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

MARINE AND MARITIME STUDIES

ATAR course examination 2018

Marking Key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

2018/61750

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

Question	Answer
1	a
2	d
3	c
4	d
5	a
6	a
7	d
8	c
9	b
10	a
11	b
12	d
13	c
14	b
15	a
16	a
17	c
18	a
19	b
20	b

Section Two: Short answer **50% (97 Marks)**

Question 21 **(19 marks)**

(a) Explain how ocean acidification is related to the enhanced greenhouse effect. (3 marks)

Description	Marks
Explanation including the following:	
Both caused by increasing CO_2	1
CO_2 dissolves in water/seawater	1
Dissolved CO_2 lowers pH/increases acidity	1
Total	**3**

(b) Describe **three** direct consequences for marine organisms from this process of ocean acidification. (6 marks)

Description	Marks
For three:	
Describes a direct consequence	2
States a direct consequence	1
Total	**6**
Answers may include but are not limited to the following points:	
• thinning of shells in organisms/acid dissolves $CaCO_3$ ions of shells • loss of limestone from reefs due to carbonate and acid reaction • decreased growth of reef-building corals and coralline algae, which are the foundation of coral reef ecosystems due to carbonate and acid reaction • shifts in species composition and distribution due to shifts in pH distribution • changes in the neurological functioning of fish due to effects of pH on physiology • altered reproductive health, growth and physiology of organisms due to effects of pH on physiology • changes in food-web structure due to loss of corals and coralline algae	
Accept any other relevant answers	

(c) Give **two** reasons why Western Australia's Leeuwin Current would have only a mild effect on pH distribution. (4 marks)

Description	Marks
For two:	
Reason explained	2
Reason stated	1
Total	**4**
Answers may include but are not limited to the following:	
• Shallow current causes little mixing • Weak current causes limited water distribution • Flows North to South resulting in decreasing pH • Close to coast affecting only narrow band of ocean water • Very little difference in pH where it originates causing little effect on pH	
Accept any other relevant answers	

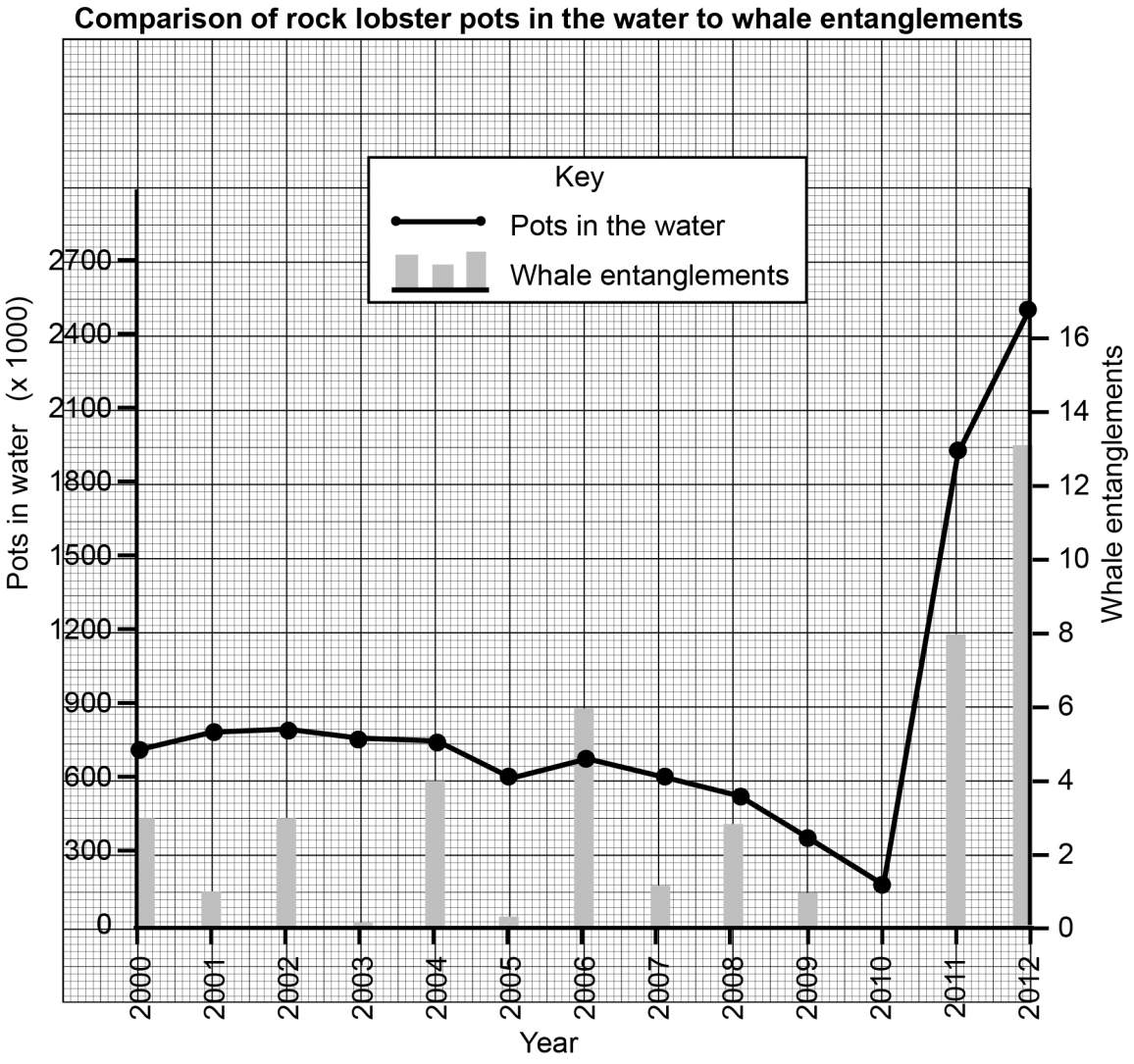
(d) Explain briefly the process of anthropogenic greenhouse effect and explain how it results in changes to global sea levels. (6 marks)

