



Western Australian Certificate of Education Examination, 2014

Question/Answer Booklet

MARINE AND MARITIME STUDIES

Stage 3

Please place your student identification label in this box

Student Number: In figures

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In words

Time allowed for this paper

Reading time before commencing work: ten minutes

Working time for paper: 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: non-programmable calculators approved for use in the WACE examinations

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 notes or other items of a non-personal nature in the examination room. 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 exam
Section One: Multiple-choice	20	20	20	20	20
Section Two: Short answer	6	6	90	70	50
Section Three: Extended answer	4	2	70	50	30
Total					100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2014*. 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. 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.

Sections Two and Three: Write your answers in this Question/Answer Booklet.

3. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
 - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
 - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Section One: Multiple-choice

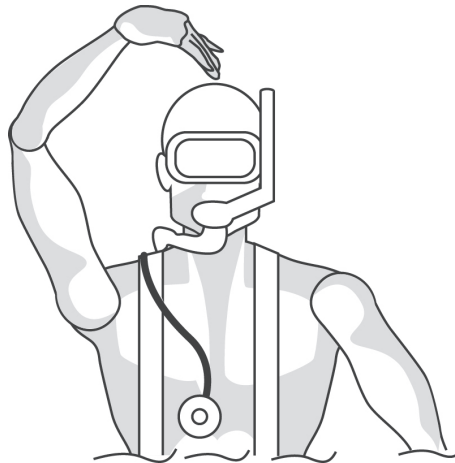
20% (20 Marks)

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. 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.

1. What is the name of the island in the Abrolhos that is often referred to as 'Batavia's Graveyard'?
 - (a) Beacon Island
 - (b) West Wallabi Island
 - (c) Pelsaert Island
 - (d) Tamar Island

2. You are snorkelling with your buddy and they perform the signal shown below.

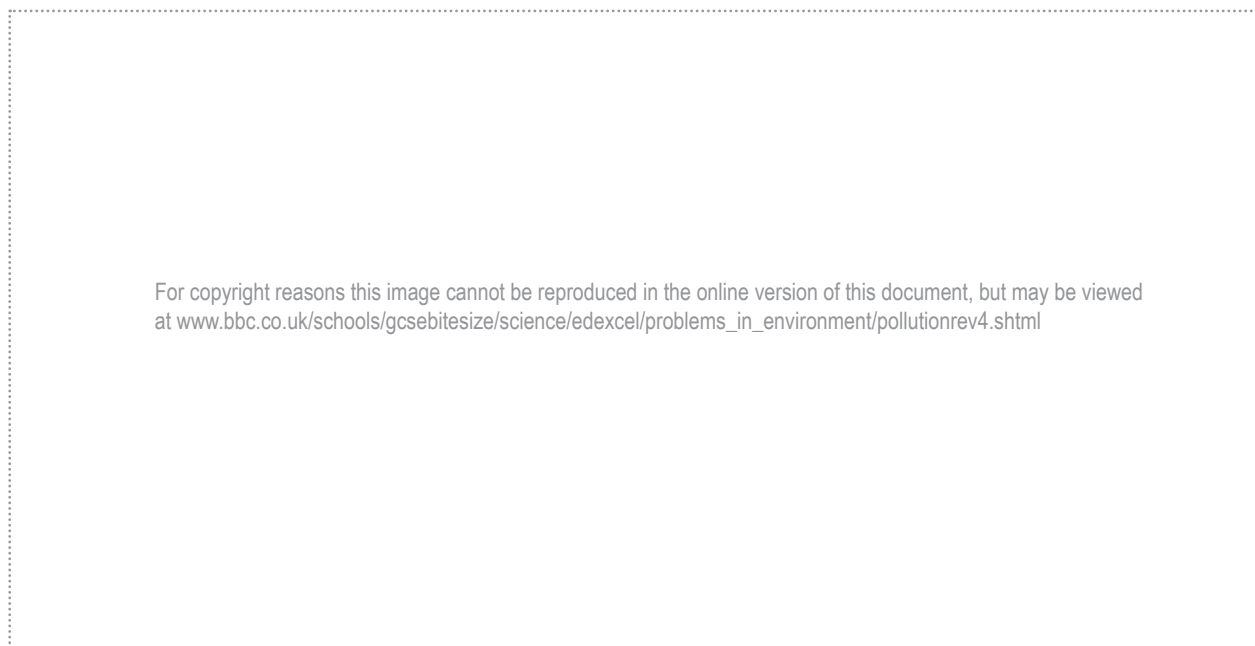


- What does this signal communicate?
- (a) 'Move towards your left.'
 - (b) 'There is something on my head.'
 - (c) 'There is a crayfish buoy over there.'
 - (d) 'OK?' or 'OK!'
-
3. Which of the following is considered the greatest advantage of the hydrofoil hull design?
 - (a) It provides a stable platform.
 - (b) It lifts the boat out of the water during forward motion in order to reduce hull drag.
 - (c) The full displacement hull form allows for constant speed in most conditions.
 - (d) It has a shallow draft.

See next page

4. Which of the following **best** describes 'income' in the sand budget?
- (a) deposition into bays and rivers
 - (b) outgoing longshore drift
 - (c) incoming longshore transport
 - (d) wind (offshore)
5. The buoyancy of a snorkeller, whose mass in air is 80 kg and who displaces 74 kg of water, can be described as
- (a) positive.
 - (b) neutral.
 - (c) negative.
 - (d) alternative.

