Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Education
June 2004
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

BIOLOGY (SPECIFICATION B) BYB3/W
Unit 3 Physiology and Transport

Tuesday 8 June 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

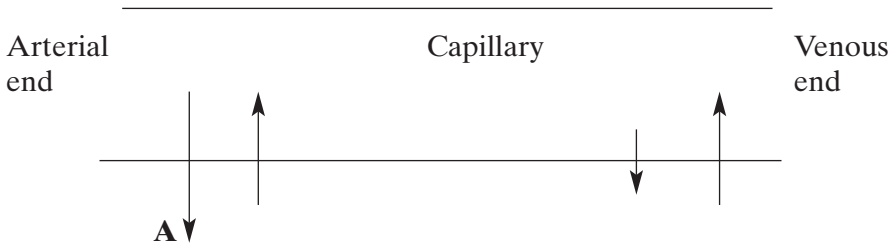
Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

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 Tissue fluid is formed when water and small molecules pass out of capillaries at their arterial end. The diagram shows some pressures involved in tissue fluid formation. The relative lengths of the arrows indicate the size of the pressures.



(a) What causes the pressure represented by the arrow labelled **A**?

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(1 mark)

(b) Explain why there is a net loss of water from a capillary at the arterial end.

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(2 marks)

(c) The total volume of fluid that passes from the capillaries to the surrounding tissue fluid is normally greater than the volume that is reabsorbed into them. Describe what happens to this extra fluid.

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(2 marks)

(d) Tissue fluid accumulates in the tissues of people who do not eat enough protein. Explain why.

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(2 marks)

7

TURN OVER FOR THE NEXT QUESTION

2 (a) Describe and explain how you would expect the sugar content in the phloem of a plant to vary over a period of 24 hours.

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(2 marks)

(b) In an investigation a ring of tissue was removed from the stem of a plant. A control plant was left untreated. The mean sugar concentration in all of the phloem above the position of the ring was measured over a period of 18 hours. The table shows the results.

	Mean sugar concentration/arbitrary units	
Time of day	**Plant with ring of tissue removed**	**Control plant**
0700	0.75	0.75
1500	1.00	0.80
1900	0.90	0.70
0100	0.85	0.60

The mean sugar concentration in the phloem above the position of the ring was higher in the ringed plant than in the control. Suggest an explanation for this.

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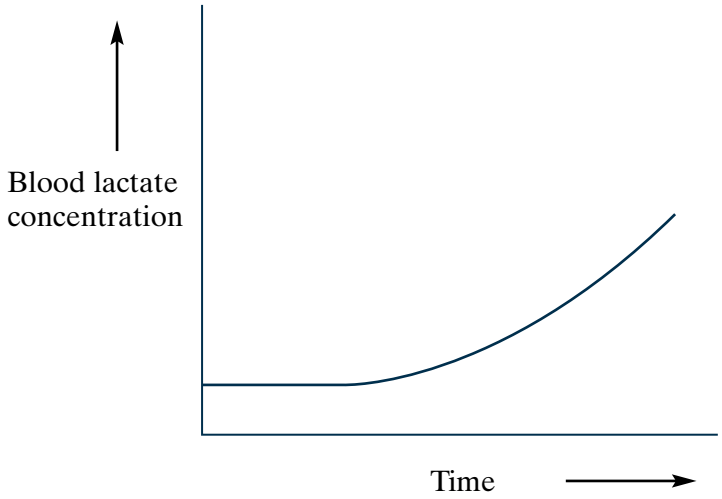
(3 marks)

5

3 Active muscles produce lactate, some of which diffuses into the blood. An athlete ran on a treadmill at a constant speed. The concentration of lactate in the blood was measured at regular intervals. The graph shows the results.



(a) Explain the shape of the curve.

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(3 marks)

(b) What happens to the lactate when the athlete stops running?

