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

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

MARINE SCIENCE **9693/03**

Structured Questions **For Examination from 2009**

SPECIMEN PAPER

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.

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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
Total	

This document consists of **17** printed pages and **1** blank page.

For Examiner's Use

1 **(a)** Fig. 1.1 shows the relationship between light intensity and relative rate of photosynthesis in planktonic diatoms.

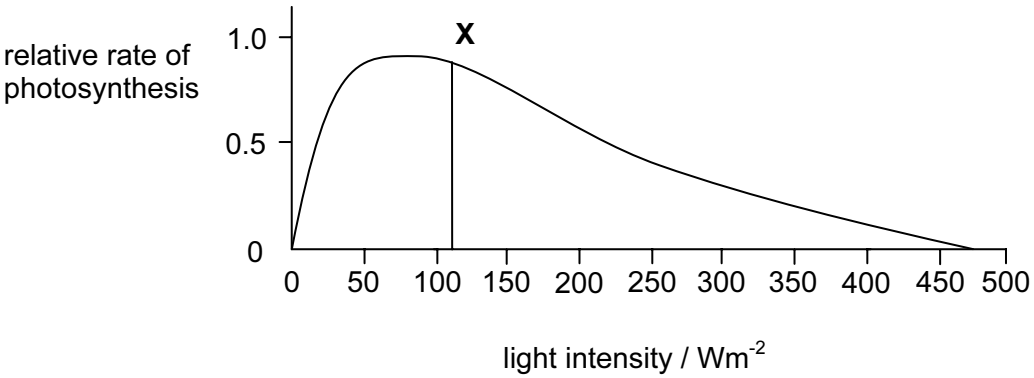

Fig. 1.1

(i) **On Fig. 1.1**, draw a line from the x-axis to the curve, to show the point at which light is no longer a limiting factor on photosynthesis. [1]

(ii) Explain the shape of the curve between the line you have drawn on Fig. 1.1 and the line labelled **X** in Fig. 1.1.

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..... [2]

(b) Fig. 1.2 shows the relationship between photosynthesis, respiration and depth.

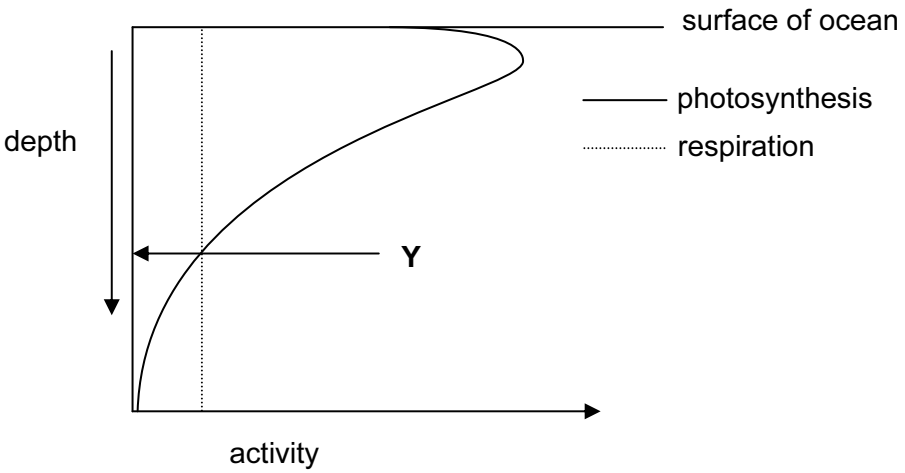

Fig. 1.2

For Examiner's Use

(i) Use the information in Fig. 1.1 to explain the shape of the curve showing photosynthesis in Fig. 1.2.

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..... [4]

(ii) Explain why phytoplankton cannot live permanently at a depth below that shown by point **Y** on Fig. 1.2.

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..... [2]

(c) Some species of dinoflagellates form part of the phytoplankton. Explain how these dinoflagellates obtain sufficient light exposure for optimum photosynthesis.

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[Total: 11]

2 Fig. 2.1 shows the time taken for diffusion from the external environment to the cells of a multicellular organism and a unicellular organism.

