



**BIOLOGY  
HIGHER LEVEL  
PAPER 2**

Wednesday 15 November 2000 (afternoon)

2 hours 15 minutes

Name

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Number

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**INSTRUCTIONS TO CANDIDATES**

- Write your candidate name and number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: Answer all of Section A in the spaces provided.
- Section B: Answer two questions from Section B. You may use the lined pages at the end of this paper or continue your answers in a continuation answer booklet, and indicate the number of booklets used in the box below. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.
- At the end of the examination, indicate the numbers of the Section B questions answered in the boxes below.

QUESTIONS ANSWERED		EXAMINER	TEAM LEADER	IBCA
SECTION A	ALL	/32	/32	/32
SECTION B				
QUESTION	.....	/20	/20	/20
QUESTION	.....	/20	/20	/20
NUMBER OF CONTINUATION BOOKLETS USED	.....	TOTAL /72	TOTAL /72	TOTAL /72

SECTION A

Candidates must answer **all** questions in the spaces provided.

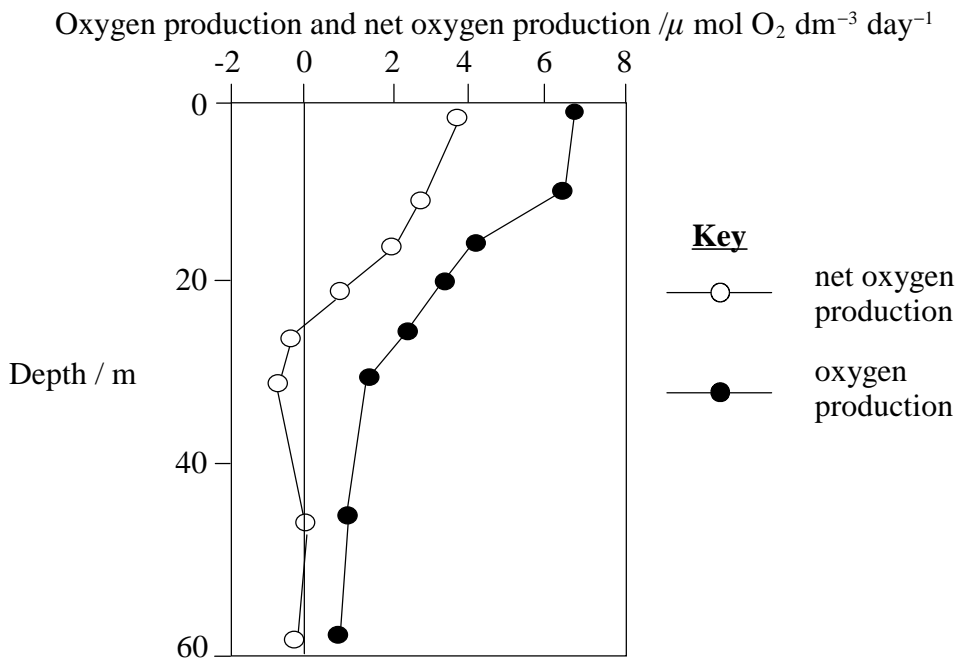
- 1. Very large numbers of microscopic algae exist in ocean communities away from land. Approximately half of all photosynthesis on Earth occurs in these algae. They also carry out cell respiration. Marine biologists investigated ocean water at a series of depths at many sites. They measured the **changes** in oxygen content of the water in the light and in the dark.

From their measurements they calculated:

- the rate of **oxygen production** by the photosynthesising algae
- the rate of **oxygen use** in cell respiration by the whole community.

The difference between the rate of oxygen production and oxygen use is the **net oxygen production** of the community.

The results for one site in the North Atlantic are shown below:



[Source: P J le B Williams, *Nature*, (1998), 394, pages 55-57]

- (a) (i) Using only the data in the graph, outline the relationship between depth and **net** oxygen production from 0 to 30 metres. [2]

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- (ii) Suggest a hypothesis to account for this relationship. [2]

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(This question continues on the following page)

(Question 1 continued)