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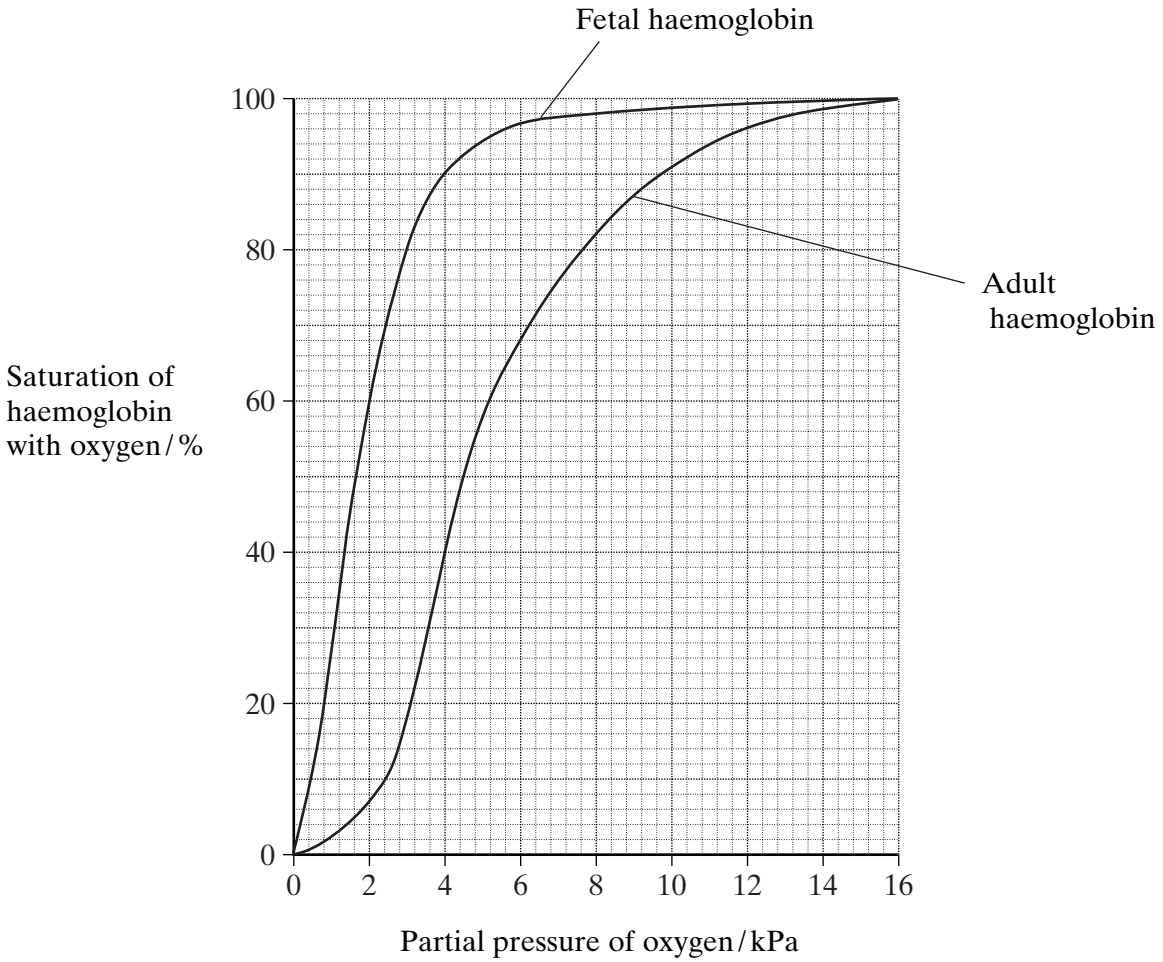
(2 marks)

5

4 The graph shows dissociation curves for haemoglobin in a fetus and in an adult.



(a) (i) What is the difference in percentage saturation between fetal haemoglobin and adult haemoglobin at a partial pressure of 3 kPa?

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(1 mark)

(ii) Explain the advantage of the curve for fetal haemoglobin being different from the curve for adult haemoglobin.

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(2 marks)

(b) The dissociation curve for adult haemoglobin changes during vigorous exercise.