For Examiner's Use

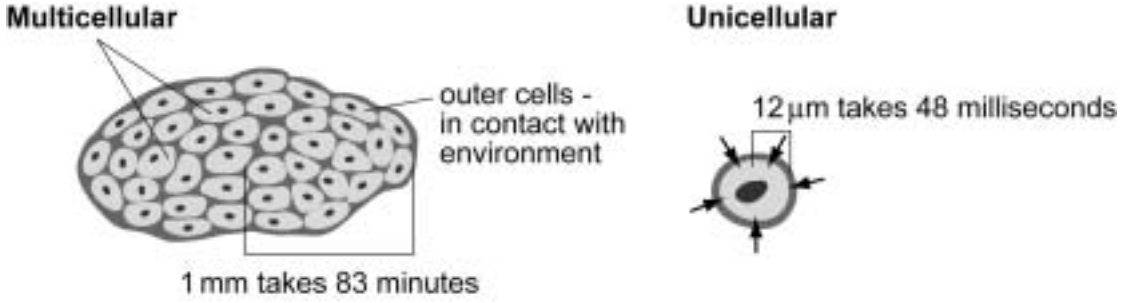

Fig. 2.1

(a) (i) Calculate how much faster the rate of diffusion in this unicellular organism is in comparison to this multicellular organism. Show your working.

..... [4]

(ii) Explain why the rate of diffusion limits the size of a multicellular organism without a transport system.

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..... [2]

(iii) Describe the role of a transport system in overcoming this limit on size of a multicellular organism.

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..... [2]

(b) Table 2.1 shows the thicknesses of the three layers between the water and the blood in the gill lamellae of three species of fish.

Table 2.1

species	epithelial cells/μm	basement membrane/μm	endothelial lining of capillary/μm
X	10.379	0.652	0.571
Y	0.330	1.276	0.204
Z	0.742	0.529	0.388

Species Z can move more actively than either of the other two species.

Explain how the data in Table 2.1 supports this observation.

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..... [3]

[Total: 11]

For Examiner's Use

3 Fig. 3.1 shows the life cycle of the North Atlantic salmon.

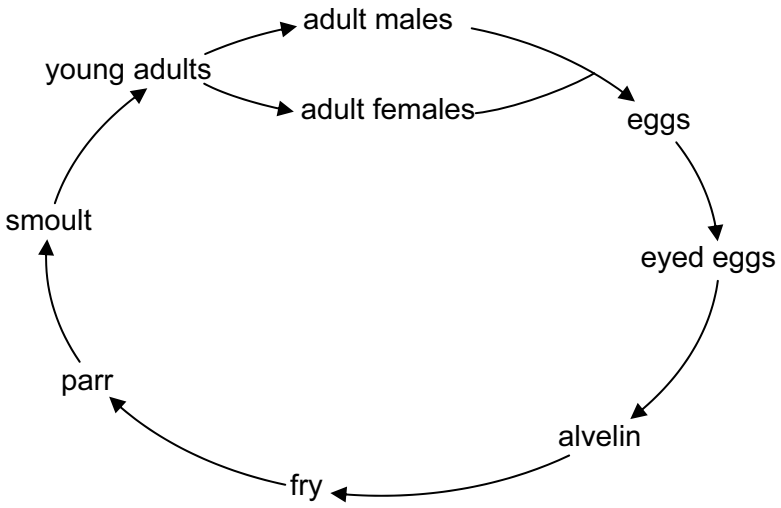

Fig. 3.1

(a) Complete Table 3.1 by matching the stage of the life cycle of the North Atlantic salmon to the environment where it is most likely to be found.

Table 3.1

environment	**stage of life cycle**
	eggs
between gravel in a stream bed	
	parr
estuaries	

[4]

(b) (i) Describe how sexual development differs between salmon and grouper.

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..... [2]

(ii) Explain why the eggs of groupers are more liable to predation than the eggs of salmon species.

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..... [2]

[Total: 8]

For Examiner's Use

4 **(a)** State the definition for each of the following terms.

(i) gene .....

..... [1]

(ii) genotype .....

..... [1]

(iii) genetic engineering .....

..... [1]

(b) Animals are often genetically modified by injecting the wanted gene into the nucleus of cells which are then cloned.

