scientific knowledge to explain, in detail, unfamiliar contexts or examples.
Selects and accurately evaluates scientific information from a variety of sources to present logical, well-developed arguments which are supported by relevant, detailed evidence.
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Science inquiry skills
Formulates a hypothesis that states the relationship between dependent and independent variables.
Designs investigations to identify dependent and independent variables, and control appropriate variables.
Describes the experimental method in detail and accurately collects data.
Organises data logically and accurately processes data.
Presents data in a range of forms, including graphs, tables and charts, to reveal patterns and relationships.
Comprehensively explains trends using data, including numerical data when appropriate, as evidence to draw conclusions that relate to the hypothesis.
Evaluates the experimental method and provides specific relevant suggestions to improve the validity and reliability of the data collected.
Communicates detailed and relevant information and concepts logically and coherently, using correct terminology and appropriate conventions.
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Practical
Independently uses an extensive variety of resources and equipment to achieve results that meet design or performance requirements.
Manages the work and/or leisure environment consistently through hazard recognition and demonstration of safety and selection of appropriate operational procedures.
Performs tasks fluently with negligible discrepancies from defined standards within the allocated time.
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B	**Understanding and applying concepts**
	Applies models and scientific principles to accurately explain simple, and some complex, systems and processes.
	Supports responses with appropriate examples and accurate diagrams.
	Presents explanations of concepts logically and/or sequentially.
	Applies scientific knowledge to explain unfamiliar contexts or examples, sometimes lacking detail.
	Selects and evaluates scientific information from a variety of sources to present logical arguments which are supported by relevant evidence.
	Science inquiry skills
	Formulates a hypothesis that states the relationship between dependent and independent variables.
	Designs investigations to identify dependent and independent variables, and control appropriate variables.
	Describes the experimental method and accurately collects data.
	Organises data logically and usually processes data accurately.
	Presents data in a range of forms, including graphs, tables and charts, to reveal patterns and relationships.
	Explains trends using some numerical data, where appropriate, and uses evidence to draw conclusions that relate to the hypothesis.
	Evaluates the experimental method and provides relevant suggestions to improve the validity and reliability of the data collected.
	Communicates information and concepts logically, using correct terminology and appropriate conventions.
	Practical
	Independently uses a variety of resources and equipment to achieve results that meet most design or performance requirements.
	Manages aspects of the work and/or leisure environment frequently through hazard recognition and 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.

C	**Understanding and applying concepts**
	Applies models and scientific principles to describe simple systems and processes.
	Provides examples in some responses.
	Draws simple diagrams.
	Explains simple cause and effect with some errors and omissions.
	Links concepts at a superficial level only.
	Provides responses to unfamiliar contexts which are generic and lack specific application of scientific knowledge.
	Selects some scientific information to provide generalised arguments or statements supported by some evidence.
	Science inquiry skills
	Formulates a hypothesis that links dependent and independent variables.
	Designs investigations to identify and control some variables, and briefly outlines the experimental method and collects data.
	Organises and processes data with some errors or omissions.
	Presents data using basic tables and appropriate graphs.
	Describes trends in the data and draws simple conclusions that may not be linked back to the hypothesis.
	Provides general suggestions to improve the investigation.
	Communicates information and concepts, without detail, using some correct terminology and appropriate conventions.
	Practical
	Uses resources as directed and implements plans and achieves results that meet some design or performance requirements.
	Manages the work and/or leisure environment occasionally through hazard recognition and demonstration of safety and selection of appropriate operational procedures for working with selected equipment.
	Performs tasks with a number of obvious skill faults which are not always self-corrected within the allocated time.

D	**Understanding and applying concepts** Incorrectly applies scientific models and principles to describe systems and processes. Selects poor examples or omits examples. Presents diagrams which are incomplete or incorrect. Links cause and effect in simple situations without providing an explanation. Shows limited recall of facts. Inconsistently applies principles to familiar and unfamiliar contexts. Makes little use of scientific information to present statements of ideas with limited development of an argument. Provides limited supporting evidence. Provides responses that contain multiple errors, inconsistencies and misconceptions, and do not address the key elements of the question. Incorrectly describes the relationships between data and concepts using inappropriate terminology. **Science inquiry skills** Provides a statement that identifies one or more relevant variables without making links between them. Does not distinguish between the dependent, independent and controlled variables. Describes an experimental method which lacks detail. Presents data that is unclear, insufficient and lacks appropriate processing. Identifies trends in the data incorrectly or overlooks trends. Includes anomalous results in the data without identifying them as anomalous. Offers simple conclusions that are not supported by the data or are not related to the hypothesis. Provides trivial or irrelevant suggestions for improving the investigation. Communicates information using everyday language with frequent errors in the use of conventions. **Practical** With guidance and direction, makes limited use of resources and demonstrates limited implementation of plans and design or performance requirements. With 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 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.
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.
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 (in the school/agricultural college context)	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.