

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Education
January 2004
Advanced Subsidiary Examination



BIOLOGY (SPECIFICATION B)
Unit 1 Core Principles

BYB1

Thursday 8 January 2004 Morning Session

In addition to this paper you will require:

- a ruler with millimetre measurements.

You may use a calculator.

Time allowed: 1 hour

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. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

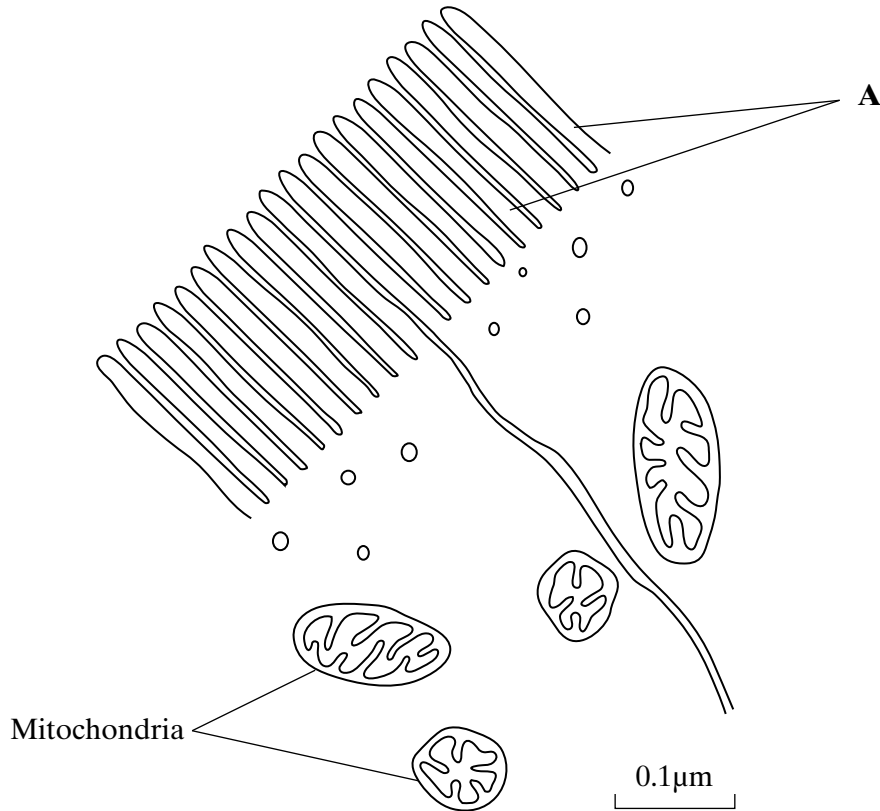
Information

- The maximum mark for this paper is 54.
- Mark allocations are shown in brackets.
- Answers for **Questions 1 to 6** are expected to be short and precise.
- Question 7** should be answered in continuous prose. Quality of Written Communication will be assessed in the answer. You will be awarded up to 1 mark for 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 legibility of your handwriting and the accuracy of your spelling, punctuation and grammar will also be taken into account.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
QWC			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

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

- 1** The drawing shows an electron micrograph of parts of epithelial cells from the small intestine.



- (a) (i) Name the structures labelled **A**.

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(1 mark)

- (ii) Explain how these structures help in the absorption of substances from the small intestine.

.....
.....
(1 mark)

- (b) (i) The scale bar on this drawing represents a length of 0.1 μm. Calculate the magnification of the drawing. Show your working.

Magnification.....
(2 marks)

(ii) Explain why an electron microscope shows more detail of cell structure than a light microscope.

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(2 marks)

(c) The length of mitochondria can vary from 1.5µm to 10µm but their width never exceeds 1µm. Explain the advantage of the width of mitochondria being no more than 1µm.

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(1 mark)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 2 (a) **Figure 1** shows the structure of a molecule of glycerol and a molecule of fatty acid.

