



Cambridge International AS & A Level

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MARINE SCIENCE

9693/04

Paper 4 A2 Data-Handling and Free-Response

October/November 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 **16** pages. Any blank pages are indicated.

Section A

Answer **both** questions in this section.

- 1 The effect of different wavelengths of light on the rate of photosynthesis of two species of marine algae, **A** and **B**, was investigated. Fig. 1.1 shows the apparatus used.

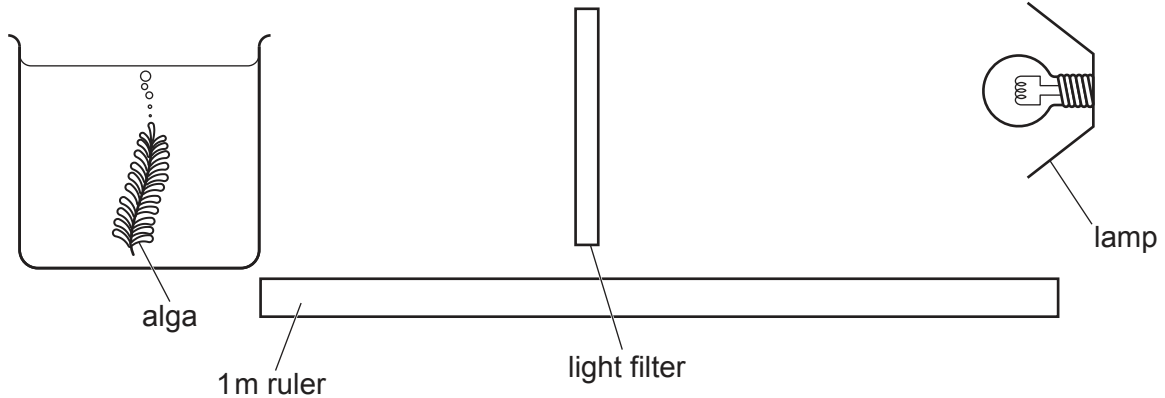


Fig. 1.1

Pieces of alga **A** were placed into a beaker of sea water and exposed to light of wavelength 450 nm for ten minutes. This was repeated four times and the mean rate of bubbles produced per minute was calculated.

This was repeated with light of different wavelengths using different coloured light filters.

The experiment was then repeated with alga **B**.

The results are shown in Table 1.1.

Table 1.1

wavelength of light/nm	mean rate of bubbles produced by algae/bubbles per minute	
	A	B
450	20	17
490	29	22
520	16	17
575	2	12
610	15	15
710	26	21

(a) The age, mass and surface areas of the algae were kept constant.

Suggest an explanation for keeping **one** other named variable constant.

