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Centre Number						Candidate Number					
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General Certificate of Education  
 June 2005  
 Advanced Level Examination



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

**BYA9/W**

Friday 24 June 2005 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 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 marked.

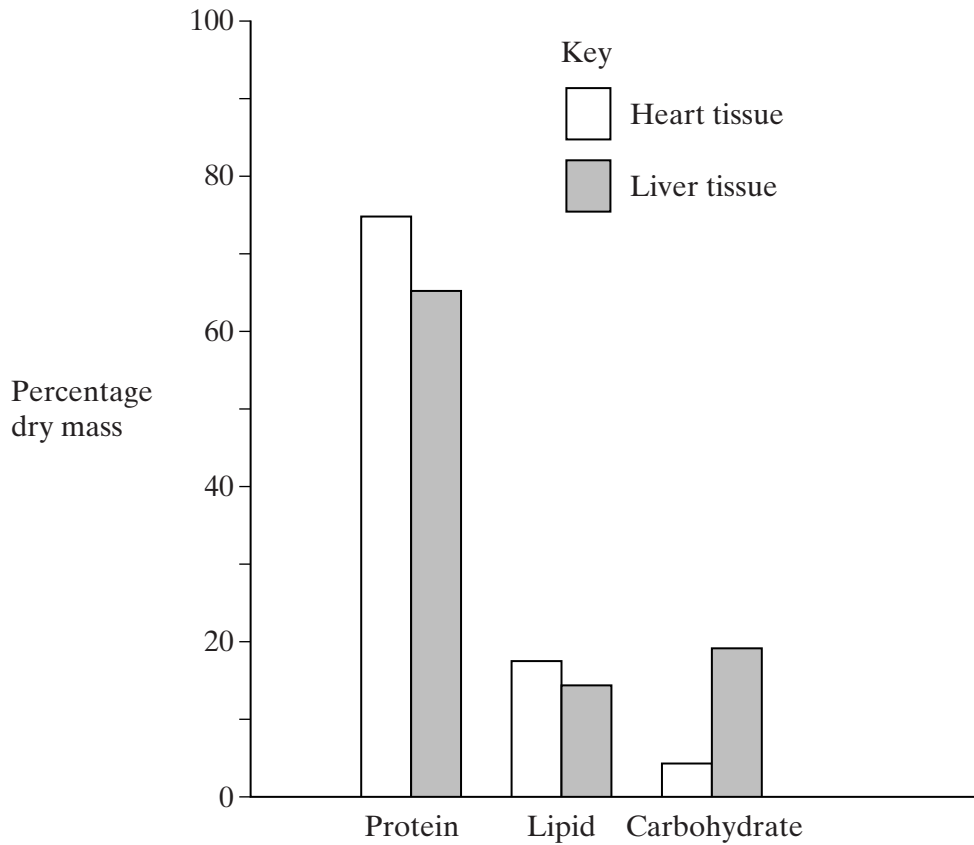
**Information**

- The maximum mark for this paper is 60.
- Mark allocations are shown in brackets.
- This unit assesses your understanding of the relationship between the different aspects of biology.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.

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

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

**1** The bar chart shows the composition of tissue from the heart and from the liver of a human.



(a) Give **two** functions of lipids in the cells of heart tissue.

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(2 marks)

(b) Measuring the composition of the tissues in terms of dry mass gives more reliable results than measuring composition as fresh mass. Explain why.

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(1 mark)

- (c) (i) Suggest an explanation for the higher percentage of carbohydrate in liver tissue than in heart tissue.

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(1 mark)

- (ii) If a person goes without food for a period of 12 hours, the percentages of all the substances in liver tissue would differ from those shown in the bar chart. How would you expect them to differ? Explain your answer.

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(4 marks)

Another important substance found in the body is water. The total volume of water in the blood plasma (**A**) may be calculated by the dilution technique. This technique is similar in principle to the mark-release-recapture technique for estimating animal populations. A known mass of a protein (**B**) which distributes itself evenly through the plasma is injected into the blood. A sample of blood plasma is then taken after a suitable time. The volume of the sample (**C**) and the mass of the injected protein in it (**D**) are measured.

- (d) Write a simple equation using the letters **A**, **B**, **C** and **D** to show how the total volume of water in the blood plasma would be calculated. Show how you arrived at your answer.

(2 marks)

**QUESTION 1 CONTINUES ON THE NEXT PAGE**

**Turn over** ►

- (e) (i) Protein can be used for measuring the total volume of water in the blood plasma but amino acids cannot be. Explain why.

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(2 marks)

- (ii) Suggest how the results obtained with the dilution technique would be affected if the time interval between injecting the protein and taking the sample of blood plasma were very short. Give the reason for your answer.

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(2 marks)

The concentration of haemoglobin in a mother's blood is monitored during pregnancy. In order to interpret the figures obtained, adjustments are made for the altitude at which she lives. The table shows the adjustments which are made in interpreting the concentration of haemoglobin for American women (1 foot = 0.3 m).