(i) Sketch on the graph the position of the curve during vigorous exercise.

(1 mark)

(ii) Explain the advantage of this change in position.

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(2 marks)

6

TURN OVER FOR THE NEXT QUESTION

5 (a) Describe the function of stretch receptors in the process of breathing.

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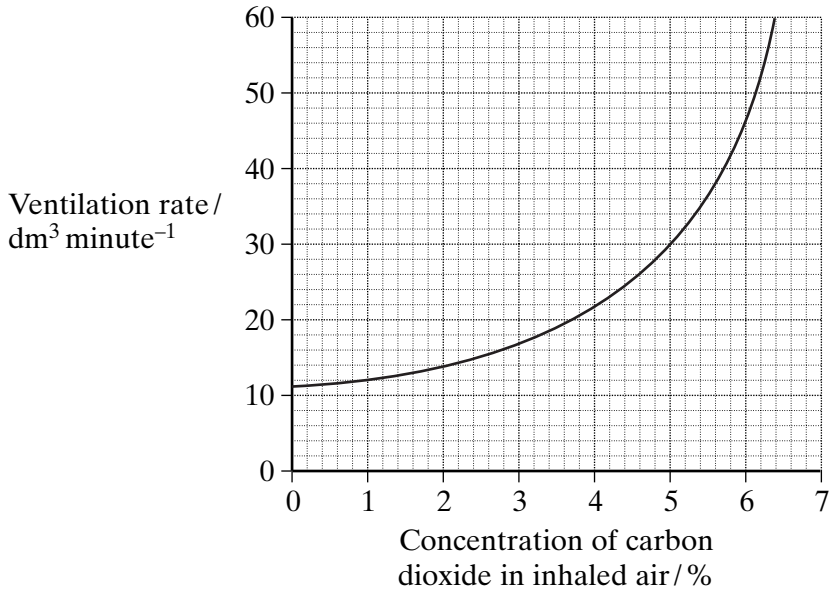
(2 marks)

(b) The graph shows the effect of changing the concentration of carbon dioxide in inhaled air on the ventilation rate.



(i) Use the graph to calculate the percentage increase in ventilation rate when the concentration of carbon dioxide in inhaled air rises from 0 % to 5 %. Show your working.

Answer .....

(2 marks)

(ii) Describe how the rise in carbon dioxide concentration of inhaled air leads to a change in the breathing rate.

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(4 marks)

8

6 (a) The apoplast pathway is one of the routes followed by water from a root hair, through the cortex, to the endodermis of the root.

(i) What is meant by the *apoplast* pathway?

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(1 mark)

(ii) Explain how the structure of the endodermis affects the passage of water by this pathway.

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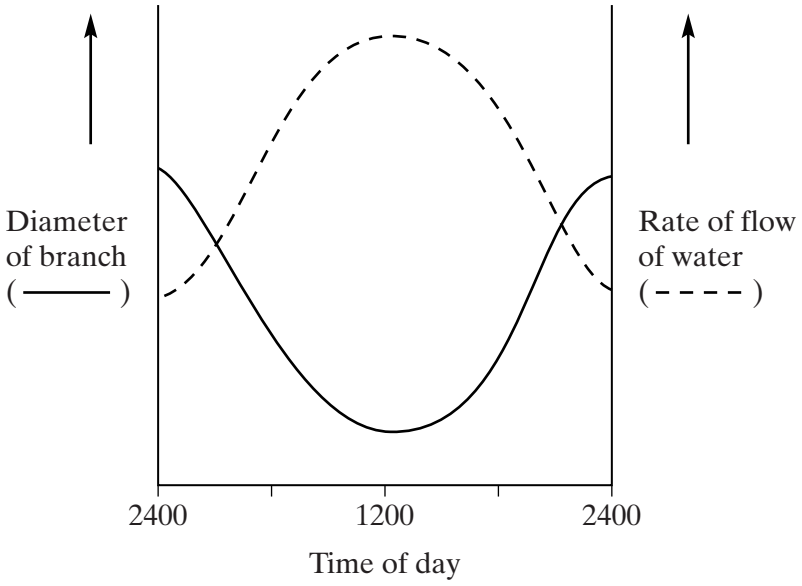
(3 marks)

(b) The diameter of a branch of a tree and the rate of flow of water through the branch were measured over a 24-hour period. The results are shown in the graph.