Description	Marks
Explanation incorporates the following points:	
Process:	
Increased CO_2 in the atmosphere (produced by anthropogenic means)	1
Causes incoming infrared radiation to stay/be trapped in the atmosphere	1
Causes atmospheric temperatures to increase	1
Subtotal	**3**
Result:	
Temperature absorbed by ocean	1
Increased thermal expansion of water	1
Melting of ice (and snow) over the land	1
Subtotal	**3**
Total	**6**
Accept any other relevant answers	

Question 22 **(16 marks)**

(a) Graph both of these sets of data on the grid below representing pots in the water as a line graph and whale entanglements as a column graph. (8 marks)

Description	Marks
Graph should show the following points:	



Title	1
Appropriate scale used for each set of data	1–2
Half or more of grid used	1
Points are joined for pots in the water	1
Correct use of column graph for whale entanglements	1
Appropriate keys for pots and entanglements	1–2
Total	**8**

(b) Write a hypothesis that the scientists may have been investigating. (2 marks)

Description	Marks
2 marks if answer shows relationship. 1 mark if answer shows a link only.	
Independent variable related to dependent variable	1–2
Example: Increased rock lobster pots changes whale entanglements (1 mark) Example: Increased rock lobster pots increases whale entanglements (2 marks)	
Total	**2**

(c) Identify **two** sources of error that could occur in the collection of this data. (2 marks)

Description	Marks
Any two of the following:	
• Insufficient reporting of data resulting in data missed in the report • Entangled animals may have died and sunk resulting in data missed in the report • Escaped after brief entanglement resulting in animals not being seen to be included in report	1–2
Total	**2**
Accept any other relevant answers.	

(d) State a conclusion that may be drawn from the data and support your conclusion. (2 marks)

Description	Marks
1 mark for the conclusion and 1 mark for the support of statement	
Increased pots in the water have resulted in increased whale entanglements – the largest number of entanglements have occurred with the largest number of pots in the water in 2012.	1–2
Total	**2**
Accept any other relevant answers.	

(e) List **two** rules for in-water human interactions to further protect whales. (2 marks)

Description	Marks
Any two of the following for 1 mark each:	
• no entering water within 100 m • not intentionally make any noise to attract • touching or feeding not allowed • number of people in water with them • number of boats close by • not hamper progress	1–2
Total	**2**
Accept any other relevant answers.	

