

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

For Examiner's Use

General Certificate of Education
June 2008
Advanced Level Examination



HUMAN BIOLOGY (SPECIFICATION A)
Unit 9 (Written Synoptic)

BYA9/W

Wednesday 18 June 2008 1.30 pm to 3.15 pm

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

Time allowed: 1 hour 45 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided but note that **Question 3** offers a choice of essays.
Answers written in margins or on blank pages will not be marked.
- 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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Question	Mark	Question	Mark
1			
2			
3			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			



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

- 1 If we do nothing to limit the rise in the concentration of carbon dioxide in the atmosphere, the mean world temperature could be 3 °C higher by the year 2100.

Scientists investigated the effect of increased temperature on the growth of crop plants. They grew single plants in small pots in a growth cabinet at different temperatures.

Other scientists criticised the conclusions drawn from these investigations. They argued that conditions in a growth cabinet are different from those in fields, where crop plants and weeds grow together.

- 1 (a) Explain how each of the following limits the conclusions that may be drawn from these investigations about how rising temperatures affect field crops.

- 1 (a) (i) Only the crop plants are present in the growth cabinet.

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 (2 marks)
 (Extra space)

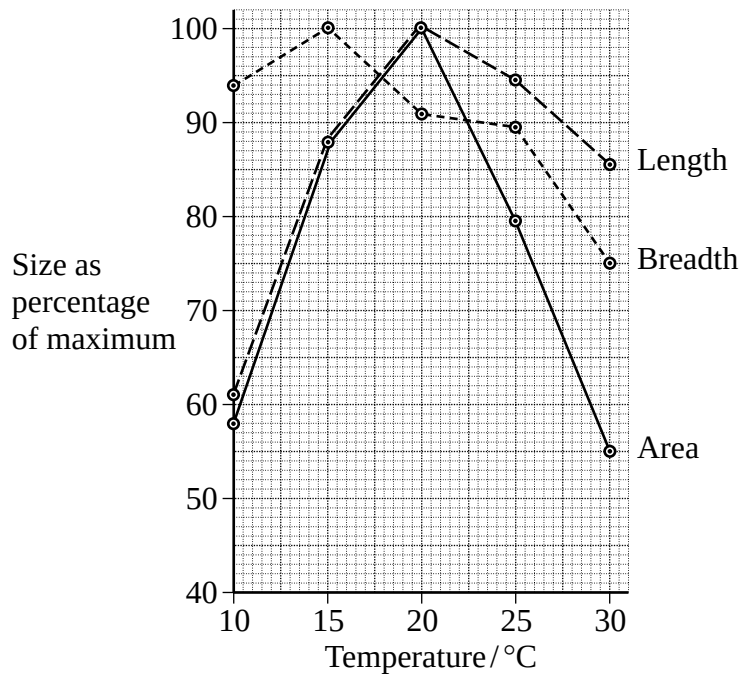
- 1 (a) (ii) The plants are grown in an airtight growth cabinet.

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 (2 marks)
 (Extra space)



- 1 (b) The graph shows some features of the leaves of wheat plants grown at different temperatures in a growth cabinet.



- 1 (b) (i) The mean leaf area at 20 °C was 30 cm². What was the mean leaf area at 30 °C?

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(1 mark)

- 1 (b) (ii) Increasing the temperature at which the wheat plants were grown from 15 °C to 20 °C affects the shape of the leaves. Use the graph to describe how.

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(1 mark)

- 1 (b) (iii) Would you be justified in concluding from the graph that increasing the temperature from 20 °C to 30 °C would decrease the rate of photosynthesis? Give the reasons for your answer.

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(3 marks)

Question 1 continues on the next page

Turn over ►

- 1 (c) Vets at a research station in a hot, dry part of India collected data about three groups of cattle. The three groups were
- A Jersey (European breed)
 - B Jersey $\times$ Sahiwal cross
 - C Sahiwal (local breed)

All three groups were free to feed whenever they chose.

The vets investigated the effect of temperature on breathing rate and the core body temperature of these three groups of cattle. Some of the results are shown in **Table 1**.

Table 1

Air temperature / °C	Mean breathing rate/breaths per minute			Mean core body temperature / °C		
	Group A	Group B	Group C	Group A	Group B	Group C
20.0	28	20	20	37.8	37.9	38.0
22.8	28	21	20	37.9	37.9	38.3
26.1	47	28	20	38.2	38.0	38.2
32.2	92	42	23	38.3	38.3	38.0
36.7	123	91	26	39.2	38.4	38.2
38.8	131	98	28	39.5	38.4	38.4

- 1 (c) (i) Describe the relationship shown in **Table 1** between air temperature, mean breathing rate and mean core body temperature of the cattle in group A.

