2023/9198
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Government of **Western Australia**
School Curriculum and Standards Authority

ATAR course examination, 2022

Question/Answer booklet

MARINE AND MARITIME STUDIES

Please place your student identification label in this box

WA student number: In figures | | | | | | | | | |

In words _____

_____

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer booklet
Multiple-choice answer sheet

Number of additional answer booklets used (if applicable): ☐

To be provided by the candidate

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

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of examination
Section One Multiple-choice	20	20	20	20	20
Section Two Short answer	6	6	90	100	50
Section Three Extended answer	4	2	70	40	30
				Total	100

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2022: Part II Examinations*. Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

   Section One: Answer all questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

   Section Two: Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens. Wherever possible, confine your answers to the line spaces provided.

   Section Three: Consists of four questions. You must answer two questions. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.

3. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.

4. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

See next page

Section One: Multiple-choice **20% (20 Marks)**

This section has **20** questions. Answer **all** questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 20 minutes.

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1. Using your tongue as a piston and pushing air toward the back of your throat describes **most** accurately which method of equalisation while snorkelling or diving?

   (a) Frenzel
   (b) Toynbee
   (c) Valsalva
   (d) Eckman

2. Many deepwater fish species have a red-coloured appearance. This is due to

   (a) the need to attract a mate.
   (b) residing in warm waters.
   (c) the need to camouflage at depth.
   (d) physiological adaptations.

3. A new hand signal is being adopted by the diving community. What does the signal shown below indicate to a dive buddy?

   (a) do not undertake flash photography
   (b) safety stop at 5 metres for 3 minutes
   (c) the diver can see plastic and they want to take it out of the water
   (d) the diver has a problem with their mask

See next page

4. The movement of sand onshore, offshore and along the shore **best** describes

(a) longshore drift.
(b) the sand budget.
(c) the natural process of accretion.
(d) the events that occur during winter storms.

5. Identify the role of Ariaen Jacobsz in the events of the Batavia wreck.

(a) lead mutineer
(b) skipper
(c) soldier
(d) commander

6. Corals are categorised as which morphological form of the phylum cnidaria?

(a) medusa
(b) polyp
(c) anemone
(d) symbiont

7. A diver requires 6 kg of weight in addition to their scuba kit to achieve neutral buoyancy in the ocean. What will happen when they dive using the same kit in a river?

(a) they will be negatively buoyant
(b) they will be neutrally buoyant
(c) they will be positively buoyant
(d) their buoyancy will be the same

8. Ships of opportunity conduct surveys as part of the Australian Continuous Plankton Recorder (AusCPR) project to identify plankton species. From which depth would they collect plankton?

(a) 10 m
(b) 50 m
(c) 100 m
(d) 500 m

9. Which of the following would **not** be a factor affecting coral abundance in a habitat?

(a) water temperature
(b) water pH
(c) water salinity
(d) season

See next page

10. While examining miscroscope slides obtained from the tissue of a coral specimen, green structures were observed. These would **most** likely be

(a) bacteria.
(b) nematocysts.
(c) zooxanthellae.
(d) coelenteron.

11. In the marine food chain shown below, how many kilograms of protein can a humpback whale gain from 200 000 kg of phytoplankton?

Phytoplankton → Krill → Humpback whale

(a) 20 kg
(b) 200 kg
(c) 2000 kg
(d) 20 000 kg

12. Light can travel through water; however, when it passes from air into water, it bends. This is called

(a) diffraction.
(b) refraction.
(c) absorption.
(d) reflection.

13. In Western Australian marine parks and reserves, oil and gas extraction can be permitted. In which zone would this occur?

(a) sanctuary
(b) recreation
(c) general use
(d) special-purpose

14. The term 'accretion' refers to

(a) the deposition of sediment offshore.
(b) sand build-up on one side of a groyne.
(c) the removal of sand through dredging.
(d) the addition of sandbags for beach protection.

See next page

15.

