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

MARINE AND MARITIME STUDIES

ATAR course examination 2021

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.

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

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

Section Two: Short answer **50% (99 Marks)**

Question 21 **(16 marks)**

(a) Complete the following table by identifying the missing information. The first row has been completed as an example. In the '(In)famous' box there may be more than one possible response. Only **one** response is required for each box. (6 marks)

Description	Marks
For each response	
States correct response (one mark per box)	1–6
Total	**6**

Person's Family name	Position on Batavia	(In)famous for
(Gijsbert) Bastiaensz	Preacher	Kept detailed diary of mutiny events that occurred.
Pelsaert	Commander/Senior Merchant	**Any one of** • **control of fleet** • **initially camped on Traitor's Island** • **sailed to Batavia (now Jakarta) to get help** • **punished mutineers** • **carried out rescue**
(Adrian) Jacobsz	**Ship's Captain /Skipper**	**Any one of** • **on watch when ran aground** • **arrested in Jakarta for negligence** • **conspired with Cornelisz prior to the wrecking**
(Jeronimus) **Cornelisz**	Under Merchant	Stayed on board the wreck until last minutes before the ship broke up.
(Wiebbi) Hayes	**Soldier**	Informed Pelsaert of mutiny and massacres.

(b) Outline the process involved in the degradation of iron objects found on the Batavia shipwreck. (4 marks)

Description	Marks
Outlines the following process	
Erosion (through sand and water movements)	1
React with chloride/salts	1
Corrosion/formation of rust or iron compounds	1
Iron compounds unstable (and so easily removed while in the water)	1
Total	**4**
Accept other relevant answers.	

Question 21 (continued)

(c) Describe the processes that would be carried out to preserve/restore iron objects on the Batavia shipwreck in the laboratory. (6 marks)

Description	Marks
Describes any **three** (maximum two marks each) of the following processes: • x-ray artefact – to reveal the state of the contained iron object • remove concretions by mechanical methods (e.g. scraping) and using weak acids to remove $CaCO_3$ • keep in sea water until ready to remove salts to avoid further degradation • remove salts (from the object) by reducing the concentrations of salts of the solution the object is immersed in, until placed in pure water • electrolysis – use electrodes (cathodes) to reduce oxides to iron metal • remove oxygen contact as much as possible to avoid further degradation • reduce contact with dissimilar/less reactive metals to avoid increasing the rate of corrosion • coat with wax or other corrosion inhibitor to avoid further degradation and protect for display.	1–6
Total	**6**
Accept other relevant answers.	

Question 22 **(20 marks)**

(a) Identify the independent and dependent variables in this hypothesis. (2 marks)

Description	Marks
Independent variable: distance from shore	1
Dependent variable: phytoplankton numbers	1
Total	**2**

(b) Outline **one** possible experimental method that could be used for testing the hypothesis from part (a). (4 marks)

