

Surname						Other Names					
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General Certificate of Education
 January 2004
 Advanced Subsidiary Examination



**BIOLOGY (SPECIFICATION B)
 Unit 3 Physiology and Transport**

BYB3/W

Thursday 8 January 2004 Morning Session

In addition to this paper you will require:

- a ruler with millimetre measurements.

You may use a calculator.

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

Time allowed: 1 hour

Instructions

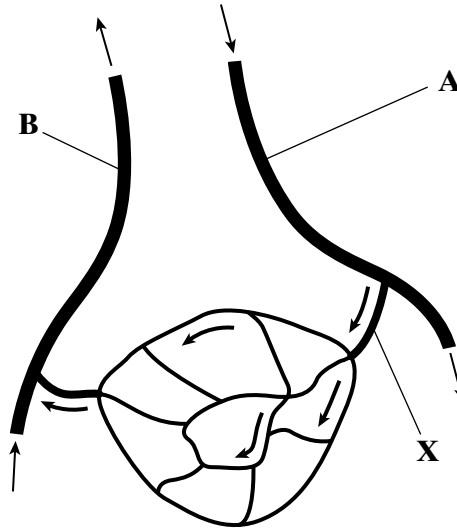
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

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.

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

1 The diagram shows some blood vessels in muscle tissue.



Not drawn to scale

(a) (i) Which type of blood vessel is **X**?

.....
(1 mark)

(ii) Name **two** substances which are at a higher concentration in the blood at **A** than in the blood at **B**.

1

2

(1 mark)

(b) The table shows the mean diameter of the lumen and the rate of blood flow in some types of human blood vessel.

Type of blood vessel	Mean diameter of lumen/ μm	Rate of blood flow/ cm s^{-1}
Artery	400	10 – 40
Arteriole	30	0.1 – 10
Capillary	8	less than 0.1

Using information in the table, explain what causes the rate of blood flow to be slower in capillaries than in other vessels.

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(2 marks)

(c) (i) Which type of blood vessel has most elastic tissue in its wall?

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(1 mark)

(ii) How does this elastic tissue help to smooth out the flow of blood in the blood vessel?

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(2 marks)

7

Turn over 

- 2 (a) The table shows the transpiration rate of a group of plants exposed to different humidities at a temperature of 25°C.

Humidity / %	Transpiration rate / arbitrary units
20	26.0
40	21.0
50	16.5
60	11.0
70	9.5

Describe and explain the relationship between humidity and transpiration rate.