named variable

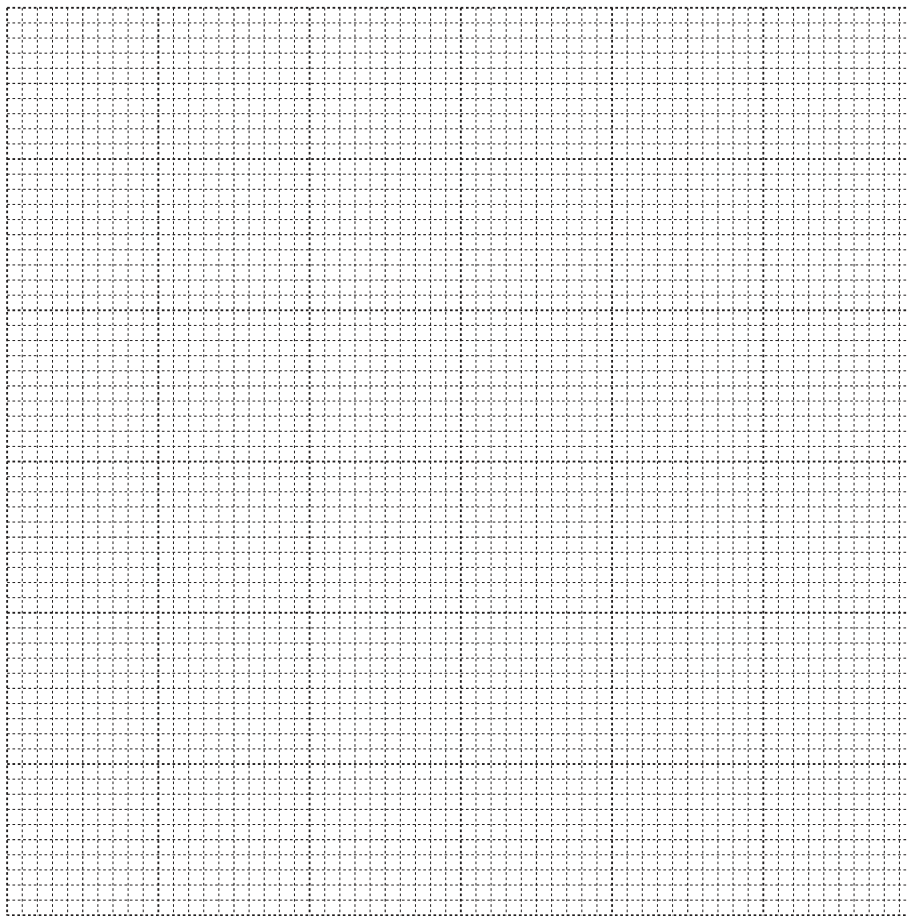
explanation

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[2]

(b) Draw a line graph to show the effect of light wavelength on the rate of photosynthesis by both algae.



[5]

- 2 Tributyltin (TBT) was often added to antifouling paint and used extensively in the 20th century. It affects the development of larvae of molluscs such as oysters.

The effect of different concentrations of TBT on the development of the larvae of two species of mollusc, **A** and **B**, was investigated. Larvae were exposed to different concentrations of TBT and the percentage of larvae that developed normally was determined after 48 hours.

The results are shown in Fig. 2.1.

