Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

3620666281

MARINE SCIENCE **9693/03**

Paper 3 A2 Structured Questions **October/November 2014**

1 hour 30 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.

Answer **all** questions.
Write your answers in the spaces provided on the question paper.
The number of marks is given in brackets [ ] at the end of each question or part question.
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.

This document consists of **15** printed pages and **5** blank page.

CAMBRIDGE International Examinations

[Turn over

1 **(a)** Table 1.1 shows the mean percentage of three gases in the surface sea water and in the atmosphere.

Table 1.1

gas	percentage in surface sea water	percentage in the atmosphere
nitrogen	48	78
oxygen	36	21
carbon dioxide	15	0.04

(i) State a biological process that releases oxygen into the environment.

..... [1]

(ii) State a biological process that releases carbon dioxide into the environment.

..... [1]

(iii) Suggest **one** reason for the difference between the percentages of the gases in the atmosphere and in surface sea water.

.....

..... [1]

(b) Fig. 1.1 shows the solubility of carbon dioxide in pure water at different temperatures.

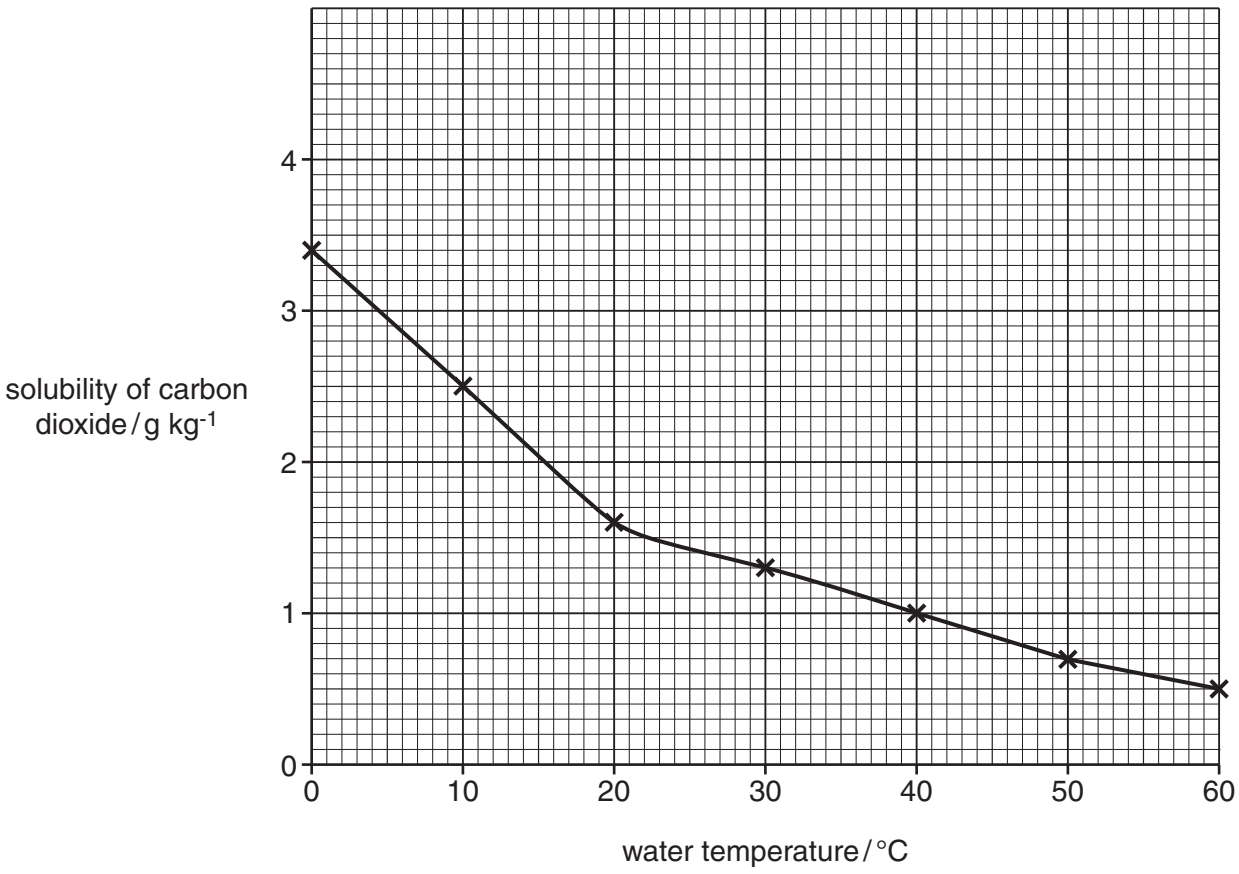

Fig. 1.1

(i) With reference to the information in Fig. 1.1, describe the effect of temperature on the solubility of carbon dioxide.

