INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

N99/410/H(2)

BIOLOGY

Higher Level

Wednesday 10 November 1999 (afternoon)

Paper 2 — 2 hours 15 minutes

A

Candidate name:	Candidate category & number:

This examination paper consists of 2 sections, Section A and Section B.
The maximum mark for Section A is 32.
The maximum mark for Section B is 40.
The maximum mark for this paper is 72.

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 attach extra sheets of paper with your candidate number clearly marked at the top.

At the end of the examination, complete box B below with the number of each question answered in Section B.

B

QUESTIONS ANSWERED	
A/ALL	
B/	
B/	
Number of extra sheets attached	

C

EXAMINER	TEAM LEADER
/32	/32
/20	/20
/20	/20
TOTAL /72	TOTAL /72

D

IBCA
/32
/20
/20
TOTAL /72

EXAMINATION MATERIALS

Required:
Calculator

Allowed:
A simple translating dictionary for candidates not working in their own language

SECTION A

1. Flowering plants have evolved many special mechanisms to promote cross-pollination. An unusual approach involves the production of heat by parts of some plants to help them attract pollinating insects. These are called thermogenic plants. Some of them can raise the temperature of their flowers by as much as 35 °C. The source of the heat is cell respiration, which can happen at extremely high rates for a few hours during the time of flowering. *Arum maculatum* is a thermogenic species. It produces heat in its spadix, a club-shaped structure, located in the centre of its flowers.

The table below shows the results of an investigation of how the dry matter and water content of the spadix of *A. maculatum* change around the time of the flowering. The measurements were taken at the end of each day.

Day	Dry mass / % of total mass	Water / % of total mass
1	28.9	71.1
2	33.9	66.1
3	33.6	66.4
4	7.5	92.4
5	7.6	92.4
6	8.2	91.8
7	6.8	93.2

(a) Outline the changes in the composition of the spadix of *A. maculatum* during the time of flowering. *[2]*

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(b) (i) Identify the day on which heat was generated by the spadix. *[1]*

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(ii) Explain your answer to (i). *[2]*

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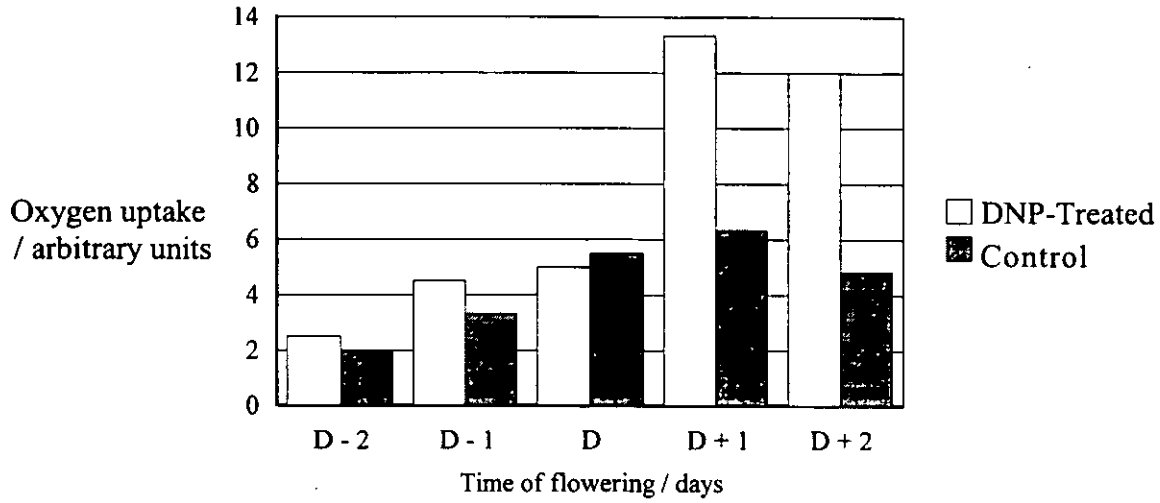
(This question continues on the following page)

(Question 1 continued)

The voodoo lily (*Sauromatum guttatum*) generates heat in the same way as *A. maculatum*. Plant physiologists did an experiment to investigate the respiration of the spadix of *S. guttatum* during the period of heat generation. A chemical compound called DNP (2,4-dinitrophenol) which acts as uncoupler was used. In uncoupled respiration the energy released by oxidation of substrates is converted into heat without ATP production. Sections of spadix from five days around the time of flowering were either treated with DNP or were left untreated as controls. The rate of respiration was found by measuring oxygen uptake. The results are shown in the bar chart below. D = the day of flowering.



(c) Outline the precise role of oxygen in respiration. *[2]*

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(d) Using only the data in the bar chart, describe the effect of DNP on the rate of respiration during the time of flowering. *[2]*

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(e) Explain the results on the day of flowering (D). *[2]*

