2025/7666
Web version of 2024/77292

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

ATAR course examination, 2024

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	105	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 2024: 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. The role of a dive buddy does **not** include

   (a) logistical planning of excursions, including sea and weather conditions.
   (b) assisting with cramp removal, over exertion or fatigue.
   (c) taking film footage or photographs.
   (d) checking equipment is fitted correctly and securely.

2. The universal rule of ‘right hand release’ for weight belts is used because

   (a) it ensures the weight belt buckle is in line with the rest of the equipment.
   (b) the weight belt will sit more comfortably in this position.
   (c) research conducted globally has shown that the majority of divers are right handed.
   (d) it ensures that all divers are aware how to release a buddy’s weight belt quickly in an emergency.

3. This hand signal indicates which of the following?

   (a) buddy up
   (b) go in the direction I am pointing
   (c) which way do we go?
   (d) who will lead and who will follow?

See next page

4. Bioaccumulation occurs when

   (a) organisms ingest heavy metals and then pass them onto organisms of higher trophic levels.
   (b) a producer absorbs a toxic substance and transfers it to a first order consumer.
   (c) a toxic chemical accumulates within a particular trophic level.
   (d) the concentration of a toxic substance in an organism's tissues increases gradually over time.

5. High-quality dive mask skirts are typically constructed of

   (a) tempered silicone.
   (b) softened rubber.
   (c) silicone.
   (d) bakelite.

6. Declining water quality in estuaries is often associated with eutrophication. Common features of eutrophication in these waterways are

   (a) harmful algal blooms, reduced dissolved oxygen and increased turbidity.
   (b) increased biological activity, including spawning events and fish growth.
   (c) harmful chemicals and high concentrations of toxic metals in the sediment.
   (d) increases in the populations of invasive species.

7. Wooden artefacts recovered from submerged wreck sites can often hold eight times more water than those found on dry land. Through conservation processes, this water is usually replaced with

   (a) acryloid b72.
   (b) polyethylene glycol.
   (c) parrafin wax.
   (d) 10% oxalic acid solution.

8. Calculate the volume of a free diver's lungs at 40 m, when their volume in air is 4.5 L.

   (a) 0.75 L
   (b) 0.9 L
   (c) 1.13 L
   (d) 1.20 L

9. When trying to locate a historical shipwreck, the **least** effective method to use would be

   (a) side scan sonar.
   (b) a magnetometer to detect ferrous artefacts.
   (c) historical records to gain an insight into proposed locations.
   (d) aerial surveys of deep water sites.

See next page

10. The steps for caring for a mask after snorkelling or diving are given in the table below:

Step	Action
A	Allow to dry away from direct sunlight
B	Inspect for wear and tear
C	Store in a cool, dry place
D	Rinse in fresh water

Which of the following gives the correct sequence of steps A to D?

(a) D, A, C, B
(b) B, C, D, A
(c) D, B, A, C
(d) A, B, C, D

11. Marine ecosystems in Western Australian waters are classified as being of low or moderate productivity due to

(a) the Leeuwin Current, limited input of nutrients from river discharge and old, weathered terrestrial land forms.
(b) low ocean temperatures, limited sunlight and minimal atmospheric activity.
(c) very high biological turnover reducing the overall productivity of marine ecosystems.
(d) the lack of coral reefs in temperate marine waters.

12. Scientific research often relies on averages as a method of identifying trends and patterns in a data set. One limitation of using an average is that it

(a) is a simple statistic to calculate and is therefore unreliable.
(b) is only useful for small data sets.
(c) can be distorted by extreme values and outliers.
(d) is only useful when comparing multiple sets of data and cannot be used for single populations.

13. The biomass of each successive tropic level in a food chain is approximately what percentage of the level below it?

(a) 8%
(b) 10%
(c) 12%
(d) 20%

See next page

14. Western rock lobster have a complicated lifecycle that involves several changes as they age. The phyllosoma stage is planktonic and individuals in this stage are classified as

    (a) holoplankton.
    (b) benthoplankton.
    (c) nektoplankton.
    (d) meroplankton.