Question 23 **(16 marks)**

(a) Describe why coral reefs are considered important to the marine environment? (2 marks)

Description	Marks
Describes why coral reefs are important	2
States why coral reefs are important	1
Total	**2**
Answers may include but are not limited to: • protection of coastlines from storms/waves • habitats and shelter for organisms • a source of nutrients in food chains	
Accept any other relevant answers.	

(b) Explain what occurs to the cells of coral during a bleaching event. (6 marks)

Description	Marks
Explanation incorporates the following points:	
Coral cells detect a trigger	1
Zooxanthellae inside cells produce waste/toxins	1
Zooxanthellae expelled/leave the coral cell	1
Coral cell appears white	1
Coral has decreased nutrients	1
Cell dies/Zooxanthellae may return if triggers removed	1
Total	**6**
Triggers include: • increased water temperature (most commonly due to global warming), or reduced water temperatures • increased solar irradiance • increased sedimentation • bacterial infections • changes in salinity • herbicides • extreme low tide and exposure • elevated sea levels due to global warming • mineral dust from dust storms • pollutants such as common sunscreen ingredients that are non-biodegradable and can wash off of skin • ocean acidification due to elevated levels of CO_2 caused by air pollution.	
Accept any other relevant answers.	

Question 23 (continued)

(c) Other than increases in ocean temperature and acidification, describe **two** causes for the coral bleaching at the Houtman Abrolhos Islands. (4 marks)

Description	Marks
2 marks for comprehensive description and 1 mark for limited description. Any two of the following causes:	
• increased solar irradiance – causes stress to the coral	1–2
• increased sedimentation – causes stress to the coral	1–2
• bacterial infections – causes stress to the coral	1–2
• changes in salinity – causes stress to the coral	1–2
• herbicides – causes cellular damage	1–2
• extreme low tide and exposure – causes damage to coral cells	1–2
• elevated sea levels due to global warming – causes increased depth and reduction in light levels	1–2
• mineral dust from dust storms – reduces light reaching the zooxanthallae	1–2
• pollutants such as common sunscreen ingredients that are non-biodegradable and can wash off of skin – causes damage to the coral cells	1–2
Total	**4**

(d) Describe **two** consequences of losing the coral reef at the Houtman Abrolhos Islands. (4 marks)

Description	Marks
2 marks for comprehensive description and 1 mark for limited description. Any two of the following:	
• loss of local species (e.g. lobster) resulting from loss of habitat	1–2
• loss of source of nutrients in food chains as a result of loss of corals primary production	1–2
• reduction in employment opportunities due to species loss (Department of Fisheries)	1-2
Total	**4**

Question 24 **(17 marks)**

(a) What is the historical cause for so many bones being recovered from the Islands that are attributed to the *Batavia* wreck? (3 marks)

Description	Marks
Shipwreck left mutineers	1
Mutineers killed other survivors	1
These bodies were buried	1
Total	**3**

(b) Describe **two** survey methods that would have enabled Donohue to draw this diagram. (4 marks)

Description	Marks
2 marks for full description and 1 mark for brief description. Any two of the following methods:	
• photography – allows items to be placed exactly on the drawing	1–2
• transects – allows a grid to be drawn for placement of items	1–2
• quadrats – allows exact placement of items along transects	1–2
• sonar – allows the mapping of the area from the surface	1–2
• magnetometer – allows placement of metal items from the surface	1–2
Total	**4**

(c) Compare the recovery of the 32 coins (in the centre of the vessel) with that of the building blocks. (4 marks)

Description	Marks
Coins are small and building blocks big	1
Coins can be brought to surface by hand/catch bags/by divers	1
Building blocks needed to be brought to surface by lift bags	1
Blocks also brought to surface by drums and larger bags	1
Total	**4**

Question 24 (continued)

(d) (i) Explain how the timbers were treated immediately following removal and why they had to be treated. (2 marks)

Description	Marks
Explanation includes:	
Kept in sea water	1
Slows down decay when exposed to other environments	1
Total	**2**

(ii) Identify **two** steps that could be taken to protect the timbers for longer periods of time. (2 marks)

Description	Marks
Slowly remove and replace sea water with fresh	1
Replace water with waxes/PEG	1
Total	**2**

