



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

CANDIDATE  
 NAME

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**MARINE SCIENCE**

**9693/03**

Structured Questions

**May/June 2012**

Paper 3

**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 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.

Write your answers in the spaces provided on the question paper.

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.

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<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>5</b>	
<b>6</b>	
<b>7</b>	
<b>Total</b>	

This document consists of **14** printed pages and **2** blank pages.



1 The carbon dioxide concentration in the atmosphere is increasing.

(a) (i) Explain how this increase in carbon dioxide concentration will affect the chemistry of sea water.

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

(ii) Phytoplankton are primary producers in the marine ecosystem. Some types of phytoplankton have external structures containing calcium carbonate.

Explain how the change in the chemistry of sea water you have described in (a)(i) might affect these external structures.

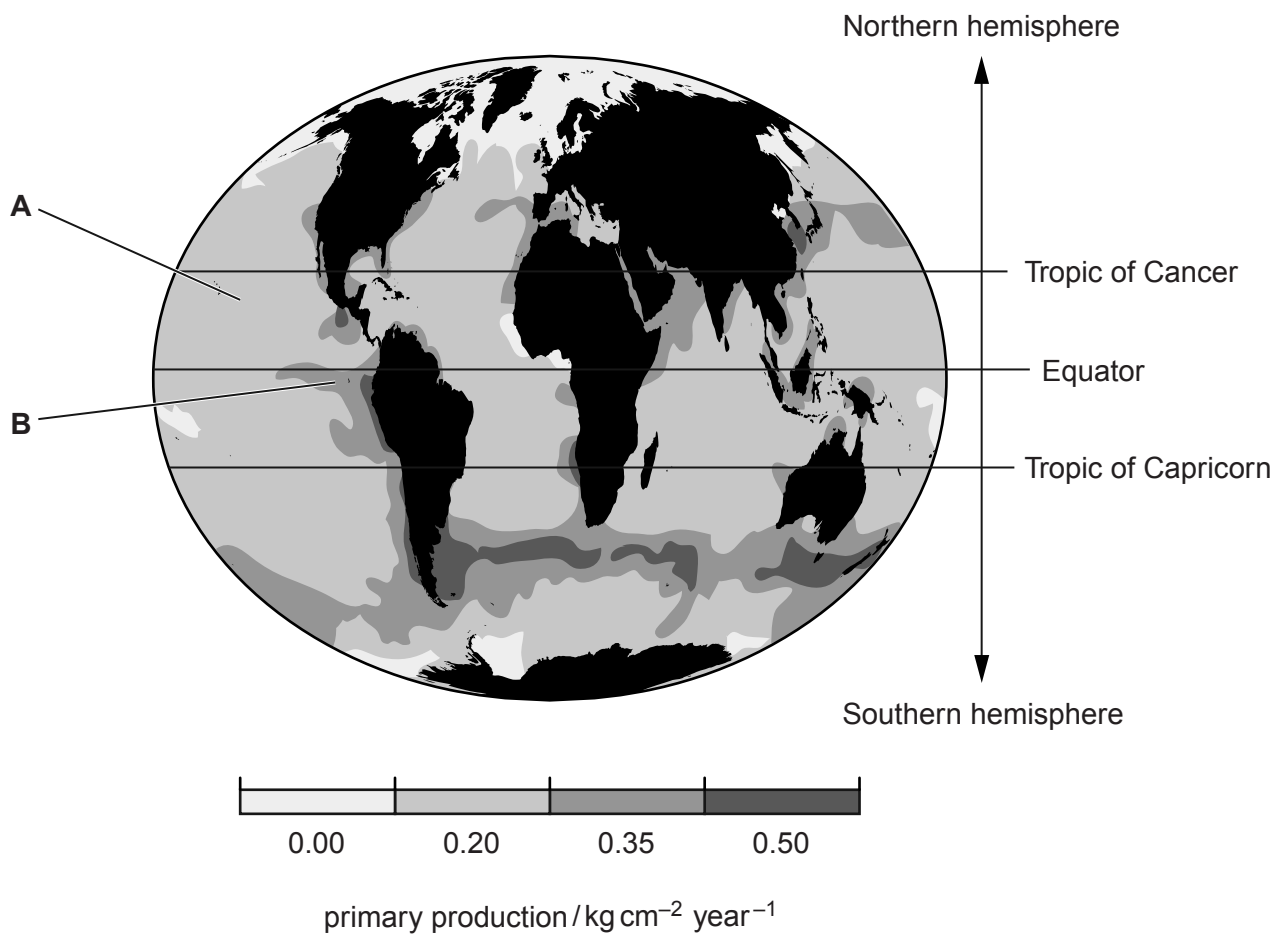
.....  
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.....  
..... [2]

