

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Education
January 2009
Advanced Subsidiary Examination



BIOLOGY/HUMAN BIOLOGY (SPECIFICATION A) BYA1
Unit 1 Molecules, Cells and Systems

Thursday 8 January 2009 9.00 am to 10.30 am

<p>For this paper you must have:</p> <ul style="list-style-type: none"> a ruler with millimetre measurements. <p>You may use a calculator.</p>
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Time allowed: 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. **Answers written in margins or on blank pages will not be marked.**
- If you need extra space use page 22 for your answers.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.
- You will be marked on your ability to use good English, to organise information clearly and to use accurate scientific terminology where appropriate.

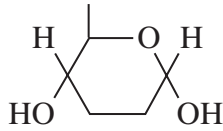
For Examiner's Use			
Question	Mark	Question	Mark
1			
2			
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Total (Column 1) →			
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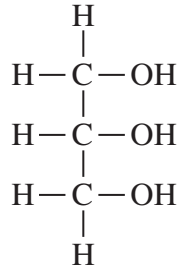
J A N 0 9 B Y A 1 0 1

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

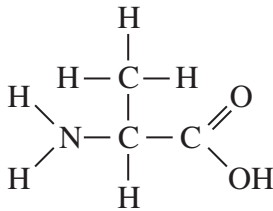
1 The diagram shows molecules of four biologically important substances.



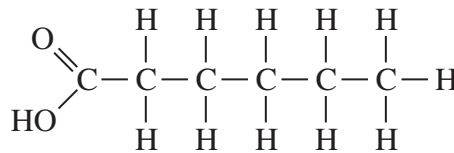
Substance **A**



Substance **B**



Substance **C**



Substance **D**

1 (a) A chemical element found in a molecule of substance **C** is not found in molecules of the other three substances. Name this element.

.....
(1 mark)

1 (b) (i) Describe how a biochemical test could be used to show that a solution contained a reducing sugar.

.....
.....
.....
.....
(2 marks)

1 (b) (ii) Which of the substances **A** to **D** will give a positive result with this biochemical test?

.....
(1 mark)



1 (c) (i) Explain what is meant by a condensation reaction.

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

1 (c) (ii) Which of the substances **A** to **D** has molecules that will join together by peptide bonds?

.....
(1 mark)

1 (d) (i) Which of the substances **A** to **D** is a fatty acid?

.....
(1 mark)

1 (d) (ii) The structure of a saturated fatty acid is different from the structure of an unsaturated fatty acid. Describe how.

.....
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(2 marks)

Turn over for the next question



2 (a) Describe the path by which carbon dioxide molecules diffuse from the blood in a capillary to the lumen of an alveolus.

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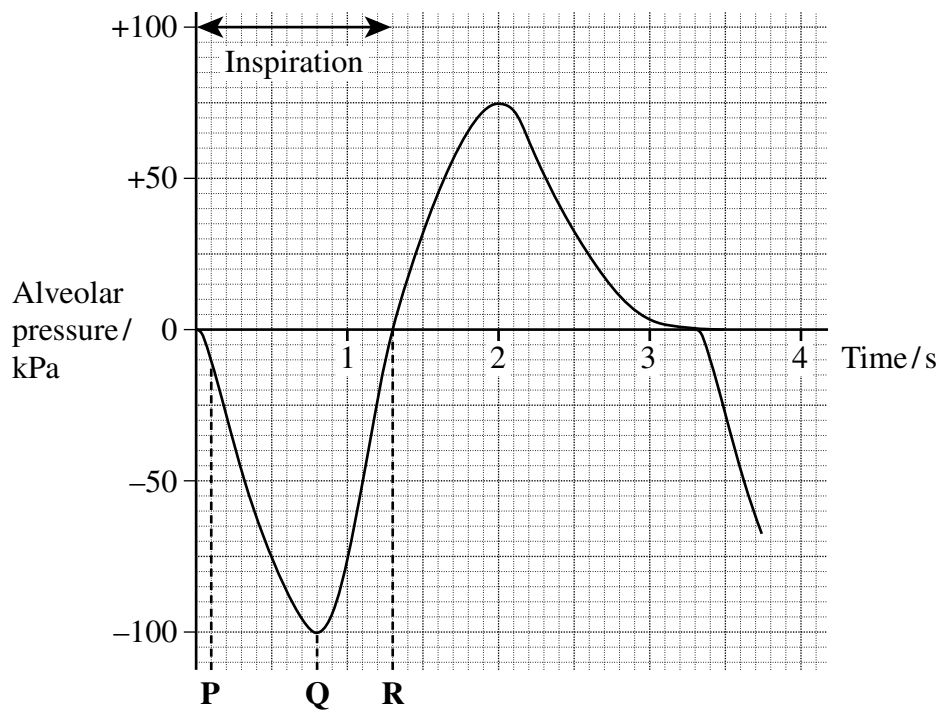
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(2 marks)