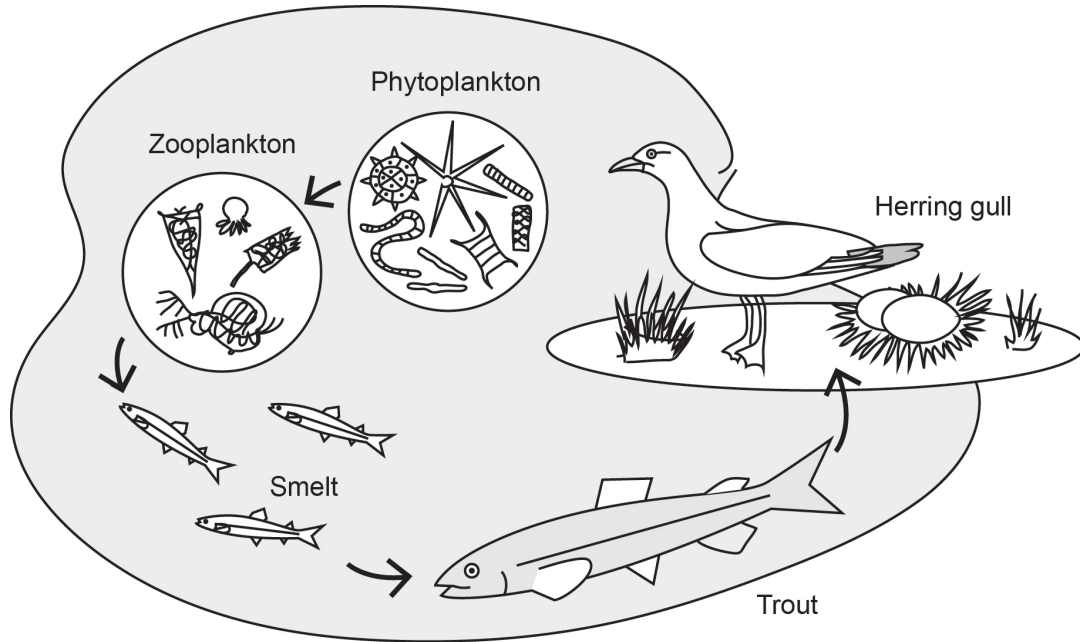
Question 6 relates to the information shown in the diagram below. The five steps take place over a period of time.



6. Which of the following processes does the diagram **best** illustrate?
- (a) eutrophication
 - (b) photosynthesis
 - (c) decomposition
 - (d) biomagnification

7. Which of the following is considered an advantage of the SWATH hull design?
- (a) Maintains normal cruising speed in rough, head seas.
 - (b) Has quick turning manoeuvrability.
 - (c) Allows for constant speed in most conditions.
 - (d) Has a shallow draft, which increases stability.

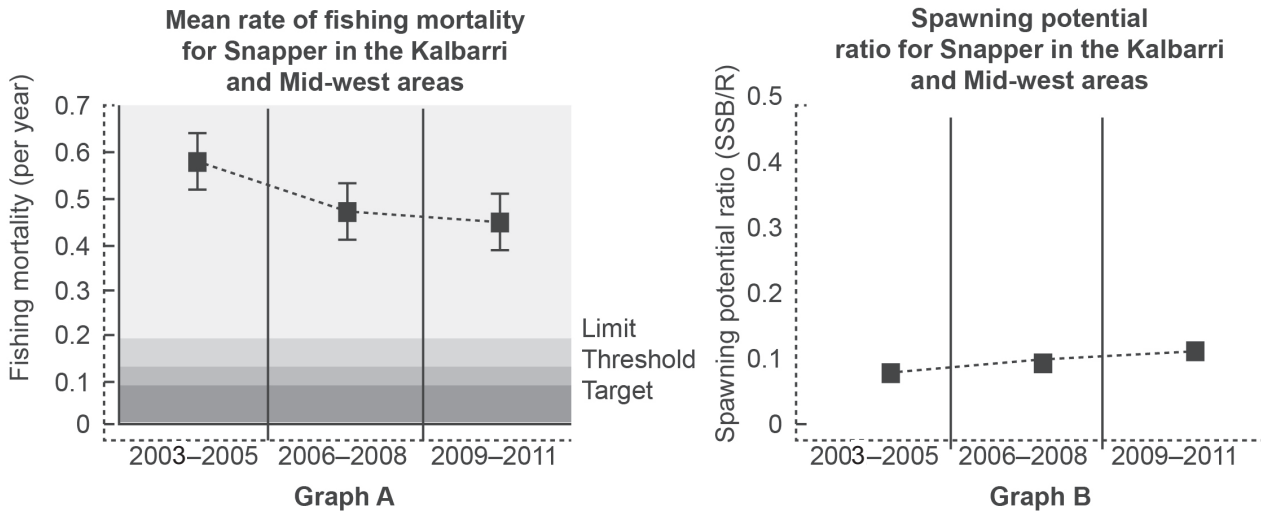
Question 8 relates to the diagram below, which shows the flow of matter along a food chain in an estuarine environment.