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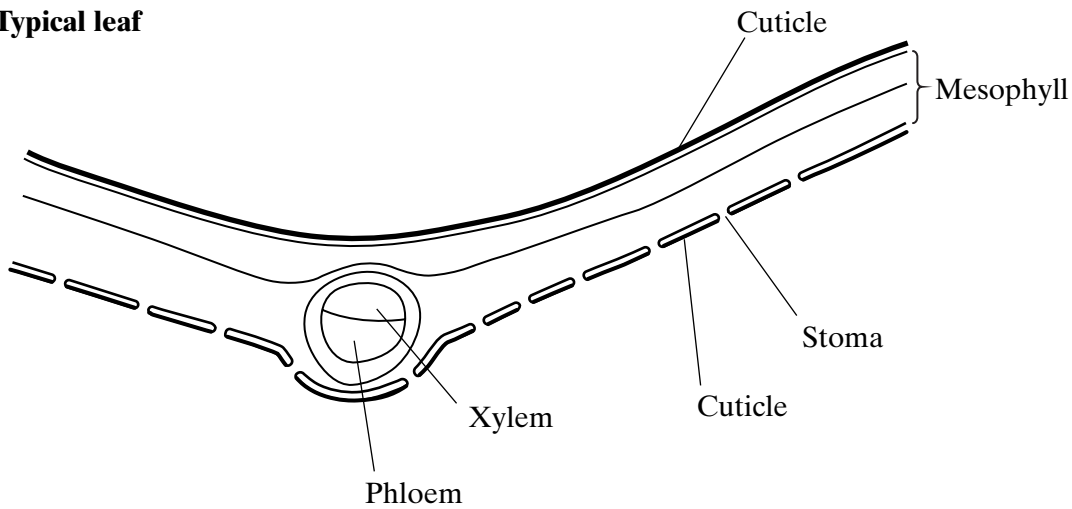
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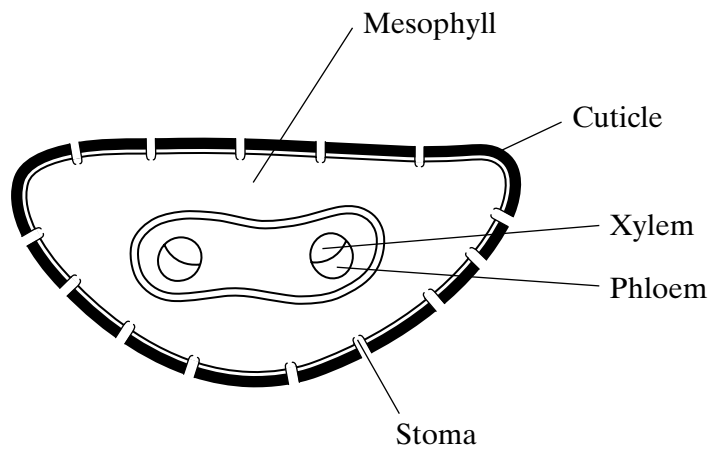
(3 marks)

(b) The diagrams show a section through a typical leaf and a section through a leaf from a xerophytic plant. The xerophytic leaf has a lower transpiration rate than the typical leaf.

Typical leaf



Xerophytic leaf



Describe **two** features shown in the diagram of the xerophytic leaf which reduce transpiration rate. Explain how each of these features contributes to a lower transpiration rate.

Feature 1

Explanation

.....

Feature 2

Explanation

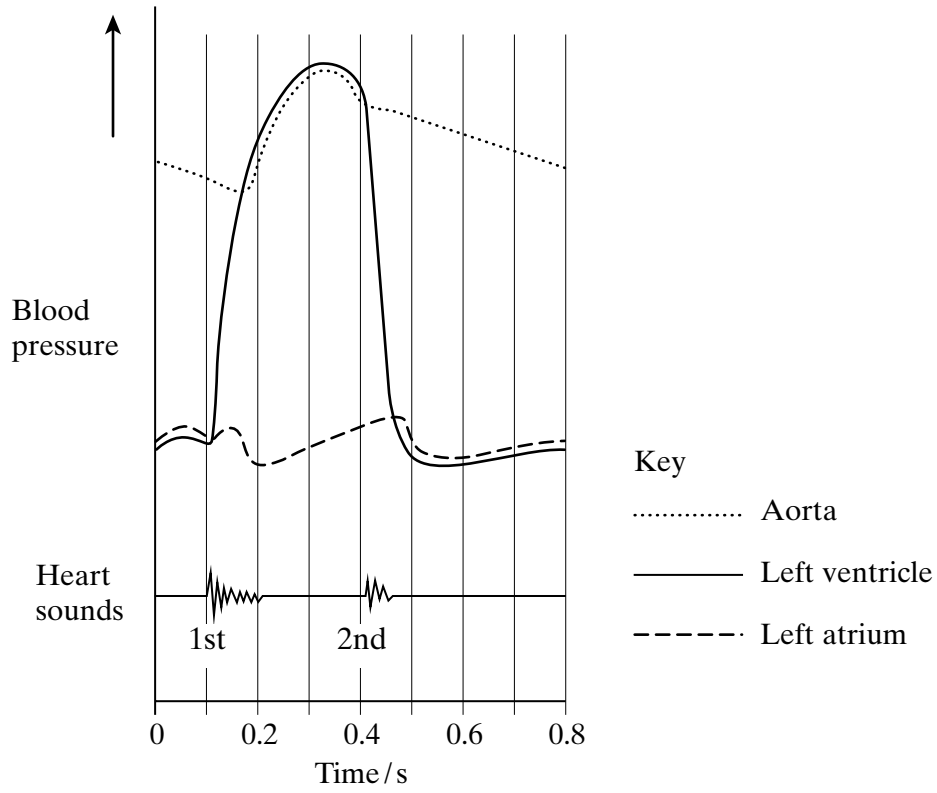
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(4 marks)