.....

.....

.....

..... [2]

(ii) The solubility of carbon dioxide in sea water is less than in pure water.

On Fig. 1.1, sketch a curve to show the effect of temperature on the solubility of carbon dioxide in sea water. [1]

(c) (i) Explain what is meant by the term *thermocline*.

.....

.....

.....

..... [2]

(ii) Describe the effect of a thermocline on the availability of carbon dioxide at different depths of the ocean.

.....

.....

.....

..... [2]

(d) The surface temperature in the North Atlantic Ocean ranges from 12 °C to 16 °C.
The surface temperature in the Mid-Atlantic Ocean ranges from 22 °C to 26 °C.

Explain how the difference in the availability of carbon dioxide in these two regions of the Atlantic Ocean might affect the population of primary producers.

.....

.....

.....

.....

..... [2]

[Total: 12]

2 **(a)** Explain why marine fish tend to lose water to the sea.

.....

.....

.....

.....

.....

..... [3]

(b) Fig. 2.1 shows the change in concentration of body fluids of three types of organism, **A**, **B** and **C**, exposed to a range of different salinities of water.

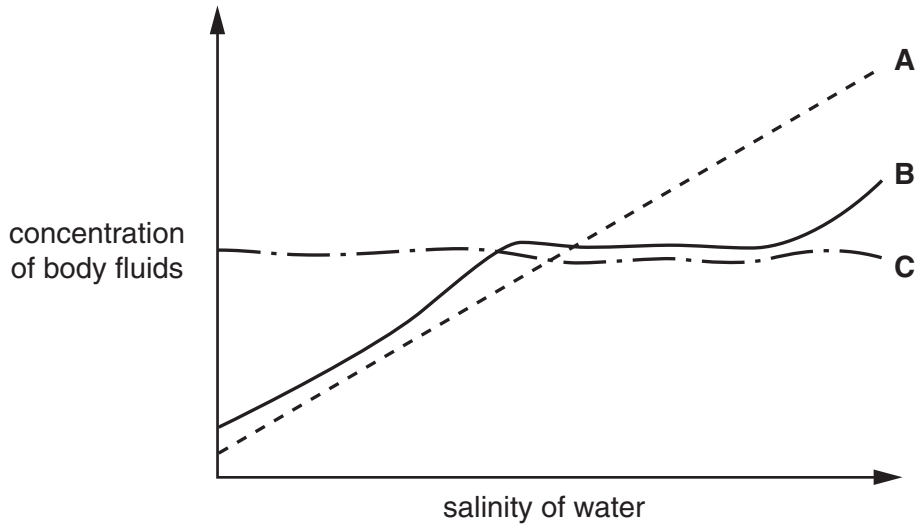

Fig. 2.1

State, with reasons, which of these organisms, **A**, **B** or **C**, is likely to be a mussel and which is likely to be a marine bony fish.

mussel .....

reason .....

.....

marine bony fish .....

reason .....

..... [4]

(c) Table 2.1 shows the concentration of some of the solutes present in sea water and in the body fluids of fish living at different depths.

Table 2. 1

solute	concentration of solute within fluid / mmol dm^{-3}				
	sea water	surface water shark	surface water bony fish	mid water bony fish	benthic bony fish
urea	0	363	4	1	2
trimethylamine oxide	0	66	14	12	51
chloride ions	550	235	176	267	242
sodium ions	470	230	198	282	225

With reference to Table 2.1 state which fish:

(i) is likely to lose least water

..... [1]

(ii) is likely to lose most water.

..... [1]

(iii) Suggest an explanation for your answers to **(i)** and **(ii)**.

.....

.....

.....

.....

.....

..... [3]

(iv) Suggest a role in osmoregulation for urea and trimethylamine oxide.