15. Sand nourishment is characterised by

    (a) using dredging vessels to create deep channels offshore of an eroded beach to reduce destructive wave energy.
    (b) the movement of sand from an area of accretion to an area of erosion, using heavy machinery.
    (c) the automated movement of sand using a pumping system.
    (d) replenishing sand during periods of accretion by collecting excess sand in bags and storing it for periods of erosion.

16. Artificial reefs are structures used to manage erosion on targeted beaches. A secondary advantage of using this type of structure, **not** associated with coastal erosion, is that they

    (a) provide added protection from incoming stormy weather.
    (b) allow councils to use waste materials when forming the reef structure.
    (c) attract fish stocks and provide habitats for marine organisms to settle on.
    (d) are aesthetically pleasing for beach goers.

17. Shallow water blackouts are often attributed to divers who hyperventilate before a dive. Hyperventilation causes

    (a) a decrease in the concentration of carbon dioxide in the body, which delays a diver's urge to breathe, causing them to overstay at depth.
    (b) an increase in the concentration of oxygen, which moves directly to muscle tissues once the diver is submerged, causing light-headedness.
    (c) an increase in the capacity of a diver's lungs, which shrink rapidly on ascent, causing the blackout.
    (d) a decrease in the concentration of oxygen and an increase in the concentration of nitrogen, which can increase the likelihood of decompression illnesses.

18. When towing a tired buddy back to the boat, an important safety consideration is to

    (a) ensure their mask is off, and their head is back so that they can see.
    (b) check they have all of their equipment.
    (c) check the area for sharks and other dangerous creatures.
    (d) ensure their mask is on so that their face is protected if any waves wash over them.

See next page

19. One outcome of increasing sea surface temperatures is

(a) the reduction of mixing between surface and deep waters due to the presence of a thermocline.
(b) an increase in the distribution of cool, nutrient rich waters due to the larger difference in surface and deep-water temperatures.
(c) an increase in the exchange of nutrients between polar and temperate waters.
(d) a reduction in the distribution of tropical species due to a decrease in the availability and accessibility of dissolved nutrients.

20. One disadvantage of a canal is that it requires frequent dredging to ensure that the waterway is clear for vessels. A **direct** consequence of this dredging is

(a) a reduction in predatory seabird populations, due to a decrease in the availability of marine fish species.
(b) a decline in water quality, due to an increase in turbidity.
(c) a reduction in photosynthetic activity in the canal, due to declining water quality.
(d) an increase in the speed of longshore drift on the coastline surrounding the canal.

End of Section One

See next page

Section Two: Short answer **50% (105 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 **(15 marks)**

Iron artefacts are a common source of information found on historical shipwrecks due to the prevalence of this material in the 1600s–1800s. Artefacts such as cannons, anchors and ship fixings can help maritime archaeologists identify the origin and purpose of a submerged wreck, offering valuable insights into historical maritime culture.

(a) Identify the decay process that iron artefacts undergo when submerged in seawater. (1 mark)

(b) Outline the main stabilisation process that can be used for *in situ* iron artefacts and describe **one** example of a way in which this stabilisation can be achieved. (4 marks)

Process:

Example:

A large, concreted mass is retrieved by a diver from an historical wreck site. The artefact is logged and transported to a museum for further analysis.

(c) Identify the process used to determine what artefacts may be contained within the mass. (1 mark)

(d) Outline the process of concretion and state **three** ways in which this process can slow the decay of some artefacts. (5 marks)

Process:

One:

Two:

Three:

(e) Suggest **two** ways in which climate change could affect the concretion process. (4 marks)

One:

Two:

See next page

Question 22 **(16 marks)**

When planning a snorkel or dive, the management of buoyancy is an important factor in ensuring a comfortable and safe experience.

(a) State Archimedes' principle. (1 mark)

(b) Explain how Archimedes' principle relates to the process that free divers use to check they are neutrally buoyant at the surface. (3 marks)

You are planning on free diving to 30 m in the ocean.