(iii) An increase in carbon dioxide concentration of sea water may cause a decrease in biodiversity of the phytoplankton. Suggest a reason why this may happen.

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

(b) Fig. 1.1 shows the global primary productivity due to phytoplankton.

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**Fig. 1.1**

(i) Using the information in Fig. 1.1, describe the pattern shown by the primary productivity of the phytoplankton.

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[3]

(ii) Suggest reasons why the primary productivity of the phytoplankton is higher in area B than in area A.

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[2]

[Total: 10]

**[Turn over**

2 (a) Explain why marine bony fish need to regulate their water content and ion content.

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..... [3]

(b) Salt forms sodium ions and chloride ions in the blood of marine fish. Chloride cells in the gills of these fish absorb excess chloride ions from the blood and actively excrete them from the gills.

Fig. 2.1 shows a photograph of two chloride cells from the gills of a marine fish as seen using an electron microscope.

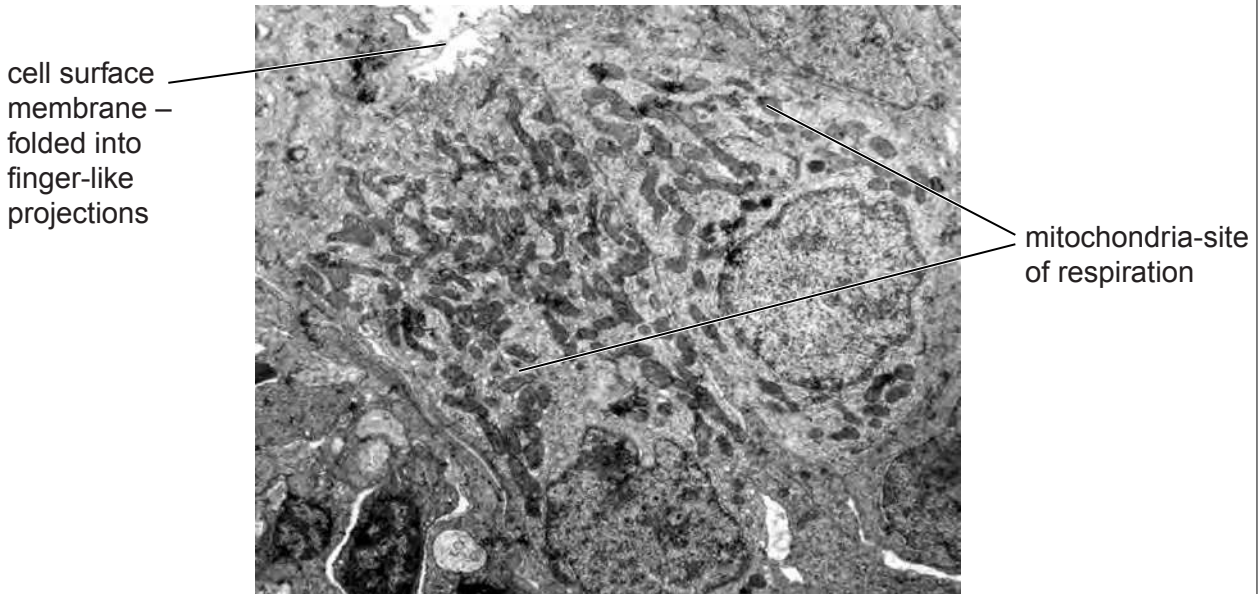


Fig. 2.1

Explain how the two labelled features of these cells, shown in Fig. 2.1, would help the function of these cells.

*mitochondria* .....

.....

.....