Feeding relationship in an estuarine environment

8. If the estuarine water was contaminated with a heavy metal such as mercury, which organism in the food chain would have the highest concentration of mercury in their body tissue?
- (a) Smelt (small fish)
 - (b) Phytoplankton
 - (c) Herring gull (fish eating bird)
 - (d) Trout (predatory fish)
9. Tony is selling his boat on a local website. In his advertisement, he lists the following features of his boat's hull:
- reduced buoyancy in the forward portions
 - long thin hull
 - very fine bow.
- Tony is **most** likely to be selling a boat with which hull design type?
- (a) SWATH
 - (b) hard chine
 - (c) hydrofoil
 - (d) wave piercer

Questions 10 and 11 refer to the information contained in the graphs below. The graphs show fishing mortality rate (Graph A) and spawning potential ratio (Graph B) for Snapper in the Kalbarri and Mid-west areas, combined for three consecutive, three-year assessment periods between 2003 and 2011.



10. A valid conclusion to be drawn from Graph A about the mean fishing mortality rate is?
- (a) Over time, the fishing mortality rate has stayed constant.
 - (b) While the fishing mortality rate has decreased over the three assessment periods, it is not at a sustainable level for future generations.
 - (c) The fishing mortality rate has decreased over the three assessment periods and is definitely at a sustainable level for future generations.
 - (d) The fishing mortality rate must be further increased to meet the target reference point.
11. Taking both Graph A and Graph B into consideration, what conclusion can be reached with regard to future stock recovery of Snapper in the Kalbarri and Mid-West areas?
- (a) Slow level of stock recovery, as the fishing mortality rate is decreasing while the spawning potential rate is increasing.
 - (b) Fast level of stock recovery, as the fishing mortality rate is decreasing while the spawning potential rate is increasing.
 - (c) Slow level of stock recovery, as the fishing mortality rate is increasing while the spawning potential rate is increasing.
 - (d) Fast level of stock recovery, as the fishing mortality rate is increasing while the spawning potential rate is increasing.

12. Shown below is a summary list of methods used in the laboratory to treat the silver Netherlands 'rijksdaalders' and German 'thalers' (coins) recovered from the *Batavia*.

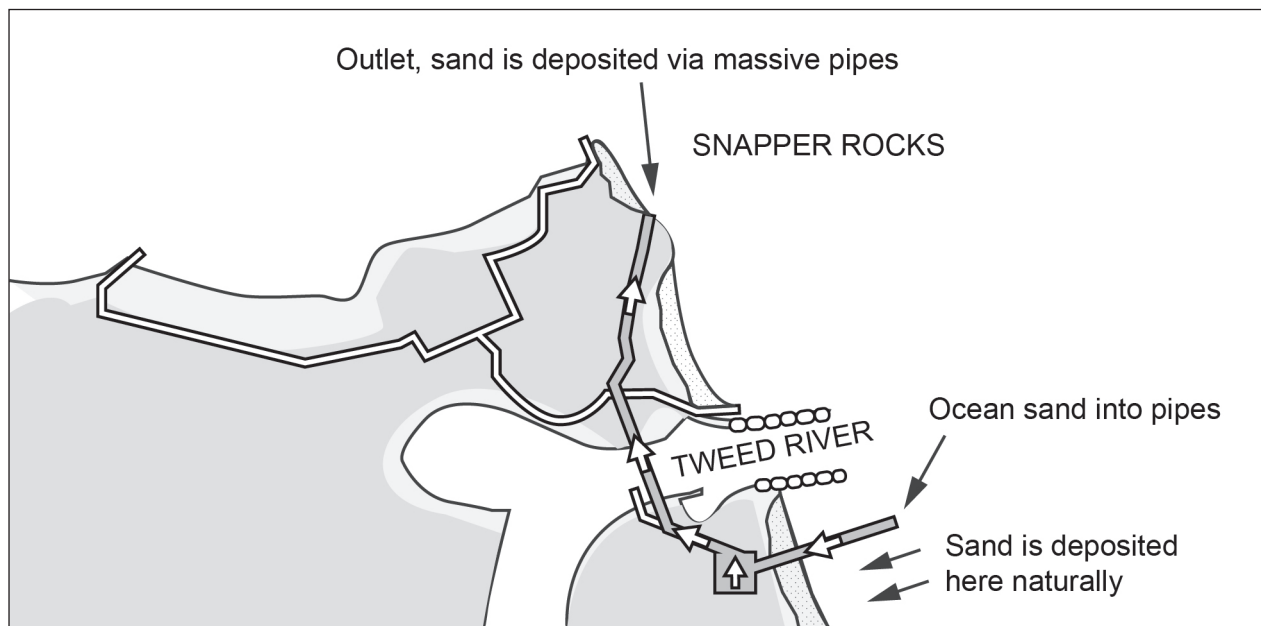
The methods are not listed in the correct sequence.

	Method used to treat the <i>Batavia</i>'s silver 'rijksdaalders' and 'thalers'.
1	Coins chemically reduced in alkaline dithionite solution.
2	Coins rinsed and soaked in fresh water to remove alkaline dithionite solution.
3	Coins treated with 10% hydrochloric acid to dissolve calcareous concretion and copper corrosion products.
4	Coins may require a second or third treatment of alkaline dithionite solution and some mechanical cleaning (e.g. dental picks) if unwanted corrosion products persist.
5	Coins dried and dull coins may be brightened by polishing with a fiberglass brush and an acrylic or wax coating applied to inhibit tarnishing.