(c) (i) State which law of physics, other than Archimedes' principle, is relevant to this situation. (1 mark)

(ii) Identify what effect this law has on a free diver's buoyancy as they descend. (1 mark)

(iii) Identify **one** advantage and **one** disadvantage of starting the dive positively buoyant, and suggest a way of overcoming the disadvantage. (3 marks)

Advantage: _____

_____

Disadvantage: _____

_____

Suggestion: _____

_____

You are planning to dive in Shark Bay, Western Australia, in an area of hypersaline ocean water that has a density of 1.045 kg/L. Kitted up to free dive, on the day you displace 100 L and weigh in at 100 kg.

(d) Calculate how much weight you will need to wear to achieve neutral buoyancy at the surface. Show all workings. (3 marks)

_____

_____

_____

_____

_____

_____

You see an online advertisement for a small air cylinder. The advertisement states that it will allow snorkellers to extend their time underwater, with no additional training.

(e) Describe **two** problems that you may encounter in using this cylinder. (4 marks)

One: _____

_____

_____

_____

Two: _____

_____

_____

_____

Question 23 **(20 marks)**

(a) State **three** roles that scientific research plays in managing the marine environment. (3 marks)

One: _____

_____

Two: _____

_____

Three: _____

_____

(b) Describe the term ‘citizen science’. (2 marks)

_____

_____

_____

_____

(c) Comment on the benefit that citizen science can have in scientific research associated with managing the marine environment. (4 marks)

_____

_____

_____

_____

_____

_____

_____

_____

See next page

In Coral Bay, Western Australia, citizen scientists can take photographs of the spot pattern on whale sharks. These photographs can be uploaded to a range of scientific databases for further research and analysis.

(d) Describe **two** ways in which this initiative assists with the conservation of whale shark populations in Australia. (4 marks)

One: _____

Two: _____

(e) Define 'ecotourism' and contrast this with regular tourism. (3 marks)

(f) Explain why it is important to have clear rules regarding the protection of cetaceans when participating in water-based ecotourism activities. (4 marks)

See next page

Question 24 **(20 marks)**

The West Coast Demersal Scalefish Resource (WCDSR), which includes dhufish, pink snapper and baldchin groper, has recently undergone fisheries management changes. These changes are in response to the fishery failing to meet the required population recovery benchmarks.

From 2010 to 2020, scientists from the Department of Primary Industries and Regional Development (DPIRD) collected data on populations of mature dhufish in two locations along the Perth metropolitan coast. Previous research suggests that each location required at least 320 mature individuals to reach sustainable levels. Halfway through the study in 2015, DPIRD implemented a demersal fishing ban at Location 2, preventing fishing of all demersal fish species managed under the WCDSR.

Annual counts of mature dhufish at each location, collected from the 10-year study, are shown in the table below:

