

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Education
 January 2003
 Advanced Subsidiary Examination



BIOLOGY (SPECIFICATION B)
Unit 3 Physiology and Transport

BYB3/W

Wednesday 15 January 2003 Afternoon 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			
6			
7			
QWC			
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 15 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 **Section A** and **Section B** 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.

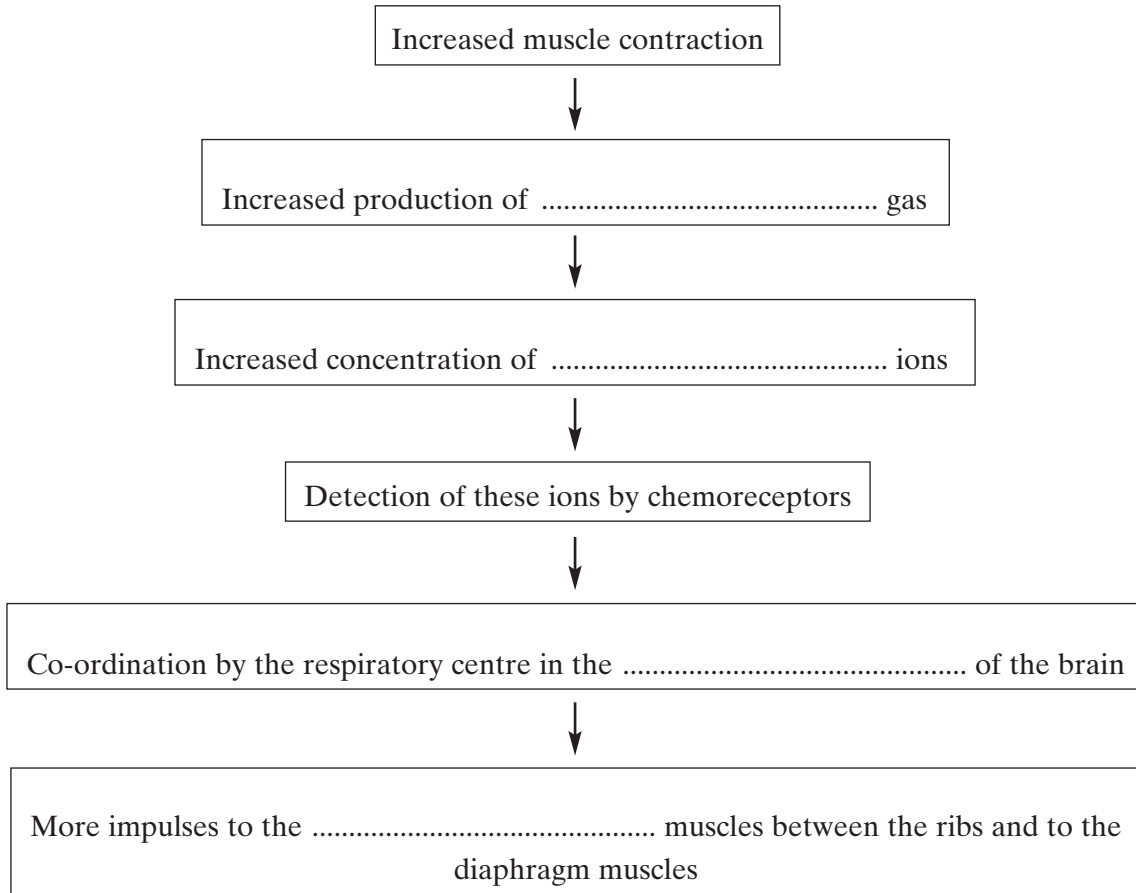
Information

- The maximum mark for this paper is 66.
- Mark allocations are shown in brackets.
- Answers for **Section A** are expected to be short and precise.
- Questions in **Section B** should be answered in continuous prose where appropriate. Quality of Written Communication will be assessed in these answers.
- In addition to the mark allocations indicated within **Section B**, 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 degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.

SECTION A

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

- 1 (a) When muscle activity increases, the rate of breathing also increases. Complete the chart to show some of the changes that cause this increase in the rate of breathing.



(4 marks)

- (b) Describe the function of the stretch receptors in the lungs.