The correct order to treat coins in the process of restoration is

- (a) 1, 3, 4, 2, 5.
 (b) 2, 3, 1, 4, 5.
 (c) 3, 1, 4, 2, 5.
 (d) 1, 2, 3, 4, 5.
13. Why are introduced species detrimental to the marine environment?
- (a) People will fish for introduced species, rather than the native species, so the increased abundance of native species will cause a negative impact on the environment.
 (b) They are often effective competitors and out-compete native species for resources, thus decreasing the population of native species in a given area.
 (c) Introduced species are not able to survive in new areas with different species present because they are incapable of meeting their requirements in a foreign environment.
 (d) Introduced species are unable to integrate into an ecosystem, as they are not native to the area, so their presence is detrimental.

Questions 14 and 15 relate to the following diagram that identifies a coastal engineering structure at Snapper Rocks, Gold Coast, Queensland.



Coastal engineering structure at Snapper Rocks, Gold Coast, Queensland.

14. The engineering structure **best** described by the above diagram is a sand

- (a) bypass system.
- (b) budget system.
- (c) accretion system.
- (d) deposit system.

15. The engineering structure is a solution to sand

- (a) filtration.
- (b) balance.
- (c) accretion.
- (d) erosion.

16. Frank and Lisa were on the ocean comparing boats.

Frank was test-driving 'Boat A' and remarked to Lisa, "This boat is really light and hits the waves a little differently than the others!" Lisa agreed with Frank and added "as the bow digs in, the air collar makes contact, absorbing some of the impact to further slow the deceleration."

'Boat A' is which type of boat?

- (a) fishing boat
- (b) yacht
- (c) rigid inflatable boat
- (d) dive boat

17. What is the **best** method of relieving leg cramps while snorkelling/diving?
- (a) bend your knee and pull your heel backward to your body
 - (b) rotate your ankle in a clockwise direction
 - (c) pull the tip of the fin toward your chest
 - (d) keep moving, the pain will eventually go away
18. Alice was snorkelling at Rottneest Island on a calm day. She duck dived to investigate a sea urchin and then heard a loud reverberating noise like a boat's propeller. She became worried, as she could not tell which direction the noise was coming from. Alice resurfaced slowly, turning 360° on ascent, and when she surfaced, saw the boat was a safe distance away.
- Why couldn't Alice tell which direction the sound was coming from?
- (a) The direction of sound changes with the movement of water, making it difficult to hear sounds properly.
 - (b) The speed of sound is faster in water, so it is difficult to determine the direction of sound underwater.
 - (c) Because Alice is upside down and underwater, her eardrum has become distorted and therefore she is unable to hear properly.
 - (d) The water transmits sound more slowly than air, so what is heard is interpreted as confusing.
19. Which one of the following about Global Mean Sea Level (GMSL) is correct?
- (a) A rise in GMSL will cause the sea levels around the world to change uniformly as water is added via ocean thermal expansion and the melting of the glaciers.
 - (b) Ocean thermal expansion and the melting of glaciers are contributing to the rise in GMSL.
 - (c) The effect of rising GMSL will be felt during extreme storm conditions, when storm surges combine with lower sea levels to enable inundation and damaging waves to affect built infrastructure and natural ecosystems.
 - (d) Human activities, such as the burning of coal and oil, and deforestation, have increased the extent of the ozone layer. This insulating layer warms the atmosphere and this in turn melts the glaciers and adds water to the GMSL.
20. Which one of the following is considered an advantage of artificial reefs?
- (a) They provide shelter for marine organisms and increase the energy of waves approaching the shore (coastline protection).
 - (b) They attract smaller organisms, which are vital sources of food for different marine species, thus decreasing biodiversity of an area.
 - (c) They can be used to destroy existing rough bottom habitat, so that a quality fishing ground is developed close to access areas.
 - (d) They can generate social and economic benefits to the community by enhancing the local recreational experience and tourism opportunities.

End of Section One

See next page

Section Two: Short answer

50% (70 Marks)

This section has **six (6)** questions. Answer **all** questions. Write your answers in the spaces provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
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Suggested working time: 90 minutes.

Question 21

(6 marks)

Explain how coral reefs are important to the marine environment in the following contexts:

(a) coastal protection

(3 marks)

