



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

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
NUMBER

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MARINE SCIENCE

9693/04

Data-Handling and Free-Response

October/November 2011

Paper 4

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 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.

Section A

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

Section B

Answer **all** questions.
Write your answers on the lined pages provided.

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.

For Examiner's Use	
1	
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Total	

This document consists of **7** printed pages and **5** lined pages.



Section A

Answer **all** questions.

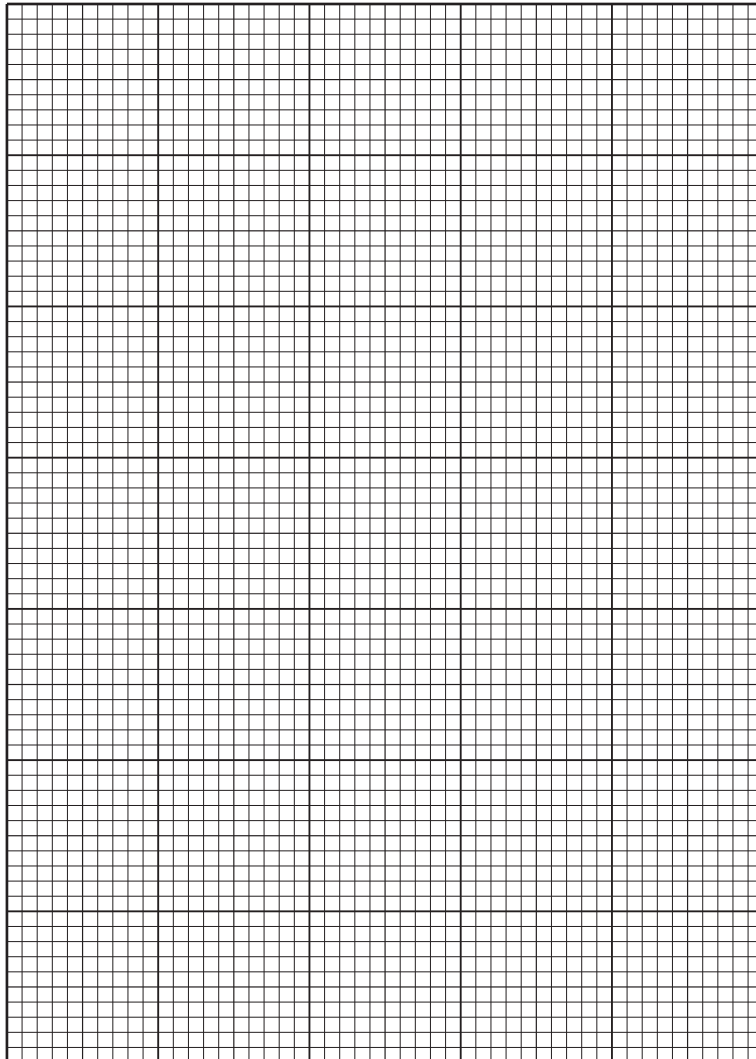
- 1 A survey was carried out into the concentration of mercury in different body tissues of bottlenose dolphins.

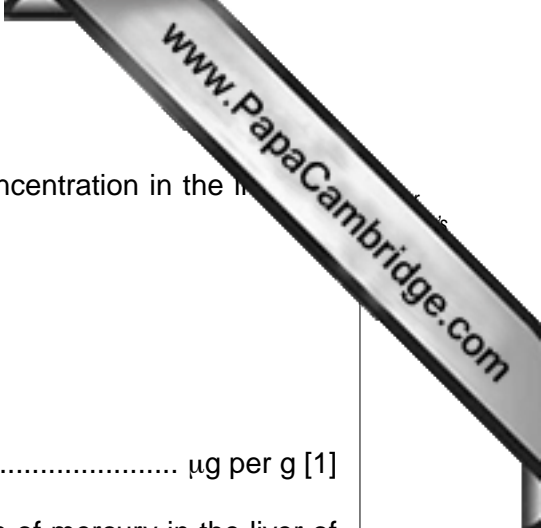
The tissue samples were obtained from dead bottlenose dolphins that were found washed up on the shores of the Eastern Adriatic Sea. Tissues from seven juvenile dolphins (less than 6 years old) and ten adult dolphins (older than 6 years) were obtained and the mean concentrations of mercury in these tissues were determined. The results are shown in Table 1.1.

Table 1.1

age of dolphin	mean concentration of mercury/ μg per g		
	in muscle	in liver	in kidney
juvenile	3	31	6
adult	25	331	22

- (a) Plot these results in a suitable graphical form on the grid provided below.





- (b) (i) Calculate the difference between the mean mercury concentration in the liver of the adult and juvenile dolphins.

..... $\mu\text{g per g}$ [1]

- (ii) Express this difference as a percentage of concentration of mercury in the liver of the juvenile dolphins.