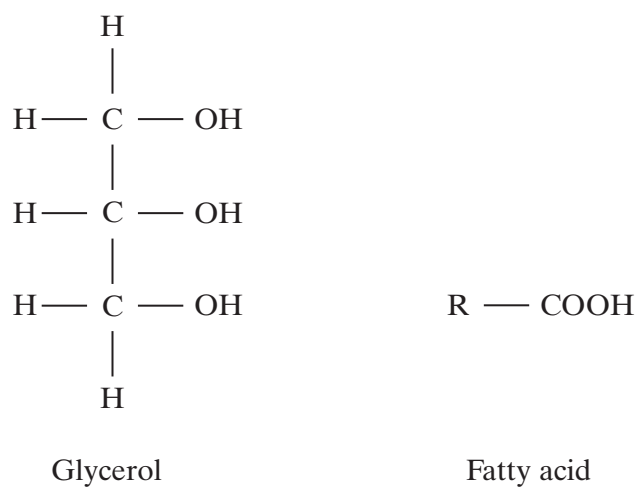


Figure 1

Draw a diagram to show the structure of a triglyceride molecule.

(2 marks)

- (b) Explain why triglycerides are **not** considered to be polymers.

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(1 mark)

(c) **Figure 2** shows two types of fat storage cell. Mammals living in cold conditions have more brown fat cells than mammals living in tropical conditions.

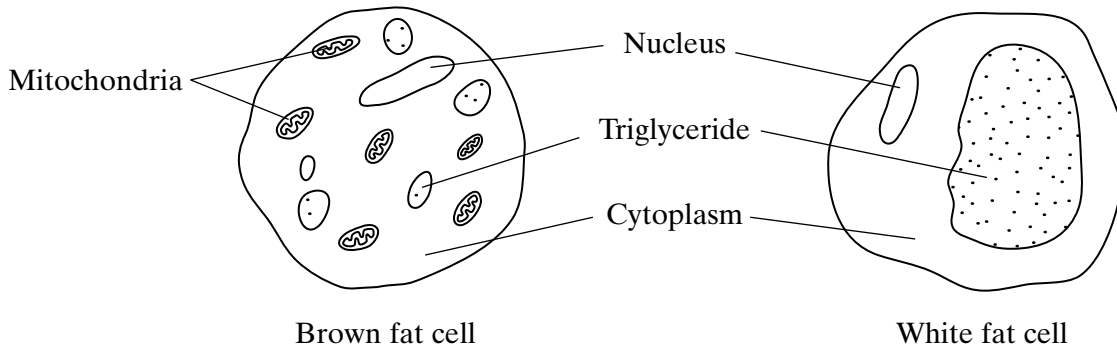


Figure 2

Using evidence from **Figure 2** to support your answer, suggest how the function of brown fat cells differs from that of white fat cells.

