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books used

External assessment

Question and response book

# Marine Science

## Paper 1

### Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

### General instructions

- Answer all questions in this question and response book.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

### Section 1 (15 marks)

- 15 multiple choice questions

### Section 2 (45 marks)

- 10 short response questions

## Section 1

### Instructions

- Choose the best answer for Questions 1–15.
- This section has 15 questions and is worth 15 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

|          | A                                | B                     | C                     | D                     |
|----------|----------------------------------|-----------------------|-----------------------|-----------------------|
| Example: | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

|     | A                     | B                     | C                     | D                     |
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## Section 2

### Instructions

- Write using black or blue pen.
  - If you need more space for a response, use the additional pages at the back of this book.
    - On the additional pages, write the question number you are responding to.
    - Cancel any incorrect response by ruling a single diagonal line through your work.
    - Write the page number of your alternative/additional response, i.e. See page ...
    - If you do not do this, your original response will be marked.
  - This section has 10 questions and is worth 45 marks.
- 

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### QUESTION 16 (4 marks)

Explain how marine protected areas (MPAs) can be used to improve the health of a highly connected but degraded marine ecosystem.

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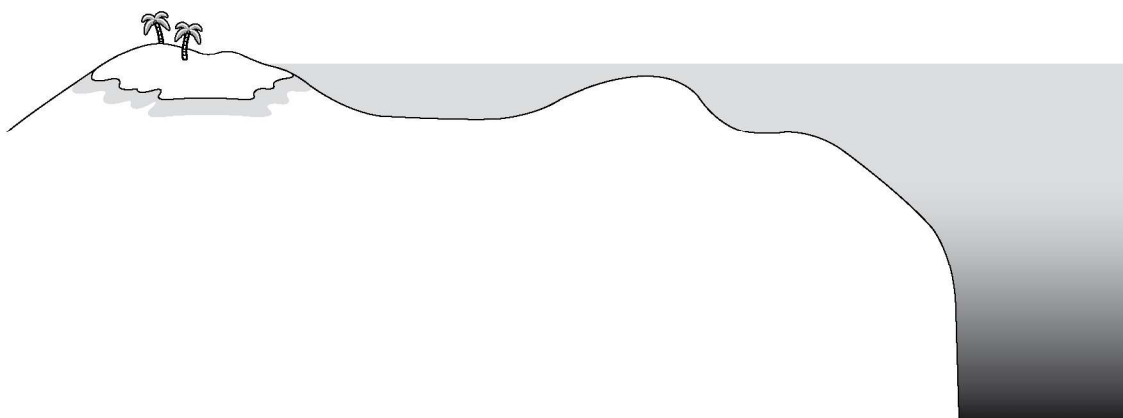
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### QUESTION 17 (2 marks)

A reef cross-section is shown in the diagram.

Identify the following zones by labelling them on the reef cross-section.

- reef crest
- back reef



**Note:** If you make a mistake in the diagram, cancel it by ruling a single diagonal line through your work and use the additional response space on page 14 of this question and response book.

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**QUESTION 18 (4 marks)**

Explain the importance of mangrove ecosystems in terms of species replenishment for coral reefs.

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**QUESTION 19 (4 marks)**

Describe the relationship between coral polyps in a coral colony.

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### QUESTION 20 (8 marks)

Changes to ocean chemistry and pH were estimated using modelling, and the effects of these changes on calcified marine organisms are shown.

|  | Pre-industrial | 1990    | 2 ×<br>pre-industrial | 4 ×<br>pre-industrial | 6 ×<br>pre-industrial |
|--|----------------|---------|-----------------------|-----------------------|-----------------------|
| Atmospheric concentration of CO <sub>2</sub> | 280 ppm        | 380 ppm | 560 ppm               | 1120 ppm              | 1680 ppm              |
| Average pH of surface oceans                 | 8.18           | 8.07    | 7.92                  | 7.65                  | 7.49                  |
| Calcite saturation                           | 5.3            | 4.4     | 3.3                   | 1.9                   | 1.3                   |
| Aragonite saturation                         | 3.4            | 2.8     | 2.1                   | 1.2                   | 0.9                   |

| Organisms                        | Form of calcium carbonate | Habitat               |
|----------------------------------|---------------------------|-----------------------|
| Macroalgae <sup>1</sup>          | Aragonite or calcite      | Benthic               |
| Corals: warm water<br>cold water | Aragonite<br>Aragonite    | Benthic<br>Benthic    |
| Crustaceans <sup>1</sup>         | Calcite                   | Benthic or planktonic |

<sup>1</sup> Not all members of the group are calcified.

