Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

BIOLOGY **9700/04**

Paper 4 Structured Questions A2 Core

October/November 2006

1 hour 15 minutes

Candidates answer on the Question Paper.
Additional Materials: Answer Paper.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.
Write in dark blue or black pen.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer **one** question.
Circle the number of the Section B question you have answered in the grid below.

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	
Section A	
6 or 7	
Total	

This document consists of **12** printed pages and **4** lined pages.

Section A

Answer **all** questions.

Write your answers in the spaces provided.

1 Carbohydrates and lipids are important fuels in generating ATP in animal cells.

(a) Explain the relative energy values of carbohydrate and lipid as respiratory substrates.

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..... [3]

Aerobic respiration uses oxygen and produces carbon dioxide as a waste substance. Animal cell metabolism can be analysed using the respiratory quotient, RQ. The RQ is the volume of the carbon dioxide produced divided by the volume of the oxygen consumed.

(b) State typical RQ values for carbohydrates and lipids.

carbohydrate .....

lipid ..... [2]

The Siberian hamster, a small rodent like a mouse, had its RQ measured at different air temperatures. Fig. 1.1 shows the results of this experiment.

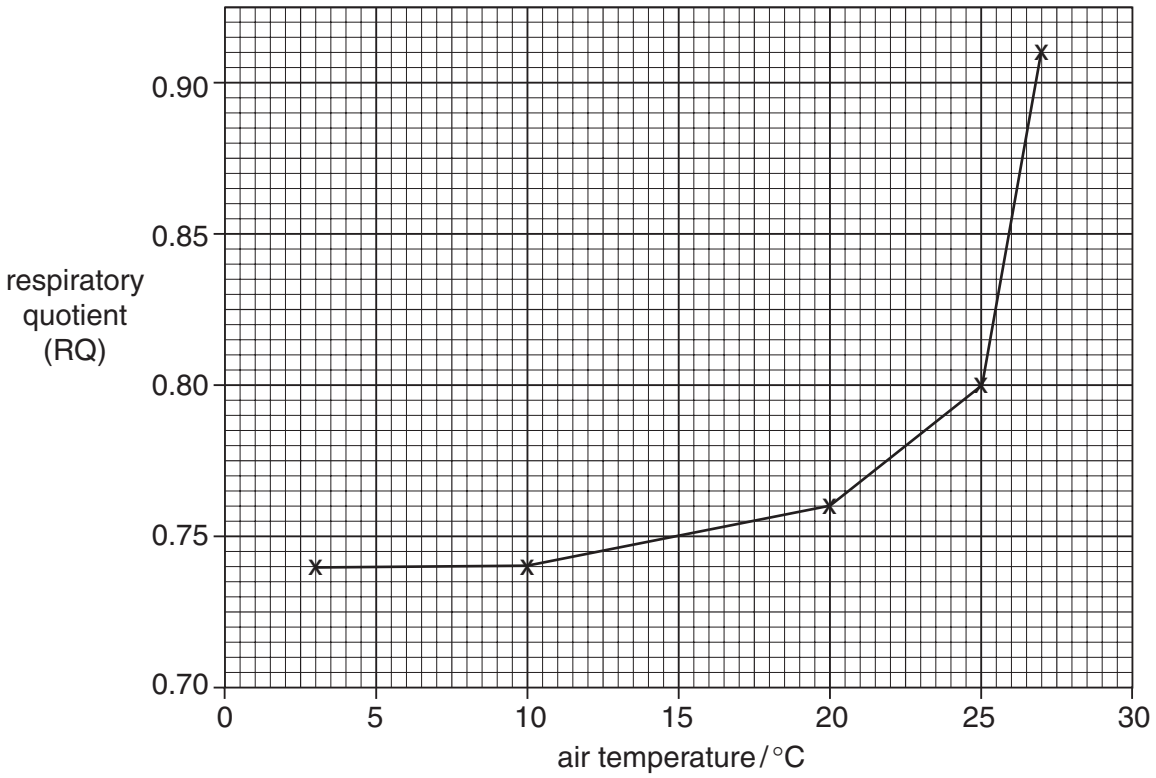

Fig. 1.1

(c) Using the information in Fig. 1.1, describe and explain the relationship between RQ and air temperature.