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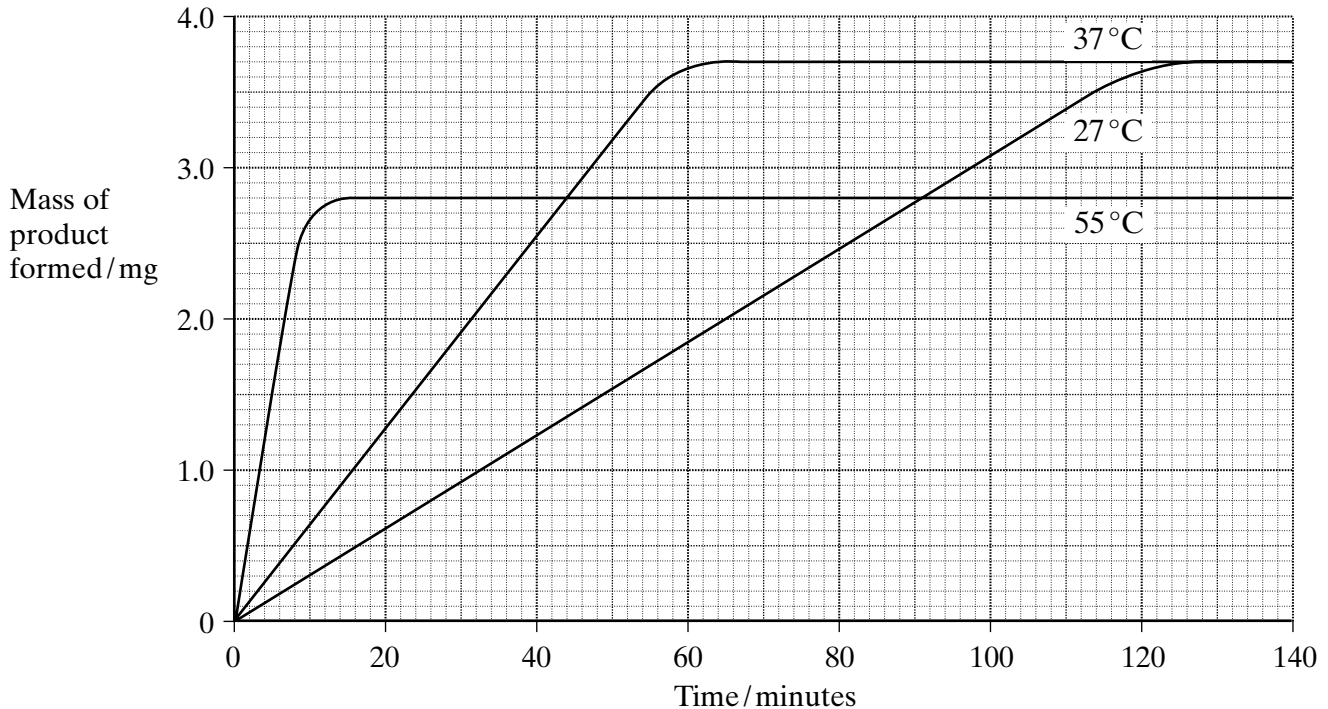
(3 marks)

6

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 3 A student carried out an investigation into the mass of product formed in an enzyme-controlled reaction at three different temperatures. Only the temperature was different for each experiment. The results are shown in the graph.



- (a) Use your knowledge of enzymes to explain

- (i) why the initial rate of reaction was highest at 55 °C;

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(2 marks)

- (ii) the shape of the curve for 55 °C after 20 minutes.

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(3 marks)

(b) Explain why the curves for 27°C and 37°C level out at the same value.

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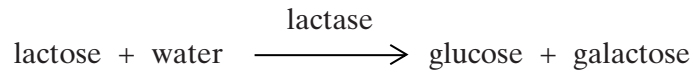
(2 marks)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 4 Lactose is a disaccharide sugar which can be broken down by the enzyme lactase into two monosaccharides, glucose and galactose.



- (a) The formula for galactose is $\text{C}_6\text{H}_{12}\text{O}_6$. What is the formula for lactose?

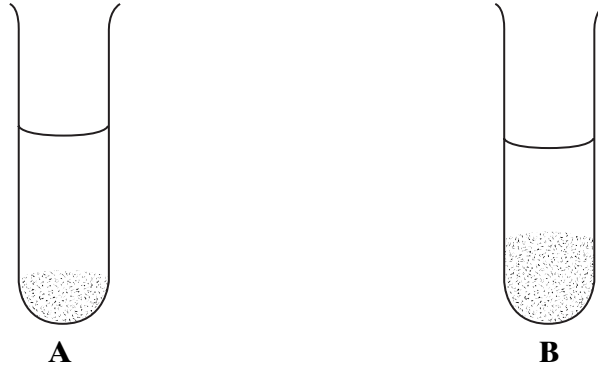
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(2 marks)

- (b) A solution containing the enzyme lactase was added to a lactose solution. The solution was incubated at 40°C for one hour. Sample **A** was removed from the tube before incubation. Sample **B** was removed after one hour.

- (i) Describe a chemical test you could carry out on sample **A** to show that lactose is a reducing sugar.