(a) 1, 2, 3, 4
(b) 2, 3, 4, 5, 6
(c) 2, 3, 4, 6, 7
(d) 3, 5, 6, 7

16. Which of the following substances would be used to remove iron oxide stains from ceramic artefacts?

(a) polyethylene glycol
(b) acryloid B-72
(c) oxalic acid
(d) de-ionised water

17. Which of the following factors **most** significantly increase the rate of decay of a shipwreck?

(a) water movement and temperature
(b) organisms that deposit calcareous substances and contribute to concretion
(c) deposition and accumulation of sediment over the top of the wreck, which results in anoxic conditions
(d) salinity of the site

18. A pulmonary barotrauma can result from

(a) breathing in while ascending.
(b) ascending too slowly.
(c) ascending while holding one's breath.
(d) all of the above.

See next page

19. Timber artefacts need ambient factors to be controlled when put on display. Which of the following does **not** need to be controlled?

(a) carbon dioxide concentration
(b) humidity
(c) light
(d) temperature

20. The Batavia carried sandstone blocks on its voyage. The blocks were intended to be used as a portico in the Dutch East Indies. What was another use for the blocks?

(a) bilge
(b) infrastructure
(c) weaponry
(d) ballast

End of Section One

See next page

Section Two: Short answer **50% (100 Marks)**

This section has **six** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

Question 21 **(22 marks)**

Eutrophication can be a major issue affecting Australia's estuarine and coastal marine environments. It has negative impacts on aquatic life and can degrade recreational opportunities in affected waterways.

(a) Explain the process of 'eutrophication'. (5 marks)

(b) Identify **two** pollutants that cause eutrophication and state the possible source of each pollutant. (4 marks)

Pollutant	Source

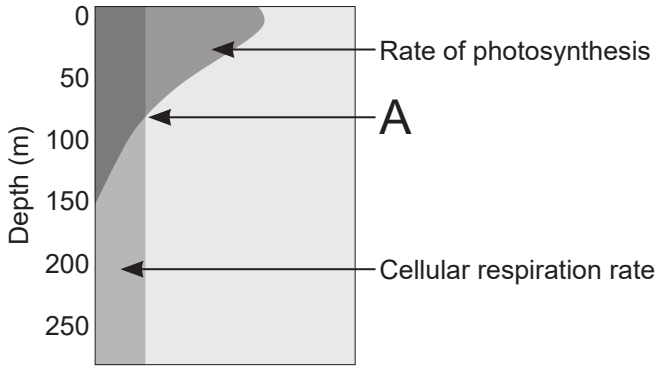
(c) Propose a method to monitor eutrophication in a waterway. (5 marks)

See next page

Question 21 (continued)

Under normal circumstances, when there is **not** eutrophication in an aquatic environment, the graph below illustrates the typical conditions expected in such an aquatic environment.

The rate of photosynthesis and respiration with increasing depth in an aquatic environment



(d) Describe and account for the relationship shown by the graph. (4 marks)

(e) Describe the significance of the point labelled A in the graph. (2 marks)

(f) State a suitable hypothesis that a scientist gathering this data could have been investigating. (2 marks)

See next page

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See next page

Question 22 **(19 marks)**

The giant clam, *Tridacna gigas*, is the largest aquatic mollusc on Earth, growing up to one metre in length and weighing up to 250 kg. These animals are found in the tropical waters of the Indo-Pacific. New research has found that their populations are at risk due to ocean acidification caused by increased carbon dioxide emissions.

(a) Explain the process of 'ocean acidification'. (5 marks)

(b) Explain **two** ways in which ocean acidification affects shell-building marine species such as the giant clam. (6 marks)

One:

Two:

Citizen science programs are being used throughout the Indo-Pacific region to enhance knowledge of the demographics of this species.

(c) (i) Outline what is meant by the term 'citizen science'. (2 marks)

(ii) Discuss how programs such as these can assist in the conservation of a species. (6 marks)

