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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MARINE SCIENCE **9693/04**

Data-Handling and Free-Response **May/June 2012**

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.

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.
Write your answers on the lined pages provided.

For Examiner's Use	
1	
2	
3	
4	
Total	

This document consists of **12** printed pages.

UNIVERSITY of CAMBRIDGE International Examinations

Section A

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Answer **all** questions in this section.

1 An investigation into the effect of temperature on the respiration rate of the adult male pilchard, *Sardinops sagax*, was carried out.

Ten adult male fish of similar mass were placed in a circular fibreglass pool of 2.0 m diameter and depth 2.0 m.

The volume of oxygen consumed by the fish over a one hour period was measured.

The experiment was carried out for temperatures between 10 °C and 22 °C at 2 °C intervals.

Fish were not fed for a period of two days prior to experimentation.

The results are shown in Table 1.1.

Table 1.1

temperature / °C	**mean rate of respiration / mg O_2 consumed per hour per kg of wet mass**
10	0.13
12	0.14
14	0.15
16	0.17
18	0.19
20	0.23
22	0.27

(a) Plot a graph of mean rate of respiration of the fish against temperature and draw a line of best fit.

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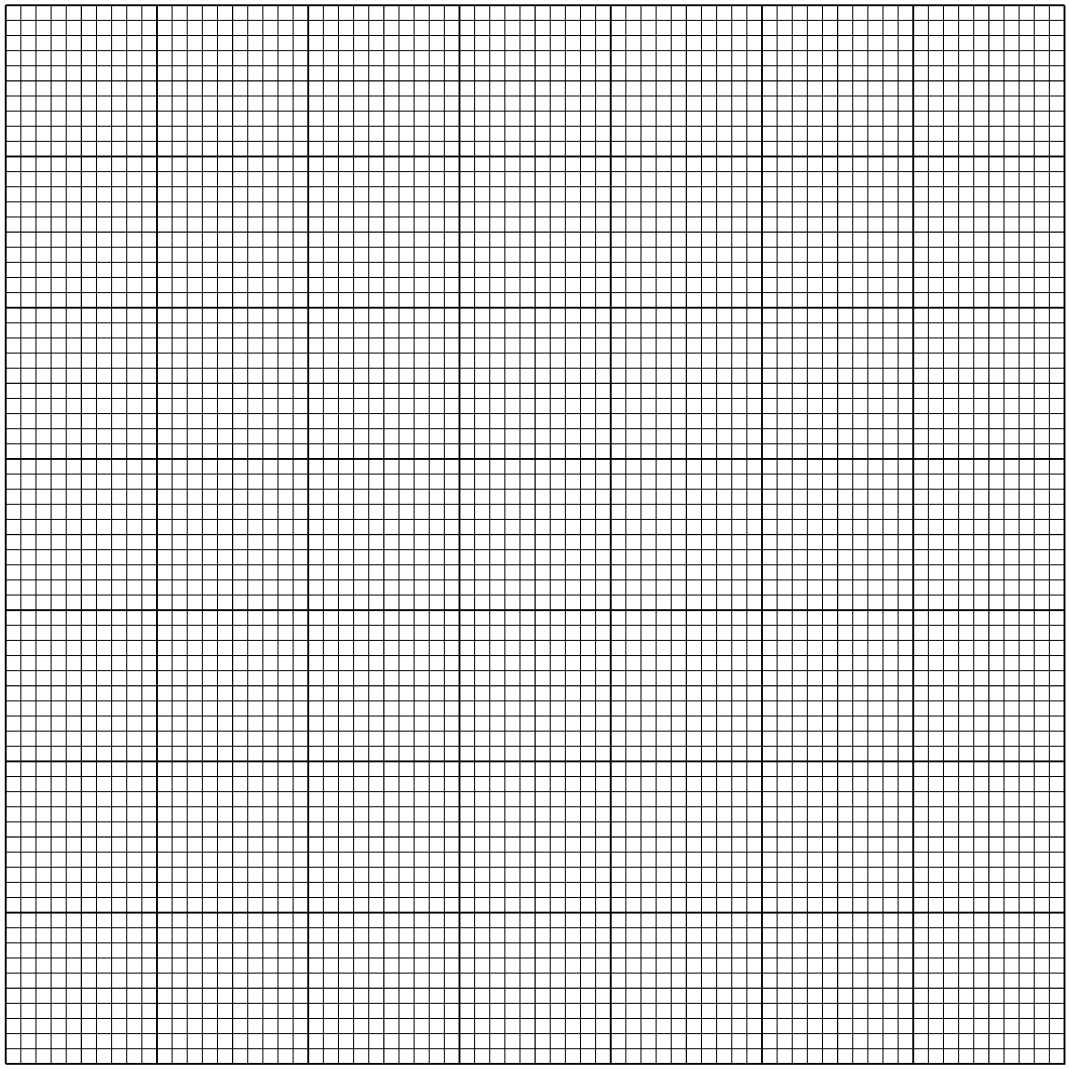