*cell surface membrane* .....

.....

..... [4]

(c) The effect of carbon dioxide on the ion regulation in a species of marine fish was investigated. Fish were divided into two groups and treated as follows.

- Group **A** was kept in sea water containing the normal concentration of carbon dioxide.
- Group **B** was kept in sea water containing a higher concentration of carbon dioxide.
- The oxygen consumption of both groups of fish was measured over a period of six weeks.

Some of the findings of the investigation were

- The rate of oxygen consumption of group **A** remained unchanged through the investigation.
- The rate of oxygen consumption of group **B** rose initially, then fell after 3 days and then remained unchanged.

(i) State the purpose of including group **A** in this investigation.

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

(ii) State **two** variables that should have been controlled in this investigation.

1. ....  
 .....  
 2. ....  
 ..... [2]

(d) Suggest a hypothesis that can be formulated on the basis of these results.

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

[Total: 11]

3 (a) Outline the life cycle of a salmon.

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..... [4]

(b) Describe how the life cycle of a tuna differs from that of a salmon.

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..... [3]

(c) Suggest how the habitat where tuna breed may affect the survival of the next generation of fish.

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..... [2]

[Total: 9]

**Turn over for Question 4**

- 4 (a) A marine satellite information system (MARSIS) is used for remote sensing around the coast of India.

Data about sea temperature are used to predict weather changes and to identify potential fishing zones (PFZs) in the Indian Ocean. Information about these PFZs is sent out to fishing communities using television, radio, newspapers and fax.

Suggest **two** advantages to the fishing communities of information about PFZs.

- 1. ....
- .....
- 2. ....
- ..... [2]

- (b) Fig. 4.1 shows the catch per unit effort (CPUE) in two different areas of the ocean. In each area the CPUE was compared for a PFZ zone and a non-PFZ zone.

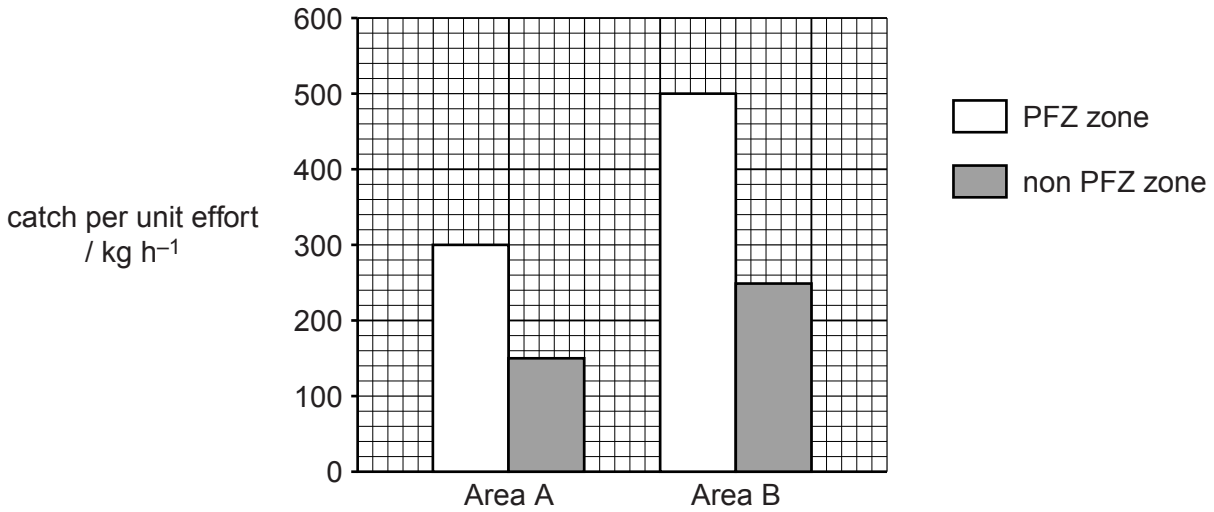


Fig. 4.1

- (i) State how CPUE is calculated.
- ..... [1]

- (ii) With reference to Fig. 4.1, describe the effect of PFZs on CPUE.
- .....
- .....
- .....
- ..... [2]



(iii) Explain how the use of PFZs could lead to a fishery becoming unsustainable.