(iii) In some cases the timbers were left untreated and in water. Describe a non-destructive method that could be used to preserve the information that the timbers provide to archaeologists. (2 marks)

Description	Marks
2 marks for comprehensive description and 1 mark for limited description.	
Limited – X-ray/ultrasound	1
Comprehensive – X-ray/ultrasound used to image the interior of the object	2
Total	**2**

Question 25 **(18 marks)**

(a) Name this method and describe the steps used to perform it. (3 marks)

Description	Marks
Blast method	1
Any two steps as below:	
• at the surface keep head level • blast air from the mouth • forcing water and air out of snorkel	1–2
Total	**3**

(b) Name and describe another method that can be used to clear a snorkel. (3 marks)

Description	Marks
Displacement method	1
Description includes the following two points:	
Approaching surface tilt head to look upwards	1
Push air into snorkel	1
Total	**3**

(c) Name **two** parts that are added to a modern snorkel to reduce water inside the barrel and state how each part works. (4 marks)

Description	Marks
1 mark for part, 1 mark for function:	
Purge valve Allows water to drain from the snorkel	1–2
Dry top/dry valve/guard Prevents water getting into snorkel/allows water to drain instead of entering snorkel	1–2
Total	**4**

Question 25 (continued)

(d) (i) Explain how anti-fogs are used to prevent masks from fogging while in use. (4 marks)

Description	Marks
Description includes the following points:	
Applied directly to the interior of the glass	1
Stops condensation/water from warmer air meeting cooler glass	1
Act as a surfactant	1
Reduces surface tension	1
Total	**4**

(ii) Describe the steps a snorkeller should take when fitting a mask to stop it from flooding. (2 marks)

Description	Marks
Description includes the following points:	
Ensure correct fit	1
Ensure no hair/objects between skirt and face	1
Total	**2**

(iii) Describe the steps a snorkeller would take while under water to clear a partially-flooded mask. (2 marks)

Description	Marks
A full description that includes any two of the following points:	
• tilt head upwards • hold top of skirt closed/against face • breathe out through nose to push air into mask and water out	1–2
Total	**2**

Question 26 **(11 marks)**

(a) State Boyle's Law. (3 marks)

Description	Marks
Statement includes the following points:	
Pressure of a gas	1
Is inversely proportional to its volume	1
At a constant temperature	1
Total	**3**

(b) Explain the relevance of Boyle's Law to divers. (4 marks)

Description	Marks
Explanation includes the following points:	
As depth increases, pressure increases (and decreases ascending)	1
Therefore as depth increases the volume inside the lungs/body decreases (and increases ascending)	1
Expanding and contracting gases cause issues/damage to the human body	1
Such as bends/decompression sickness/barotraumas	1
Total	**4**

(c) Define a barotrauma and give **one** example of this diving problem. (4 marks)

Description	Marks
Definition includes the following points:	
A barotrauma is a pressure related injury	1
Caused by expanding or contracting gases	1
Causing physical damage	1
Example given	1
Total	**4**
Examples might include: • ear barotrauma – damage to ear drum or cochlea • squeeze – mask/tooth/sinus damaged by expanding air • pulmonary barotrauma – lungs damaged.	
Accept any other relevant answers.	

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

Question 27 **(20 marks)**

(a) Explain **two** ways in which this system aims to prevent new pests arriving in Australia via shipping and the aquarium trade. (8 marks)

Description	Marks
Explanation of how to prevent pests from arriving on ships	4
Substantial description of how to prevent pests from arriving on ships	3
Limited description of how to prevent pests from arriving on ships	2
Statement about how to prevent pests from arriving on ships	1
Subtotal	**4**
Explanation of how to prevent pests due to aquarium trade	4
Substantial description of how to prevent pests due to aquarium trade	3
Limited description of how to prevent pests due to aquarium trade	2
Statement about how to prevent pests due to aquarium trade	1
Subtotal	**4**
Total	**8**

Answers might also include:
Shipping:
- Ballast water removal and treatment removes pests before they enter waterways closer to the coast
- Biofouling management and treatment removes the ability for pests to attach to hulls and therefore arriving

Aquarium:
- Aquarium organism quarantine allows time for disease and issues to present themselves before releasing for purchase
- Aquarium organism treatment prevents disease from arriving with aquarium species
- Destroying/removing aquarium organisms safely, i.e. not in local waters prevents them from entering local waters.