Fig. 4.1 shows a section of genetic material that might be used in genetic engineering.

promotor wanted gene fluorescent marker gene

Fig. 4.1

(i) Explain the role of the promoter attached to the wanted gene.

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..... [2]

(ii) Fluorescent marker genes code for the production of an enzyme that reacts with a dye in the growth medium of cloned cells causing the cells to fluoresce in ultraviolet light.

Explain why a fluorescent marker gene is often attached to a wanted gene.

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..... [2]

(c) State **one** difference between genetic engineering and selective breeding.

For Examiner's Use

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..... [1]

[Total: 8]

5 Fig. 5.1 shows the factors than influence the population biomass of a fish stock.

For Examiner's Use

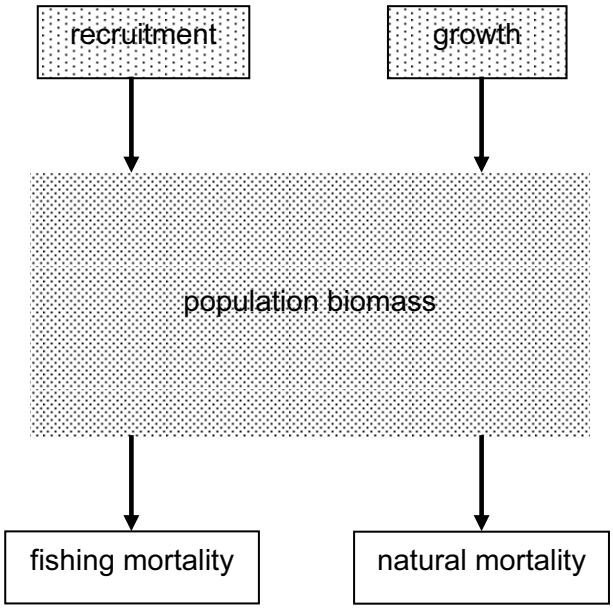

Fig. 5.1

(a) (i) Define the term *recruitment*.

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..... [2]

(ii) Describe and explain the effect of a progressive increase in fishing effort on recruitment.

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..... [4]

(b) Fishing at maximum sustainable yield (MSY) is one way of maintaining fish stocks.

Explain the relationship between MSY and recruitment.

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..... [1]

(c) Fig. 5.2 shows the mass and number of fish in a population at different ages.
Fig. 5.3 shows the biomass of the population at different ages.

For Examiner's Use

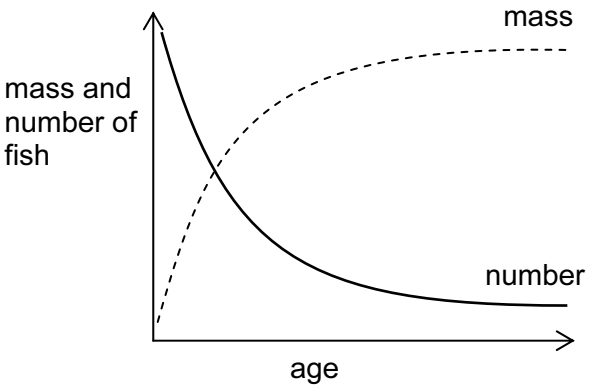

Fig. 5.2

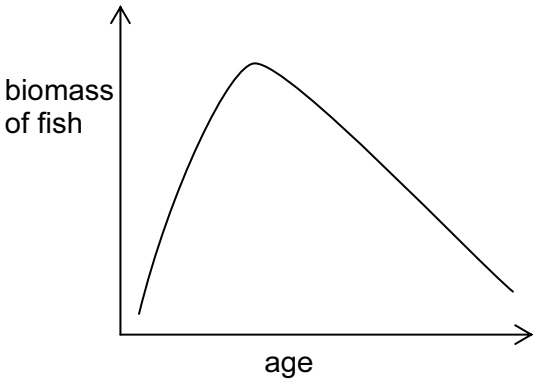

Fig. 5.3

Use the information in Fig. 5.2 to explain the shape of the population biomass curve in Fig. 5.3.