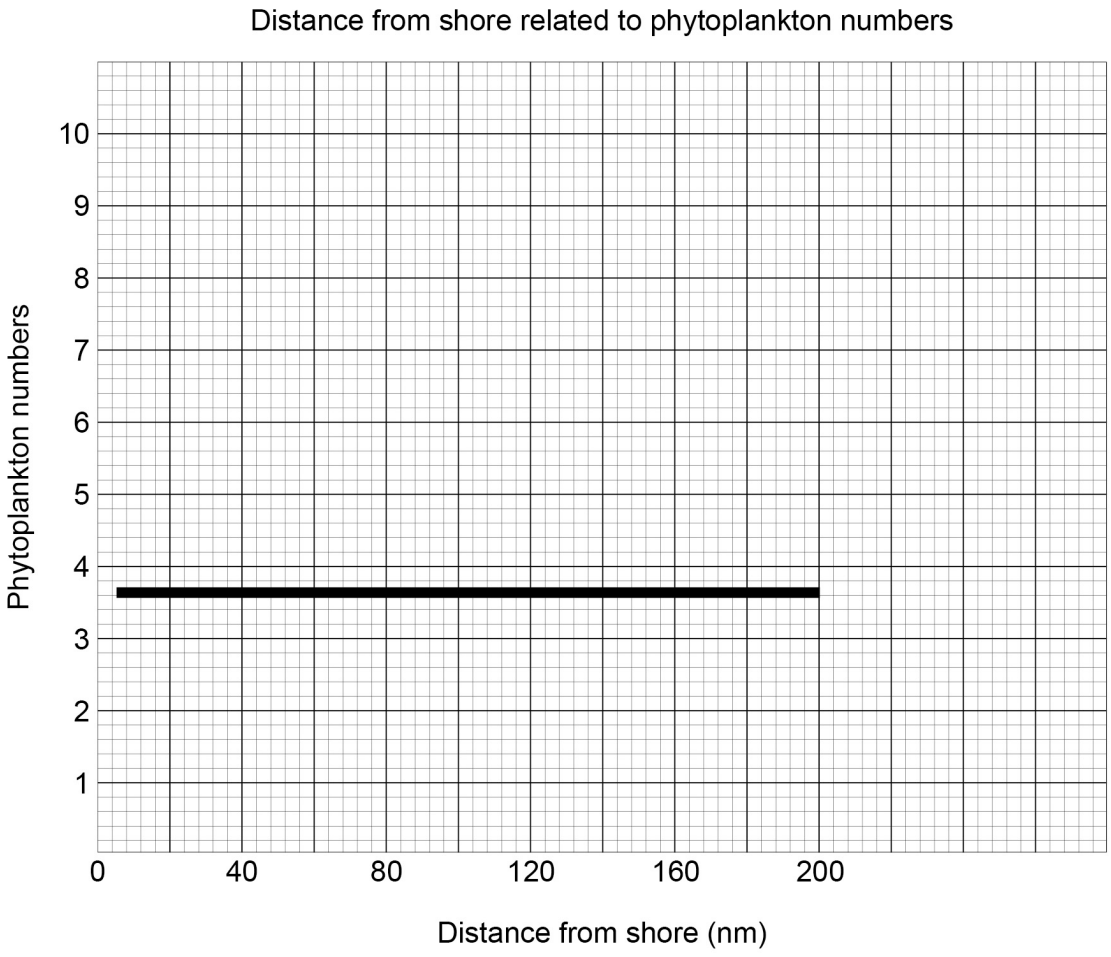
Description	Marks
Includes any **four** of the following: • transect out from 5 nm to 200 nm • sample water at regular intervals (e.g. every 5 nm) • use net/bottles or trapping device • isolate phytoplankton • count (and record).	1–4
Total	**4**
Accept other relevant answers.	

Question 22 (continued)

(c) On the grid below, sketch a graph to illustrate the expected results from the hypothesis in part (a). (5 marks)

Description	Marks
Title: must include two variables and general comment related to them	1
Y- axis titled	1
X-axis titled and with units	1
Spacing of parameters even (on each axis)	1
Straight line from 5 to 200 nm	1
Total	**5**

- Sample graph



Accept other relevant answers.

Note: numbers not required on Y axis for full marks

(d) Explain the results of this investigation, in light of the possible flow of the Leeuwin and other currents. (7 marks)

Description	Marks
Explanation links the even and higher distributions of phytoplankton in the water at the stated distances to the changes in nutrient levels in the water	1–2
Explanation includes the following: • Leeuwin Current low in nutrients so from 5-50 nm population is even/low • Between 50-100 nm the Leeuwin Current and West Australia currents interact to form an eddy which leads to an upwelling (of deeper water) that brings colder and nutrient rich water to the surface. • This mixes with the warmer Leeuwin Current and increases the nutrients in the surface water. • The phytoplankton use nutrients (and warmish Leeuwin water) to increase their numbers • Beyond 100 nm the currents no longer interact and there is no upwelling so nutrient levels reduce and so the phytoplankton population returns to the level in 5-50 nm.	1–5
Total	**7**
Accept other relevant answers.	