(b) Explain **two** pieces of information that would need to be known about the marine organism itself. How would this information be used to minimise further issues with it?

(5 marks)

Description	Marks
For two:	
1 mark for each piece of information and 1 mark for how that is related to being important.	1–2
Subtotal	**4**
Development of response plan for future occurrences (explanation of response plan accepted)	1
Total	**5**
Information that may be required may include:	
• taxonomy – providing structural information to be used to treat the pest • known distribution (global/Australian, native/non-native) – allowing information about where they can be found and what they may be affecting • life history – providing details about stages and dispersal of the pest • ecology – providing information about what other animals may interact with the pest • environmental tolerances – allowing for treatments based upon what they cannot tolerate • potential impact – providing information about what organisms will be affected and developing a triage system of impact	
Accept any other relevant answers.	

(c) Explain what information would be required to determine the method to be used to minimise the spread and impact of pests once established. Describe **two** methods that might be used to remove established populations. (7 marks)

Description	Marks
Information	
Explanation of information required to minimise the spread and impact of pests	3
Description of information required to minimise the spread and impact of pests	2
Statement of information required to minimise the spread and impact of pests	1
Subtotal	**3**
Method (2 methods × 2 marks each)	
Describes a method of removing established populations	2
States a method of removing established populations	1
Subtotal	**4**
Total	**7**

Answers might include:

- the pathways and vectors by which the species may be spread
- methods to prevent spread of the organism
- methods for undertaking surveys to:
  - delimit established populations
  - trace an incursion
  - monitor the effectiveness of management measures

- methods of removal
  - physically removing by person – person picks up and removes pest
  - Mechanical removal by using underwater vacuum, suction and filtering systems/water blasting
  - trapping by capturing the pest
  - ecological control by using natural predators
  - changing water parameters by manipulating water level /Salinity/shading/heat treatments
  - wrapping and encapsulating artificial structures allows the organism to be isolated
  - smothering removes oxygen for the pest
  - chemical control such as by adding toxins/direct chemical injection/lime treatment/poison baits and barriers/salinity to kill the pests

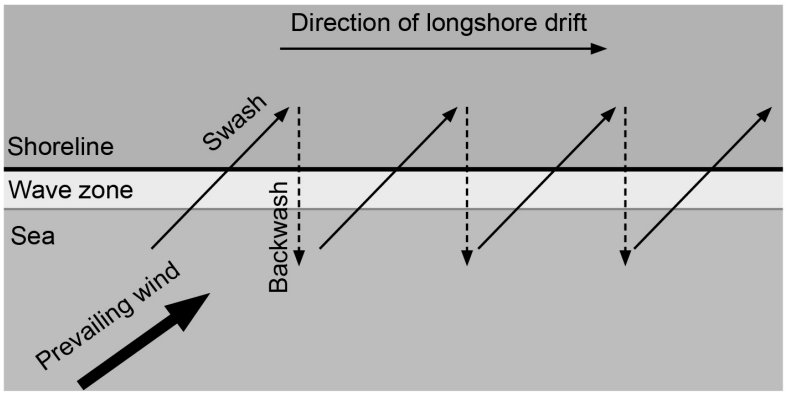
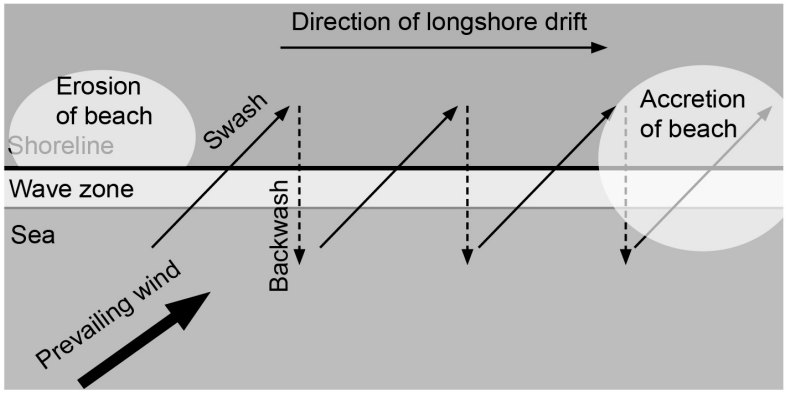
Accept any other relevant answers.