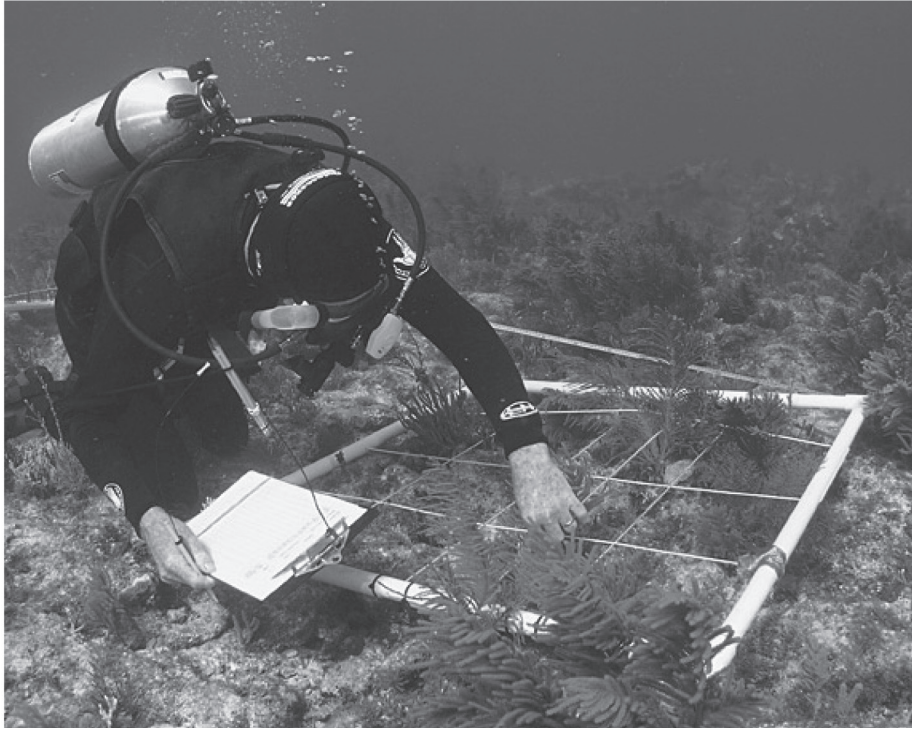
(b) establishment of associated ecosystems.

(3 marks)

Question 22

(5 marks)

The photograph below shows a diver conducting underwater research.



- (a) (i) List **two** methods that the diver might use to minimise sources of error when conducting such research. (2 marks)

One: _____

Two: _____

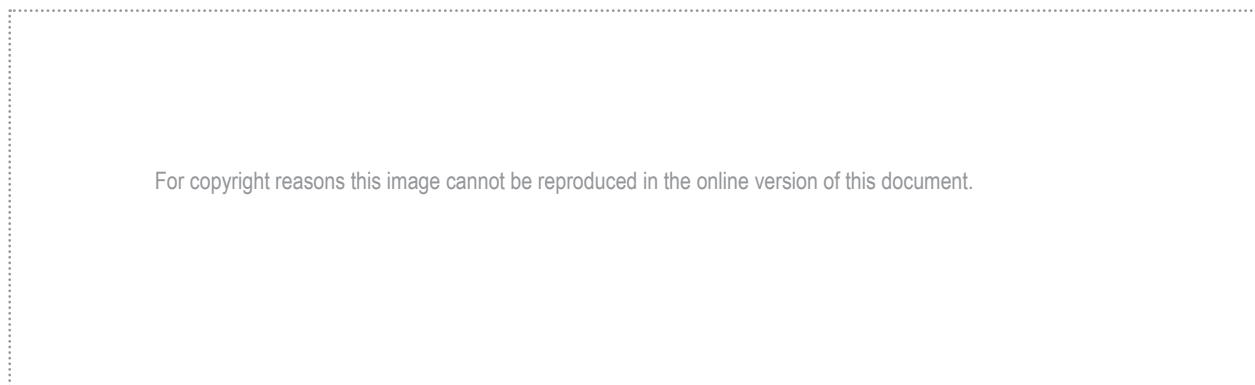
- (ii) State how **one** of these methods minimise experimental error. (1 mark)

- (b) In the photograph, you can see a piece of equipment that assists the diver to record the experiment. Explain how it contributes to the collection of data. (2 marks)

Question 23

(10 marks)

The diagram below shows a common science laboratory apparatus known as a Cartesian diver.



When the sides of the bottle are squeezed, the Cartesian diver descends through the water column. When the sides of the bottle are released, the diver returns to the surface.

(a) Explain, using the term **density**, what is happening to the air in the gas pocket as the diver:

(i) descends (2 marks)

(ii) ascends. (2 marks)

(b) Describe what happens to the buoyancy of an object as its density increases. (2 marks)

- (c) When in seawater, a snorkeller displaces a volume of 68 L. On land, she has a mass of 62 kg. Show your calculations to determine the upthrust force acting upon the snorkeller in the seawater. (4 marks)
- Note: Assume the density in seawater is approximately 1 kg/L.

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Question 24

(19 marks)

- (a) Describe in detail the relationship between corals and their zooxanthellae. (5 marks)

In mid-January 2011, the National Oceanic and Atmospheric Administration (NOAA) placed Ningaloo Reef on a Bleaching Alert. Bundegi Reef, in the northeastern section of the Ningaloo Marine Park, was severely affected by this episode and suffered visible coral bleaching.

- (b) State **two** factors that can cause coral bleaching. (2 marks)

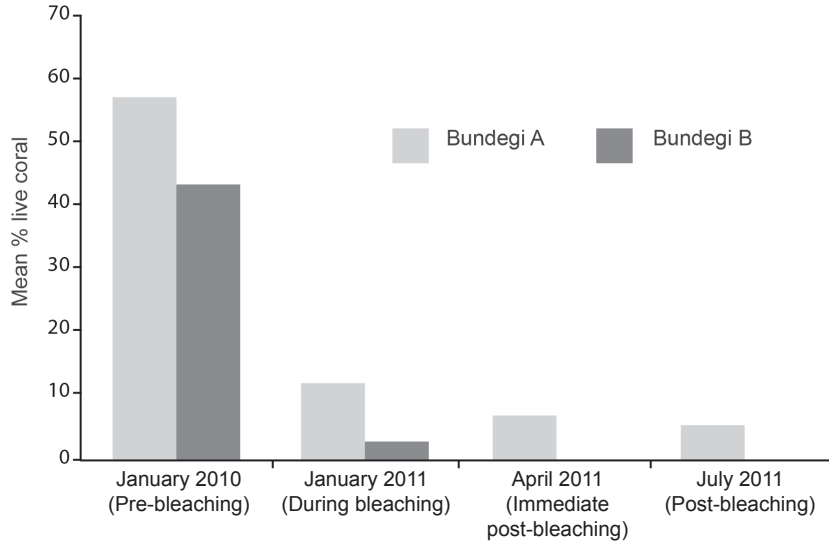
One: _____

Two: _____

- (c) Describe the steps involved in the coral bleaching process. (5 marks)