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

(c) Describe how each of the following are used to ensure that fish stocks are exploited in a sustainable manner.

1. restrictions on fishing times .....  
.....  
.....  
.....

2. restrictions on fishing method .....  
.....  
.....  
.....

3. restrictions on fishing intensity .....  
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.....  
..... [6]

[Total: 13]

- 5 (a) Fig. 5.1 shows the site of a proposed aquaculture development to rear a species of fish that does not live in that area of the world.

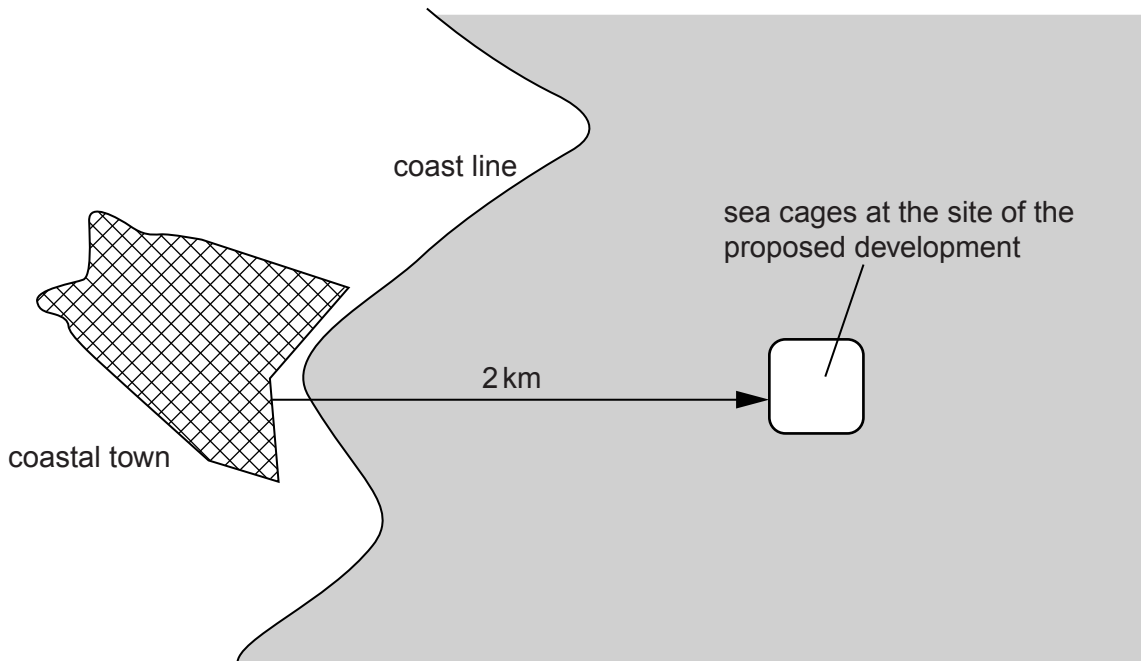


Fig. 5.1

- The fish eggs will be collected from adult fish reared in a hatchery alongside the sea cages.
- Young fish from the hatchery will be transferred to the sea cages.
- Food will be supplied as pellets containing antibiotics.
- The sea cages will be treated with chemicals to prevent algae and molluscs growing.

- (i) Suggest why the use of sea cages rather than enclosed land based tanks will help to reduce the cost of rearing the fish in this proposed intensive aquaculture system.

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

- (ii) Suggest **one** reason why this species of fish should be reared in sea cages that keep them separate from the local species.

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



- 6 (a) Sea birds contaminated by oil have been used for many years as indicators of oil pollution at sea. Most sea birds feed by diving into water to catch fish.

Suggest why this method of feeding increases the risk of death of sea birds due to oil pollution.

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..... [4]

- (b) The information below is about some research in Canada in 2002 carried out by The World Wildlife Fund for Nature Canada into the effects of oil pollution on sea birds.

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- (i) Suggest why, during the 10 year study period, oil released from ship cleaning had a much greater impact than accidental spills.

