Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

For Examiner's Use

General Certificate of Education
June 2007
Advanced Level Examination

BIOLOGY (SPECIFICATION A) **BYA8/W**
Unit 8 (Written Synoptic)

Friday 22 June 2007 1.30 pm to 3.15 pm

No additional materials are required.
You may use a calculator.

Time allowed: 1 hour 45 minutes

For Examiner's Use			
Question	Mark	Question	Mark
1			
2			
3			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided but note that **Question 3** offers a choice of essays.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 60.
- The marks for questions are shown in brackets.
- This unit assesses your understanding of the relationship between the different aspects of biology.
- You will be marked on your ability to use good English, to organise information clearly and to use accurate scientific terminology where appropriate.

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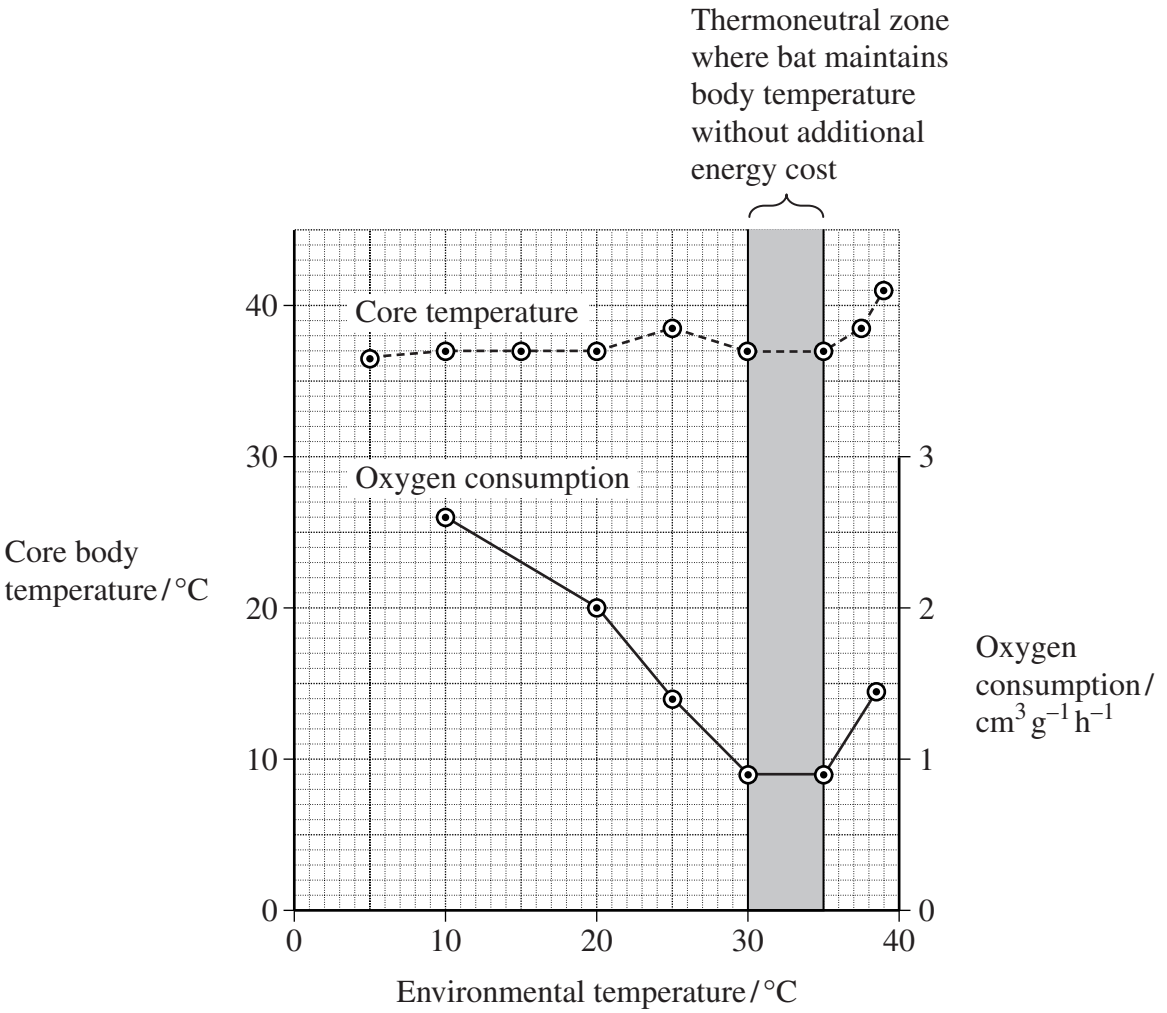
Answer **all** questions in the spaces provided.