The graph shows changes in pressure in the human lungs during breathing.



2 (b) (i) Explain how the diaphragm causes the pressure changes between points P and Q on the graph.

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.....

(2 marks)



2 (b) (ii) Explain the change in pressure between points **Q** and **R** on the graph.

.....
.....

(1 mark)

2 (c) Use the graph to calculate the ventilation rate of the person whose breathing is shown. Give your answer in breaths per minute. Show your working.

Answer breaths per minute (2 marks)

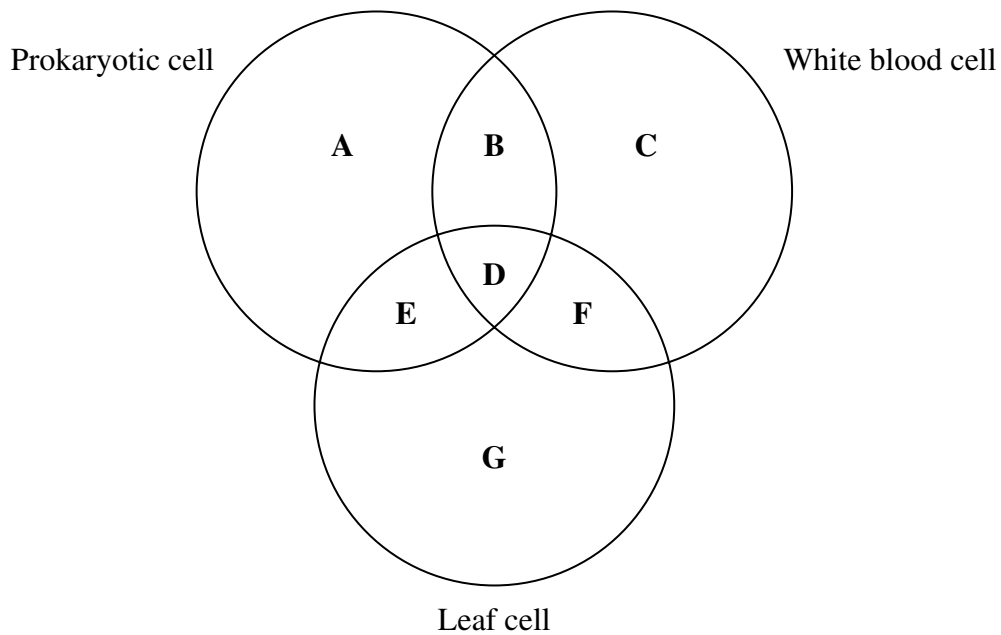
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Turn over for the next question

Turn over ►



- 3 In the diagram, the circles represent three types of cell. The letters **A** to **G** represent features found in these cells.



- 3 (a) In which space **A** to **G** would you put the following?

- 3 (a) (i) Nucleus

.....
(1 mark)

- 3 (a) (ii) Cell wall

.....
(1 mark)

- 3 (b) Name **one** organelle that should be put in

- 3 (b) (i) space **D**

.....
(1 mark)

- 3 (b) (ii) space **G**.