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(2 marks)

- (ii) This chemical test was carried out on samples **A** and **B**. All experimental variables were the same in the testing of the two samples. Both tubes were left for ten minutes to allow the precipitate to settle. The diagram shows the result.



Is galactose a reducing sugar?

Explain how the results in the diagram support your answer.

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(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

Turn over

5 (a) Oxygen and water move through plasma membranes into cells. Describe **two** ways in which these movements are similar.

1

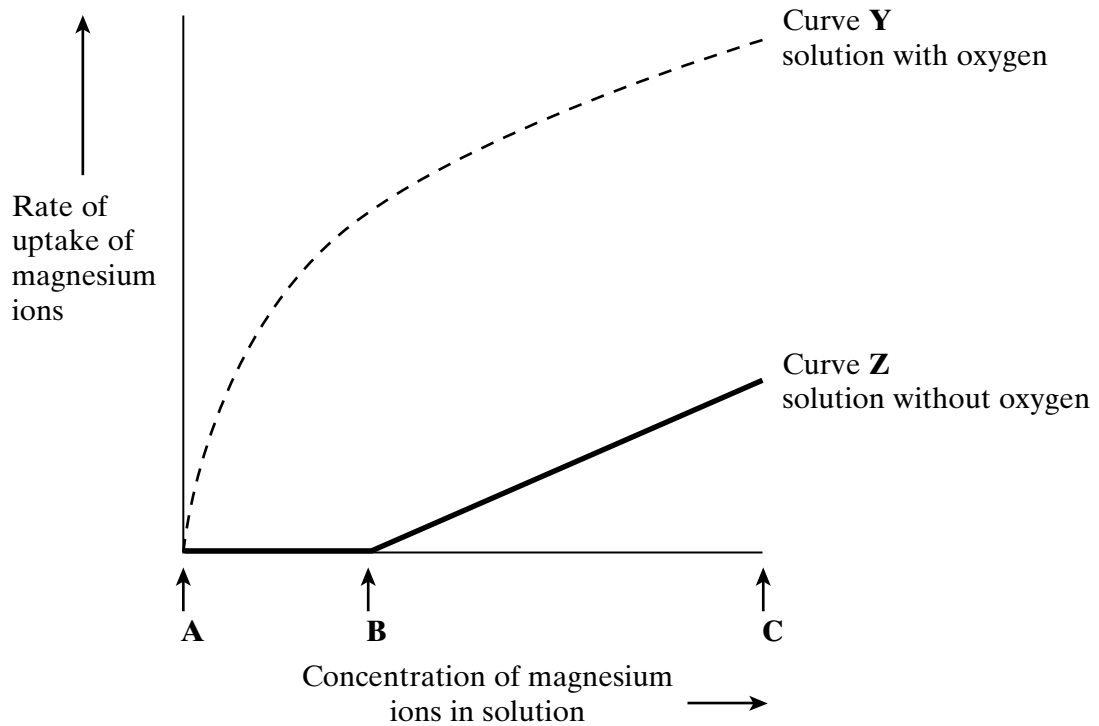
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2

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(2 marks)

The graph shows the effect of concentration on the rate of uptake of magnesium ions by root hair cells.



(b) For curve **Y** name the process the cells are using to absorb magnesium ions between concentrations **A** and **B**. Use information in the graph to explain your answer.

Name of process

Explanation

.....

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(2 marks)

- (c) In the solution without oxygen, explain why no magnesium ions are taken up between concentrations **A** and **B**.

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(1 mark)

- (d) For curve **Z** explain why the rate of uptake increases between **B** and **C**.

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(1 mark)

6

TURN OVER FOR THE NEXT QUESTION

Turn over ►

6 (a) Endopeptidases and exopeptidases are involved in the digestion of proteins in mammals.

(i) Describe the action of endopeptidases on a protein.