1 Bats are the only mammals that can fly. They are very similar to other mammals but they have a number of adaptations associated with the high energy demands of flight.

The graph shows the effect of environmental temperature on a small bat's core body temperature and oxygen consumption. The bat had a body mass of 7 g.



(a) The fall in environmental temperature from 30 °C to 10 °C brings about the change in oxygen consumption shown in the graph. Explain how.

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(3 marks)

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(b) Positive feedback occurs when a departure from a set level or norm sets in motion changes that bring about further departure.

(i) The change in core body temperature above an environmental temperature of 35 °C is an example of positive feedback. Explain why the continued rise in core body temperature occurs.

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(2 marks)

(ii) Positive feedback is important in other systems in the body. Describe **one** way in which positive feedback, other than the effect of temperature, is important in the transmission of a nerve impulse.

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(2 marks)

(c) A flying fox is a large bat with a body mass of approximately 1.2 kg. Its thermoneutral zone is between 25 °C and 35 °C.
The thermoneutral zone of a flying fox is different from the thermoneutral zone of the small bat shown in the graph. Explain why.

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(2 marks)

Question 1 continues on the next page

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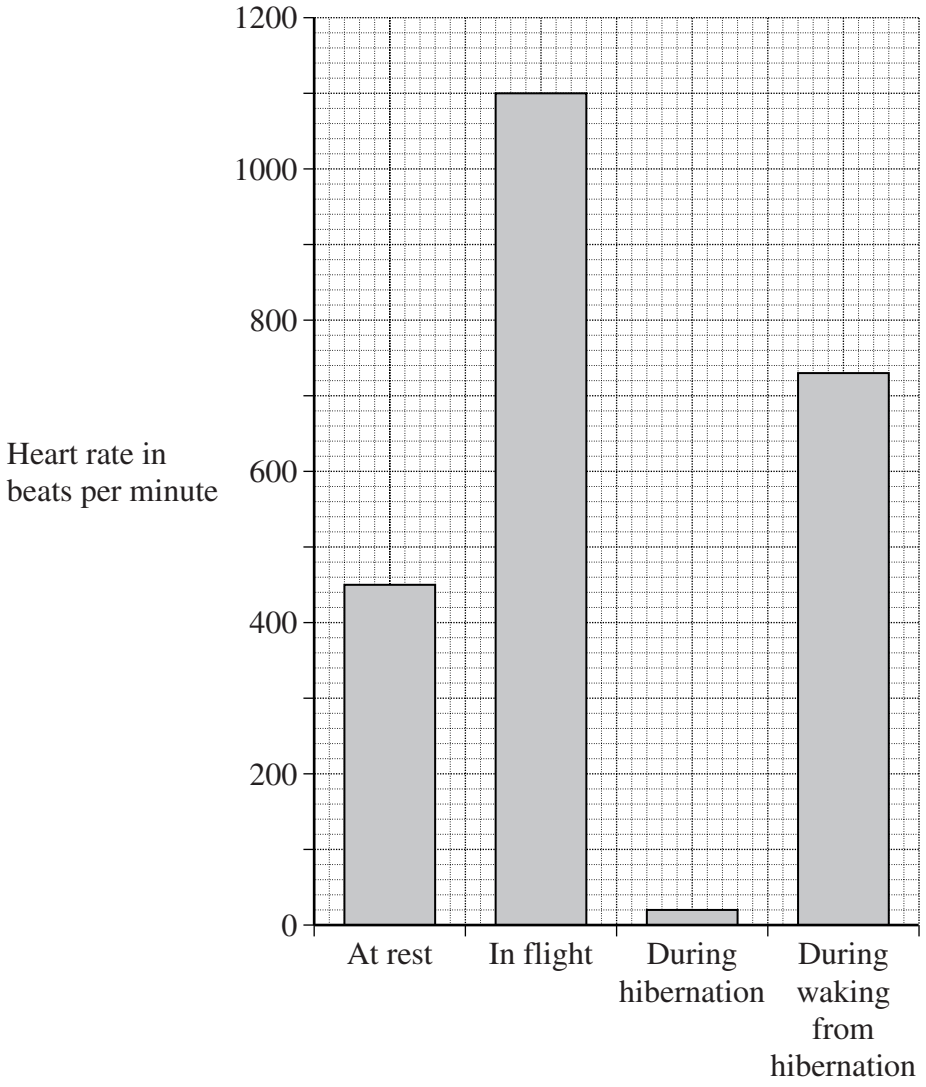
The barchart shows how the heart rate of a bat changes with activity.