[3]

(b) Use your line of best fit to estimate the mean rate of respiration of the pilchards at 15 °C.

..... [1]

(c) Suggest why the fish were not fed for two days prior to the experiment.

.....

..... [1]

(d) Other than not feeding the fish for two days, state **two** other factors that were controlled.

1 .....

2 .....

[1]

(e) Pilchards feed on phytoplankton and zooplankton.

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Recent data concerning blooms of phytoplankton in oceans have suggested that raised ocean temperatures can have a negative effect on phytoplankton productivity.

Use this information and the data from Table 1.1 to suggest and explain how global warming could affect pilchard populations.

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..... [4]

[Total:10]

2 An investigation was carried out into the growth rate of the fish tilapia, *Tilapia mossambica*, under different conditions. Tilapia is a species that is frequently grown using aquaculture.

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Fifty young female fish were taken and placed into a rectangular tank of dimensions 15 m × 15 m × 2 m. The fish were fed daily with 2 kg of high protein food pellets and the mean wet masses of the fish recorded every fifty days. The results are shown in Fig. 2.1.

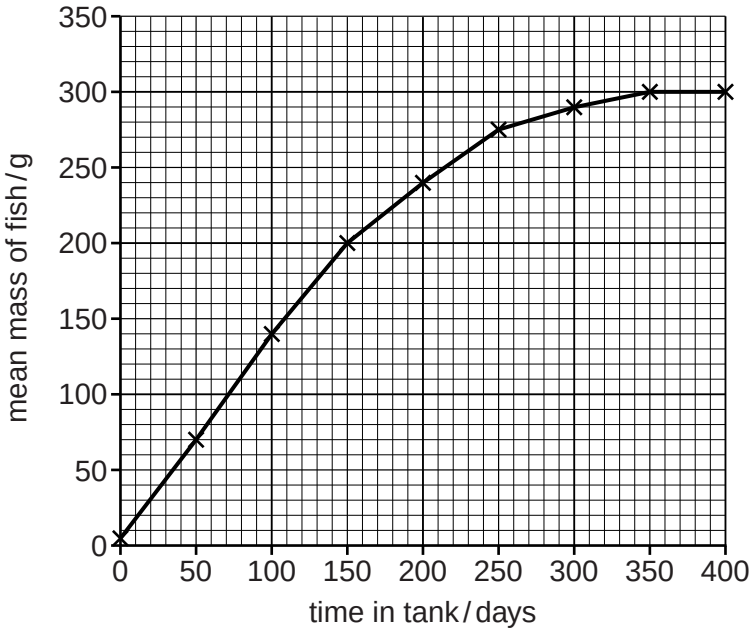

Fig. 2.1

(a) Describe how the mean mass of the female tilapia changes over the period of 0 to 400 days.

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..... [2]

(b) Use Fig. 2.1 to suggest what would be an optimal time, in days, to harvest the female tilapia. Explain your choice.

number of days .....

explanation .....

.....

.....

.....

[3]

(c) In a further series of experiments, the growth of male tilapia was investigated, and also the effect of two different diets on the growth of both male and female tilapia.

In these experiments, the fish were treated as follows:

- 50 female fish were given a high protein diet,
- 50 female fish were given a low protein diet,
- 50 male fish were given a high protein diet,
- 50 male fish were given a low protein diet.