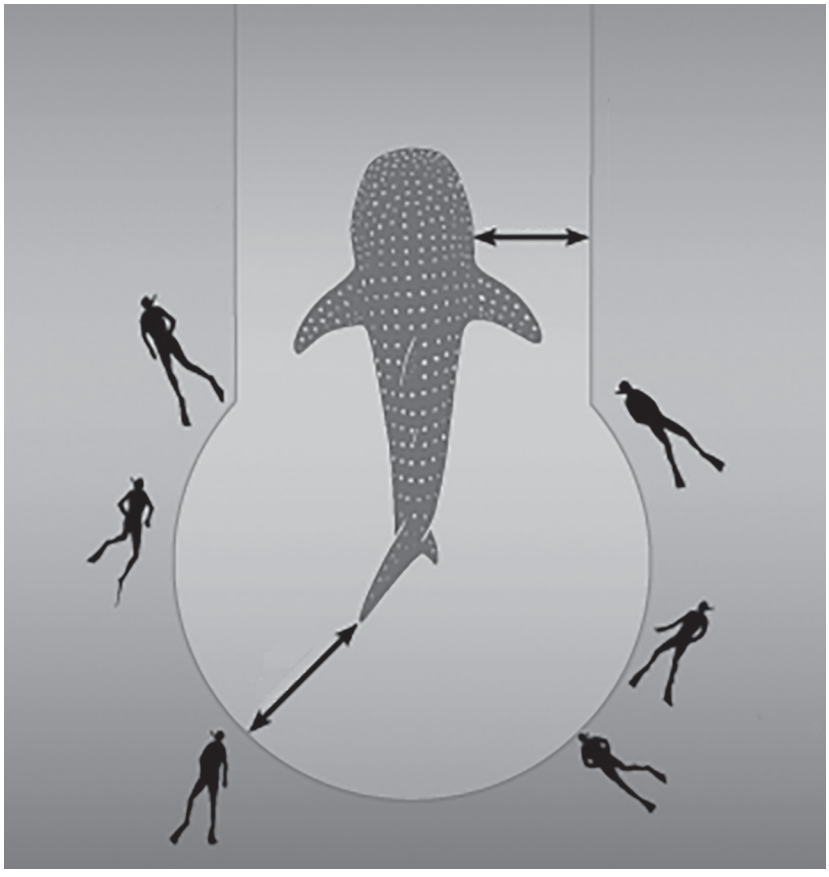
Question 23 **(10 marks)**

Ecotourism presents many benefits for marine flora and fauna as well as for the Australian economy.

(a) Define the term 'ecotourism' **and** state how it differs from regular tourism. (2 marks)

Interactions with whale sharks are an iconic ecotourism experience conducted in Western Australia.

(b) (i) On the diagram below, add the mandated distances a swimmer must keep from the head **and** tail of a whale shark. (2 marks)



(ii) List **three** additional rules that swimmers are required to follow during their interactions with whale sharks. (3 marks)

One: _____

_____

Two: _____

_____

Three: _____

_____

(c) Explain why it is important to have clear rules in place for ecotourism operations such as the whale shark interactions in Western Australia. (3 marks)

_____

_____

_____

_____

_____

_____

Question 24 **(11 marks)**

Marine pollutants, such as petroleum oil, pose tremendous threats to the marine environment.

(a) Define the term 'marine pollutant' and name **two** other types of marine pollutants. (3 marks)

Definition: _____

_____

One: _____

_____

Two: _____

_____

(b) Identify **four** sources through which petroleum oil could enter the marine environment. (4 marks)

One: _____

_____

Two: _____

_____

Three: _____

_____

Four: _____

_____

An Australian oil and gas company plans to relocate part of a decommissioned oil facility on the sea floor to create an artificial reef, approximately 2 km from the Ningaloo Coast World Heritage Area in Western Australia.

(c) Describe **two** possible benefits of this plan. (4 marks)

One: _____

_____

_____

_____

Two: _____

_____

_____

_____

Question 25 **(17 marks)**

(a) Complete the table below summarising the typical equipment used during snorkelling and diving. (5 marks)

Equipment	Main material(s) typically made from	How equipment helps during snorkelling and diving
Weights	Lead	
Snorkel		Allows the diver to breathe at the surface.
	Rubber, plastic or carbon fibre	Allows the diver to move more efficiently in the water and swim without using their arms.
Wet suit		

A diver is experiencing a persistent problem with their mask, where it is regularly filling with water while they dive.

(b) Describe a probable cause for water filling the mask. (2 marks)

See next page

Diving equipment is designed to enhance the safety and comfort of the user. Scuba divers should always carry a snorkel with them while diving.

(c) Explain why a snorkel is considered an essential piece of equipment when diving. (4 marks)

The dimensions of a snorkel are an important part of its design.