Question 28 **(20 marks)**

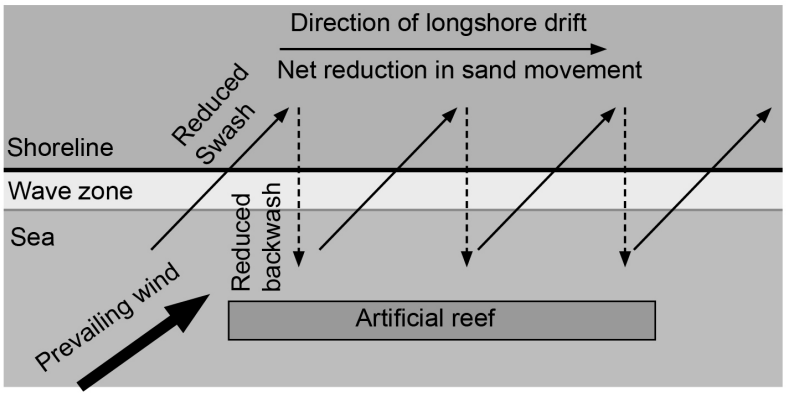
(a) Name **three** community groups that would benefit from the artificial reefs and state how they would benefit. (6 marks)

Description	Marks
1 mark for each group and 1 mark for how they would benefit.	
Each community group named	1–3
Correct benefit stated for each group	1–3
Total	**6**
Answers might include: • fishers – reef attracts fish • tourists – reef provides venue to visit • business – reef and surrounds attracts visitors.	
Accept any other relevant answers.	

(b) Use diagrams to explain the process of longshore drift and the accreting and eroding of beaches. (8 marks)

Description	Marks
Longshore drift explanation and diagram include the following components:	
Has a diagram	1
Explanation direction of drift Includes:	
Swash/backwash interaction	1
Prevailing wind causing swell	1
A zig-zag movement of sand.	1
	
Accreting and eroding beaches explained with diagram including the following:	
Has a diagram	1
Explanation accretion at one point includes:	
Accretion as build-up of sand	1
Erosion as removal of sand	1
Shows a similar amount of sand accreted as eroded.	1
	
Total	**8**

(c) Draw a diagram to explain how an artificial reef placed horizontal to the shore could be used as a means of reducing coastal erosion. (6 marks)

Description	Marks
A diagram with an explanation that includes the following components:	
Has a diagram	1
Explanation involves longshore drift	1
Shows horizontal placement of artificial reef	1
Reduced swash	1
Reduced backwash	1
Reduced net reduction in sand movement	1
	
Total	**6**

Question 29 **(20 marks)**

(a) Describe **three** methods that Mr Ballard may have used to locate the wreck of *HMAS Canberra*. (9 marks)

Description	Marks
For each method below – 3 marks for a comprehensive description for each method 2 marks for a limited description for each 1 mark for stating a piece of method only.	
Three methods of locating the shipwreck described	1–9
Total	**9**
Answers might include: • historical records – using ships logs/journal accounts/ newspaper reports to reduce search area • magnetometer – measures magnetic field fluctuations/towed behind ship/creates image of seafloor • sonar – Measures depth of ocean/ from bottom of boat/creates image of seafloor • ROV/Camera – Takes footage/ towed behind ship/gets viewed to see directly what exists there • local knowledge – locals able to relate local knowledge/information relevant to the wreck or area to reduce search area	
Accept any other relevant answers.	

(b) Describe how the process of photogrammetry is carried out and how it can be used as a method of preservation. (5 marks)

Description	Marks
3 marks for a comprehensive description 2 marks for a limited description 1 mark for stating a piece of information only	
Description of photogrammetry process	1–3
Use as a means of preservation	1–2
Total	**5**
Answers might include: • the science of making measurements from photographs, especially for recovering the exact positions of surface points. • photographs used to determine size, shape, and position of photographic features • these allow size to be determined and with GPS coordinates provide a 3D model • allows the wreck to be left in-situ • a 3D model/image can be used of the wreck site for archaeological processes.	
Accept any other relevant answers.	