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..... [4]

(d) State a circumstance under which the RQ value would rise to over 1.0.

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..... [1]

[Total: 10]

2 The colour of the tips of the hair in Australian Shepherd dogs is controlled by a gene at the **A** locus. There are three alleles at this locus which are:

$\mathbf{A^s}$ Black hair tips

$\mathbf{A^y}$ Red hair tips

$\mathbf{A^t}$ Copper hair tips

A cross between two dogs with copper hair tips will always produce offspring with copper hair tips. A cross between two dogs with black hair tips may produce some offspring with red hair tips and some with copper hair tips.

(a) State the ratio of **offspring** phenotypes from the following crosses:

(i) $\mathbf{A^sA^t}$ $\mathbf{A^yA^y}$

offspring phenotypes .....

ratio .....

(ii) $\mathbf{A^sA^t}$ $\mathbf{A^tA^y}$

offspring phenotypes .....

ratio .....

(iii) $\mathbf{A^yA^t}$ $\mathbf{A^yA^t}$

offspring phenotypes .....

ratio ..... [6]

(b) A dog breeder wishes to know whether a dog with red hair tips is either homozygous or heterozygous for this characteristic.

(i) State the cross needed to determine the dog's genotype.

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(ii) Explain why the offspring of this cross will reveal the genotype of the dog.

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[Total: 10]

3 In mammalian kidneys, the loop of Henle is closely associated with the process of osmoregulation.

(a) Explain what is meant by osmoregulation.

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Fig. 3.1 shows the water potential of renal fluid as it passes through the loop of Henle.

