



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
 General Certificate of Education
 Advanced Subsidiary Level and Advanced Level

CANDIDATE
 NAME

CENTRE
 NUMBER

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 NUMBER

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MARINE SCIENCE

9693/04

Data-Handling and Free-Response

May/June 2011

Paper 4

1 hour 15 minutes

Candidates answer Section A on the Question Paper.

Additional Materials: Answer Booklet/Paper

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 on both sides of the paper.
 You may use a soft pencil for any diagrams, graphs or rough working.
 Do not use staples, paper clips, highlighters, glue or correction fluid.
DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

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.

Section A

Answer **all** questions.
 Write your answers in the spaces provided on the question paper.

Section B

Answer **all** questions.
 Answer the questions on the separate answer paper provided.

For Examiner's Use	
1	
2	
3	
4	
Total	

This document consists of **6** printed pages and **2** blank pages.



Section A

Answer **both** questions in this section.

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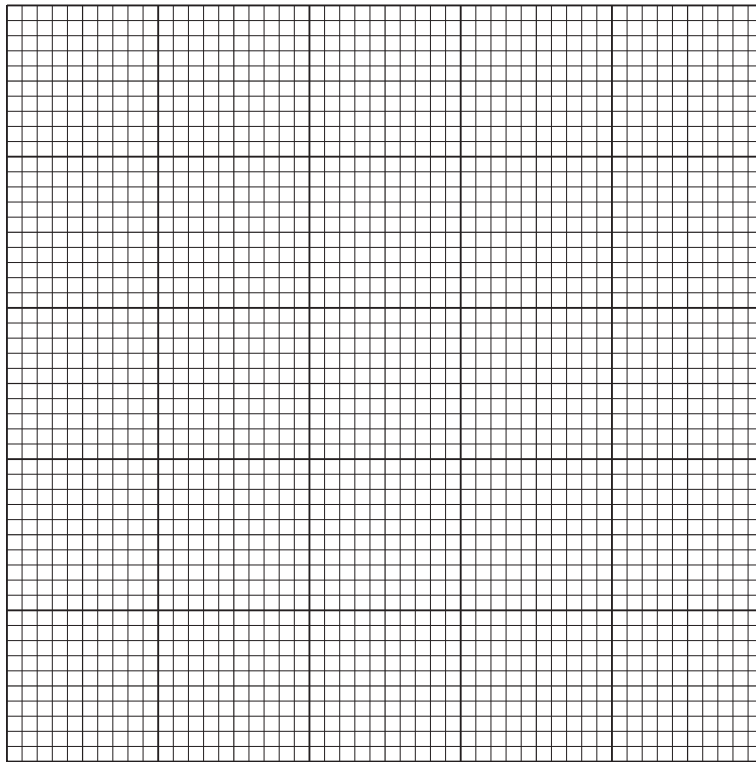
- 1 Catch per unit of fishing effort (CPUE) is the total catch divided by the total amount of effort used to harvest the catch. The effort is a measure of the number of days the fleet is at sea and the size and efficiency of the vessels.
- (a) Table 1.1 shows the catches and efforts of a UK North Sea fishing fleet for a period of 10 consecutive years. Calculate the catch per unit effort (CPUE) for year 6 and record it in Table 1.1. [1]

Table 1.1

year	catch/ tonnes	fishing effort	catch per unit effort (CPUE)
1	53940	17.4	3100
2	127050	38.5	3300
3	164840	63.4	2600
4	226520	80.9	2800
5	136800	91.2	1500
6	113040	94.2	
7	133380	102.6	1300
8	59400	54.0	1100
9	72380	51.7	1400
10	91350	60.9	1500

- (b) Use Table 1.1 to plot a line graph of catch per unit effort against year. Draw a line of best fit.

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[3]

- (c) (i) Describe the trend shown by your graph.

.....
..... [2]

- (ii) Using your graph of CPUE against time, suggest explanations for the changes in CPUE over the 10 year time period.

.....
.....
.....
.....
..... [3]

- (d) Suggest **one** reason why catch data may be inaccurate.

.....
..... [1]

- (e) Further information about fish stocks may be needed to ensure that fish can be exploited on a sustainable basis.

Suggest **two** of these pieces of information.

1

.....

2

.....

[2]

[Total: 12]

- 2 An investigation was carried out into factors that affect the rate of oxygen consumption of a range of marine species of fish.

Table 2.1 shows a comparison of the rate of oxygen consumption, gill surface areas and body masses of a range of species of marine fish.

Table 2.1

species	rate of oxygen consumption / $\text{mg kg}^{-1}\text{hr}^{-1}$	gill surface area / cm^2	body mass / g	gill surface area : body mass ratio
juvenile yellow fin tuna	1835	36680	3326	11.03
adult yellow fin tuna	1677	321600	50800	6.33
thornback ray	346	3574	2930	1.22
Atlantic bonito	1724	13040	2192	5.95
flounder	157	924	490	

- (a) Calculate the gill surface area : body mass ratio for the flounder and record it in Table 2.1. Show your working.

Gill surface area : body mass ratio is calculated by dividing the gill surface area by the body mass.

[1]

(b) Calculate the percentage decrease in gill surface area: body mass ratio for the yellow fin tuna as it changes from a juvenile to an adult. Show your working.

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[2]

(c) Use the information in Table 2.1 and your own knowledge to suggest explanations for the differences in the gill surface area: mass ratios of these fish.

.....
.....
.....
.....

[4]

(d) Suggest why the gill surface area: body mass ratio rather than the gill surface area alone should be used to compare the rate of oxygen consumption of these species.

.....
.....

[1]

[Total: 8]

Section B

Answer **all** questions in this section.

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3 (a) Define each of the following terms.

(i) *biotechnology*

(ii) *genetic engineering*

(iii) *selective breeding*

[3]

(b) Describe how a named species of fish may be genetically engineered and how this may be of advantage to humans. [6]

(c) (i) State what is meant by the term *precautionary principle*. [1]

(ii) Explain why the precautionary principle is relevant to the aquaculture of genetically engineered species. [5]

[Total: 15]

4 (a) Describe the evidence which suggests that global warming is occurring. [4]

(b) Describe the possible effects of global warming. [4]

(c) Discuss the evidence for and against the hypothesis that global warming is caused by human activity. [7]

[Total: 15]

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Copyright Acknowledgements:

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<http://www.fao.org/docrep/x5685e/x5685e04.htm>.

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