Scientists tracked coral cover at Bundegi Reef over an 18-month period and reported on the mortality and survival of coral colonies over this period. They conducted their study along two transect lines, Bundegi A and Bundegi B. The graph below summarises their results.

Mean percentage live coral cover at the two Bundegi sites over the 18-month period



- (d) Describe the changes in the percentage of live coral from January 2010 to July 2011 at the two locations. (5 marks)

- (e) Propose an explanation to account for the difference in the mean percentage live coral between the two locations (Bundegi A and Bundegi B) after bleaching. (2 marks)

Question 25

(10 marks)

(a) (i) What is a longshore current?

(3 marks)

(ii) What **two** features of a wave influence the strength of a longshore current?

(2 marks)

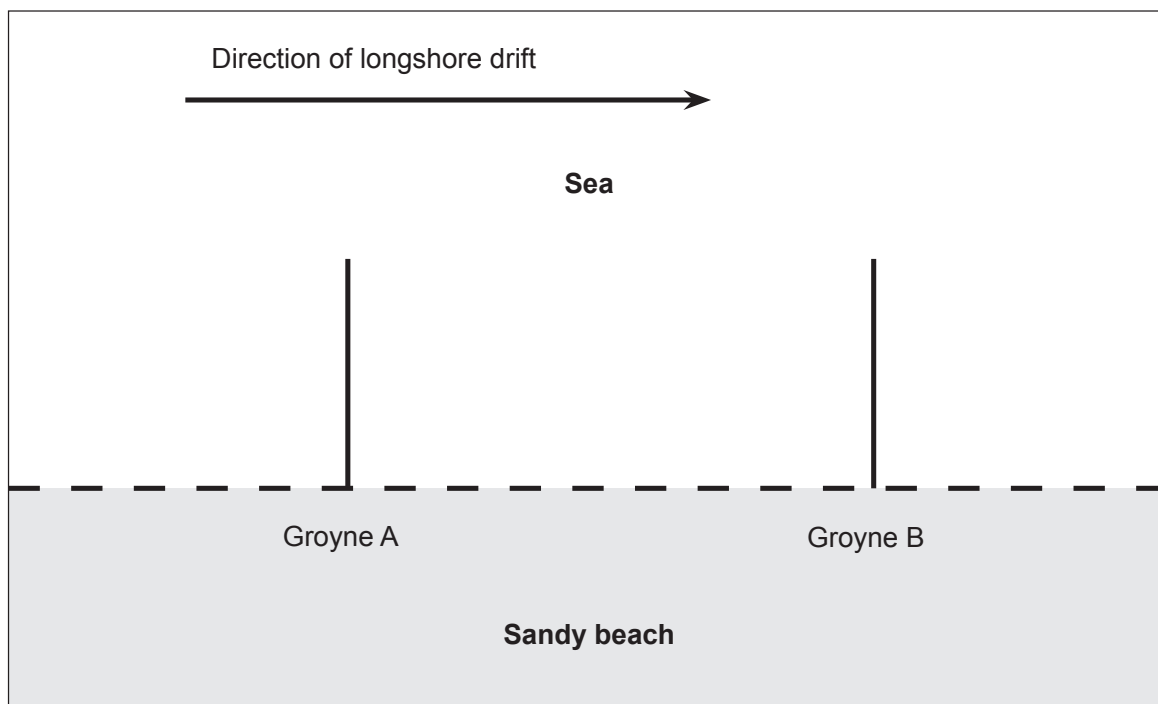
One: _____

Two: _____

(b) The diagram below represents the interaction between a longshore drift and an area of coastline with two groynes extending out to sea. Add fully annotated labels to show:

- areas of deposition
- areas of erosion
- direction of wavefront.

(5 marks)