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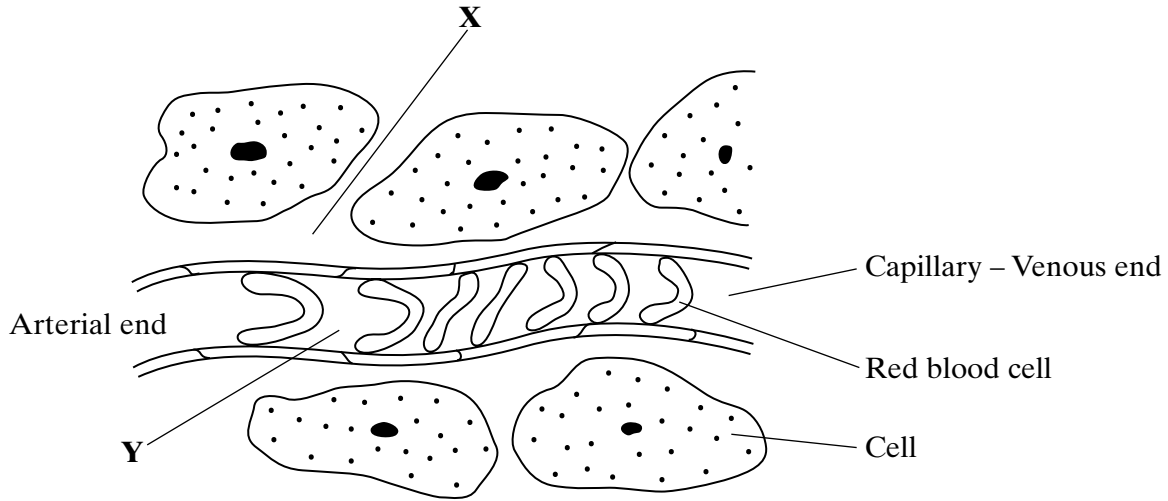
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(2 marks)

2 The diagram shows a blood capillary and some surrounding cells.



(a) Name the fluid

at **X**

at **Y**.

(2 marks)

(b) Give **one** way in which the composition of the fluid at **X** differs from the composition of the fluid at **Y**.

.....
.....

(1 mark)

(c) (i) At the venous end of the capillary, water passes from fluid **X** into fluid **Y**. Name the process by which this happens.

.....
(1 mark)

(ii) Which system returns excess fluid **X** to blood vessels in the neck?

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(1 mark)

(d) As the red blood cells pass through the capillary they bend as shown in the diagram. Suggest **one** way in which this makes them better at carrying out their function.

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(1 mark)

3 (a) Which substance is the immediate source of energy for muscle contraction?

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(1 mark)

(b) (i) Which substance is the waste product of anaerobic respiration in muscles?

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(1 mark)

(ii) Describe what happens to this waste product when the muscles start respiring aerobically.

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(2 marks)

(c) In an investigation, athletes ran as fast as they could for three different periods of time. The percentage of energy derived from aerobic and anaerobic respiration during each test was measured. The table shows the results.

Length of test /s	Energy obtained from	
	aerobic respiration / %	anaerobic respiration / %
10	3	97
30	28	72
90	46	54

(i) The world record for the 100m sprint is 9.84s. A top-class sprinter does not need to breathe in during a 100m sprint. Use information in the table to explain why.

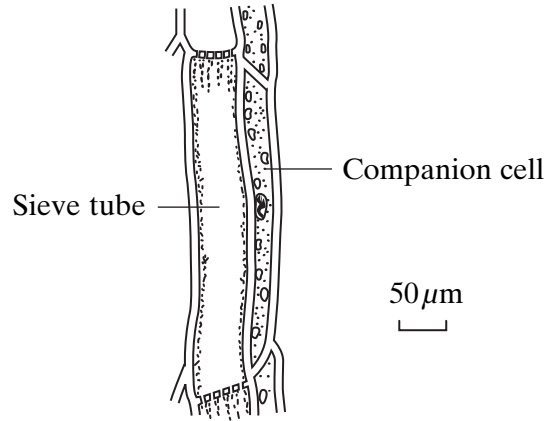
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(2 marks)

(ii) In the test that lasted 90s, the speed at which the athletes ran decreased before the end of the test. Suggest and explain **one** reason why their speed of running decreased.

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4 The diagram shows some cells from phloem tissue.