..... % [1]

- (c) Using the information in Table 1.1, compare the changes in the concentration of mercury in the different tissues between juvenile and adult dolphins.

.....

 [2]

- (d) Suggest **one** reason for the difference in mercury concentration between juvenile and adult dolphin liver.

.....
 [1]

- (e) In a separate investigation, the mean mercury concentrations of sea bream, and zooplankton were determined. The results are shown in Table 1.2.

Table 1.2

species	mean concentration of mercury/ $\mu\text{g per g}$
zooplankton	0.122
sea bream	5.443

Suggest an explanation for the different concentrations of mercury in the zooplankton, sea bream, and dolphin.

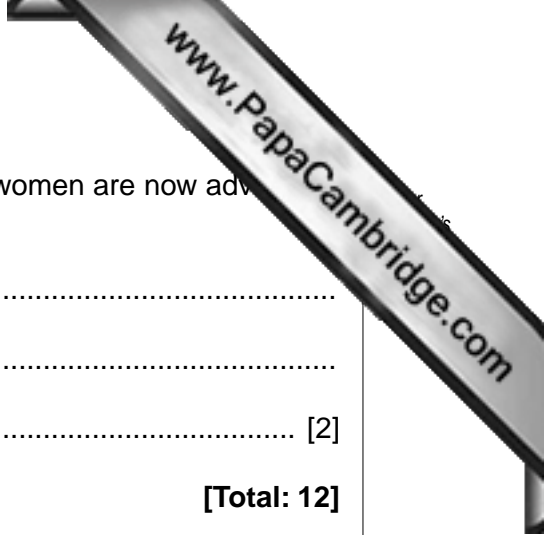
.....

 [2]

- (f) Use the data in Tables 1.1 and 1.2 to suggest why pregnant women are now advised to eat no more than four medium sized tins of tuna per week.

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

[Total: 12]



- 2 Atlantic salmon spend the majority of their life cycle in the ocean. Prior to spawning, they migrate through estuarine water into the fresh water of rivers. Table 2.1 shows the concentrations of ocean water, the body fluid of salmon and fresh water.

Table 2.1

sample	total ion concentration /g per cm ³
ocean water	3.5
body fluid of salmon	1.0
fresh water	0.05

- (a) Use the information in Table 2.1 to explain why salmon need to regulate the ion content and the volume of water in their body fluid in each of the following:

- (i) ocean water

.....

 [2]

- (ii) fresh water

.....

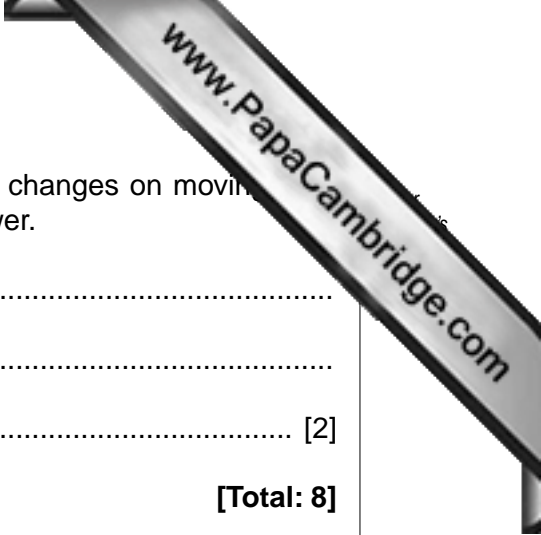
 [2]

- (b) Juvenile salmon drink water at an average rate of 1.2 cm³ per kg of body mass per hr whilst in fresh water.

- (i) Calculate the volume of water that a 5 kg salmon drinks in 2 hours in fresh water.

[1]

- (ii) The same juvenile salmon is found to produce urine at a rate of 1.5 cm³ per kg of body mass per hr. Calculate the additional volume of water absorbed by the salmon in 2 hours in fresh water.



(c) Suggest how the volume and concentration of salmon urine changes on moving from ocean water to fresh water. Give an explanation for your answer.

.....

.....

..... [2]

[Total: 8]

Section B

Answer **all** questions in this section on the lined pages provided.

- 3 (a) Describe and explain the restrictions that can be used to ensure that fish stocks can be exploited on a sustainable basis. [10]
- (b) Describe the principal methods that can be taken by governments to monitor and enforce fishing practices. [5]
- 4 (a) Explain the meaning of the term *conservation* and its importance to coastal and marine ecosystems. [3]
- (b) Suggest and explain **two** factors that must be considered for the successful conservation of a marine species. [4]
- (c) Describe and explain the steps that may be taken to ensure that ecotourism has a minimal impact on marine species and ecosystems. [8]

[Total: 30]

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