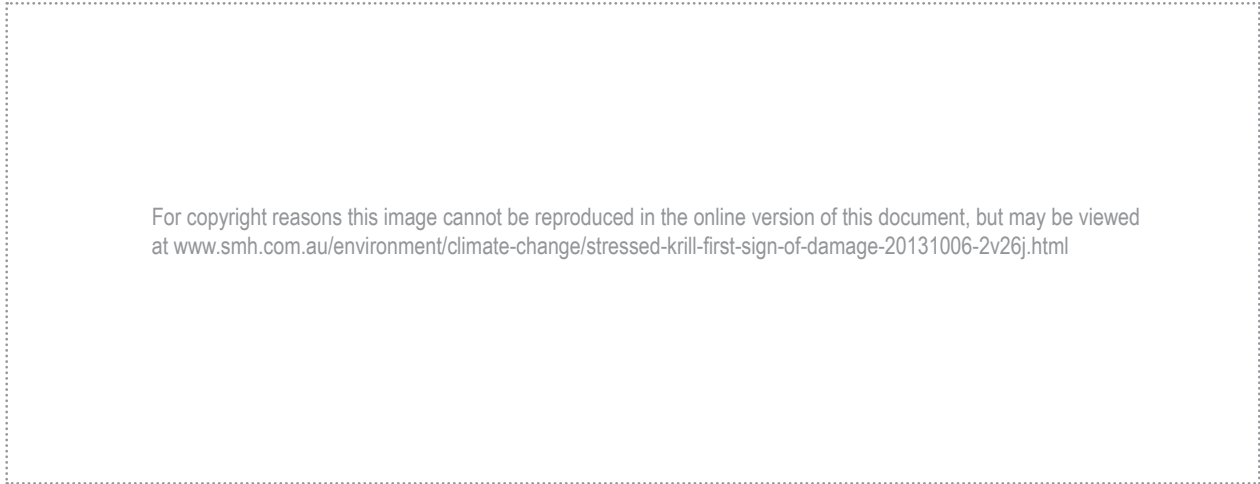


Question 26

(20 marks)

Krill are small marine crustaceans found throughout the oceans.

There are five species of krill found in Antarctic waters. The most dominant of these is the Antarctic krill, *Euphausia superba*. Below is a drawing of an Antarctic krill.



Antarctic krill, *Euphausia superba*.

- (a) Krill are considered as part of the zooplankton in the ocean.

To which category of plankton do they belong – Holoplankton or Meroplankton? Explain your answer. (3 marks)

Question 26 (continued)

(b) Antarctic krill are the 'keystone species' for most Southern Ocean food webs.

(i) Explain the term 'keystone species'. (2 marks)

(ii) What effect would an increase in krill numbers have on fish stocks in the Southern Ocean? Account for this effect. (2 marks)

(c) Antarctic krill have been commercially harvested for the past 35 years.

The fishing of Antarctic krill is managed by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), which involves 24 member countries and the European Union (EU).

Name and explain **two** controls that you would expect the CCAMLR to impose on fishing operators to minimise the impact that harvesting Antarctic krill would have on the surrounding ecosystem. (4 marks)

Control	Explanation
One:	
Two:	

(d) With increased scientific interest in the potential impacts of the enhanced greenhouse effect, in 2010, researchers examined how elevated carbon dioxide (CO₂) levels affected krill development, using samples from the Southern Ocean.

(i) State a significant effect of elevated atmospheric CO₂ levels in the ocean. (1 mark)

(ii) Explain how elevated CO₂ levels can affect a body of water such as the Southern Ocean. (4 marks)

(iii) The scientists found that elevated CO₂ levels in aquarium tanks led to the krill eggs failing to develop properly. Explain the long-term implications of this discovery for the Southern Ocean. (4 marks)

End of Section Two

See next page

Section Three: Extended answer**30% (50 Marks)**

This section contains **four (4)** questions. You must answer **two (2)** questions. Write your answers on the lined pages provided following Question 30.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 70 minutes.

Question 27**(25 marks)**

In 1946, those countries involved in whaling signed an international treaty, the International Convention for the Regulation of Whaling (ICRW). The body formed to implement the ICRW was called the International Whaling Commission (IWC).

- (a) What is the main duty of the IWC and how does it meet this responsibility? (4 marks)
- (b) Describe **four** ways in which human interactions during whale watching are managed. (4 marks)
- (c) Southern Right Whales are currently listed as endangered under the Commonwealth *Environment Protection and Biodiversity Act (1999)* because they have undergone a severe reduction in numbers as a result of commercial whaling.

One of the actions listed in the Conservation Management Plan for the Southern Right Whale is to 'measure and monitor population recovery'.

Design a study that could be used to estimate the rate of recovery for this species. Your answer should include reference to an aim, methods to be used and a discussion of the implications of possible results. (10 marks)

- (d) Using environmentally based reasoning, write a letter to the Australian Government explaining why you believe that cetaceans need to be globally protected. (7 marks)

Question 28

(25 marks)

On a clear, sunny and calm day, Wrecks-R-Us were working on a shipwreck as salvage operators. A wave came unexpectedly and washed an expensive dive camera off the back of the boat. Diver Dan was ordered by the captain to go into the water and retrieve the camera, which had sunk to a depth of 23 m.

- (a) What pressure would be exerted on Diver Dan's body at a depth of 23 m if the pressure at the surface was 1 atm? Show your working. (3 marks)
- (b) An air bubble was trapped in the damaged waterproof casing of the dive camera. What would be the volume of this air bubble at a depth of 23 m, if it had a volume of 25 mL at the surface? Show your working. (4 marks)
- (c) Diver Dan snorkelled to the seafloor to retrieve his camera. His lung volume was 1.1 L at 23 m. What was the volume of his lungs when he returned to the surface? Show your working. (4 marks)
- (d) (i) Unfortunately, Diver Dan dropped the camera on his ascent and it landed on a rocky ledge at 15 m. The casing for the camera had rainbow stripes along both sides. When he reached the camera on his second dive, what colours could he still see on the side of his camera? (The colours of the rainbow include red, orange, yellow, green, blue, indigo and violet.) (4 marks)
- (ii) Explain why Diver Dan couldn't see all of the colours of the rainbow at 15 m. (2 marks)
- (e) Name **two** types of barotraumas. Describe their signs and symptoms and explain what techniques Diver Dan could use to avoid them while diving. (8 marks)

Question 29

(25 marks)

(a) The following equipment is used to locate shipwrecks:

- magnetometer
- side scan sonar
- remotely operated vehicle (ROV).