(d) Discuss how the length and/or bore (diameter) of a snorkel can influence its effectiveness. (6 marks)

See next page

Question 26 **(21 marks)**

Australian author Henrietta Drake-Brockman is famous for writing *Voyage to Disaster* which is based on materials from Dutch archives and E.D. Drok's translations of Francisco Pelsaert's journals. Drake-Brockman later assisted in locating the resting place of the Batavia and one of the wreck's anchors is named '*Henrietta's Anchor*' in appreciation of her contribution.

(a) Explain how historical records can be useful in locating shipwreck sites. (3 marks)

(b) Outline the steps that lead to the waterlogging of timber artefacts. (4 marks)

See next page

(c) Explain why special care is required for the management of waterlogged timber artefacts. (3 marks)

The timber artefact pictured below was found at a depth of 12 m. It has a volume of 42 L and predicted mass while submerged of 120 kg. Maritime archaeologists intend to recover the artefact using lift bags.

(d) Calculate the volume of air that will be required to make the artefact neutrally buoyant at 12 m. Show your workings in the space below.

Note: the density of seawater is 1.03 kg/L. (3 marks)

Volume of air required: _____

See next page

Question 26 (continued)

(e) Outline why more air would be required than the value calculated in part (d) to actually lift the object to the surface. (2 marks)

(f) A dive charter anchors at a mooring in water near the wreck that is 12 m deep. Identify the **most** suitable method of entry for divers in this location and summarise the steps. (6 marks)

Method of entry: _____

Summary of steps: _____

End of Section Two

Section Three: Extended answer **30% (40 Marks)**

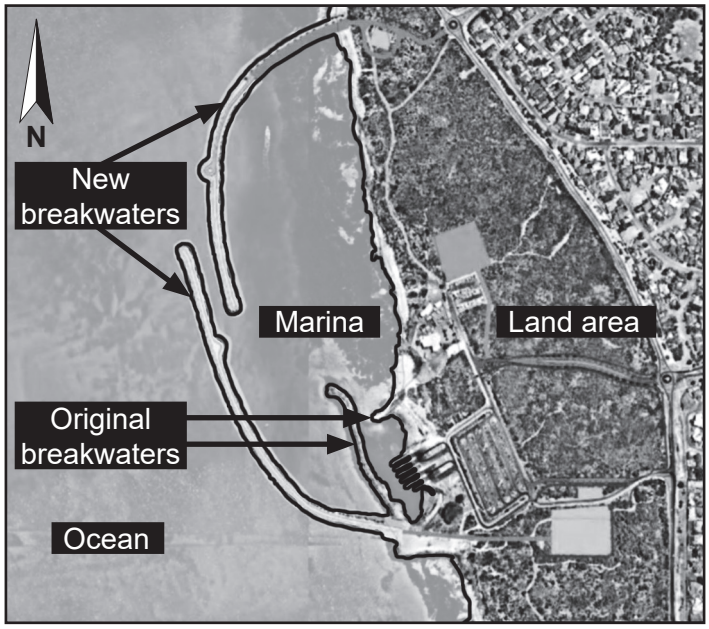
This section contains **four** questions. You must answer **two** questions. Write your answers on the lined pages provided following Question 30.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 70 minutes.

Question 27 **(20 marks)**

Ocean Reef Marina is undergoing a significant expansion project in which the breakwaters are being extended further out to sea. The image below shows the original and new breakwaters.



(a) Construct a labelled diagram to show how a marina is expected to affect longshore drift in the surrounding area during the Western Australian summer. (6 marks)

(b) Propose **three** possible impacts of the expansion of the Ocean Reef Marina on the surrounding marine environment. For each, suggest a method to minimise the impact. (6 marks)

(c) Describe the features, role **and** impacts of the following coastal engineering structures:
- sand bypass systems
- canals. (8 marks)

Question 28 **(20 marks)**

Marine ecosystems are affected by the ocean currents that are found in that area.

(a) Identify **two** major Western Australian ocean currents and describe the influence of each on Western Australian marine ecosystems. (8 marks)

(b) Discuss how ocean warming and increasing stratification will result in major changes in phytoplankton in terms of: (12 marks)
- abundance
- distribution, and
- seasonal fluctuations.

Question 29 **(20 marks)**

The enhanced greenhouse effect is damaging marine habitats and coral communities.