(e) List **two** other variables that could be measured to help the researchers to support the explanation of this anomaly in phytoplankton distribution. (2 marks)

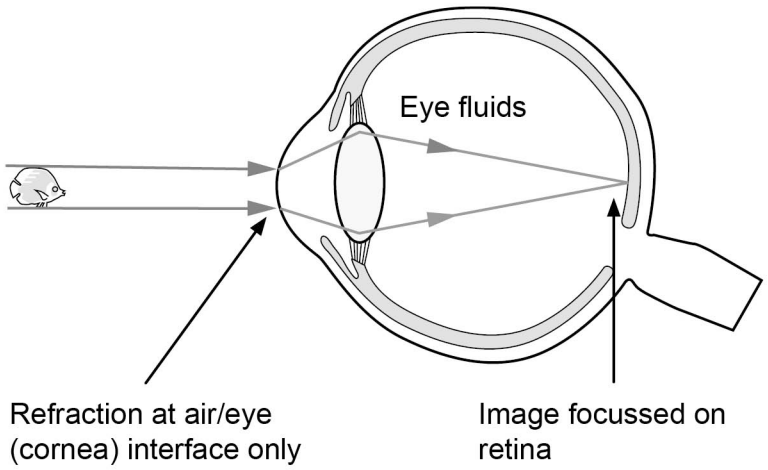
Description	Marks
Water temperature and	1
Nutrient levels (e.g. nitrate/nitrite, phosphorus, iron)	1
Total	**2**
Accept other relevant answers.	

Question 23 **(17 marks)**

(a) With the aid of the diagram below, explain how an image is formed when the viewer is out of water. (3 marks)

Description	Marks
Diagram and explanation to show the following	
Light (from object) is refracted/(bent) when it enters/passes through the cornea	1
It is further refracted by lens such that image is focused on retina	1
Appropriately annotated diagram	1
Total	**3**

Diagram eye

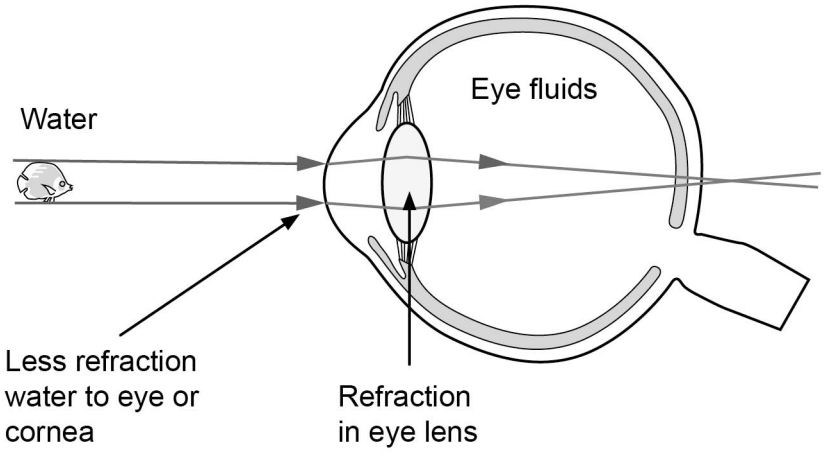


Accept other relevant answers.

(b) When the eye is under water, the image is magnified. With the aid of diagram below, describe how this occurs. (2 marks)

Description	Marks
Diagram and description to show the following	
Image is focused behind retina	1
Appropriately labelled diagram	1
Total	**2**

Diagram eye



Accept other relevant answers.

(c) Explain why there is a difference between the image on the land and in the water. (3 marks)

Description	Marks
Explanation is to include the following	
Water has larger refractive index/greater optical density than air/almost the same as the eye's lens and fluids	1
Light refracted less when passes through cornea than when on land	1
Image would be focused behind retina/image on retina is out of focus	1
Total	**3**
Accept other relevant answers.	

(d) Outline the necessary pre-dive and post-dive care for snorkelling equipment.