7

Turn over ▶

3 The graph shows changes in pressure in the aorta, left ventricle and left atrium during one heart beat.



(a) The maximum pressure in the left atrium is lower than the maximum pressure in the left ventricle. What causes this difference in maximum pressure?

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(1 mark)

(b) A stethoscope can be used to listen to the sounds made by the heart.

(i) What is the evidence from the graph that the first heart sound is caused by the atrioventricular valve closing?

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(1 mark)

(ii) What causes the second heart sound? Give the reason for your answer.

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(2 marks)

(c) Heart rate increases during exercise. Describe the part played by chemoreceptors and the medulla in increasing heart rate.

(i) chemoreceptors

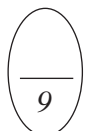
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(ii) medulla

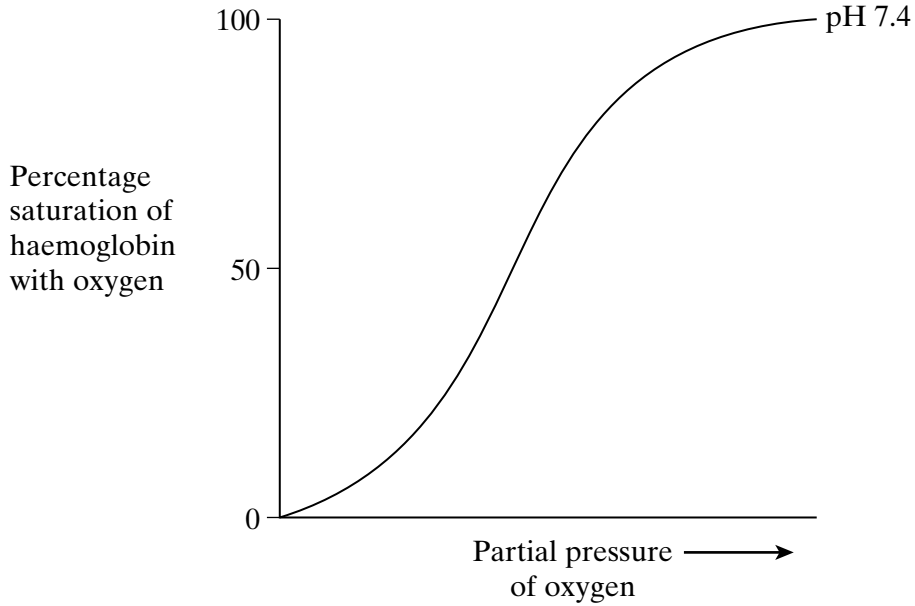
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(5 marks)

Turn over 



- 4 (a) The graph shows a dissociation curve for human haemoglobin at pH 7.4. The position of the curve is different at pH 7.2.



- (i) Sketch a curve on the graph to show the likely position of the dissociation curve at pH 7.2.

(1 mark)

- (ii) Explain how a change in pH from 7.4 to 7.2 affects the supply of oxygen by haemoglobin to the tissues.

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(2 marks)

(b) Explain what causes the pH to be reduced from 7.4 to 7.2 in a tissue.

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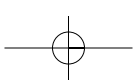
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(3 marks)

6

TURN OVER FOR THE NEXT QUESTION

Turn over 



5 When one mole of glucose is burned, 2800 kJ of energy are released. However, when one mole of glucose is respired aerobically, only 40% of the energy released is incorporated into ATP. Each mole of glucose respired aerobically produces 38 moles of ATP.