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(2 marks)

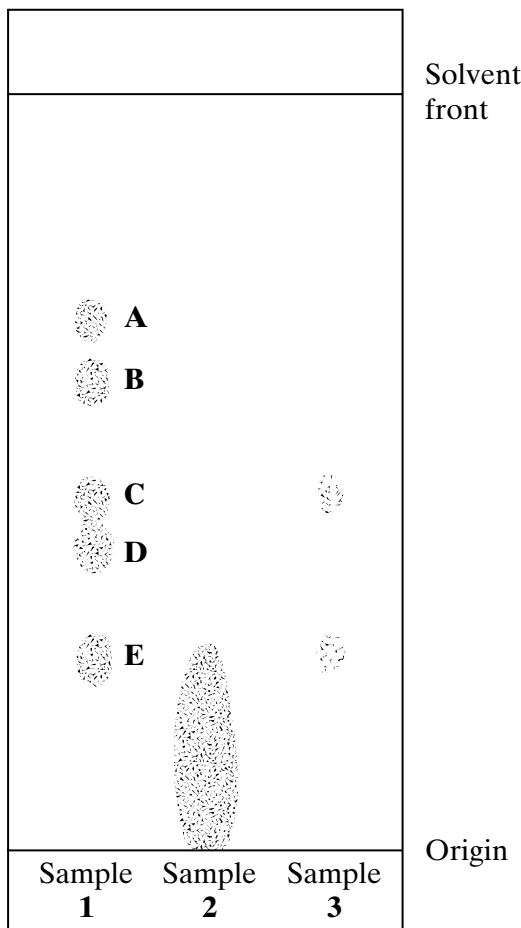
(ii) Explain how the action of endopeptidases increases the rate of action of exopeptidases.

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(1 mark)

Samples of the contents from three different regions of the gut of a mammal were collected. The samples were analysed for the presence of the products of protein digestion using paper chromatography. The chromatogram shows the results. The table gives the R_f values for seven amino acids.



Amino acid	R _f value
Histidine	0.25
Alanine	0.39
Cysteine	0.39
Glycine	0.46
Serine	0.50
Phenylalanine	0.62
Tyrosine	0.69

(b) (i) Identify amino acid **B**.

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(1 mark)

(ii) How could you achieve a better separation of amino acids **C** and **D** by chromatography?

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(2 marks)

(c) (i) Complete the table below to identify which region of the gut each of the samples was taken from.

Region	Sample
Stomach	
Small intestine – middle region	
Small intestine – lower region	

(1 mark)

(ii) Name the product of protein digestion you would expect to find in sample **2**.

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(1 mark)

(iii) Explain the difference between samples **1** and **3**.

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(1 mark)

Answers to **Question 7** should be written in continuous prose, where appropriate.
Quality of Written Communication will be assessed in the answer.

- 7 (a) Explain how the ventilation mechanism of a fish and the structure of its gills result in the efficient uptake of oxygen from water.

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(6 marks)

Table 1 compares some features of water and air.

Feature	Water	Air
Relative density	1000	1
Maximum concentration of oxygen/cm ³ dm ⁻³	9	130

Table 1

Table 2 shows some features of gas exchange in a fish and in a mammal.

Feature	Fish	Mammal
Percentage of oxygen extracted from water or air	80	25
Oxygen consumption at rest/cm ³ kg ⁻¹ hour ⁻¹	100	200

Table 2

- (b) (i) The fish has a body mass of 0.2 kg. Calculate the volume of water it will need to pass over its gills each hour to supply the oxygen required when resting. Show your working.

Answer $\text{dm}^3/\text{hour}^{-1}$
(2 marks)

- (ii) Ventilation in mammals involves movement of air to and from the gas exchange surface in a tidal pattern. Using information in the tables, explain why it is easier to move water over the gas exchange surface of a fish in one direction rather than in a tidal pattern.

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(2 marks)

- (c) A rise in the temperature of water decreases the amount of oxygen dissolved in the water. As the water temperature rises, the rate of ventilation in a fish also rises. Explain the advantage of this.

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(2 marks)

END OF QUESTIONS

QWC