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..... [2]

- (ii) The number of sea birds killed by oil is estimated by counting the number of dead oiled birds washed onto beaches. Suggest **two** reasons why these estimates may be less than the actual number killed.

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..... [2]

- (c) Table 6.1 shows the percentage of all sea bird deaths due to oiling in Canada and other Northern hemisphere countries.

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**Table 6.1**

country	percentage of deaths due to oiling
North West coast Canada	65–75
West coast Canada and United States	23
Germany	47
Denmark	47
Holland	38

- (i) Suggest **one** reason why the North West coast of Canada has a high percentage of sea bird deaths due to oiling.

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

- (ii) The illegal discharge of oil is controlled by international agreements. These include ship inspection, fines for illegal oil discharge and cleaning up of oil spillage. Suggest **two** recommendations the research report might make to help reduce the number of sea birds killed by illegal oil discharges in North West Canada.

1. ....  
 .....  
 2. ....  
 ..... [2]

- (d) Biotechnology can be used to treat oil spills.

- (i) Define the term *biotechnology*.

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

- (ii) Naturally occurring species of bacteria that can digest oil have been genetically engineered to increase their efficiency in removing oil. Outline how these naturally occurring bacteria may have been genetically modified.

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

[Total: 15]

7 (a) Explain what is meant by the term *conservation*.

.....

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..... [2]

(b) Exploration has found that there may be gas or oil reserves in the Arctic Ocean. This area of sea is very cold and frozen for much of the year. There has been very little development in this hostile environment.

A number of oil companies want to develop an offshore, deep sea drilling platform. The government of Greenland is in discussion about the potential for exploiting these oil reserves.

Fig. 7.1 shows the appearance of an offshore drilling rig.

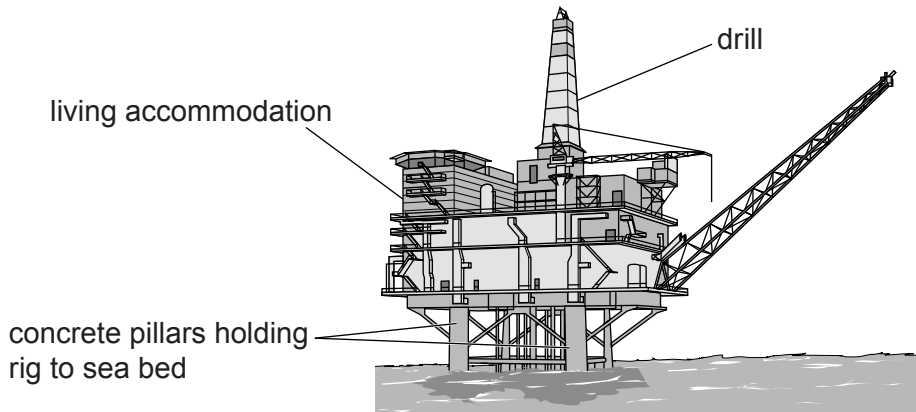


Fig. 7. 1

In a public debate about the proposed deep sea drilling, conservation groups and the owners of the exploration rig presented their views.

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(i) Suggest reasons the exploration company might give for allowing deep sea drilling.

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..... [3]

(ii) Suggest and explain reasons that the conservation group might give to prevent deep sea drilling.

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..... [3]

[Total: 8]

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*Copyright Acknowledgements:*

Question 1 Fig. 1.1	© <a href="http://news.mongabay.com/2006/1013-fsu.html">http://news.mongabay.com/2006/1013-fsu.html</a> .
Question 4 Fig. 4.1	© <a href="http://dod.nic.in/marsis.htm">http://dod.nic.in/marsis.htm</a> .
Question 6	© <a href="http://www.commondreams.org/headline/2010/08/31-2">www.ca/downloads/wwf_northwestatlantic_seabirdsandshipsourcepollution.pdf</a> .
Question 7	© <a href="http://www.commondreams.org/headline/2010/08/31-2">http://www.commondreams.org/headline/2010/08/31-2</a> .
Question 7 Fig. 7.1	© Drawing of oil platform; <a href="http://www.timtim.com/drawing/view/drawing_id/252">http://www.timtim.com/drawing/view/drawing_id/252</a> .

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