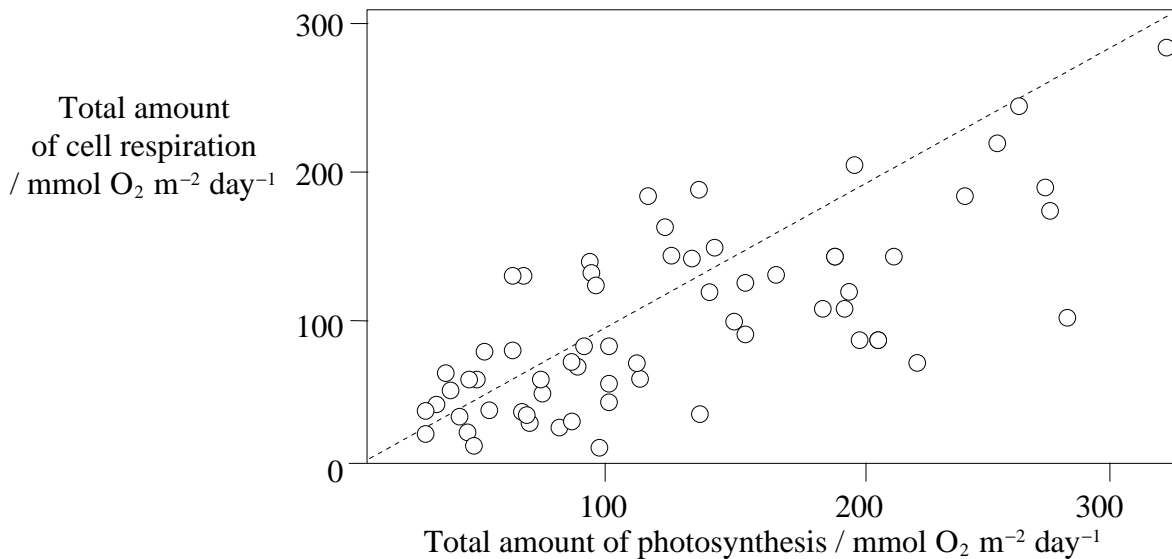
- (b) The graph shows that at 53 and 60 metres depth the **net** oxygen production was higher than at 30 metres. Explain this increase, using the data in the graph. [2]

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The marine biologists combined the data for all depths and calculated the total amounts of photosynthesis and cell respiration for the site in the North Atlantic and for other ocean sites around the world. The results are plotted in the scattergram below. The dotted line links points at which oxygen production by photosynthesis and oxygen use in cell respiration would be equal.



- (c) Although there is considerable variation in the data, the scattergram shows an overall relationship between total amounts of photosynthesis and cell respiration.

- (i) State the relationship. [1]

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- (ii) Suggest an explanation for the relationship, based on the activities of autotrophs and heterotrophs in the community. [2]

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(Question 1 continued)

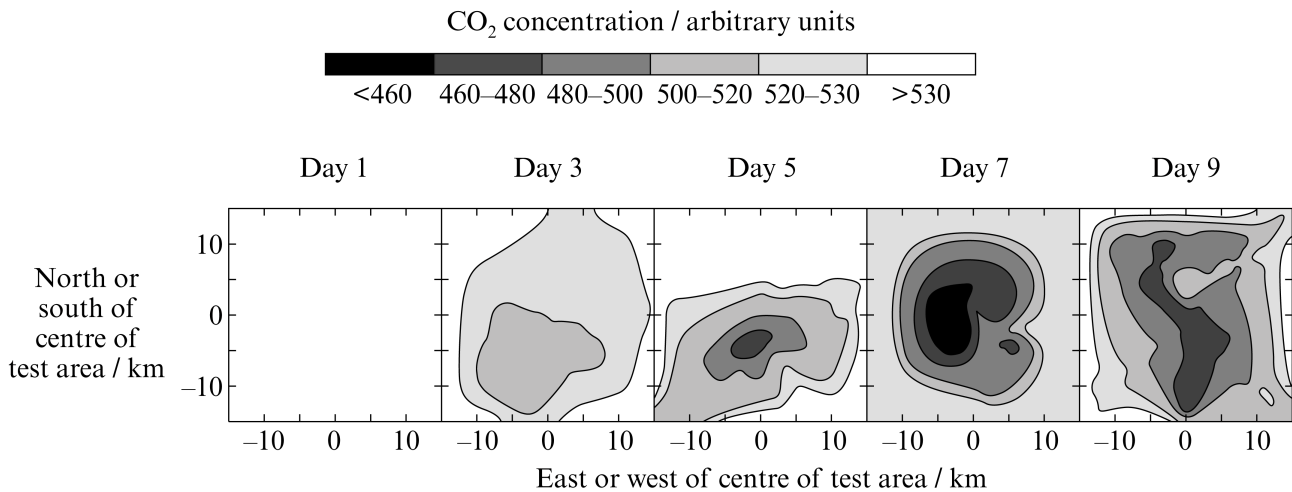
The sites used in the investigation are a representative sample of the Earth's oceans.

- (d) Using the data in the scattergram, identify whether the total amount of photosynthesis or cell respiration was larger in most of the sites. [1]

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Some ocean regions contain significantly fewer algae than other regions. One possible reason for this is low levels of iron (Fe) in the water. To test this hypothesis 225 kg of iron, in the form of soluble salts, was scattered in a 72 km<sup>2</sup> area of the Pacific Ocean containing few algae. This was done on one day in May 1995.

The chart below shows the carbon dioxide concentration of the water in the release area and surrounding area in the nine days following the release of the iron salts.