(a) Name the main carbohydrate transported by phloem tissue.

..... (1 mark)

(b) Describe and explain **two** ways in which the sieve tubes are adapted for their transport function.

1

2

(4 marks)

(c) (i) Carbohydrate enters the sieve tubes in the leaves. What effect does the entry of the carbohydrate have on the water potential in the sieve tubes?

..... (1 mark)

(ii) Explain how this effect may result in mass flow of substances in the phloem.

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(2 marks)

5 Earthworms have long, thin bodies and live in damp soil. They have no special breathing organs; they simply absorb oxygen directly through the skin. **Figure 1** shows part of the blood system in a section across an earthworm.

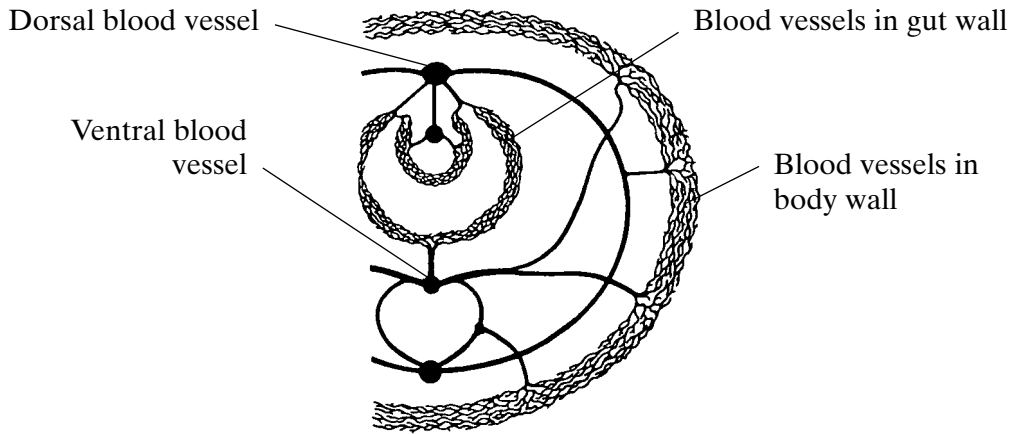


Figure 1

(a) Using information from **Figure 1**, explain **two** ways in which the blood vessels in the body wall help the earthworm to absorb oxygen.

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- 2
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(2 marks)

(b) The blood of the earthworm is circulated by five pairs of simple ‘hearts’ which connect the dorsal and ventral blood vessels. Each heart has muscular walls which contract and contains valves, as shown in **Figure 2**.

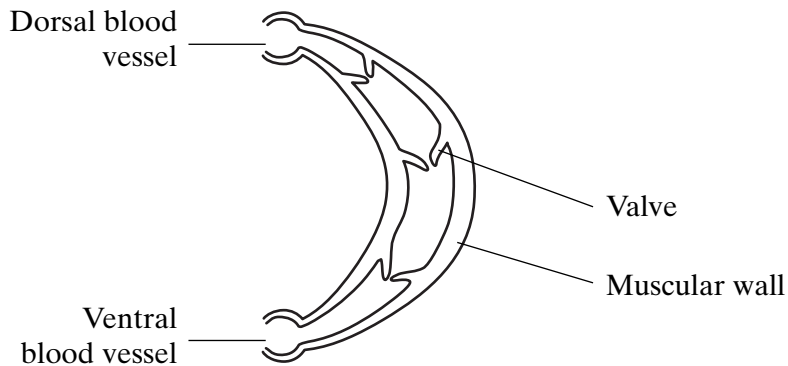


Figure 2

Explain how the valves ensure that blood flows in one direction only.

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- (c) The blood of an earthworm contains haemoglobin. Describe how haemoglobin helps the blood of the earthworm to transport oxygen.

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(2 marks)

- (d) The lugworm is similar to an earthworm, but lives in seashore mud where there is a very low oxygen concentration. **Figure 3** shows the oxygen haemoglobin dissociation curves of the lugworm and the earthworm.