Using your knowledge of cohesion-tension theory

(i) describe and explain the changes in rate of flow of water in the branch over the 24 hour period;

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(3 marks)

(ii) explain why the diameter of the branch decreased during the first 12 hours.

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(1 mark)

(c) A stem was cut from a transpiring plant. The cut end of the stem was put into a solution of picric acid, which kills plant cells. The transpiration stream continued. Suggest an explanation for this observation.

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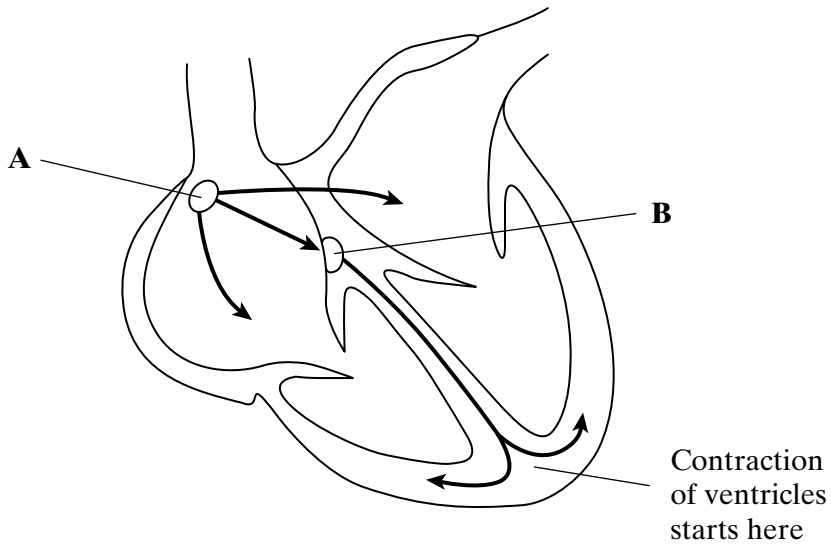
(2 marks)

10

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

7 The diagram shows the pathways in the heart for the conduction of electrical impulses during the cardiac cycle.



(a) Name structure **A**.

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(1 mark)

(b) Explain why each of the following is important in pumping blood through the heart.

(i) There is a short delay in the passage of impulses through part **B**.

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(1 mark)

(ii) The contraction of the ventricles starts at the base.

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(1 mark)

(c) The table shows the blood pressure in the left atrium, the left ventricle and the aorta at different times during part of a cardiac cycle.

	Blood pressure/kPa		
Time/s	**Left atrium**	**Left ventricle**	**Aorta**
0.0	0.5	0.4	10.6
0.1	1.2	0.7	10.6
0.2	0.3	6.7	10.6
0.3	0.4	17.3	16.0
0.4	0.8	8.0	12.0

(i) At which time is blood flowing into the aorta?

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(1 mark)

(ii) Between which times are the atrioventricular valves closed?

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(1 mark)

(d) The maximum pressure in the left ventricle is higher than the maximum pressure in the right ventricle. What causes this difference in pressure?

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(1 mark)

QUESTION 7 CONTINUES ON THE NEXT PAGE

(e) The information below compares some features of different blood vessels.

		Blood vessel		
		Artery	**Capillary**	**Vein**
Property	Mean diameter of vessel	4.0 mm	8.0 µm	5.0 mm
	Mean thickness of wall	1.0 mm	0.5 µm	0.5 mm
		Relative thickness (shown by length of bar)		
Tissues present in wall	Endothelium			
	Elastic tissue			
	Muscle			

Use the information to explain how the structures of the walls of arteries, veins and capillaries are related to their functions.

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(6 marks)

12

END OF QUESTIONS

QWC

1

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