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*[5 marks]*

[3 marks]

6 of 14

### QUESTION 21 (5 marks)

Mercury is a heavy metal known to be dangerous to both natural ecosystems and humans, due to its high toxicity. The concentration of mercury in the producers and consumers that form a food web was recorded.

| Source               | Concentration of mercury (ppm) |
|----------------------|--------------------------------|
| Seawater             | 1.6                            |
| Sediment on seafloor | 1.6                            |
| Phytoplankton        | 2.8                            |
| Zooplankton          | 6.4                            |
| Hardyheads           | 107                            |
| Tuna                 | 3200                           |
| Humans               | 17 300                         |

Use the evidence to draw a conclusion about the process of bioaccumulation of mercury in tuna.

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**QUESTION 22 (3 marks)**

Explain how upwelling influences the distribution of fish populations.

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**QUESTION 23 (6 marks)**

- a) Explain how land-based flooding impacts the salinity and turbidity of a nearby reef. *[2 marks]*

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- b) Describe the impact that changes in turbidity from land-based flooding would have on the zooxanthellae and coral of a nearby reef. *[4 marks]*

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**QUESTION 24 (5 marks)**

Identify and explain factors between the atmosphere and the ocean that influence land and sea breezes on a daily basis.

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**QUESTION 25 (4 marks)**

Explain the effect that increased ocean productivity at the surface has on the carbonate compensation depth (CCD).

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 3. *What is the research methodology?*  
 4. *What are the results of the study?*  
 5. *What are the conclusions of the study?*  
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 7. *What are the implications of the study?*  
 8. *What are the future research directions?*  
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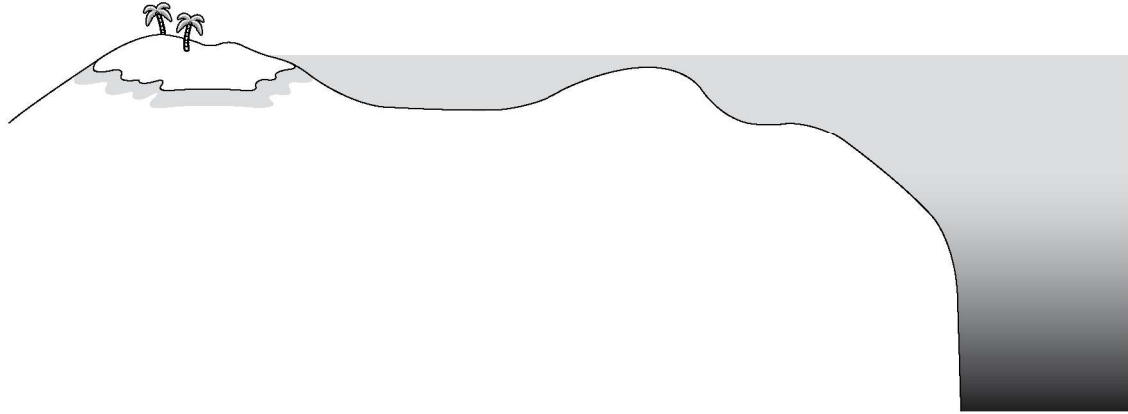


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### ADDITIONAL RESPONSE SPACE FOR QUESTION 17

If you want this diagram to be marked, rule a diagonal line through the diagram on page 3.



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## References

### Question 17

‘How do coral reefs form?’, *National Ocean Service*, [https://oceanservice.noaa.gov/education/tutorial\\_corals/coral04\\_reefs.html](https://oceanservice.noaa.gov/education/tutorial_corals/coral04_reefs.html).

### Question 20

Data extracted from Table 1 (p. 13) & Table 2 (p. 16) in The Royal Society 2005, ‘Ocean acidification due to increasing atmospheric carbon dioxide’, *Royal Society*, [https://royalsociety.org/~media/Royal\\_Society\\_Content/policy/publications/2005/9634.pdf](https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2005/9634.pdf).



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