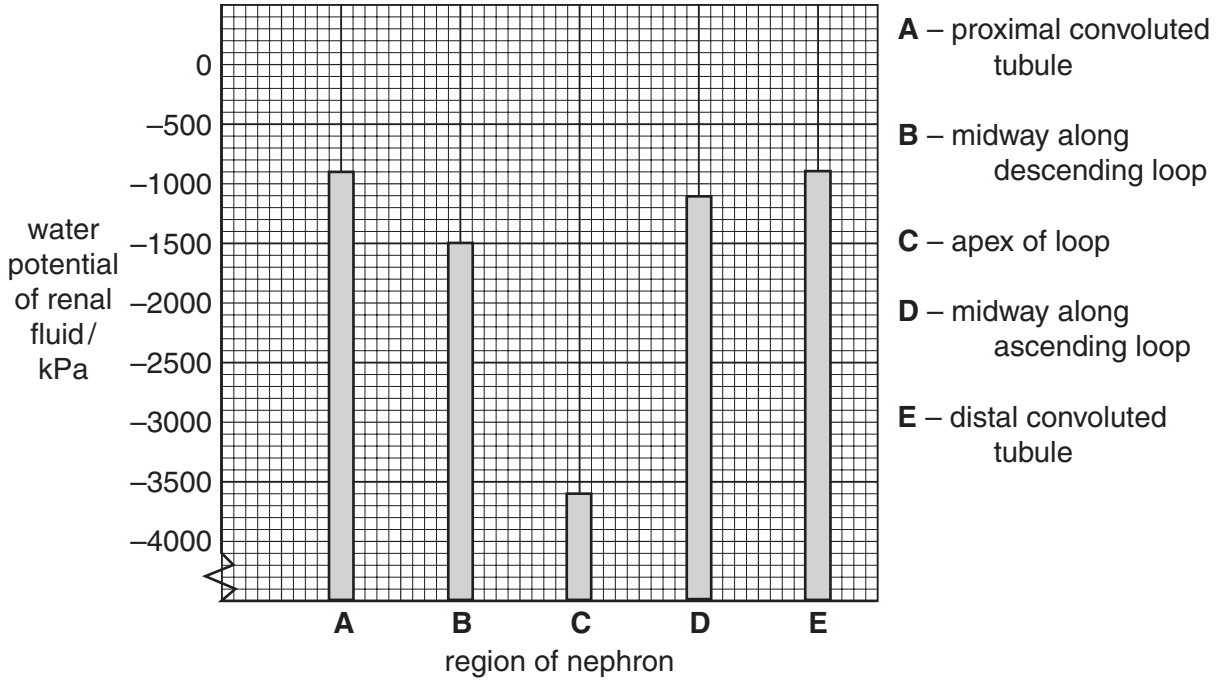

Fig. 3.1

(b) Using the information given in Fig. 3.1, describe and explain what happens to the renal fluid as it passes through the loop of Henle.

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(c) Control systems often work by using negative feedback. These systems require a receptor and an effector. In the process of osmoregulation name the receptor and effector involved.

Receptor .....

Effector ..... [2]

[Total: 9]

4 In Central America the Isthmus of Panama closed about 3 million years ago creating a land bridge between North and South America. Snapping shrimps on the Caribbean side of the isthmus appear almost identical to those on the Pacific side, having once been members of the same population. When males and females from different sides of the isthmus were put together they snapped aggressively instead of courting. They had become separate species.

An outline of the region is shown in Fig. 4.1.

Fig. 4.1

(a) The term species is often used in the context of evolution of new species. Explain the meaning of the term **species**.

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..... [2]

(b) State the likely isolating mechanism and type of speciation taking place.

Isolating mechanism .....

Type of speciation ..... [2]

(c) Explain how the process of speciation occurred in the snapping shrimp population.

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[Total: 8]

5 The lower epidermis of a dicotyledonous leaf is perforated with stomata. Each stoma is bounded by two guard cells which control the size of the pore.

Fig. 5.1 shows a scanning electron microscope photograph of an open and a closed stoma.

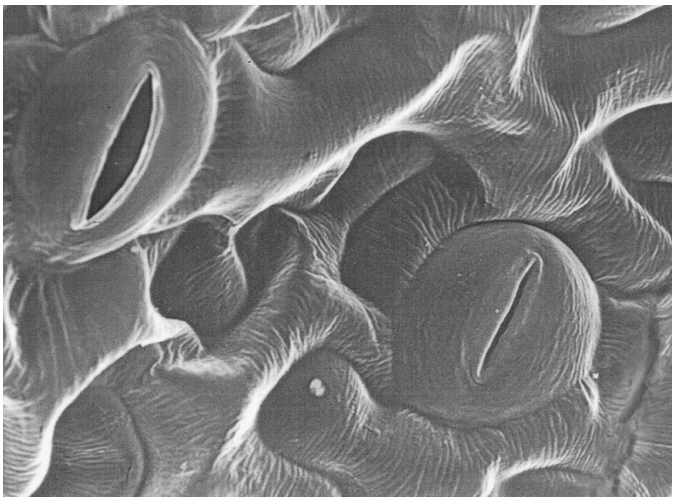

Fig. 5.1 **X4000**

(a) Calculate the length of the pore of the open stoma in Fig. 5.1.

Show your working.

Answer ..... [2]

(b) Explain the importance of abscisic acid, ABA, in causing stomatal closure.

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(c) Under conditions of low wind speed, the rate of transpiration decreases, even though the stomata of the leaves are open.

Explain why this is so.

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[Total: 8]

Section B

Answer **one** question.

6 **(a)** Describe how the structure of neurones speeds up the transmission of action potentials. [6]

(b) Explain, using a named example, how sensory receptors in mammals convert energy into action potentials. [9]

[Total: 15]

7 **(a)** Describe the transfer of light energy to chemical energy in ATP during photosynthesis. [6]

(b) Describe the process of oxidative phosphorylation. [9]

[Total: 15]