(a) (i) Calculate how much energy is incorporated into each mole of ATP. Show your working.

Answer kJ
(2 marks)

(ii) When glucose is respired what happens to the energy which is **not** incorporated into ATP?

.....
(1 mark)

(b) (i) When one mole of glucose is respired anaerobically, only 2 moles of ATP are produced. Explain why less energy is released in anaerobic respiration.

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

(ii) At the end of a sprint race, a runner continues to breathe rapidly for some time. Explain the advantage of this.

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(2 marks)

6

6 **Figure 1** illustrates the mass flow hypothesis. This hypothesis has been suggested to explain transport through the phloem.

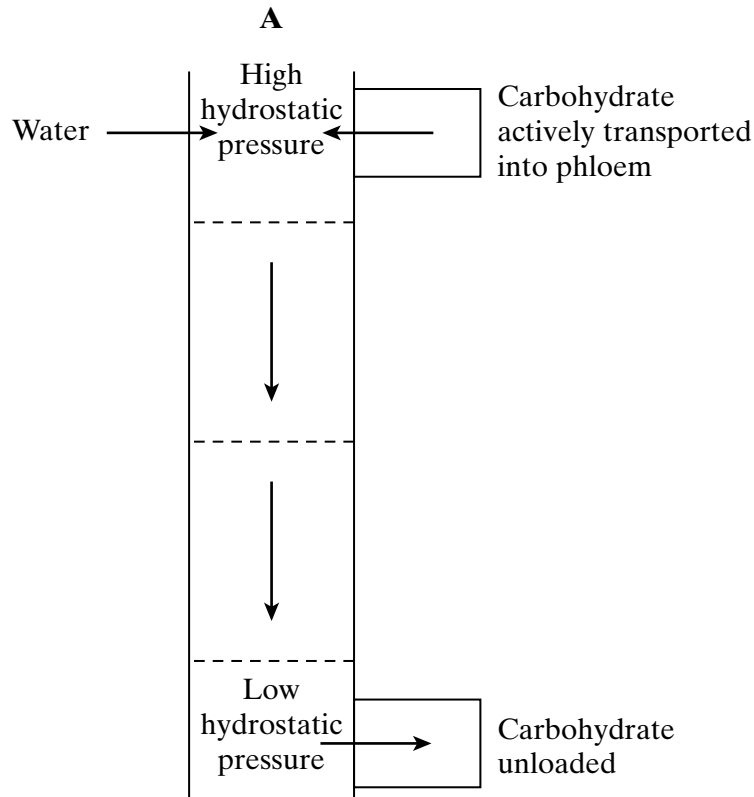


Figure 1

(a) Name the main carbohydrate transported in the phloem.

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(1 mark)

(b) Use information in **Figure 1** to explain how the high hydrostatic pressure is produced at **A**.

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(3 marks)

QUESTION 6 CONTINUES ON THE NEXT PAGE

Turn over ▶

- (c) ^{14}C may be used as a radioactive tracer. The location of the tracer can be shown by autoradiography. **Figure 2** shows a plant, in which a single leaf was supplied with $^{14}\text{CO}_2$ for fifteen minutes. The plant was left for 24 hours, then an autoradiograph of the plant was made. This is shown in **Figure 3**.