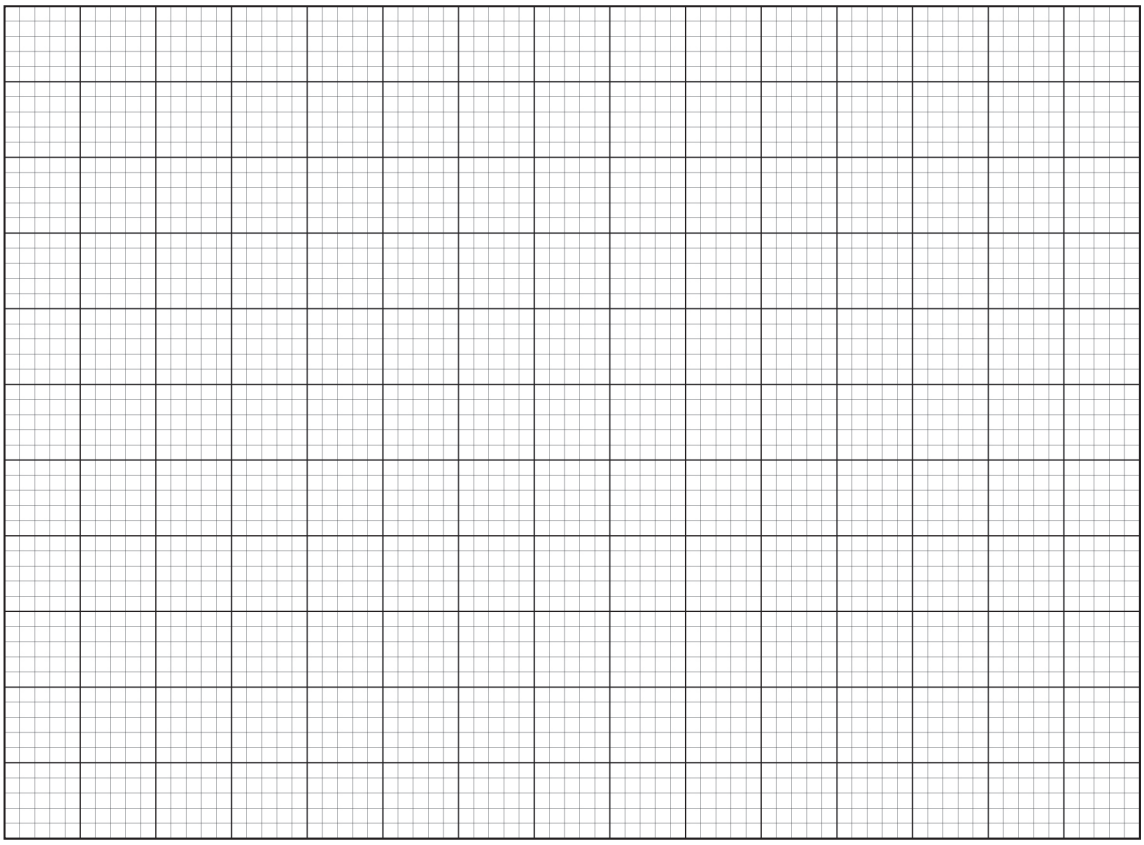
	Number of mature dhufish	
Year	**Location 1**	**Location 2**
2010	280	140
2011	220	120
2012	200	150
2013	240	190
2014	250	240
2015	270	270
2016	300	290
2017	240	460
2018	280	590
2019	350	680
2020	400	800

(a) Define ‘overfishing’. (1 mark)

(b) Propose a hypothesis that the DPIRD scientists could use for their research into the populations of mature dhufish. (2 marks)

See next page

(c) Using the grid below, construct a graph to represent the information in the table on page 14. (6 marks)



A spare grid is provided at the end of this Question/Answer booklet. If you need to use it, cross out this attempt and indicate that you have redrawn it on the spare grid.

(d) Suggest a conclusion for these results. (3 marks)

See next page

Question 24 (continued)

(e) Suggest **one** reason why there was a delay in the recovery of the dhufish population at Location 2 after the demersal ban was implemented in 2015. (2 marks)

A dhufish's diet mainly consists of smaller fish, molluscs and crustaceans living on or near the sea floor. These organisms generally feed on zooplankton, which consume phytoplankton.