.....

..... [1]

[Total: 13]

3 **(a)** Table 3.1 shows some of the stages of the life cycle of the penaeid shrimp.

Table 3.1

stage	duration of stage	size at end of stage/mm	habitat
egg	14 hours	0.02	underwater offshore
nauplius larva	48 hours	0.50	surface water offshore ↓ migrate during development ↓ inshore
protozoea larva	160 hours	2.59	
mysis larva	72 hours	4.3	
post larva	24 hours	4.6	estuaries, mangroves and coastal wetlands
juvenile	2–3 months	95–100	
adult	6–12 months	180–250	

(i) State the location of the breeding grounds of the adult shrimps.
Give a reason for your answer.

.....

..... [1]

(ii) Explain why large numbers of eggs and sperm are produced by these shrimps.

.....

.....

.....

..... [2]

(iii) State **two** advantages to the larval stages of penaeid shrimps of living in surface water.

1. .....

.....

2. .....

..... [2]

(iv) Young juvenile shrimps are scavengers, feeding on sediment. As they age, juvenile shrimps also become predators of planktonic crustacea, small fish and worms.

Table 3.1 shows that the habitat of juvenile shrimps is estuaries, mangroves and coastal wetlands.

Explain why this habitat is advantageous to juvenile shrimps.

.....

.....

.....

.....

.....

..... [2]

(b) Commercial aquaculture of shrimps along the coast of South America has increased greatly.

Large ponds are dug out along coastlines, destroying any mangroves or wetlands in the way. The ponds are stocked with juvenile shrimps and a food supply. After about four months, the ponds are drained and the adult shrimps collected, cleaned and frozen for export.

(i) Suggest **two** long-term economic disadvantages to local people of mangrove destruction.

1. .....

.....

2. .....

..... [2]

(ii) Suggest **two** ways in which destruction of mangroves for shrimp aquaculture might affect the local ecosystem.

1. .....

.....

2. .....

..... [2]

[Total: 11]

4 **(a)** The management of sustainable fishing involves monitoring and enforcement of regulations.

(i) Explain what is meant by fisheries monitoring.

.....

..... [1]

(ii) Describe **two** aspects of commercial fishing which are monitored.

1. .....

.....

2. .....

..... [2]

(iii) Describe how **two** different types of surveillance system might be used.

1. .....

.....

2. .....

..... [2]

(iv) Suggest **one** way in which a fishing vessel could be recognised by surveillance systems.

.....

..... [1]

(b) **(i)** Describe how **three** enforcement methods can help to keep commercial fishing sustainable.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Describe **three** difficulties in enforcing fishing regulations.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 12]

BLANK PAGE

5 **(a)** State what is meant by the term *aquaculture*.

.....

..... [1]

(b) Salmon is one of the world's most economically important fish in aquaculture. A small percentage of these fish are genetically engineered (GM salmon).

Outline how salmon have been genetically engineered to increase growth rate.

.....

.....

.....

.....

.....

..... [3]

(c) Salmon have been modified by artificially increasing the chromosome number so that they are sterile. This has been done with both normal salmon (non-GM salmon) and on salmon genetically engineered to increase growth rate (GM salmon).

An investigation was carried out into the sizes of salmon in four groups:

- group **A** GM salmon with normal chromosomes
- group **B** GM salmon with extra chromosomes
- group **C** non-GM salmon with normal chromosomes
- group **D** non-GM salmon with extra chromosomes

The fish produced were weighed. The maximum and minimum size in each group was recorded and the mean mass of each group calculated.

Fig. 5.1 shows the mean mass and size range for each of the groups, **A**, **B**, **C** and **D**.