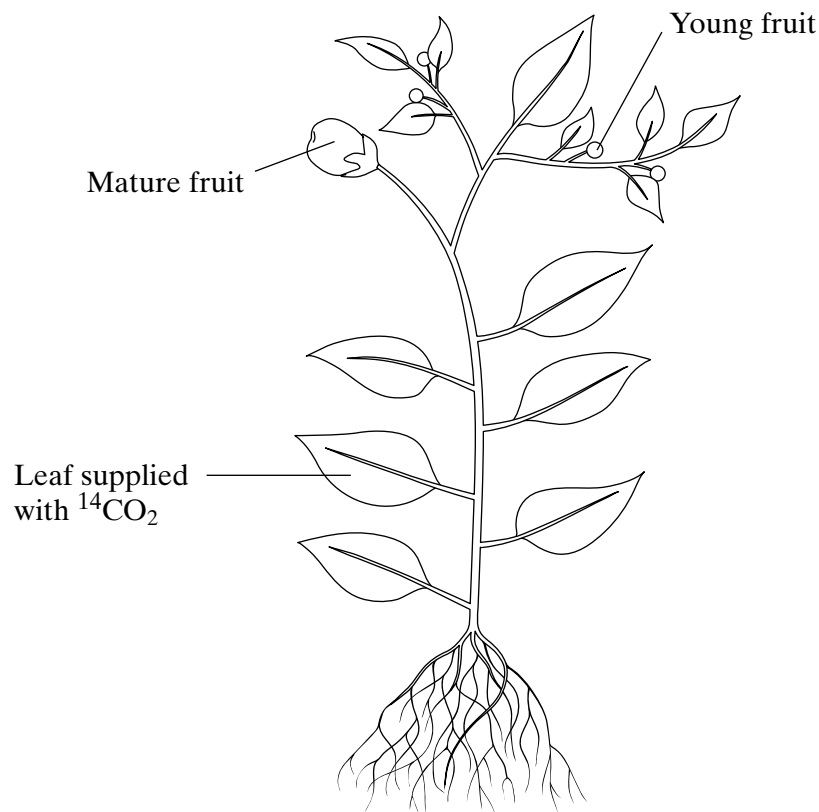


Figure 2

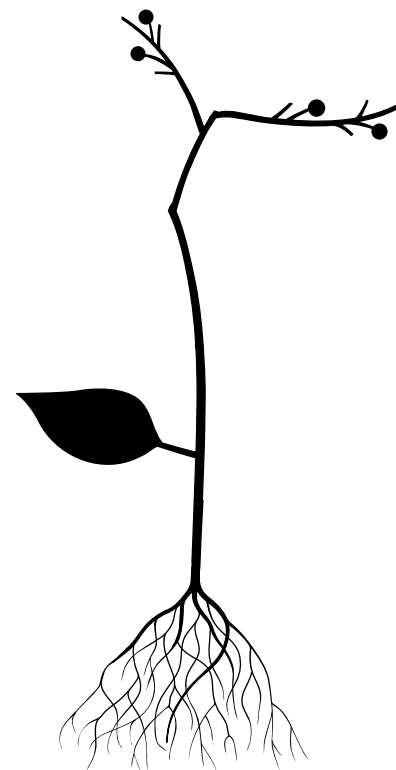


Figure 3

For each of the following statements about transport of organic solutes in this plant, write 'yes' if you think it is confirmed by evidence from the autoradiograph or 'no', if you think it is not confirmed. Give a reason for your answer in each case.

- (i) Radioactive compounds are translocated to growing regions.

Confirmed

Reason

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(1 mark)

(ii) Translocation can take place both upwards and downwards in the stem of the plant.

Confirmed

Reason

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(1 mark)

(iii) Translocation takes place in the phloem rather than the xylem.

Confirmed

Reason

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(1 mark)

(iv) Only carbohydrates are transported from leaves to other parts of the plant.

Confirmed

Reason

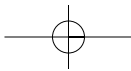
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(1 mark)

8

TURN OVER FOR THE NEXT QUESTION

Turn over 



LEAVE
MARGIN
BLANK

Question 7 should be answered in continuous prose.
Quality of Written Communication will be assessed in these answers.

- 7 (a) Describe and explain **four** ways in which the structure of a capillary adapts it for the exchange of substances between blood and the surrounding tissue.

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(4 marks)

- (b) Explain how tissue fluid is formed and how it may be returned to the circulatory system.

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(6 marks)

END OF QUESTIONS

QWC

$\frac{\quad}{10}$

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