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[Total: 10]

For Examiner's Use

6 Fig. 6.1 shows an aquaculture system used for herbivorous milkfish (*Chanos sp*).

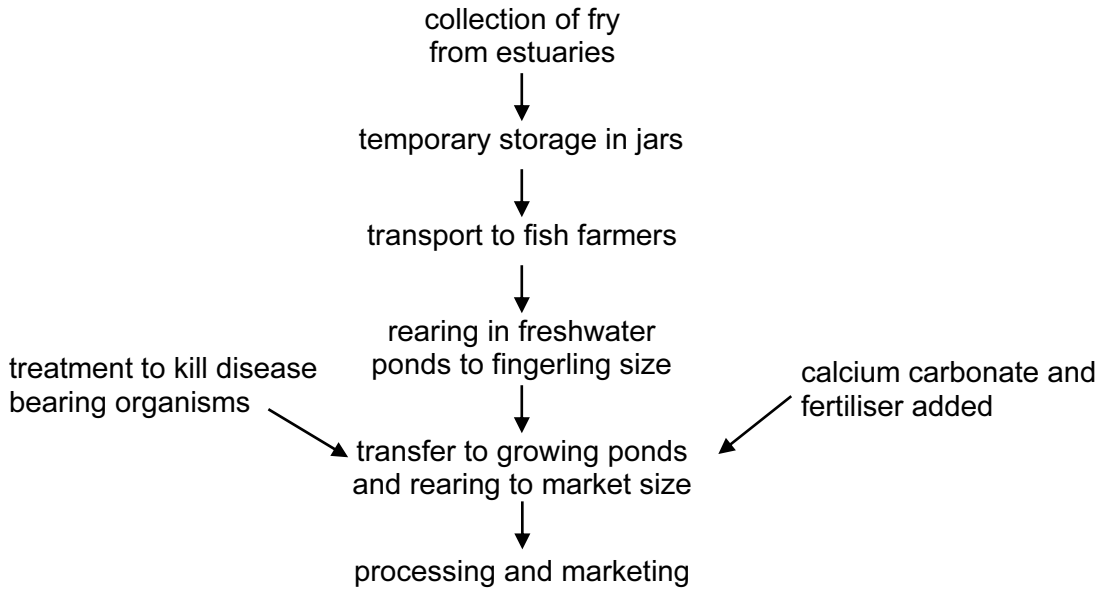

Fig. 6.1

(a) (i) State **one** reason why the system shown in Fig. 6.1 is an example of an extensive system of aquaculture.

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..... [1]

(ii) Suggest why calcium carbonate and fertiliser are added to the growing ponds.

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..... [2]

Table 6.1 shows some information about two carnivorous sea fish that can be reared in cages in an intensive aquaculture system.

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Table 6.1

	Seriola quinqueradiata (amberjack)	*Epinephelus salmoides* (grouper)
country of culture	Japan	Penang, Malaysia
stocking density		
number of fish per cubic metre of cage	10	60
mass of fish in kg per cubic metre of cage	0.15-0.55	3.4
rearing period / days	225	240
production / kg m^{-3}	0.85-14.45	41.4
initial mass / g	10-50	55.7
mass at harvest / g	1000-2000	795.9
average growth rate / g per fish per day	4.40-8.67	3.08

(b) Suggest two features of these species that make them suitable for aquaculture.

1 .....

2 ..... [2]

(c) About 55% of the money needed to rear carnivorous fish is spent on artificial foods produced from other fish.
A recent development is to use cheaper, artificial foods produced from plant sources.

(i) **Other than cost**, suggest two reasons why use of other fish as a source of food for aquaculture is decreasing.

1 .....

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2 .....

..... [2]

(ii) Suggest two reasons why plant based food sources may be more dependable than fish based food sources.

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1 .....

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2 .....

..... [2]

[Total: 9]

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7 In the Spring and Summer of 1976 a strong thermocline developed in a part of the Atlantic Bight off the coast of North America where sewage sludge is dumped. At the same time a phytoplankton bloom occurred causing the surface waters to have a higher oxygen concentration and the bottom of the water to have a lower oxygen concentration.

(a) Explain why each of the following events occurred.

(i) a phytoplankton bloom

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..... [1]

(ii) more oxygen in the surface waters

.....

..... [1]

(iii) less oxygen in the bottom water

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..... [2]

(b) Explain why the development of a thermocline increases oxygen decrease in the bottom water.