Question 29 (continued)

(c) Explain the processes of 'natural degradation' that would be occurring on the steel sections of the wreck and state **three** methods that could be used to stabilise them.

(6 marks)

Description	Marks
Explanation of natural degradation of iron includes points below	1–3
3 marks for a comprehensive explanation of degradation 2 marks for a brief explanation of degradation 1 mark for a relevant statement about degradation	
Subtotal	**3**
Three methods to stabilise 1 mark each	1–3
Subtotal	**3**
Total	**6**
Degradation • iron corrodes/rusts/formation of iron oxide • combines with oxygen • results in the metal being removed and unstable structure remaining • accelerated in most marine conditions	
Stabilisation any three of:	
• anodes (adding anodes will allow them to be reduced rather than the wreck) • remove dissimilar metals (reduces corrosion rate) • cover the metal (reduces contact with oxygen) • leave them untouched (they reach equilibrium if undisturbed) • remove organisms (organisms can enhance erosion rate)	
Accept any other relevant answers.	

Question 30 **(20 marks)**

(a) State which type of plankton might be represented by this series of images. For what reasons and benefits might this migration pattern occur? (6 marks)

Description	Marks
Zooplankton	1
Comprehensive reasons or benefits stated for vertical migration	5–4
Partial reasons or benefits stated for vertical migration	3–2
Limited reasons or benefits stated for vertical migration	1
Answers may include any of the following • avoid predators during the day • feed at night • respond to noise • avoiding damaging UV light • allows ability to feed without being predated • safety in numbers.	
Subtotal	**5**
Total	**6**
Accept any other relevant answers.	

(b) Explain how another type of plankton would show a different migration pattern to that shown in the image above and why that difference would exist. (4 marks)

Description	Marks
Phytoplankton (answer required)	1
Any three of the following points	
• require light for photosynthesis • surface during the day • so travel in opposite direction • or don't travel at all	1–3
Total	**4**

(c) Explain the characteristics of the Leeuwin and West Australian currents and how both affect the movement of plankton along the Western Australian coast. (10 marks)

Description	Marks
Any four of the following points:	
Leeuwin • warm ocean current • shallow ocean current • flows north to south along Western Australia's coastline • varies in strength/weak in summer/strong in winter • nutrient poor • driven by pressure gradient/higher water levels at equatorial area • close to coast	1–4
Any three of the following points:	
West Australia Current (or Western Australian Current) • cold surface current • flows south to north • nutrient rich • further out to sea	1–3
Answer must include the following three points:	
• Leeuwin current brings phytoplankton down from tropics • West Australian current brings zooplankton from Antarctic • mixing of nutrient-rich waters at eddies distributes nutrients	1–3
Total	**10**

ACKNOWLEDGEMENTS

Question 21(b) Text under 'Answers may include but are not limited to the following points' (3rd to 7th dot points) from: Evans, K., Bax, N. J., & Smith, D. C. (2016). *Climate change: Marine environment (2016)*. Retrieved September, 2018, from https://soe.environment.gov.au/theme/marine-environment/topic/2016/climate-change
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Question 23(a) Text under 'Answers may include but are not limited to' (all dot points) information from: Queensland Museum (n.d.). *Human Impact of the Reef*. Retrieved September, 2018, from http://www.qm.qld.gov.au/microsites/biodiscovery/05human-impact/importance-of-coral-reefs.html
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Question 27(c) Text under 'Answers might include' Information from: Commonwealth of Australia. (2015). *Australian Emergency Marine Pest Plan Rapid Response Manual Generic Manual*. Retrieved September, 2018, from http://www.agriculture.gov.au/SiteCollectionDocuments/pests-diseases-weeds/marine-pests/empplan-rapid-response-manual-generic.pdf
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Question 29(b) Text under 'Answers might include' (1st dot point) from: Photogrammetry. (2018). In *Wikipedia*. Retrieved September, 2018, from https://en.wikipedia.org/wiki/Photogrammetry
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