(i) Pre-dive care: (2 marks)

Description	Marks
Check for damage or problems with each piece (of equipment)	1
Before putting it on/fitting it	1
Total	**2**
Accept other relevant answers.	

(ii) Post-dive care: (3 marks)

Description	Marks
Check for damage (and repair if possible or buy new)	1
Wash in fresh water and dry	1
Store in cool dry place	1
Total	**3**
Accept other relevant answers.	

(e) When duck diving, while there are a number of boats moving slowly about your area, outline the precautions you should take

(i) prior to submerging. (2 marks)

Description	Marks
Dive flag clearly visible	1
Check boat movements (to see if any patterns or how close they are) and for other problems	1
Total	**2**
Accept other relevant answers.	

(ii) when ascending. (2 marks)

Description	Marks
Any **two** of the following: • raise arm above head (as commence ascent) until surface • look all around for hazards as ascending • when at surface look around 360° (for problems and make yourself visible)	1–2
Total	**2**
Accept other relevant answers.	

Question 24 (13 marks)

(a) Outline what a 'ship of opportunity' is and how it is used in collecting samples for this AusCPR database. (2 marks)

Description	Marks
Vessel hired (or volunteers) to collect samples of plankton	1
as they travel on their own route	1
Total	**2**

(b) Summarise the method used by a ship of opportunity to collect samples for the AusCPR database. (4 marks)

Description	Marks
Summary includes the following: • special device/continuous plankton recorder • towed behind vessel (for up to 450 nm but can be any known distance and speed) at a depth of 10 m (approximately) • samples of plankton trapped in device • samples preserved and given to research centre/CSIRO to be assessed.	1–4
Total	**4**
Accept other relevant answers.	

(c) Explain how the data collected for the AusCPR can be used to aid in the sustainable management of fish stocks. (4 marks)

Description	Marks
Explanation includes any **four** of the following: • plankton at bottom of biomass pyramid/food chains/webs • change in plankton will indicate change of food supply for fauna higher up food chain/web/biomass pyramid • decline in plankton indicate reduction of/pressure on higher order organisms in pyramid • from this can then reduce fishing pressure on species • to maintain fish stocks for future breeding.	1–4
Total	**4**
Accept other relevant answers.	

(d) Explain how the gradual increase in water temperature could affect whale feeding habits and whale numbers in the future. (3 marks)

Description	Marks
Explanation includes the following: • smaller plankton become more numerous at higher latitudes/polar region • less biomass available in the food chains/webs (where many whales feed) • less food for whales lowers whale numbers.	1–3
Total	**3**
Accept other relevant answers.	

Question 25 **(13 marks)**

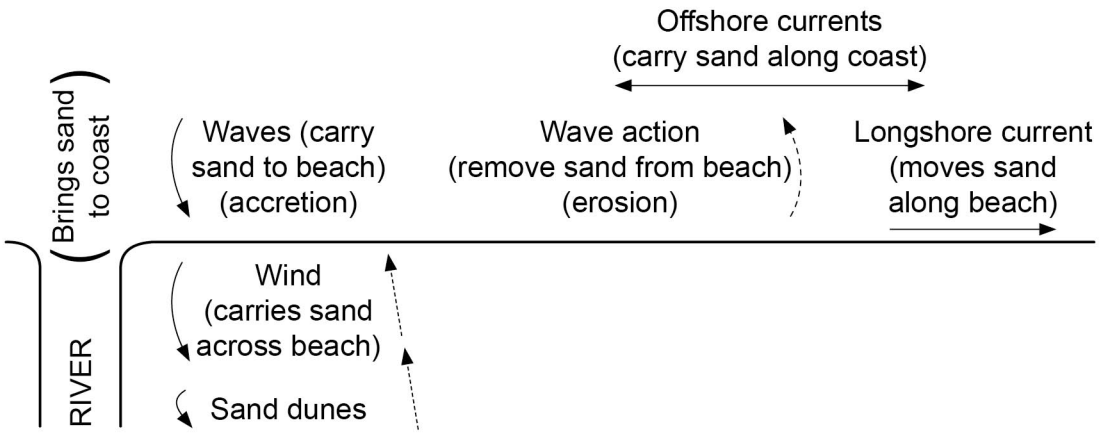
(a) Explain how the group of rocks from the image above is joined to the beach and has become part of the current shoreline. (5 marks)