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..... [2]

Fig. 7.1 shows the area of lower oxygen concentrations in the Atlantic Bight during 1976.

For Examiner's Use

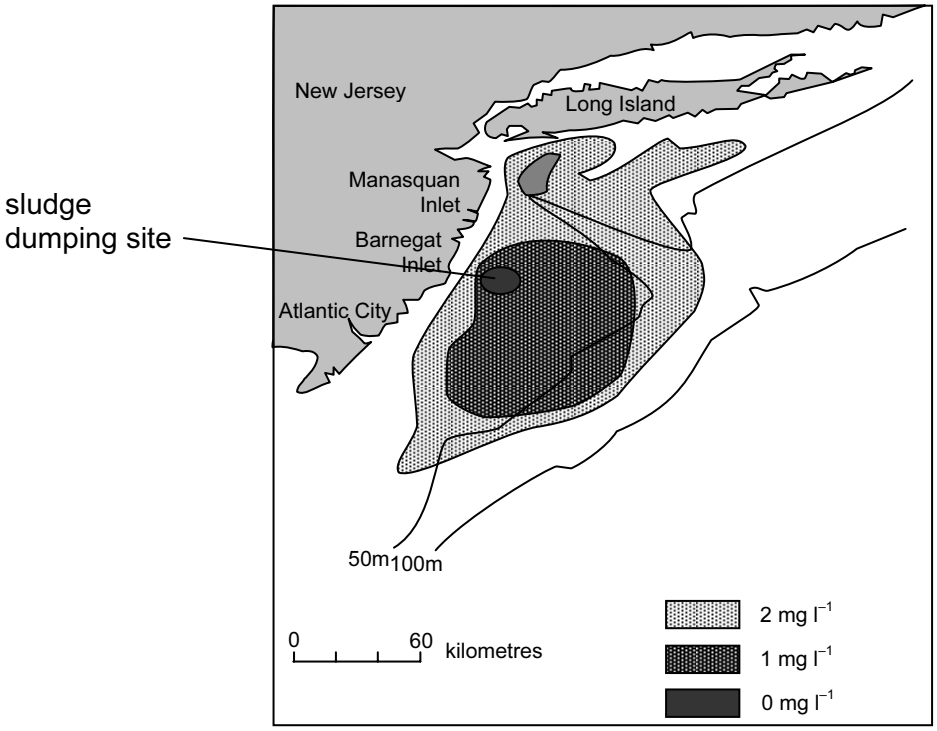

Fig. 7.1

(c) Describe and explain the likely effects on the benthic (bottom dwelling) organisms in the area affected by the oxygen decrease.

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..... [3]

[Total: 9]

For Examiner's Use

8 **(a)** State the meaning of the term conservation.

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..... [2]

(b) Read the following information about a World Wide Fund for Nature (WWF) project in Hong Kong.

20 Jul 2005

Hong Kong, China – WWF, together with the Hong Kong Youth Arts Festival (HKYAF) and Morgan Stanley, has launched a new three-year interactive educational programme aimed at increasing the awareness of Hong Kong's school children about the diversity of local marine life and conservation.

"It is our view that the marine resources in Hong Kong and elsewhere are under very serious threat from over-fishing, pollution, dredging, and other human activities that are detrimental to the marine habitat," said WWF Hong Kong Chief Education Officer (CEO) Eric Bohm.

"We believe that one essential ingredient in the conservation mix is education. It is only through educating children and adults that we can conserve and preserve our world."

Through the introduction of the *Ocean's 10* initiative – based on ten selected marine flagship species living in Hong Kong waters – WWF hopes that conservation issues such as environmental degradation, unsustainable harvesting, and pollution, which threaten the survival of these and many other marine species, can be drawn to the attention of the people of Hong Kong.

(i) Suggest why two of the human activities quoted by the CEO of Hong Kong may be a threat to marine resources.

1 .....

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2 .....

..... [2]

(ii) WWF believes that an essential part of conservation is education.

Suggest two ways in which education may contribute to conservation.

1 .....

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2 .....

..... [2]

(c) Some people believe that only species that are important to humans should be conserved.

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Explain why a conservation programme based on this belief may not be successful.

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..... [3]

[Total: 9]

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