The mean masses of the fish were measured and the data presented in Fig. 2.2.

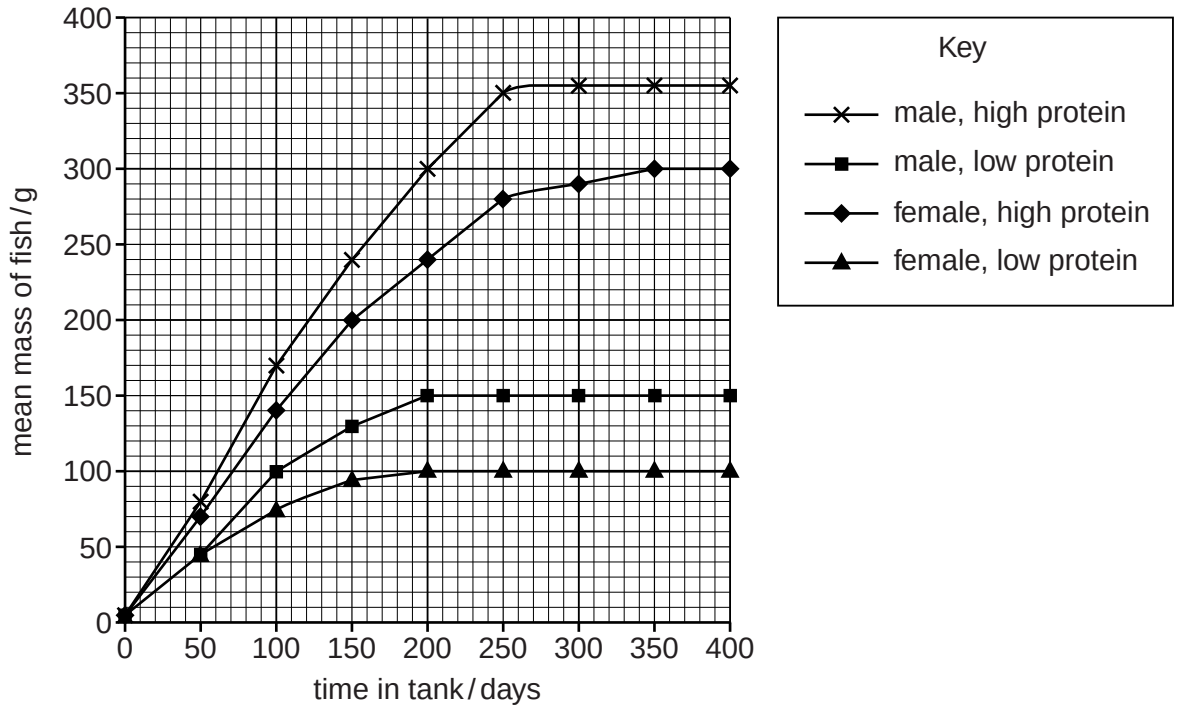

Fig. 2.2

(i) Compare the effects of feeding tilapia on a low protein diet with a high protein diet.

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..... [3]

(ii) Suggest circumstances when it might be economically beneficial to feed fish on each of the following diets.

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low protein diet

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.....

high protein diet

.....

.....
[2]

[Total: 10]

Section B

Answer **all** questions in this section.

Write your answers on the lined pages provided.

3 **(a)** Explain how the surface area to volume ratio of an organism varies according to its size and shape. [3]

(b) Compare gas exchange in a coral polyp and a grouper. [6]

(c) Skipjack tuna switch from pumped ventilation to ram ventilation as swimming speed increases. Describe how ram ventilation differs from pumped ventilation and suggest reasons for the change in method as the swimming speed increases. [6]

[Total: 15]

4 **(a)** Outline the effects of the accumulation of a named toxin in marine food chains. [4]

(b) Describe the potential ecological and economic impacts of the building of a desalination plant in a coastal area. [6]

(c) Artificial reefs may be created from wrecked ships. Discuss the possible advantages and disadvantages of these structures on marine ecology. [5]

[Total: 15]

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