

CANDIDATE  
NAME

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**MARINE SCIENCE**

**9693/04**

Paper 4 A2 Data-Handling and Free-Response

**May/June 2019**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

**Section A**

Answer **both** questions in this section.

Write your answers in the spaces provided on the Question Paper.

**Section B**

Answer **both** questions in this section.

Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **11** printed pages and **5** blank pages.

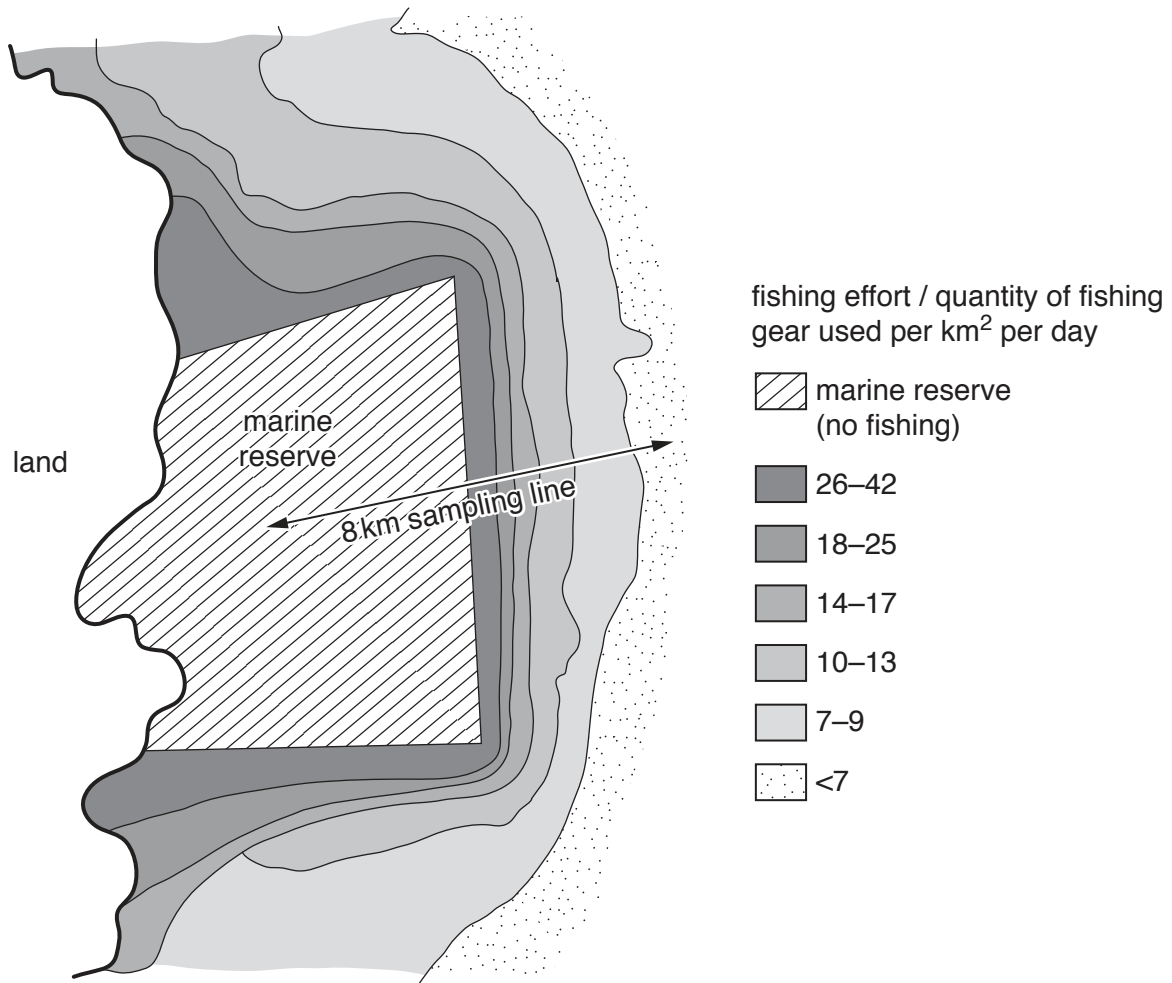


**Section A**

Answer **both** questions in this section.

- 1 A marine reserve was set up in an area of the Mediterranean Sea to protect fish stocks. No fishing was allowed within the reserve.

The mean daily fishing effort in areas surrounding the marine reserve was recorded and is shown in Fig. 1.1. Fishing effort was measured as the quantity of fishing gear used per square kilometre per day.



**Fig. 1.1**

- (a) Suggest **and** explain **one** possible reason for the differences in fishing effort surrounding the marine reserve shown in Fig. 1.1.

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..... [2]

- (b) Scientists assessed the success of the marine reserve in conserving fish stocks. They measured the number of grouper eggs in different areas of the reserve, and also outside it. The areas sampled were along an 8 km line, which started in the centre of the reserve. The sampling line is shown on Fig. 1.1.

The results are shown in Fig. 1.2. The scientists drew a line of best fit through the data points.