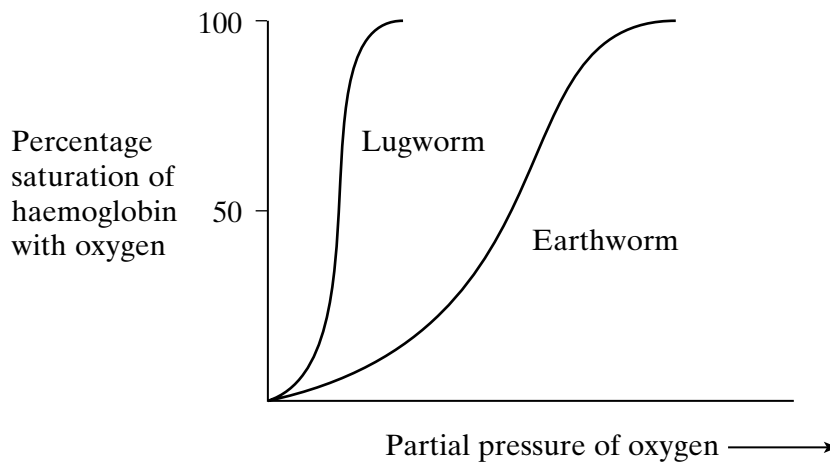


Figure 3

Explain the advantage to the lugworm of having the dissociation curve in the position shown.

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(2 marks)

SECTION B

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

Answers should be written in continuous prose, where appropriate.
Quality of Written Communication will be assessed in these answers.

6 (a) During exercise the rate of blood flow through the skeletal muscles increases.

(i) One change that increases the blood flow is an increase in the rate of heartbeat.
Give **two** other changes that will increase blood flow through the skeletal muscles.

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2

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(2 marks)

(ii) Explain **two** advantages of increasing the blood flow through the skeletal muscles during exercise.

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(2 marks)

(b) Describe how the rate of heartbeat is increased as muscle activity increases during exercise.

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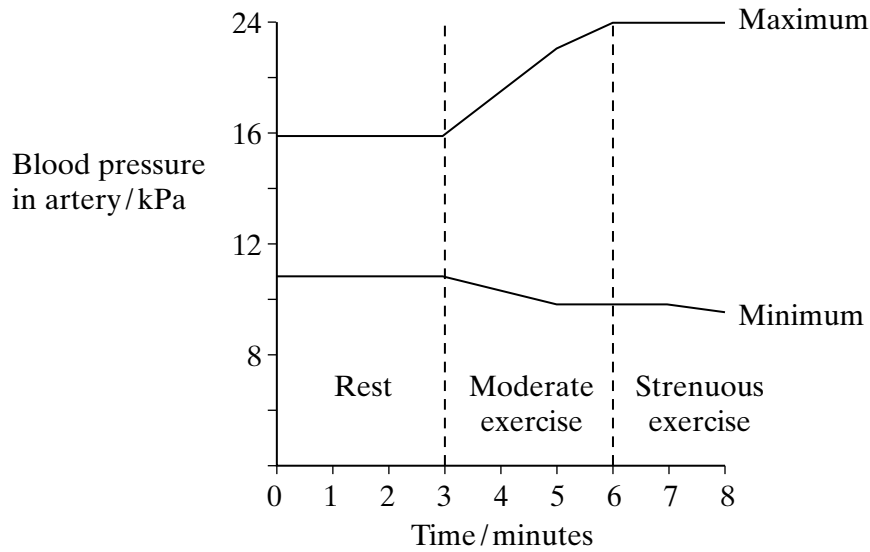
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(6 marks)

QUESTION 6 CONTINUES ON THE NEXT PAGE

- (c) A person's blood pressure was measured before and during a period of exercise. The maximum and minimum pressures in the artery of the upper arm were recorded. The results are shown in the graph.



- (i) In the heart the blood pressure falls to zero while the ventricles are filling. Use your knowledge of the structure of arteries to explain why the minimum pressure in the artery of the arm stays well above zero.

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(2 marks)

- (ii) The maximum pressure in the artery increases during moderate exercise. Suggest how this increase is produced by the action of the heart.