Description	Marks
Prevailing winds blow causing longshore drift	1
Longshore drift carries sand along the beach	1
Rocks slow the drift down so carrying less sand	1
Sand is deposited on left side of rocks/near rocks	1
So beach extends seaward eventually connecting the rocks to the shore	1
Total	**5**
Accept other relevant answers.	

(b) Define the term 'sand budget' as it is applied to coastal processes. (2 marks)

Description	Marks
Total movement of sand into	1
and out of an area	1
Total	**2**

(c) Explain, with the aid of a diagram(s), the operation of a sand budget. (6 marks)

Description	Marks
Diagrams: to show sources of sand moving in and moving out (i.e. direction of wind, waves, longshore drift)	1–2
Subtotal	**2**
Explanation	
• waves carry sand onto beach • water (pushed) along shore forms a drift/current (called longshore drift), this current carries sand along beach • wind moves sand from sand dunes onto beach/also along/across the beach • sand from rivers adds sand (to area).	1–4
Subtotal	**4**
Total	**6**
Diagrams  	
Accept other relevant answers.	

Question 26 **(20 marks)**

(a) Explain how unrestricted krill harvesting could affect the humpback whale population that migrates up and down the Western Australian coast. (3 marks)

Description	Marks
(If reduce krill there is) less food for humpbacks	1
Less whales able to survive	1
Lower numbers to migrate up WA coast (to breeding grounds)	1
Total	**3**

(b) Explain the role of the IWC and how it fulfils this role. (3 marks)

Description	Marks
Explanation includes the following: • IWC develops rules to protect whales (e.g. stop hunting of whales) • enforces these rules via sanctions on countries who break IWC rules • carries out and/or collects data on whale populations to monitor whale populations and their movements/migration.	1–3
Total	**3**
Accept other relevant answers.	

(c) Outline **seven** rules for controlling human interaction with whales for an unlicensed vessel and **four** rules for swimmers associated with licensed vessels within Western Australia.

(i) Unlicensed vessels (7 marks)

Description	Marks
Any **seven** of the following rules for unlicensed vessels: • one private vessel in whale's zone at a time • no approach zone (300 m in front and behind at angle of 60^{o} arc to direction of whale and 100 m to sides) • no waiting in front of whale • maximum speed 8 kn • 60 minutes in company of whale(s) • if approached turn off motor or put in neutral or get away • do not interrupt passage or disperse pod • if whales are agitated or disturbed leave area • no unnecessary noise or disturbances.	1–7
Total	**7**
Accept other relevant answers.	

(ii) Swimmers with licensed vessels (4 marks)

Description	Marks
Any **four** of the following rules for swimmers: • not closer than 30 m (swim away to maintain minimum of 15 m if a whale approaches) • no touching • no flash/strobe photography • no cameras on poles • max 7 swimmers and 2 crew in the water at any one time.	1–4
Total	**4**
Accept other relevant answers.	

(d) Explain how the rules from part (c) help to ensure whale populations are protected and hence encourage whale tourism in Western Australia. (3 marks)

Description	Marks
Explanation includes any **three** of the following: • not disturb whales so minimise impact to calves and mothers/not upset birthing and calf development • encourage awareness, support and appreciation of whales • contribute to sustainable and viable in-water interactions between whales and people • maintain migration routes/or areas they visit.	1–3
Total	**3**
Accept other relevant answers.	