.....
(1 mark)



3 (c) (i) Give **one** feature of a lysosome that could be seen with a transmission electron microscope.

.....
(1 mark)

3 (c) (ii) The detailed structure of a lysosome can be seen with a transmission electron microscope. It cannot be seen with an optical microscope.

Explain why the detailed structure of a lysosome cannot be seen with an optical microscope.

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.....
(2 marks)

3 (c) (iii) Immediately after giving birth, a woman's uterus weighed approximately 2 kg. As soon as the baby was born, the tissues of her uterus were invaded by white blood cells. These white blood cells contain lysosomes. Nine days after giving birth her uterus weighed about 50 g.

Explain the link between the lysosomes and the change in mass of the woman's uterus.

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(2 marks)



- 4 (a) Complete the equation to show how you could calculate stroke volume (**S**) from cardiac output (**C**) and heart rate (**H**).

$$S =$$

(1 mark)

- 4 (b) Nerves go from the brain to the heart. Describe **one** way in which these nerves may cause the heart rate to slow after a period of exercise.

.....
.....
.....
.....

(2 marks)

(Extra space).....
.....



- 4 (c) The table shows the rate of blood flow to some organs and tissues in a human at rest and during exercise.

Organ or tissue	Rate of blood flow / $\text{cm}^3 \text{g}^{-1} \text{minute}^{-1}$	
	at rest	during exercise
Brain	0.5	
Heart muscle	0.9	3.6
Kidney	4.0	4.0
Skeletal muscle	0.03	0.6

- 4 (c) (i) Use the table to estimate the rate of blood flow to the brain during exercise.

.....
(1 mark)

- 4 (c) (ii) The units in the table are $\text{cm}^3 \text{g}^{-1} \text{minute}^{-1}$. Explain why these units are given per gram.

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

- 4 (c) (iii) The flow of blood to the heart muscle changes when a person starts exercising. Explain why this change is important.

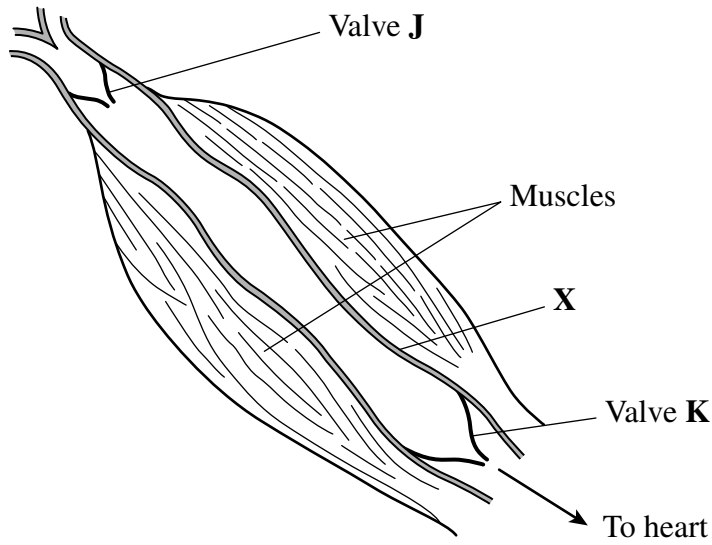
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(2 marks)

7

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5 The diagram shows part of a vein from a leg.



5 (a) (i) Complete the table to show what happens to valves **J** and **K** when the muscles shown on the diagram contract. Write the word *opens* or *closes* in the appropriate spaces in the table.

Valve J	Valve K

(1 mark)

5 (a) (ii) Explain how contraction of the muscles on the diagram produces the effect on valve **K**.

.....

(2 marks)

(Extra space)



5 (b) (i) Give **one** way in which the structure of the wall of this vein is similar to the structure of the wall of a capillary.

.....
.....

(1 mark)

5 (b) (ii) The structure of the wall of this vein at **X** is different from the structure of the wall of an artery. Complete the table to give **two** more differences between the structure of the vein and the structure of an artery.