[Source: Coale *et al*, *Nature* (1996) **383**, pages 495-501]

- (e) (i) Using only the data in the charts, **outline** the effect of release of iron on carbon dioxide concentration in the water. [2]

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- (ii) **Explain** the effects of release of iron on carbon dioxide concentrations. [2]

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(Question 1 continued)

- (f) Using the data in this question, discuss whether iron release in the Earth's oceans would reduce global warming. [3]

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- 2. (a) Define *interspecific hybridisation*. [1]

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- (b) (i) State what is done to change a species using transgenic techniques. [2]

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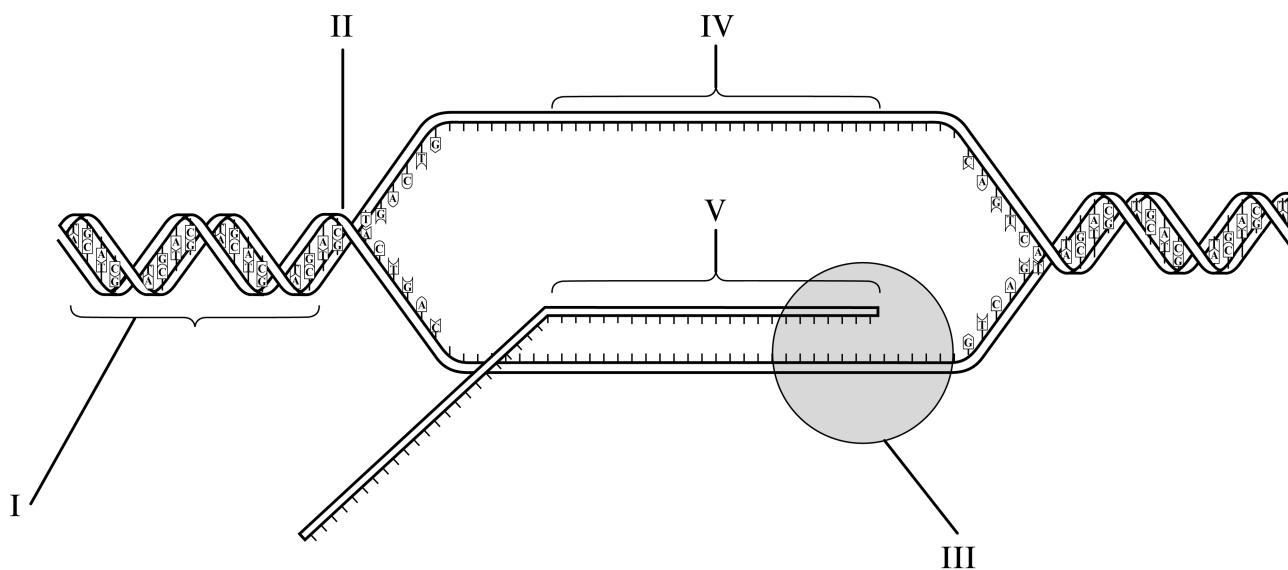
- (ii) Outline **one** ethical objection to the use of transgenic techniques. [2]

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- (iii) State **one** example of the use of transgenic techniques. [1]

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3. The diagram below represents the process of transcription. Some of the bases are shown. The positions of other bases are indicated by spikes.



- (a) State **two** features of DNA which are shown at the position labelled I. [2]

1. ....
2. ....

- (b) State which type of bonds are being **made** at the position labelled II. [1]

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- (c) Annotate the diagram with an arrow to show the direction of transcription. [1]

- (d) State the name of the enzyme labelled III. [1]

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- (e) Compare the structures of the parts of the molecules labelled IV and V. [4]

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**SECTION B**

Answer **two** questions. Up to **two** additional marks are available for the construction of your answers. You may use the lined pages at the end of this paper or continue your answers in a continuation answer booklet. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.

4. (a) Draw a diagram to show the organelles which are found in the cytoplasm of plant cells. [6]
- (b) Outline the processes that occur in a cell during *interphase*, including those needed to prepare for mitosis. [4]
- (c) Explain the reasons for *cell division* in living organisms. [8]
5. (a) Define *excretion* and *osmoregulation*. [4]
- (b) Describe *active transport* across membranes. [5]
- (c) Explain how hypertonic urine is produced in the medulla of the human kidney. [9]
6. (a) Outline **one** health problem concerned with the human transport system. [4]
- (b) Describe the cause and transmission of **one** human bacterial disease. [5]
- (c) Explain, using a named example, why many sex-linked diseases occur more frequently in men than in women. [9]
7. (a) Describe a method for measuring the size of a population of plants using quadrats. [4]
- (b) Outline, using three named examples, how different plants can be used to provide fuel, clothing and building materials. [5]
- (c) Discuss how  $C_3$ ,  $C_4$  and CAM plants are adapted to hot and dry habitats. [9]
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