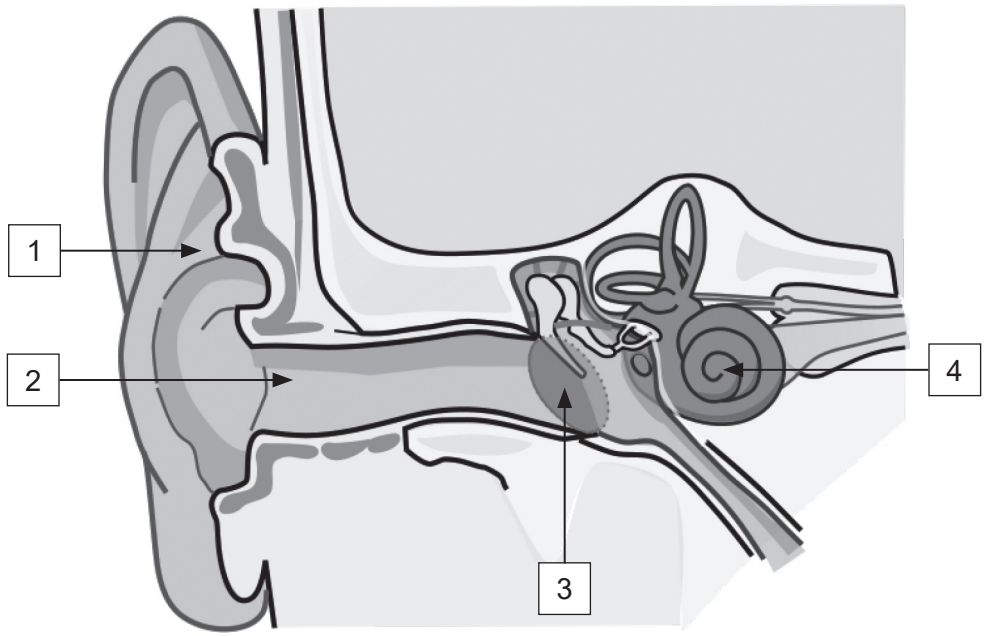
(f) Outline how a demersal fishing ban could impact the overall biomass of Location 2 compared to Location 1. Use a diagram of a biomass pyramid for each location to support your response. (6 marks)

See next page

Question 25 **(17 marks)**

Delicate mechanisms govern a person's hearing and balance. As such, our ears are not designed for the rapid pressure changes that result from diving. From minor cases of swimmer's ear to major barotraumas, ears are susceptible to damage when in the water. Fortunately, ear injuries when swimming and diving are preventable if the correct techniques and safety guidelines are used.

(a) In the table below, name the parts of the ear labelled 1 to 4 in the diagram. (4 marks)



Part	Name
1	
2	
3	
4	

See next page

Question 25 (continued)

Sound travels differently under water.

(b) (i) Explain the effect water has on sound. (3 marks)

(ii) Identify **two** issues that this may cause for divers when under the water. (2 marks)

One: _____

Two: _____

(c) Define an 'ear barotrauma' and explain how this can occur as a diver ascends. (5 marks)

