



Cambridge International AS & A Level

CANDIDATE
NAME

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MARINE SCIENCE

9693/04

Paper 4 A2 Data-Handling and Free-Response

May/June 2021

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Any blank pages are indicated.

Section A

Answer **both** questions in this section.

- 1 The area of many tropical coral reefs is decreasing. Scientists think that the reduction in area of living coral is due to global warming.

Table 1.1 shows the change in percentage cover of living coral on a reef near Indonesia, and the mean annual global release of carbon dioxide between 2000 and 2016.

Table 1.1

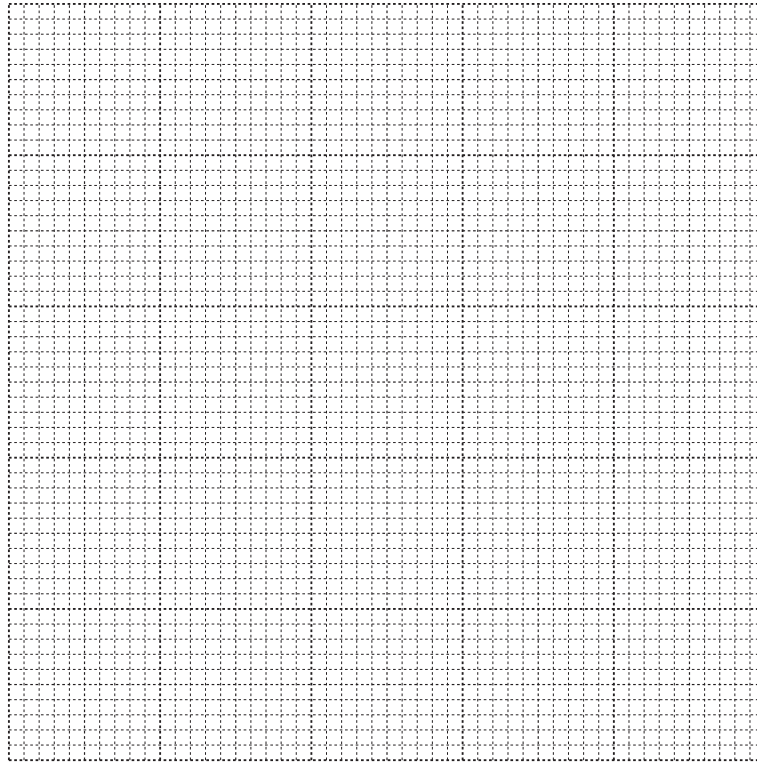
year	percentage cover of reef with living coral	mean annual global release of carbon dioxide/million tonnes
2000	68	24 000
2004	52	26 000
2008	33	32 000
2012	22	35 000
2016	18	37 000

- (a) (i) Calculate the mean annual rate of change of percentage cover of the reef with living coral between 2000 and 2016.

Space for working.

..... [2]

- (ii) Draw a line graph to show the change in percentage cover of the reef with living coral and mean annual global release of carbon dioxide between 2000 and 2016.



[6]

- (b) Discuss the extent to which the data in Table 1.1 support the hypothesis that global warming is causing a reduction in area of living coral reefs.

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..... [4]

[Total: 12]

- 2 Sand that has been contaminated with crude oil can be cleaned by specialised bacteria. These bacteria digest the oil. Algae are naturally present in the sand.

Scientists investigated if adding fertiliser to the sand speeds up this digestion process. The investigation is described in the steps below.

- Four 5 kg samples of sand were each mixed with 50 g of crude oil.
- An equal mass of bacteria which digest oil was added to each sample of sand.
- A different mass of fertiliser was added to each sample.
- The samples were left for seven weeks.
- The percentage reduction of crude oil in each sample was measured.
- The mean dry mass of algae that grew in the sand was also measured.
- The experiment was repeated five times.
- The mean percentage reduction of crude oil, and the mean dry mass of algae, for each mass of fertiliser were calculated.

The results are shown in Fig. 2.1.