(i) Describe how each of these pieces of equipment is used to locate a shipwreck.

(9 marks)

(ii) For each piece of equipment, explain the scientific principle behind its use.

(6 marks)

(b) Over four seasons of work, many artefacts were recovered from the wreck of the *Batavia*.

Name **two** methods that were used to recover artefacts and for each method:

(i) describe the science behind its use

(6 marks)

(ii) explain how it was used to recover named artefacts from the *Batavia*.

(4 marks)

Question 30

(25 marks)

In 2003, researchers noticed that children from the Moken people, who live along the Burmese archipelago and Thailand's western coast, were capable of seeing small objects underwater without the aid of goggles. As nomadic seafarers, the Moken people are renowned for their swimming and diving skills. Traditionally, they have depended on marine resources – male adults spear fish, while children dive for clams and sea cucumbers.

(a) Using clearly annotated diagrams of the eye, suggest how it is possible that the Moken children can see twice as clearly underwater as European children of the same age.

(10 marks)

(b) The researchers used a number of different black and white patterns to test the children's sharpness of vision underwater. Design an experimental method that could be used to compare the Moken children with visiting European children.

Your answer should include reference to an hypothesis, the independent, dependent and controlled variables, and a possible method of conducting the research. (10 marks)

(c) Outline the methods used to prepare, fit and care for a face mask used while snorkelling.

(5 marks)

End of questions

ACKNOWLEDGEMENTS

Section One

- Question 2** Image adapted from: *Hand signals and underwater communication* [Image]. (n.d.). Retrieved April, 2014, from www.reefscuba.com/Handsignals.htm
- Question 6** Image of an estuarine environment adapted from: BBC. (n.d.). *GCSE bitesize: Science: Problems and solutions in the environment: Pollution*, p. 4. Retrieved April, 2014, from www.bbc.co.uk/schools/gcsebitesize/science/edexcel/problems_in_environment/pollutionrev4.shtml
- Question 8** Image of feeding relationship in an estuarine environment adapted from: Environment Canada, & United States Environmental Protection Agency. (1995). *The Great Lakes: An environmental atlas and resource book* (3rd ed.). Toronto, ON: Government of Canada; & Chicago, IL: United States Environmental Protection Agency, chapter 4. Retrieved April, 2014, from www.epa.gov/greatlakes/atlas/glat-ch4.html
- Question 10–11** Graphs of mean rate of fishing mortality and spawning potential ratio for Snapper adapted from: *Key findings of the 2013 West coast demersal scalefish resource stock assessment* (Fisheries Management Paper no. 262). (2013, November). Perth: Department of Fisheries, p. 25. Retrieved April, 2014, from www.fish.wa.gov.au
- Questions 14–15** Adapted image of coastal engineering structure at Snapper Rocks, Gold Coast, Queensland from: TRESBP. (2012). *TRESBP fact sheet 2*. New South Wales: TRESBP, p. 1. © State of New South Wales through Department of Trade and Investment, Regional Infrastructure and Services. Retrieved April, 2014, from http://nickchengsgeoblog.blogspot.com.au/2011_03_01_archive.html

Section Two

- Question 22** Diver conducting underwater research [Image]. (n.d.). In *Damage Assessment, Remediation, and Restoration Program*. (n.d.). *Monitoring techniques*. Photograph courtesy of National Oceanic and Atmospheric Administration. Retrieved March, 2014, from www.darrp.noaa.gov/partner/coral/monitoring.html
- Question 23** Image of Cartesian diver experiment adapted from: Becker, B. (2001, February). Cartesian divers: Squeeze play, 6. *ChemMatters*, 19(1), 4-6.
- Question 24(d)–(e)** Data source: Depczynski, M., Gilmour, J.P., Ridgway, T., Barnes, H., Heywards, A.J., Holmes, T.H., ... & Wilson, S.K. (2013). Bleaching, coral mortality and subsequent survivorship on a West Australian fringing reef. *Coral Reefs*, 32, 233–238.

Question 26

Kindersley, D. (n.d.). *Antarctic krill*, *Euphausia superba* [Image]. In Darby, A. (2013, October 7). Stressed krill first sign of damage. *Sydney Morning Herald*. Retrieved March, 2014, from www.smh.com.au/environment/climate-change/stressed-krill-first-sign-of-damage-20131006-2v26j.html

Section Three**Question 27**

Information from: Department of Sustainability, Environment, Water, Population and Communities. (2012). *Conservation management plan for the Southern Right Whale: A recovery plan under the Environment Protection and Biodiversity Act 1999: 2011–2021*. Canberra: Commonwealth of Australia, pp. 6–7, 14. Retrieved March, 2014, from www.environment.gov.au/resource/conservation-management-plan-southern-right-whale-recovery-plan-under-environment

Question 30

Information from: Horstman, M. (2003, June 20). Asian child divers see better underwater. *ABC Science Online*. Retrieved February, 2014, from www.abc.net.au/science/articles/2003/06/20/881750.htm

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