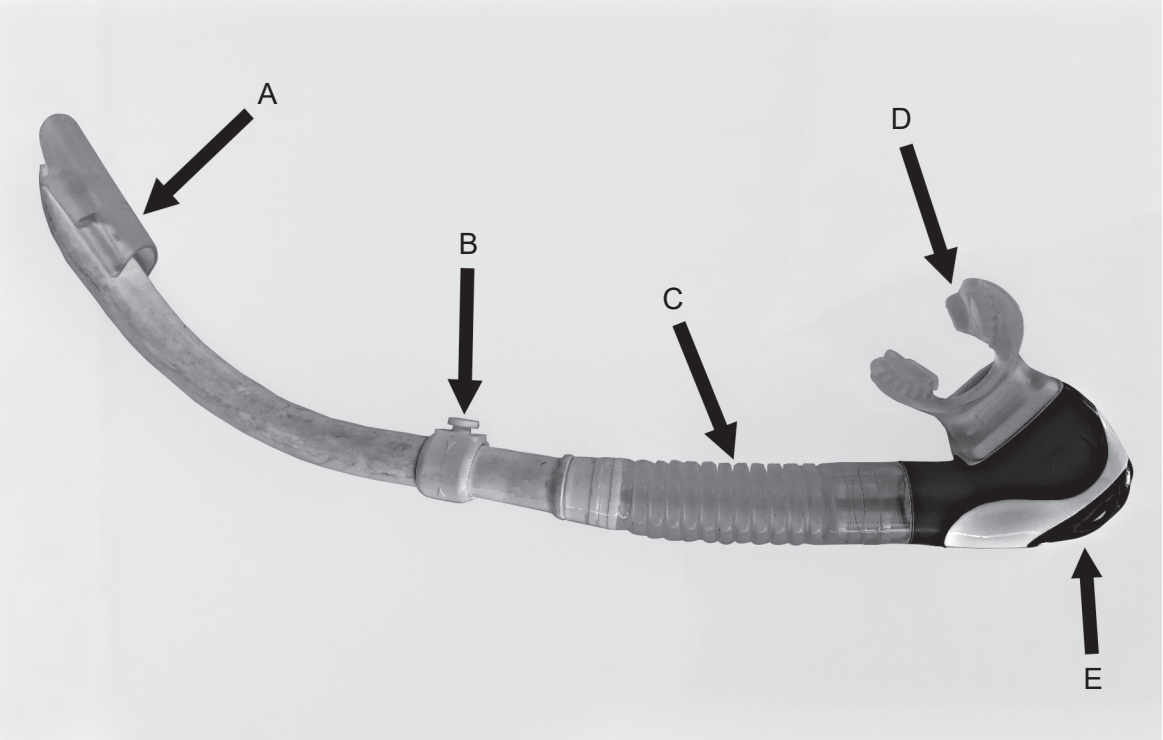
See next page

(d) State **one** potential long-term outcome of an ear barotrauma and outline the associated symptoms. (3 marks)

See next page

Question 26 **(17 marks)**

(a) Examine the picture of a semi-dry snorkel. In the space below, name the **five** parts labelled A to E and state the purpose of each. (10 marks)



A: _____

_____

B: _____

_____

C: _____

_____

D: _____

_____

E: _____

_____

See next page

(b) Explain how to clear a snorkel using the displacement method. (3 marks)

(c) Outline **two** reasons why scuba divers must ascend differently from free divers. (4 marks)

One:

Two:

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)**

The Abrolhos Islands, off Western Australia's coast, are the site of the wreck of the Dutch East India Company ship, Batavia.

(a) Outline the Batavia's final ill-fated journey. Your response should include the following:

- **two** key individuals
- the wrecking event
- the mutiny, and
- the rescue. (8 marks)

(b) Explain the purpose of a maritime archaeological survey and describe **one** method that was used to survey the wreck site of the Batavia, including a reason why it was applied to the survey process. (6 marks)

When recovering and conserving artefacts, it is important that the correct techniques are used, to ensure the integrity and preservation of the artefacts.

(c) Describe a method used to preserve the following artefacts found on the Batavia after retrieval from the water:

- a wooden piece of the hull
- silver coins. (6 marks)

Question 28 **(20 marks)**

The enhanced greenhouse effect is a leading cause in global warming and has impacts on many oceanographic factors.

(a) Describe the greenhouse gas effect and explain how global warming may result from an enhanced greenhouse effect. Draw a labelled diagram to support your response. (8 marks)

(b) Discuss how global sea levels and coral bleaching will be affected by the enhanced greenhouse effect. For each, describe **two** effects on relevant ecosystems. (12 marks)

See next page

Question 29 **(20 marks)**

The Australian Continuous Plankton Recorder (AusCPR) is an initiative that allows the health of Australia's marine waters to be monitored consistently.

(a) Contrast phytoplankton and zooplankton by referring to the following:

- role in marine ecosystems
- life cycle
- daily and seasonal distribution
- significance to fish stocks. (8 marks)

(b) Describe the AusCPR initiative and discuss how data collected from it can be used to assist the conservation of plankton in a warming climate, including the methodology used to collect plankton samples and the relevance of collected data. (12 marks)

Question 30 **(20 marks)**

The marine environment of Australia faces a number of major environmental issues that affect its long-term viability.