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(1 mark)

(Extra space)



- 1 (c) (ii) Breathing rate may help to limit the rise in core body temperature in the cattle in group A. Explain how.

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(3 marks)

- 1 (d) The vets used a statistical test to analyse the effect of a rise in temperature from 20 °C to 38.8 °C on the breathing rate of the cattle in group C.

- 1 (d) (i) Suggest the null hypothesis they should have tested.

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(1 mark)

- 1 (d) (ii) Explain why a statistical test was necessary. Use the terms chance and probability in your answer.

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(2 marks)

Question 1 continues on the next page



- 1 (e) **Table 2** shows some information about the feeding behaviour and milk yield of the cattle in the study.

Table 2

Group	Breed	Percentage of each day cattle spent feeding	Milk yield during the study / kg
A	Jersey	44.4	1776
B	Jersey × Sahiwal cross	62.0	2561
C	Sahiwal	82.1	1839

At temperatures below 20 °C, Jersey cattle can produce around 5500 kg of milk in the same time as in the study.

- 1 (e) (i) Use the data in **Table 2** to suggest why the milk yield of Jersey cattle is higher in cooler conditions.

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 (Extra space)

(2 marks)

- 1 (e) (ii) At the research station, the cattle in group **B** produced a higher milk yield than either the cattle in group **A** or the cattle in group **C**. Suggest why the cattle in group **B** produced the highest milk yield.

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 (Extra space)

(2 marks)

Turn over for the next question

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Turn over ►



2 Read the following passage.

The lumen of the human intestine is the habitat for many species of parasitic tapeworm. It is, however, a very specialised environment. This is reflected in some of the adaptations shown by these tapeworms. The tapeworms do not have circulatory or specialised gas exchange organs, and have a flattened body shape that helps the uptake of oxygen and its supply to the parasite's cells.

5

Scientists once thought that there was very little oxygen inside the human intestine, except close to the epithelium. Recent work suggests that this view is incorrect. The partial pressure of oxygen throughout most of the intestinal lumen is normally very similar to that in venous blood. The presence of a parasitic tapeworm leads to a slightly greater partial pressure of oxygen in the lumen because of the acidification of the intestine contents by the tapeworm. More acidic conditions affect the human host's oxyhaemoglobin dissociation curve. Acidification of the intestine contents has another advantage for the tapeworm. It reduces glucose absorption by the cells lining the host's intestine because it affects the relevant proteins.

10

The partial pressure of oxygen is important to the tapeworm but so is the partial pressure of carbon dioxide. There is a high partial pressure of carbon dioxide in the intestine as a result of the chemical reaction between the stomach contents and the alkaline secretion produced by the pancreas.

15

Most parasitic worms have a respiratory pathway that includes glycolysis and the Krebs cycle. Under anaerobic conditions, some species show a reversed series of Krebs cycle reactions. They use carbon dioxide to synthesise intermediate compounds in the cycle. In this process reduced NAD is oxidised, allowing glycolysis to continue.

20

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

- 2 (a) A flattened body shape helps the uptake of oxygen and its supply to the parasite's cells (lines 4–5). Explain how.

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(3 marks)



- 2 (b) Scientists once thought that there was very little oxygen inside the human intestine, except close to the epithelium (lines 6–7). Explain why scientists expected that there would be more oxygen close to the epithelium.

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(2 marks)

- 2 (c) The partial pressure of oxygen in the lumen of the intestine is slightly greater when a tapeworm is present than when there is no tapeworm present (lines 9–10). Explain how the presence of a tapeworm leads to a greater partial pressure of oxygen.

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(3 marks)

Question 2 continues on the next page



- 2 (d) (i) Acidification of the intestine contents reduces glucose absorption by the cells lining the host's intestine (lines 12–14). Explain how.

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(2 marks)

- 2 (d) (ii) The reduction of glucose absorption by the host's cells might be an advantage to the parasite. Suggest how.

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(1 mark)

- 2 (e) There is a high partial pressure of carbon dioxide in the intestine of a human (lines 16–17). Explain what causes this high partial pressure.

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(2 marks)

- 2 (f) A reversed series of the Krebs cycle reactions allows glycolysis to continue under anaerobic conditions (lines 20–23). Explain how.

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(2 marks)

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 for biological content. It will also be given for the selection and use of relevant information, and for the organisation and presentation of the essay.

EITHER A Humans and microorganisms

(25 marks)

OR **B** The biological importance of plants to humans

(25 marks)

END OF QUESTIONS

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