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

Question 27 **(20 marks)**

(a) Outline the processes that would be carried out from prior to excavation of the timber until it was displayed. (10 marks)

Description	Marks
The process	
Survey: • survey area of artefact to locate it (GPS) • photographs/mapping of site.	1–2
Excavation and recovery: • clear away debris so it is easy to attach lifting equipment (lift bag/crane) and raise to surface • support the object as it is lifted • keep wet (once out of ocean).	1–3
Preservation/Conservation: • extract water and salts slowly • progressively reduce salt concentration of rinsing water • replace water (and salts) with EDTA (PEG bath) • coat to prevent further decay	1–4
Display: • support (for strength) • display in a controlled environment (low light, low humidity).	1
Total	**10**
Accept other relevant answers.	

(b) Outline the steps museum officers would take to determine what was inside this rocky lump and whether it contained any artefact(s) from the wreck. (6 marks)

Description	Marks
Outlines the following process	
Photograph/map area to accurately locate its position	1
Clear debris away	1
Raise to surface	1
Keep wet/damp	1
Remove any obvious concretions	1
X-ray/CAT scan or such (look for image of potential artefact)	1
Total	**6**
Accept other relevant answers.	

(c) Describe **two** factors to be considered when calculating the volume of air required at the surface to raise the small cannon from this site using a lift bag. (4 marks)

Description	Marks
Any **two** of the following (2 x 2 marks each)	
• depth of water: determines pressure acting on air bag at bottom • weight of cannon/volume cannon: can calculate volume water displaced by cannon • volume of air required at bottom: air required to lift bag at that depth • density of the water: need to estimate volume cannon	1–4
Total	**4**
Accept other relevant answers.	

Question 28 (20 marks)

(a) Explain how each issue can affect a marine environment. (12 marks)

Description	Marks
Explains the role of overfishing	
Any **four** of the following: • take all catch • reduce overall numbers (or selective on some species) • reduce valuable species • reduce numbers for breeding • reduction of stock overall/disrupt food web/upset balance in system.	1–4
Subtotal	**4**
Explains the role of agriculture	
Any **four** of the following: • run-off of nutrients and such • excess enter waterways which flow into oceans which increases nutrients there • may lead to eutrophication • increase base of food web through more plant material • disruption to food web.	1–4
Subtotal	**4**
Explains the role of loss of habitat	
Any **four** of the following: • loss of protection • loss of food through loss of protection/increased predation/less food for prey • increased predation on a population • so animals leave area • disrupt breeding/feeding patterns • less of affected organisms • upset balance/numbers of organisms of each species.	1–4
Subtotal	**4**
Total	**12**
Accept other relevant answers.	

(b) Explain, using an example, why it is necessary to monitor and review a plan over the longer-term and change it if it is not achieving the intended outcomes. (4 marks)

Description	Marks
Must use an example to illustrate explanation	
Suitable example provided	1
Monitor: • able to see any changes (good or bad), or • relate changes to plan to see if fitting it.	1
Subtotal	**2**
Review: • use data from monitoring to see impact of plan on biodiversity • can then change plan accordingly to achieve aim.	1–2
Subtotal	**2**
Total	**4**
Accept other relevant answers.	

(c) Explain, using an example, how sustainable fisheries management can achieve the purpose of maintaining or improving biodiversity. (4 marks)

Description	Marks
Must use an example to illustrate explanation	
Suitable example provided	1
Explanation	
Any **three** of the following: • limit organisms able to be removed from the area (bag or size or sex limits) • remainder able to breed and replace (possibly) those removed • reduce effects on food webs in environment • reduce effect on numbers of and within species so maintain biodiversity.	1–3
Subtotal	**3**
Total	**4**
Accept other relevant answers.	

Question 29 (20 marks)

(a) Explain how the enhanced greenhouse effect impacts coral reef health **and** global sea levels (10 marks)

Description	Marks
Coral reef health	
Explains using a coherent structure how the enhanced greenhouse effect impacts coral reef health Answers could include the following: • increase atmospheric CO_2 concentration leads to ocean temperature increases (and acidification) • zooxanthellae are expelled from coral polyps due to these stressors • coral starves and dies • damage to the coral reef structure is not repaired • reduction in food source for other reef species • loss of biodiversity in reef community	1–6
Subtotal	**6**
Global sea levels	
Explains using a coherent structure how the enhanced greenhouse effect impacts global sea levels Answers include the following: • sea levels are rising • due to increased ocean temperatures • causing thermal expansion of water, and • melting of continental ice	1–4
Subtotal	**4**
Total	**10**
Accept other relevant answers.	