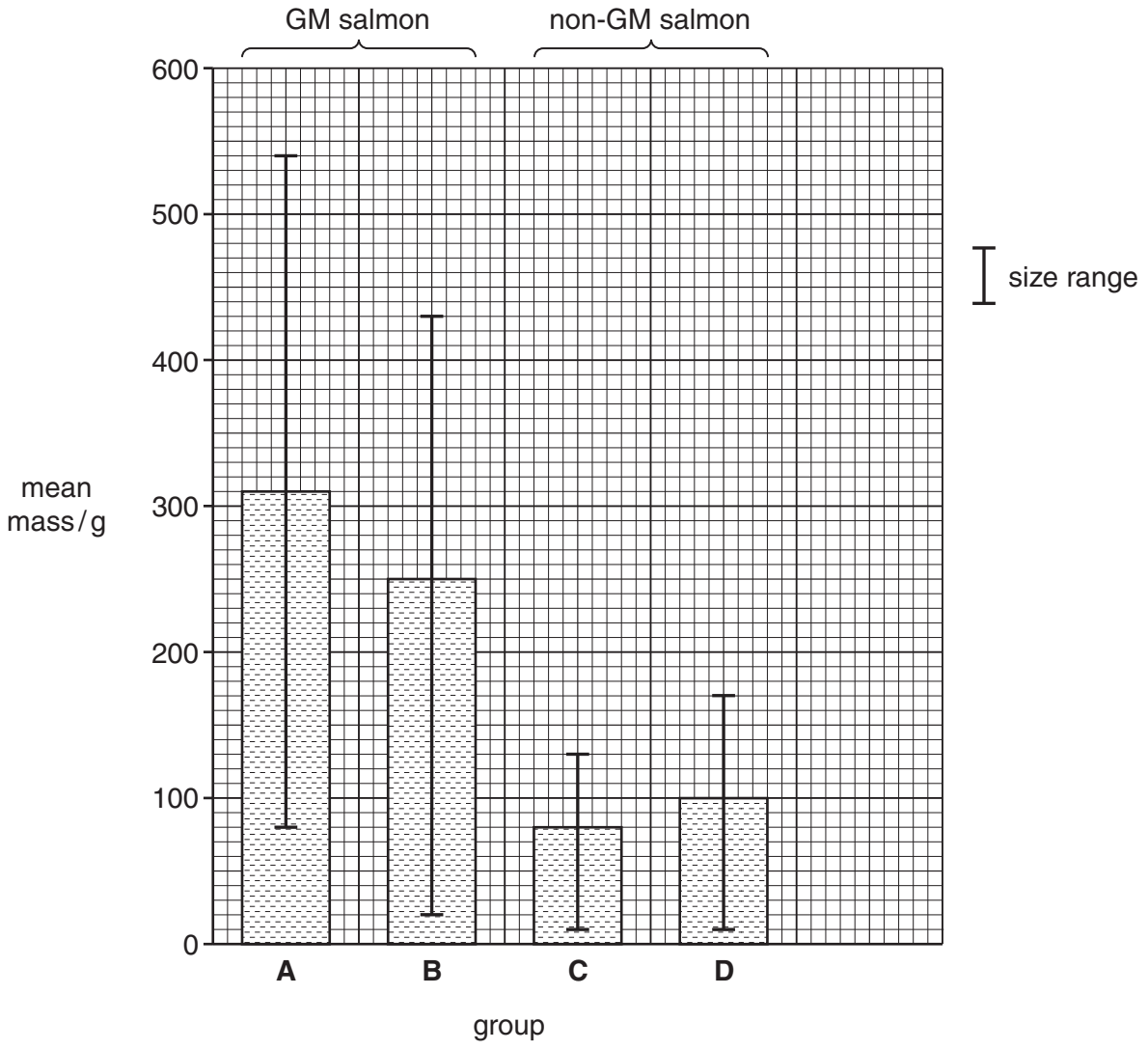

Fig. 5.1

(i) State why type **C** salmon were included in the investigation.

.....

..... [1]

(ii) State the difference in the maximum mass of GM salmon with extra chromosomes and the maximum mass of non-GM salmon with extra chromosomes.

..... [1]

(iii) The mean mass of GM salmon with extra chromosomes is 2.5 times the mean mass of non-GM salmon with extra chromosomes.

Calculate, for salmon with normal chromosomes, how much the mean mass of GM salmon has increased compared to the mean mass of non-GM salmon.

..... [2]

(iv) With reference to Fig. 5.1, describe the effect of extra chromosomes on the growth of salmon.

.....

.....

.....

..... [2]

(d) Artificially adding extra chromosomes to fish used for aquaculture has been practised for at least ten years.

Suggest **two** reasons why this type of fish is used for aquaculture.

1. .....

.....

2. .....

..... [2]

[Total: 12]

6 **(a)** Fig. 6.1 shows the world sources of mercury pollution.