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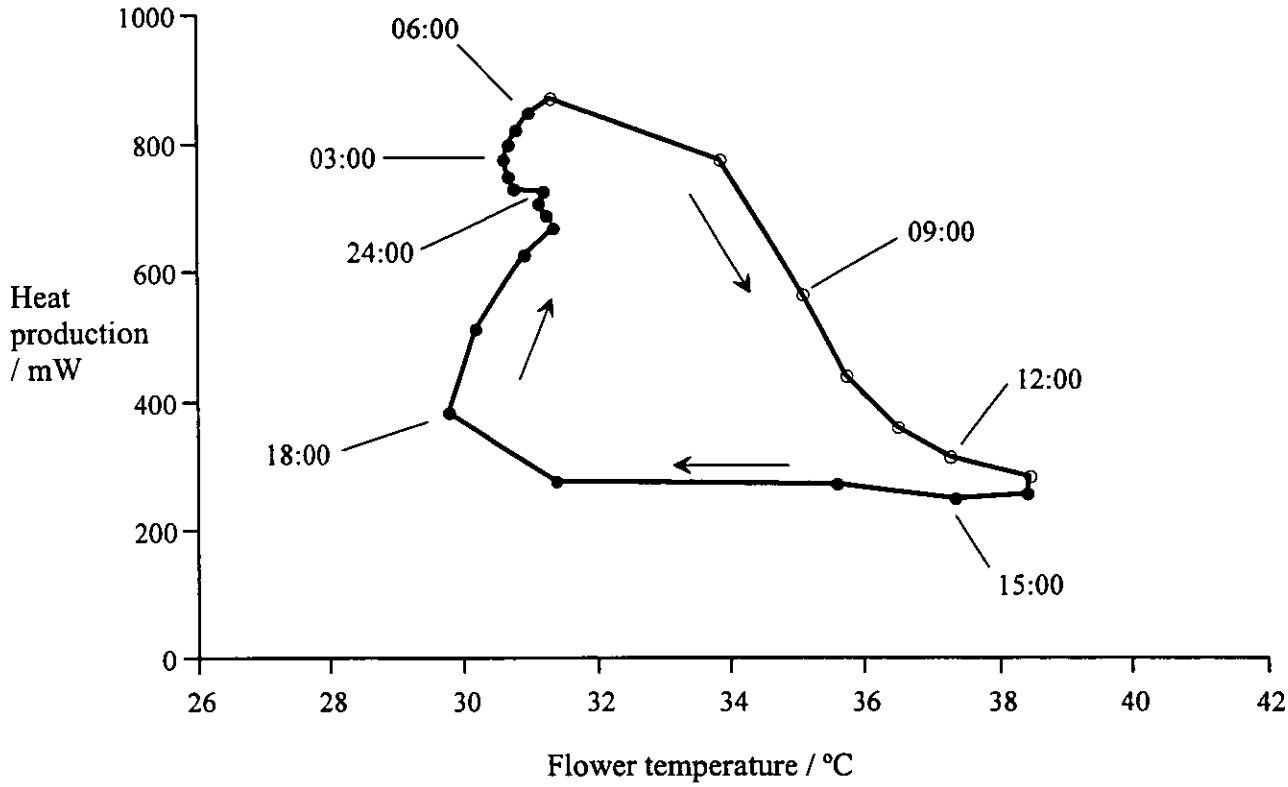
(This question continues on the following page)

(Question 1 continued)

The aquatic lotus (*Nelumbo nucifera*) is another thermogenic species. The graph below shows the rate of heat production and the flower temperature during a 24-hour period at the time of flowering. An open circle indicates a time when the external temperatures were rising and a closed circle when they were falling. The arrows show the progress of time. Some of the times are indicated.



[From: Mecuse, *The Voodoo Lily* (1996), Scientific American, 615, pages 80-89]

(f) Outline the changes in external temperature and the temperature inside the flower between 07:00 (sunrise) and 18:00 (sunset). *[2]*

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(g) The graph shows that the temperature in the flower of *N. nucifera* stayed between 29 °C and 32 °C throughout the night, despite more variable and lower external temperatures. Suggest how this was achieved, using the information given to you in question 1. *[4]*

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2. (a) Draw the structure of a nephron. *[2]*

(b) (i) Identify where most active transport occurs in the nephron. *[1]*

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(ii) Identify **one** specific location where active transport occurs in plants. *[1]*

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(c) Define *water potential*. *[1]*

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(d) Explain the process of *water uptake* in roots by osmosis. *[3]*

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(e) List **three** abiotic factors which affect the rate of transpiration in a typical terrestrial mesophytic plant. *[3]*

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2 . . . . . .

3 . . . . . .

3. (a) Compare the roles of LH and human chorionic gonadotrophin (HCG) in female reproduction. *[2]*

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(b) Outline the production of monoclonal antibodies. *[2]*

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SECTION B

*Answer TWO questions. Up to **two** additional marks are available for the quality of construction of each of your answers to each of the questions. You may use the lined pages at the end of this paper or attach sheets of paper with your candidate number clearly marked at the top.*

4. (a) Outline what is meant by the trophic level of an organism with **three** examples from one named habitat. *[4]*

(b) Evaluate whether the nutritional requirements of a human could be supplied by the same diet at all stages of life. *[9]*

(c) Apply the concept of carrying capacity to the struggle for survival resulting from overproduction of offspring. *[5]*

5. (a) List **three** functions of lipids. *[3]*

(b) Outline the production of ATP by chemiosmosis in the mitochondrion. *[6]*

(c) Explain the process of muscle contraction. *[9]*

6. (a) Outline **one** application of enzymes in biotechnology. *[4]*

(b) Draw graphs to show the effect of enzymes on the activation energy of chemical reactions. *[5]*

(c) Explain how the process of DNA replication depends on the structure of DNA. *[9]*

7. (a) List the structural differences between bryophytes and angiospermophytes. *[5]*

(b) Outline **one** example of how human activity has caused environmental change. *[4]*

(c) Explain how meiosis can result in an almost infinite genetic variety. *[9]*