(a) Name **two** major marine pollutants and identify the role each plays in the loss of marine species and/or habitats. (4 marks)

(b) Assess the effectiveness of implementing marine protected areas as a tool to conserve marine biodiversity. (6 marks)

(c) Describe **three** major ways in which marine species can be introduced to Australian marine waters and outline **two** methods Australia uses to counter the biosecurity threat posed by introduced species. (10 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: _____

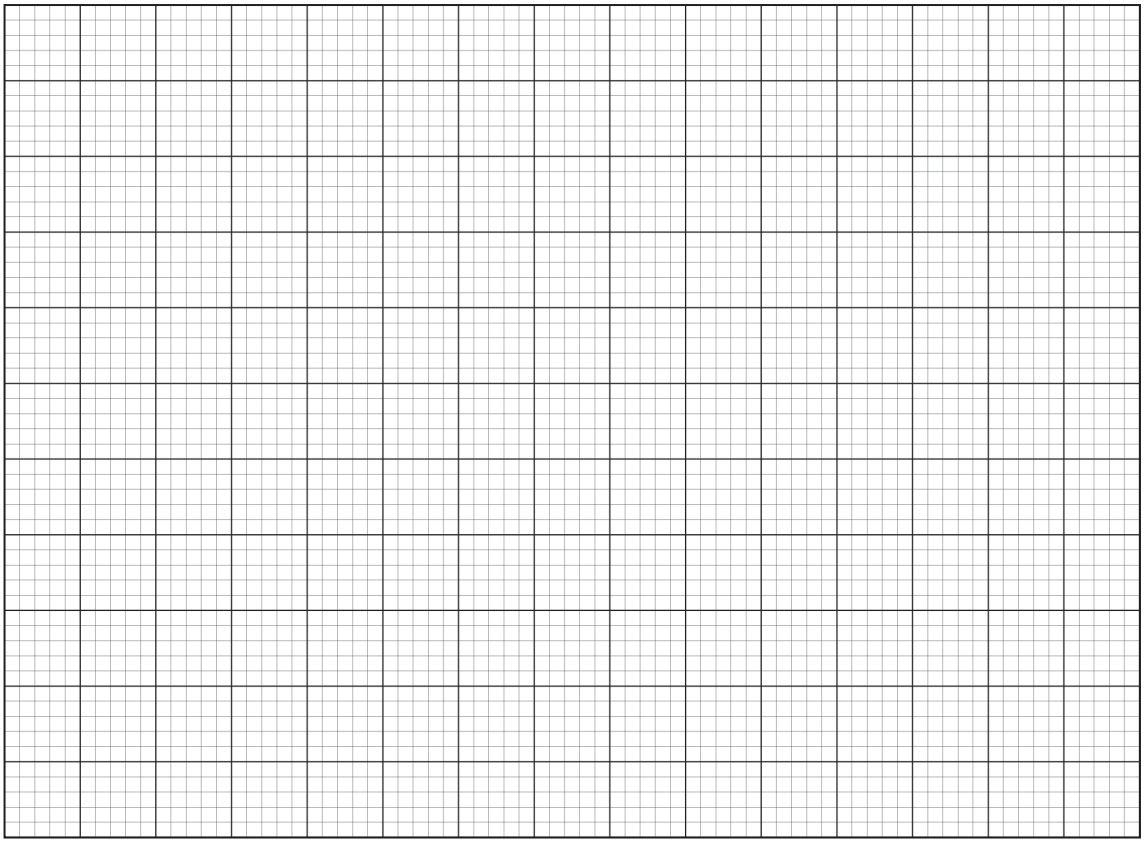
Supplementary page

Question number: _____

Supplementary page

Question number: _____

Spare grid for Question 24(c)



ACKNOWLEDGEMENTS

Question 3 Southwood, P. (2011). *Dive Hand Signal Buddy up* [Illustration]. Retrieved May, 2024, from https://commons.wikimedia.org/wiki/File:Dive_hand_signal_Buddy_up.png

Question 25(a) Adapted from: Adapted from: Komorniczak, M. (2009). *Anatomy of the Human ear* [Diagram]. Retrieved May, 2024, from https://commons.wikimedia.org/wiki/File:Anatomy_of_the_Human_Ear_blank.svg Used under Creative Commons Attribution 2.5 Generic licence.

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