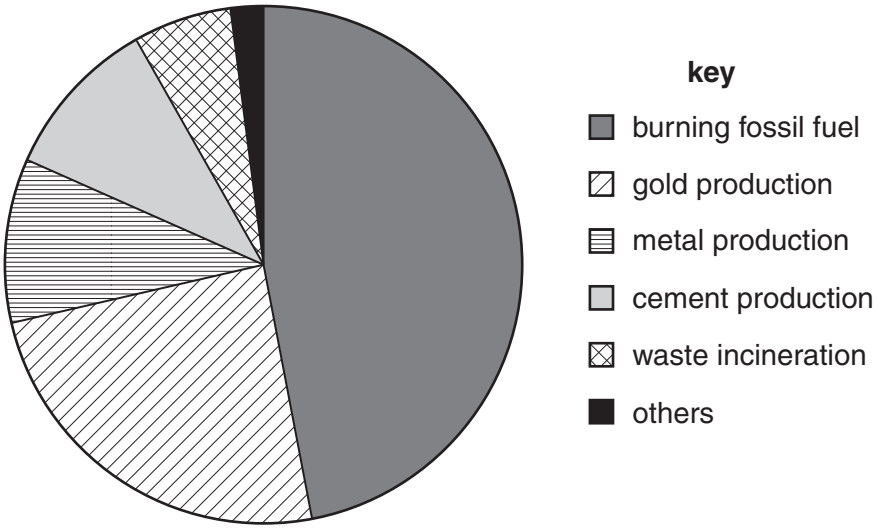

Fig. 6.1

(i) Use Fig. 6.1 to identify the source that is responsible for approximately a quarter of the world's mercury pollution.

..... [1]

(ii) Suggest **two** ways in which mercury might enter the ocean.

1. .....

.....

2. .....

..... [2]

(b) Mercury can enter marine food chains.

Sea water contains 0.1–2.0 nanograms (ng) of mercury per kilogram of water.

Table 6.1 shows the mercury concentration in different trophic levels in the marine environment.

Table 6.1

trophic level	mercury concentration / ng kg^{-1}
phytoplankton	10 000–100 000
zooplankton	20 000–100 000
molluscs and crustaceans	50 000–220 000
fish	100 000–420 000
predatory fish	330 000–1 080 000

(i) Suggest **one** route by which mercury pollutants can enter marine food chains.

.....

..... [1]

(ii) With reference to Table 6.1, explain why the concentration of mercury increases from one trophic level to the next.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(iii) Describe how the increase in mercury in higher trophic levels might affect human food sources.

.....

.....

..... [1]

[Total: 9]

[Turn over

7 **(a)** An ocean fishery is about to close because the main target fish population has collapsed.

The main fishing fleet is based in a deep water harbour next to the fish market. Support businesses for fishing, such as rope and net sales and boat repairs, are in the same area.

There are two proposals to try and find alternative employment after the fishery closes.

Proposal 1

- Local developers will expand the harbour and build a marina for leisure boats.
- Fishing boats will be converted to use for sight-seeing or tourist hire around the coast.
- The support businesses will remain to supply leisure boats.
- In the market area, gift shops and food outlets will be developed for visitors.

Proposal 2

- Outside developers will build a semi-extensive aquaculture fishery, partly based on land and partly on a sea cage platform outside the harbour area.
- Some of the fishing boats will be kept to transport farmed fish to the harbour and to catch wild stock to supply the aquaculture.
- In the long term, a fish processing business will be developed in the harbour area.

Two of the local stakeholders are the fishing boat owners and the support business owners.

(i) Suggest **one** argument each of these stakeholders might make in favour of **proposal 1**.

fishing boat owners .....

.....

support business owners .....

..... [2]

(ii) Suggest **one** argument each of these stakeholders might make in favour of **proposal 2**.

fishing boat owners .....

.....

support business owners .....

..... [2]

(b) At a public meeting with stakeholders, the view of the local people was that **proposal 1** was more risky than **proposal 2**.
Suggest **two** reasons why proposal 1 is less likely to succeed than proposal 2.

1. .....

.....

2. .....

..... [2]

[Total: 6]

BLANK PAGE

BLANK PAGE

BLANK PAGE

BLANK PAGE