

CANDIDATE  
NAME

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**MARINE SCIENCE**

**9693/04**

Paper 4 A2 Data-Handling and Free-Response

**October/November 2017**

**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 **10** printed pages and **2** blank pages.

## Section A

Answer **both** questions in this section.

- 1 An experiment was carried out to investigate the effect of temperature and mass of food on the growth of salmon.

Young salmon were placed into tanks of seawater at six different temperatures between 0°C and 25°C.

At each temperature, six different feeding regimes were used, ranging from no food given, to five feeds per day.

The fish were given the same mass of food each time they were fed.

The mean growth rate was determined by weighing the fish at the start and again after two weeks. This was expressed as mean percentage change in body mass compared to their initial mass.

The results are shown in Fig. 1.1.

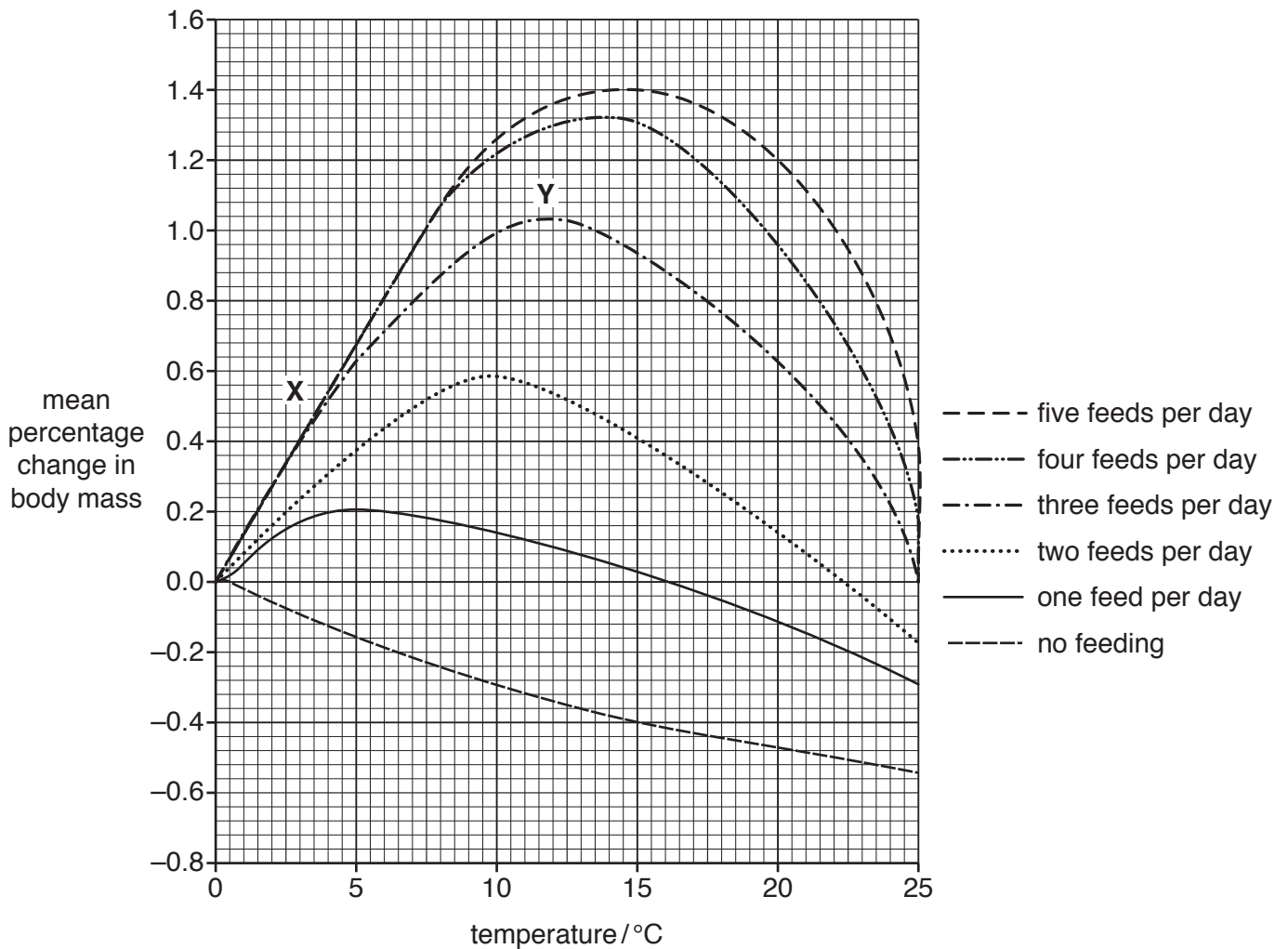


Fig. 1.1

(a) (i) State the **two** independent variables in the investigation.

.....[1]

(ii) Suggest **two** variables that should be controlled.

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

(b) The mean growth rate was expressed as the percentage change of initial body mass.

(i) Calculate the difference between the mean percentage change in mass for the fish grown at 5 °C with one feed per day and two feeds per day.

.....  
[2]

(ii) Suggest the factor that limits the growth of the fish with three feeds per day at each of points **X** and **Y** in Fig. 1.1.

In each case, explain how you reached your conclusion.

**X** .....  
.....  
.....

**Y** .....  
.....  
.....

[2]

(c) Suggest explanations for the effects of temperature and mass of food on the growth rates of the salmon.

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[4]

(d) Salmon often inhabit waters with temperatures ranging between 5 °C and 7 °C. Current models of climate change predict a possible 2 °C to 3 °C rise in temperature of the waters where salmon are found. It is also predicted that the natural food of the salmon will be dramatically reduced.

Use Fig. 1.1 to predict **and** explain the likely effects of a temperature rise of 2 °C to 3 °C on wild salmon populations.

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[3]

[Total: 13]



2 Marine protection areas (MPAs) are regions of sea or ocean where fishing is prohibited or restricted in an effort to conserve species. The impact of MPAs on the lobster populations in the sea around Norway was investigated.

In 2006, an MPA and a control area were established at site **A**. An MPA and a control area were also established at site **B**.

The control areas were the same size as the MPAs. Commercial lobster fishing took place in the control areas.

All fishing within the MPAs was restricted.

Lobsters were sampled in all MPAs and control areas using identical traps placed at a depth of between 10 m and 30 m.

Sampling of lobsters was carried out by inspecting 25 traps in each MPA and 25 traps in each control area every day for four separate days. This was repeated every year between 2006 and 2010.

Sampling was conducted between 20 August and 10 September each year.

(a) (i) Calculate the total number of samples taken each year.

.....  
[1]

(ii) Suggest why the control areas were close to each of the MPAs.

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













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