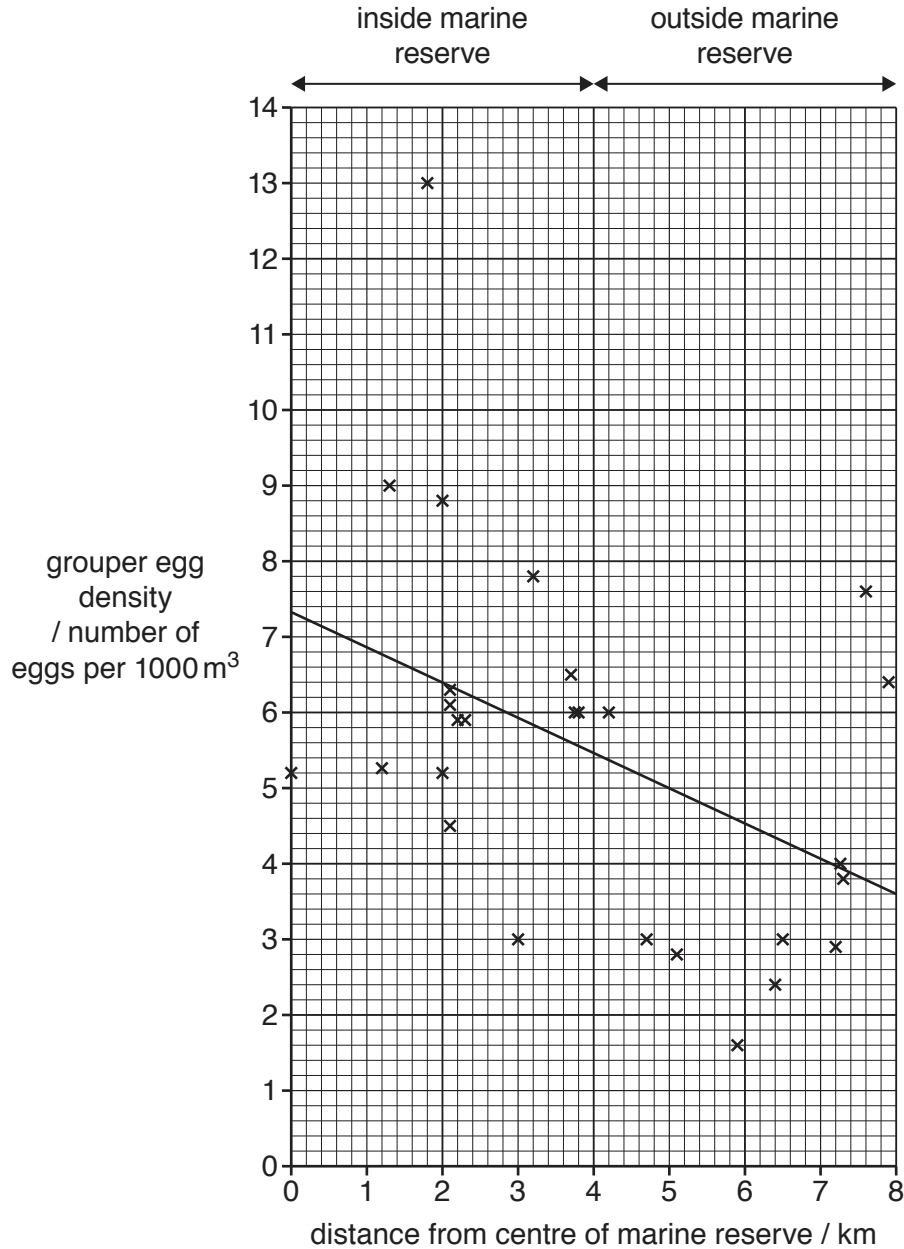


Fig. 1.2

- (i) Describe how grouper egg density changes with distance from the centre of the marine reserve.

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..... [2]

- (ii) Use the line of best fit on Fig. 1.2 to calculate the change in grouper egg density per kilometre between the centre of the reserve and a distance of 8 km from the centre.

..... eggs per 1000m<sup>3</sup> per km  
[3]

- (c) Discuss whether the information in Figs. 1.1 and 1.2 could be used to show that the marine reserve is beneficial to fish stocks in and around the reserve.

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..... [4]

[Total: 11]



- 2 One method used to measure water pollution by organic waste is to calculate the biological oxygen demand, BOD. This determines the rate at which oxygen is used by micro-organisms in the water.

To determine the BOD of water, a sample of water is taken from the sea or river and the concentration of oxygen is measured.

The sample is then placed in a tube with an airtight seal and kept at 20°C for five days. The concentration of oxygen is then measured again.

The fall in oxygen concentration is the BOD.

- (a) (i) Suggest why the airtight seals are placed on the tubes.

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..... [1]

- (ii) Explain why oxygen concentration falls in the tubes.

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..... [2]

- (b) The BOD of an estuary close to an agricultural area in Southeast Asia was measured during each month. Fertiliser use and rain levels were also monitored.

The results are shown in Table 2.1.

**Table 2.1**

month	fertiliser use	rain / mm	BOD / $\text{mg dm}^{-3}$
January	low	15	2
February	low	20	2
March	low	25	3
April	high	50	2
May	high	310	8
June	high	550	18
July	high	575	25
August	high	590	25
September	low	360	19
October	low	210	12
November	low	75	8
December	low	20	2

- (i) Calculate the percentage increase in BOD between January and August.

Show your working.

..... %  
[2]









4 Human activity is threatening the marine environment in many ways. Conservation is becoming increasingly important.

(a) Explain the meaning of the term *conservation*.

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..... [2]

(b) Artificial reefs and the release of cultivated stocks are two methods of rehabilitating depleted fish stocks.

Compare the advantages and disadvantages of these methods.

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