Altitude/feet	Correction factor for haemoglobin concentration / g dm <sup>-3</sup>
Less than 3000	0
3000 - 3999	+2
4000 - 4999	+3
5000 - 5999	+5
6000 - 6999	+7
7000 - 7999	+10
8000 - 8999	+13

- (f) (i) Explain how the percentage and partial pressure of oxygen in the air change with increasing altitude.

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(2 marks)

(ii) Explain why a correction factor for altitude has to be applied in interpreting the concentration of haemoglobin in the blood of women who are pregnant.

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(2 marks)

(g) Describe how you would use the data in the table to predict the correction factor which needed to be applied for a woman living at an altitude of between 10 000 and 10 999 feet.

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(2 marks)

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**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ▶

2 Read the following passage.

Poisons are substances which have harmful effects on mammals. This definition suggests that there is a clear distinction between substances which are poisonous and those which are not. This is not always the case. Almost all substances may be poisonous under certain conditions. Iron, for example, has a number of essential functions in the body, but can become poisonous at high concentrations. Even pure water can be harmful. When it is inhaled, for example, it is absorbed from the alveoli and causes red blood cells to burst.

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Some poisons, such as acids, cause direct damage to tissue with which they make contact. Others, however, have more specific effects. Digitalis is a poison found in foxgloves. It affects cardiac muscle but has no effect on other types of muscle. Our knowledge of the molecules found in plasma membranes offers an explanation of this selectivity.

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Many poisons enter the body through the digestive system. The mouth leads into the buccal cavity. This cavity is of little importance as far as the absorption of nutrients is concerned, but it is an important site for the absorption of poisonous substances. The wall of the buccal cavity contains many capillaries separated from the inside of the cavity by squamous epithelium. Within the buccal cavity, poisons are unlikely to have been diluted, whereas further along the gut they will be mixed with digestive secretions. A substance entering the blood system through the wall of the buccal cavity passes to the heart by a different venous pathway from one entering the blood system via the small intestine. This may well result in the poison reaching target organs in a virtually unaltered form.

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

- (a) Explain how absorption of pure water from the alveoli causes red blood cells to burst (lines 5 - 6).

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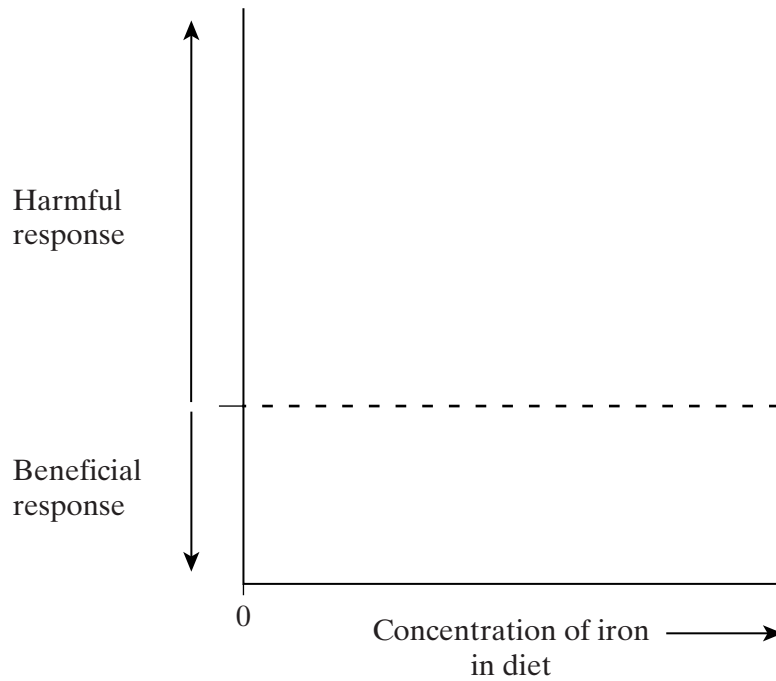
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(3 marks)

(b) Complete the diagram with a curve to show the effect on the body of the concentration of iron in the diet.



(2 marks)

(c) Use your knowledge of the functions of the molecules found in plasma membranes to explain why digitalis affects cardiac muscle but not other types of muscle (lines 8 - 9).

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(3 marks)

**QUESTION 2 CONTINUES ON THE NEXT PAGE**

**Turn over** ►

- (d) (i) Use your knowledge of Fick’s law to explain how the buccal cavity is an important site for the absorption of the poisonous substances which enter the body by way of the digestive system (lines 12 - 13).

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(3 marks)

- (ii) Explain why the buccal cavity is of little importance in the absorption of nutrients (line 12).

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(2 marks)

- (e) A poison which is absorbed through the wall of the buccal cavity may reach a target organ in a virtually unaltered form (lines 18 - 19). Suggest how the venous pathway could result in the poison being unaltered when it reaches the target organ.

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(2 marks)







Handwriting practice area consisting of 25 horizontal dotted lines.

Turn over 