(d) The activity of the parasympathetic nervous system causes one of the changes shown in the barchart. Identify which and explain how.

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(2 marks)

(e) The cardiac output of this bat is 13.5 cm^3 $minute^{-1}$ at rest and 113 cm^3 $minute^{-1}$ during flight. Calculate the change in stroke volume between rest and flight. Show your working.

Answer ..... *(2 marks)*

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The table shows some of the features of the blood of bats and of humans.

	Bat	**Human**
Haematocrit (The volume of cells in a blood sample expressed as a percentage of the sample volume)	59	45
Number of red blood cells per mm^3	12.5×10^6	5.2×10^6
Concentration of haemoglobin / g $100\,cm^{-3}$	17	17
P_{50} / kPa (Partial pressure of oxygen at which haemoglobin is 50 % saturated)	6.8	4.0

(f) (i) The red blood cells of bats are smaller than human red blood cells. Explain how the data in the table support this statement.

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(2 marks)

(ii) Suggest the advantage to the bat of very small red blood cells.

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(2 marks)

(g) The P_{50} of the bat's haemoglobin helps it to meet the high energy demands of flight. Explain how.

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(3 marks)

20

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2 Read the following passage.

All green plants are producers but some can gain part of their nutritional requirement by feeding directly on animals. These carnivorous plants are therefore also consumers. They capture and digest their animal prey, absorbing the nutrients. This allows them to survive on soils with poor nutrient levels. Carnivorous plants, however, are at a disadvantage compared with non-carnivorous plants on soils that have high concentrations of nutrients.

Investigators assessed the importance to carnivorous plants of nitrogen obtained from animals. They fed fruitflies on yeast containing ^{15}N. These fruitflies were then fed to sundew, a small carnivorous plant. In sundews, the new season's growth comes from underground storage organs. Much of the nitrogen reserve in these storage organs is in the form of the amino acid, arginine. The investigators found that 40 % of the arginine in the storage organs produced by the experimental plants contained ^{15}N. Investigations such as this led to the suggestion that the evolution of the carnivorous habit in plants is linked to nitrogen availability. Recent research suggests that phosphorus may be equally important. The presence of enzymes that digest nucleic acids, nucleases, in the digestive secretions produced by many carnivorous plants may be related to this requirement.

Many of the studies made on the ways in which carnivorous plants digest their prey have been made on pitcher plants. These plants catch insects and other small organisms in large pitcher-like extensions to their leaves. Inside the pitchers are digestive glands. Studies of digestive gland cells show that their ultrastructure is very similar to the ultrastructure of cells from the pancreas. Some of these similarities are associated with their ability to synthesise enzymes. The digestive gland cells have a double function. First they secrete the enzymes that digest the captured prey. Then they absorb the products of digestion from the nutrient-rich solution inside the pitcher, a process that is stopped by the addition of respiratory inhibitors.

Use information from the passage and your own knowledge to answer the questions.

(a) In the UK, carnivorous plants are usually found on waterlogged soils in boggy areas. Explain why these soils have a low nitrate concentration.

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(3 marks)

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(b) (i) Less of the light energy falling on a square centimetre of leaf surface is transferred to biomass in carnivorous plants than to biomass in non-carnivorous plants. Explain why.

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(3 marks)

(ii) Carnivorous plants are at a disadvantage compared with non-carnivorous plants on soils that have high concentrations of nutrients (lines 4–6). Explain why.

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(2 marks)

(c) Investigators fed fruitflies on yeast containing ^{15}N (line 8). Name **two** polymers in these fruitflies that would contain ^{15}N.

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2 .....

(1 mark)

(d) The presence of nucleases may be related to the phosphorus requirements of carnivorous plants (lines 15–17). Explain how.

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(2 marks)

Question 2 continues on the next page

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(e) Give **two** ways in which the ultrastructure of a digestive gland cell from a pitcher plant would be similar to the ultrastructure of a cell from the pancreas.
Explain each of these ways in terms of enzyme synthesis.

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2 .....

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(2 marks)

(f) By what process are the products of digestion absorbed from the nutrient-rich solution in the pitcher (lines 24–26)?
Explain the evidence for your answer.

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(2 marks)

15

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Answer **Question 3** in continuous prose.
Quality of Written Communication will be assessed in the answer.

3 Write an essay on **one** of the following topics. You should select and use information from different parts of the specification. Credit will be given not only for the biological content, but also for the selection and use of relevant information, and for the organisation and presentation of the essay.

EITHER **A** Carbon dioxide in organisms and ecosystems *(25 marks)*

OR **B** Why offspring produced by the same parents are different in appearance *(25 marks)*

END OF QUESTIONS

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