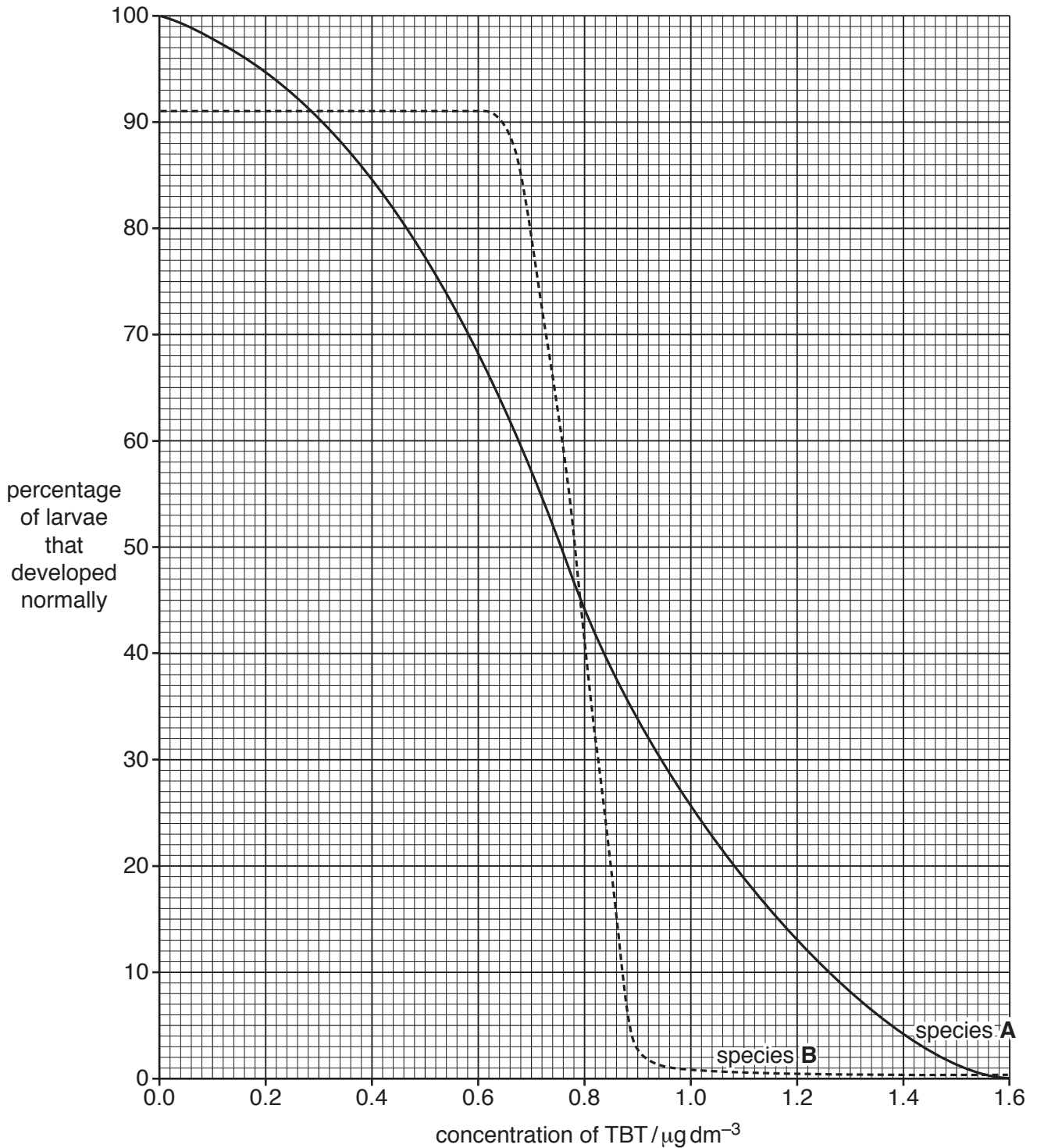


Fig. 2.1

- (a) (i) A total of 500 larvae of each species were used.

Use Fig. 2.1 to determine the number of larvae from species **A** that developed normally after exposure to $0.6 \mu\text{g dm}^{-3}$ of TBT.

..... [2]

- (ii) Compare the effect of increasing concentrations of TBT on the percentage of larvae that develop normally for species **A** and species **B**.

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..... [2]

Section B

Answer **both** questions in this section.

- 3 (a) (i) Discuss how the size and shape of marine organisms affect the need for specialised gaseous exchange organs.

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..... [4]

Fig. 3.1 shows the transport systems of a whale and a species of fish.

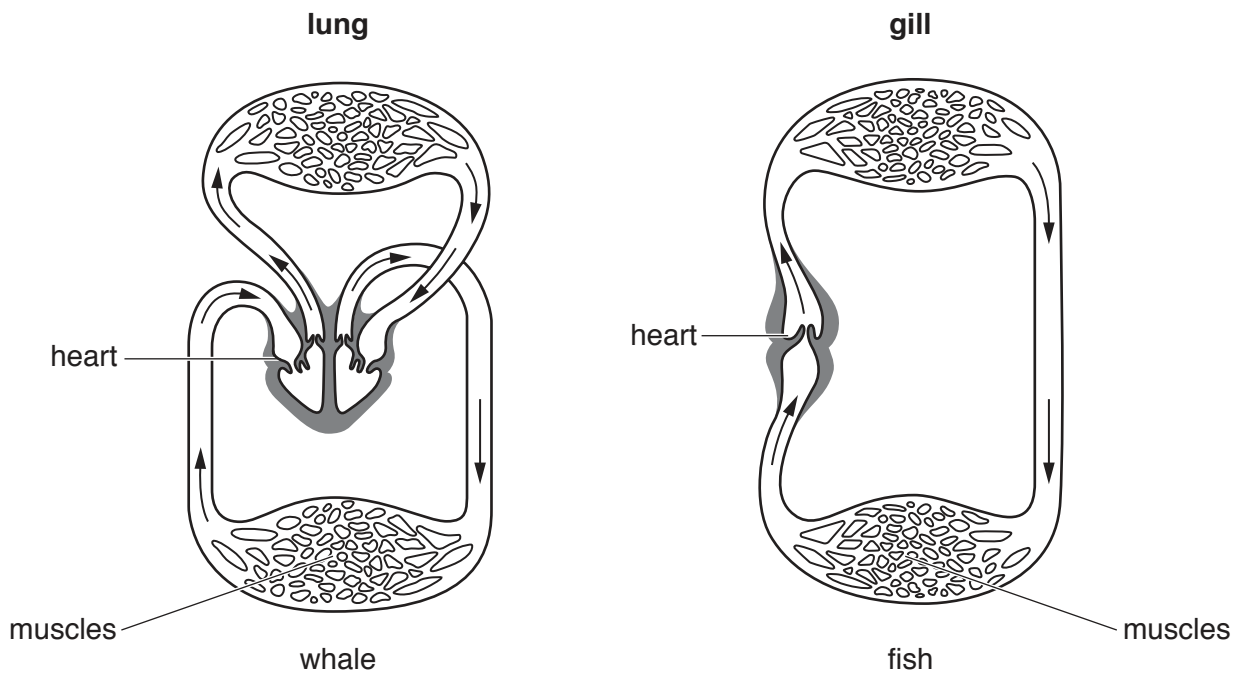


Fig. 3.1

Whales are large, active, air-breathing animals. This species of fish is smaller and less active than whales.

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