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(2 marks)

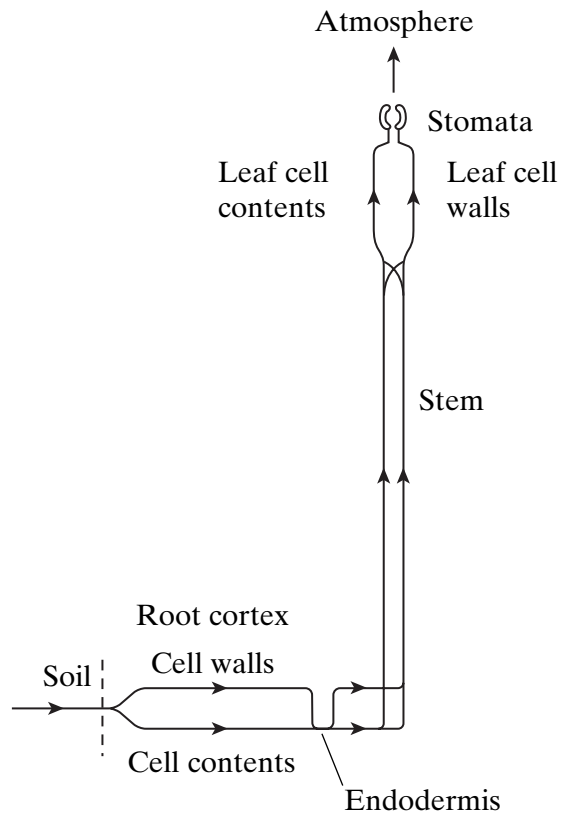
- (iii) Suggest why there was no further increase in the maximum pressure in the artery during the period of strenuous exercise.

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(1 mark)

7 The diagram shows the pathway taken by water passing through a plant.



(a) Name

(i) the process by which water enters root hairs from the soil.

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(1 mark)

(ii) the pathway through the cell walls of the root cortex.

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(1 mark)

QUESTION 7 CONTINUES ON THE NEXT PAGE

- (b) All water passes through the endodermis by the same pathway. Explain what causes this.

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(2 marks)

- (c) Describe and explain how water moves through the trunk of a tree to the leaves.

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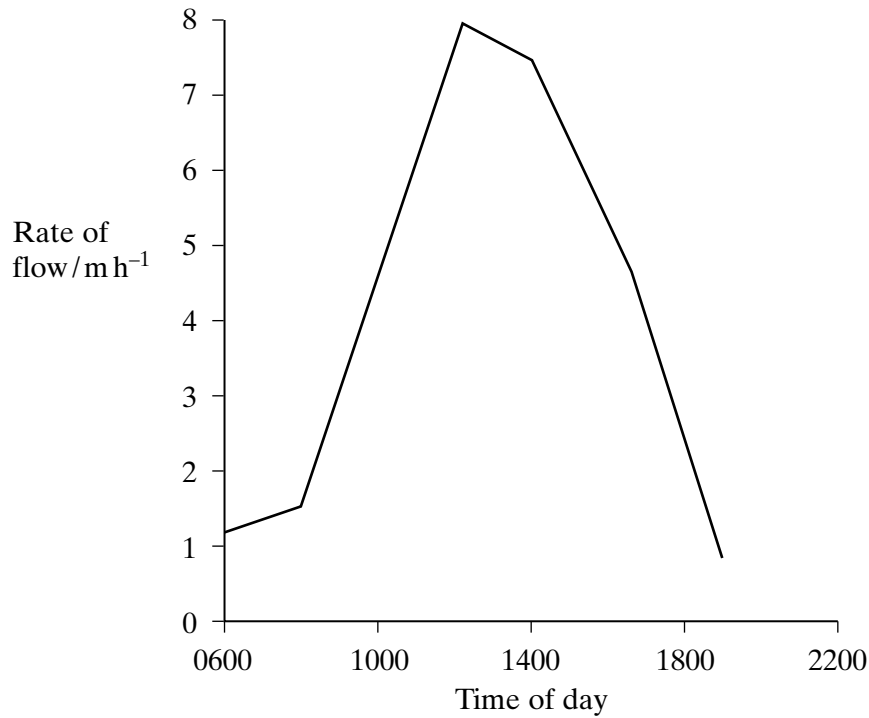
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(6 marks)

(d) The graph shows the rate of water flow through a branch near the top of a tree on a summer's day.



Describe and suggest explanations for the changes in the rate of flow during the day.

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(4 marks)

END OF QUESTIONS

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

ACKNOWLEDGEMENT OF COPYRIGHT-HOLDERS

Question 5 Figure 1 Adapted from Knut Schmidt-Neilson *Animal Physiology* (Cambridge University Press) 3rd Edition 1983.