(b) Explain with the aid of a diagram how a melting icecap could affect a thermohaline current. (10 marks)

Description	Marks
Explanation includes • water immediately surrounding melting ice has a lower temperature • the cooler water becomes more dense and the cooler water sinks • helping maintain (thermo aspect of) current • saline/salty water is more dense than fresher water • melting ice makes nearby water less saline/dilutes salinity and • water becomes less dense and so less likely to sink • reduces effects on start/maintenance of current • switching off the current	1–8
Appropriately labelled diagram	1–2
Total	**10**
Accept other relevant answers.	

Question 30 **(20 marks)**

(a) Explain, with reference to the environmental processes involved, how climate change could make it more difficult for Australia to maintain its maritime biosecurity. (5 marks)

Description	Marks
Climate change stresses a marine environment making it more susceptible to introduced foreign organisms/pests	1
Explanation may include the following: • colonisation by invasive species might arise due to ◦ increased water temperature ◦ changes in pH ◦ changes in salinity • changes to currents will redistribute invasive species.	1–4
Total	**5**
Accept other relevant answers.	

(b) Describe **three** ways in which a marine disease could be introduced into the Australian marine environment and how each way could be prevented. (6 marks)

Description	Marks
Describes any **three** of the following marine diseases and prevention measures: • Imported seafood/fish food that comes with a disease that doesn't affect humans but does affect marine organisms (e.g. white spot in the Queensland prawn industry.) Check all imported seafood/fish food for disease and stop diseased material entering. • Aquaculture can produce the conditions to allow diseases to breed unless regulated carefully (e.g. in fish food, excess food). Ensure no excess food/clean out excess food from cages and sea floor. • Dumping of aquarium animals, which may harbour disease, into water systems that eventually lead to the ocean and so introduce a disease. Ban and monitor dumping of unwanted animals/have collection points for unwanted animals. • Environmental stress resulting in the lowering of organisms' natural resistance to disease. If possible reduce stresses. • Biofouling on the hull of a vessel can introduce diseased organisms – ensure hulls are kept free of marine growth to prevent attachment or ensure hulls are cleaned prior to entry of Australian waters. • Ballast water can introduce diseased organisms if taken in from foreign waters – ensure vessels refresh ballast water outside Australian waters.	1–6
Total	**6**
Accept other relevant answers.	

Question 30 (continued)

(c) Explain how the National System endeavours to prevent new pest arrival and responds to, and minimises, the effect of marine pests in Australia. (9 marks)

Description	Marks
Prevention	
Prevent entry of pests by scrutinising sources such as biofouling/ ballast water	1
Maintain intelligence and research to identify potential pests	1
Strengthen the surveillance of our borders	1
Subtotal	**3**
Response	
Any **three** of the following: • integrate the plans between the State and Federal governments • support research and development into marine pests • strengthen the national marine pest surveillance system • review and evaluate the current surveillance system • promote education and awareness materials to engage the public interest pest surveillance.	1–3
Subtotal	**3**
Minimising	
Develop an emergency response unit	1
Increase research and development into eradication methods	1
Emphasise early detection through education	1
Subtotal	**3**
Total	**9**
Accept other relevant answers.	

ACKNOWLEDGEMENTS

Question 23(a) & (b) Diagrams adapted from: Moffatt, B. (2014). Figure 2.1 a mask helps us focus [Diagram]. In *Snorkelling workbook* (6th ed.). Wet Paper Publishers and Consultants, p. 2. https://www.wetpaper.com.au/media/SnorkellingPreview/files/assets/basic-html/index.html#page2

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