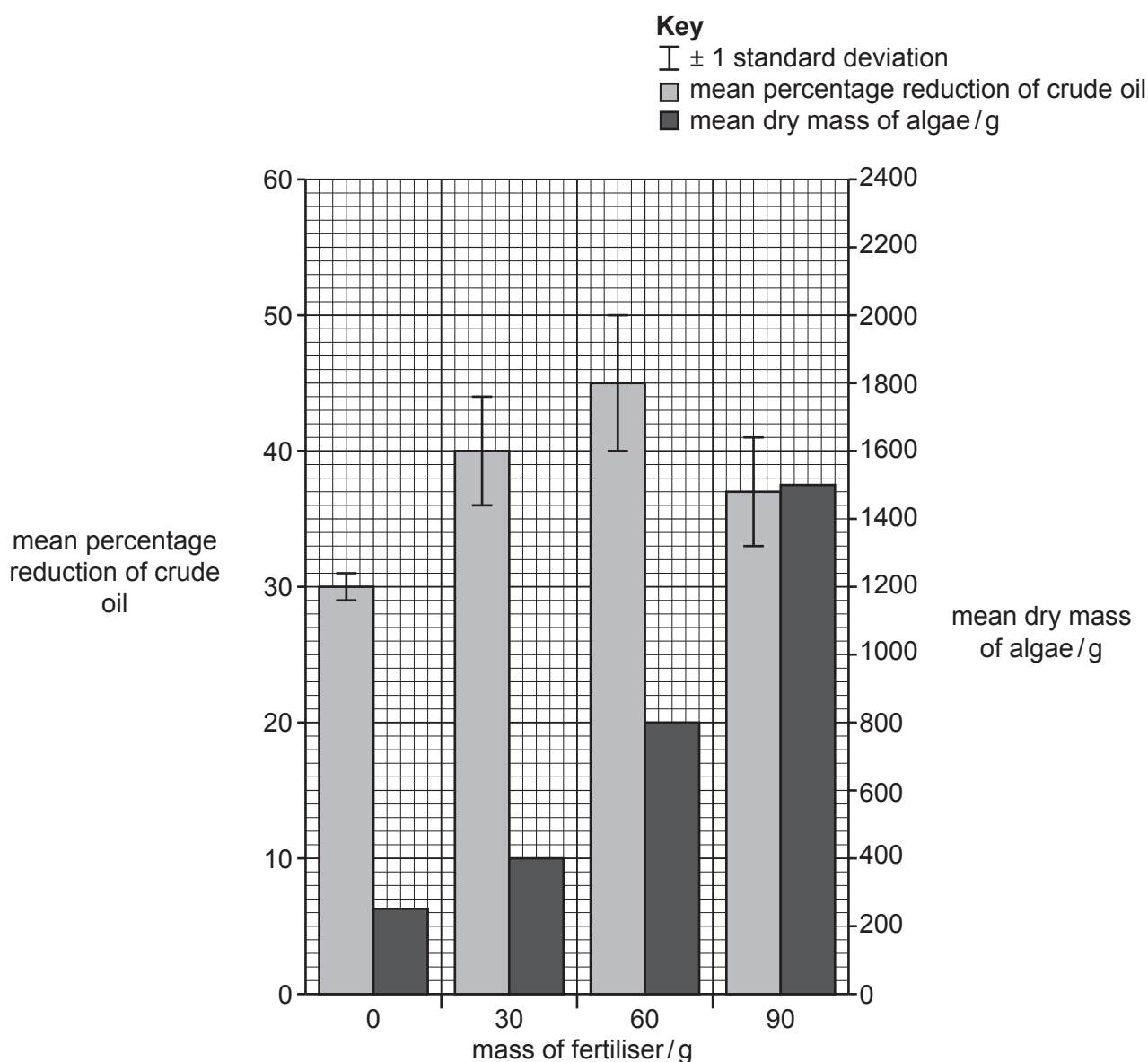


Fig. 2.1

- (a) (i) Use Fig. 2.1 to calculate the percentage increase in mean dry mass of algae when the mass of fertiliser was increased from 0 g to 90 g.

Space for working.

.....% [2]

- (ii) Describe the effect of increasing the mass of fertiliser on the mean percentage reduction of crude oil.

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- (b) The scientists concluded that 30 g of fertiliser per 5 kg sand is the ideal quantity to use to digest oil on sandy shores.

Use Fig. 2.1 to explain why 30 g of fertiliser was chosen.

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[Total: 8]

Section B

Answer **both** questions in this section.

- 3 (a) (i) Fig. 3.1 shows a diagram of a piece of *Sargassum*.

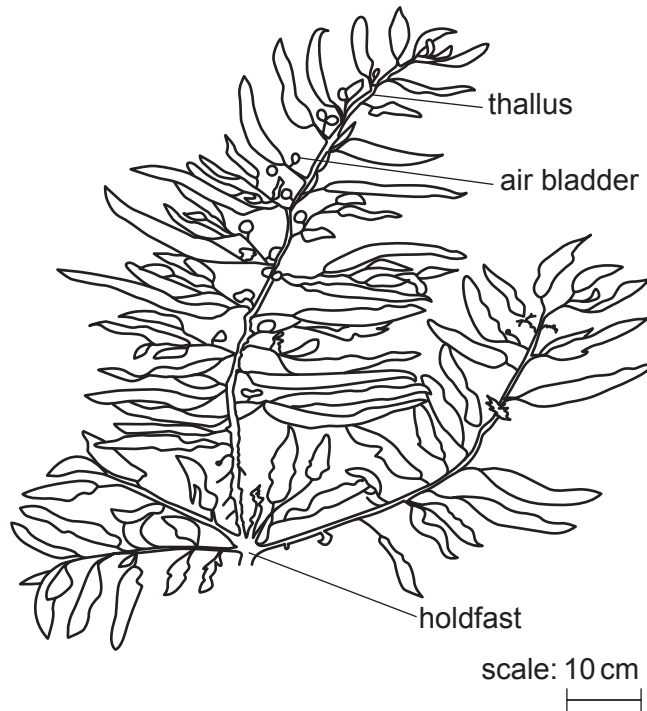


Fig. 3.1

Explain how *Sargassum* is adapted to live in its habitat.

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..... [3]

(ii) Explain why loss of the seagrass *Thalassia* could negatively impact marine ecosystems.

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(b) Discuss how the reproduction of tuna differs from the reproduction of whales.

[6]

- 4 (a) (i) Explain why the ecological linkages within a food web must be considered when planning to conserve a species.

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- (ii) Discuss the advantages **and** disadvantages of replanting mangroves to rehabilitate fish stocks.

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- (b)** Explain how negative ecological impacts of an aquaculture venture located in coastal waters can be minimised.

..... [7]

[Total: 15]

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