(a) Distinguish between the terms 'greenhouse effect' and 'enhanced greenhouse effect'. (2 marks)

(b) Explain the enhanced greenhouse effect. In your explanation include:
- a labelled diagram
- **two** types of radiation
- **two** greenhouse gases
- the key features of the enhanced greenhouse effect. (10 marks)

(c) Discuss the process of coral bleaching that can occur as a result of the enhanced greenhouse effect. (8 marks)

Question 30 **(20 marks)**

In 1915, Ernest Shackleton's vessel the *Endurance* became trapped in Antarctic ice and sank. The whereabouts of the vessel was a mystery for over 100 years until an expedition discovered it in 2022. Shipwrecks provide stories of human endeavour, and much can be learnt from their artefacts.

(a) State an example of the type of artefact that could be left on-site and protected using a sacrificial anode. Explain how a sacrificial anode works and describe the environmental conditions that would be suitable for this method of conservation. (9 marks)

(b) Soluble salts can be absorbed by pottery artefacts. Describe how salts are absorbed by pottery and explain why the absorbed salt can affect an artefact once it has been recovered from a wreck site. (4 marks)

(c) With the aid of a labelled diagram, explain how conservators remove insoluble salts from pottery artefacts. (7 marks)

End of questions

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

ACKNOWLEDGEMENTS

Question 3 Adapted from: […] Soup Foundation. (2019). [Graphic of […] hand signal]. Retrieved June, 2022, from […]

Question 15 Adapted from: International Whaling Commission. (n.d.). *History and purpose*. Retrieved June, 2022, from https://iwc.int/commission/history-and-purpose

Question 21(d)–(f) Adapted from: Webb, P. (2021). *Introduction to oceanography* (Fig. 7.3.1) [Graph]. Retrieved June, 2022, from https://rwu.pressbooks.pub/webboceanography/chapter/7-3-factors-influencing-production/ Used under Creative Commons Attribution 4.0 International licence.

Question 22 Paragraphs 1–2 information from: Watson, S., & Neo, M. L. (2021, December 14). Our iconic giant clams face new threats from warmer waters and acidic oceans – let's buy them time. *The Conversation*. Retrieved June, 2022, from https://theconversation.com/our-iconic-giant-clams-face-new-threats-from-warmer-waters-and-acidic-oceans-lets-buy-them-time-172607

Question 23(b) Diagram adapted from:
Department of Biodiversity, Conservation and Attractions. (2022). *Whale shark swim contact zone* [Infographic]. Retrieved June, 2022, from https://www.dpaw.wa.gov.au/plants-and-animals/animals/whale-sharks?showall=&start=2

Cinz. (n.d.). *Hand drawn whale shark ocean life free* [Graphic]. Retrieved June, 2022, from, https://pngtree.com/freepng/hand-drawn-whale-shark-ocean-life_6847776.html

[Graphic of diver silhouettes]. (n.d.). Retrieved June, 2022, from https://365psd.com/vector/19-vector-diver-58724

Question 26 Paragraph 1 information from: Henrietta Drake-Brockman. (2022). In *Wikipedia*. Retrieved June, 2022, from https://en.wikipedia.org/w/index.php?title=Henrietta_Drake-Brockman&oldid=1090606993

Question 26(d) Adapted from: [Image of a plank of wood with texture]. (2017). Retrieved June, 2022, from https://pxhere.com/en/photo/764955

Question 27 Sentence 1 information from: Brown, T. (2020, April 24). Ocean Reef Marina hits major milestone. *Joondalup Times*. Retrieved June, 2022, from https://www.perthnow.com.au/community-news/joondalup-times/ocean-reef-marina-hits-major-milestone-c-997711

Image adapted from: Department of Planning, Lands and Heritage. (n.d.). *An artist impression of the finished breakwaters at Ocean Reef Marina* [Map]. Retrieved June, 2022, from https://www.perthnow.com.au/community-news/joondalup-times/ocean-reef-marina-hits-major-milestone-c-997711

Question 30 Paragraph 1 information from: McGreevy, N. (2022, March 11). Wreck of Shackleton's 'Endurance' discovered in icy Antarctic depths. *Smithsonian Magazine*. Retrieved June, 2022, from https://www.smithsonianmag.com/smart-news/ernest-shackleton-ship-discovery-antarctic-explorer-history-180979702/

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