Vein	Artery
Wall thin compared to diameter	Wall thick compared to diameter

(2 marks)

6

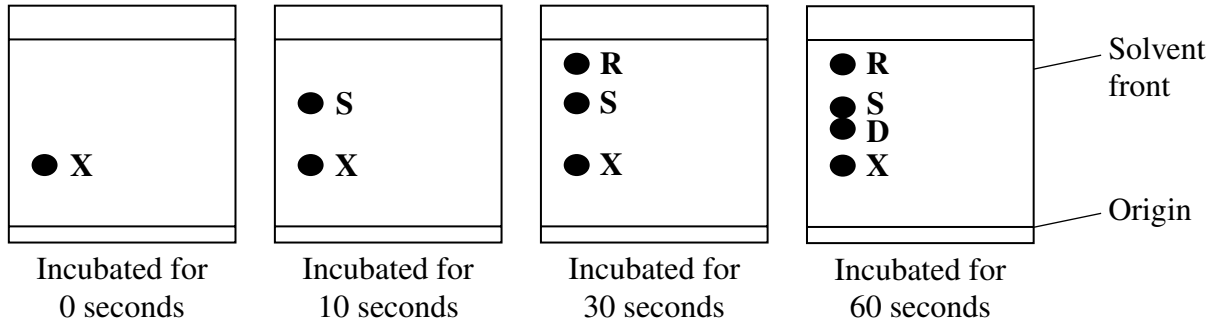
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- 6 A biochemical pathway involves several reactions. Scientists incubated cells with substance **X**. At specific time intervals, they collected some of the cells, killed them and crushed them in a solvent. They used chromatography to separate the substances in the resulting solutions.

The diagram shows four of the chromatograms they produced.



- 6 (a) The scientists killed the cells before crushing them in the solvent. Explain why.

.....

 (1 mark)

- 6 (b) (i) What measurements would you need to take to calculate the R_f value of substance **S**?

.....

- 6 (b) (ii) Describe how you would use these measurements to calculate the R_f value of substance **S**.

.....

 (2 marks)



6 (c) Describe how you would use two-way chromatography to further separate substances **S** and **D**.

.....
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.....
.....

(2 marks)

6 (d) Which of the four substances was the last substance produced in this pathway? Give the reason for your answer.

Substance

Reason

.....
.....

(2 marks)

Turn over for the next question

7

Turn over ►



7 Read the following passage.

In a healthy person, tissue fluid is always being formed and returned to the circulatory system. At the arterial end of a capillary, fluid is forced out of the blood. At the venous end, water moves back into the blood bringing waste substances with it.

There are some conditions that disrupt these processes. One of the conditions results from a diet that is deficient in protein. Such a diet leads to a low concentration of protein in the blood plasma. People with protein-deficient diets often have swollen ankles and feet. Other people may be infected with parasitic worms. These worms may block the lymph vessels in which they live. This may also cause swollen ankles and feet. 5

Cancers are diseases in which there are masses of rapidly dividing cells. These masses of cells are called tumours. The blood vessels in a tumour are different from those in healthy tissue. These blood vessels may be large in diameter. Blood vessels may even be absent from some parts of the tumour. In a tumour, the hydrostatic pressure of the fluid outside the capillaries is very high. This may block the transport of substances from the tumour capillaries. 10 15

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



7 (b) (i) At the venous end of the capillary, water moves back into the blood (lines 2 to 3). Use your knowledge of water potential to explain how.

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(2 marks)

7 (b) (ii) People with a low concentration of protein in their blood plasma often have swollen ankles and feet (lines 6 to 7). Explain why.

.....
.....
.....
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.....
.....

(3 marks)

(Extra space)
.....
.....



7 (b) (iii) Explain why parasitic worms that live in lymph vessels may cause swollen ankles and feet (lines 7 to 9).

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(2 marks)

7 (c) Scientists found that drugs used to treat a tumour do not reach all the cells in the tumour. Use information in lines 10 to 15 to give **one** reason for this.

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(2 marks)

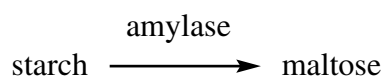
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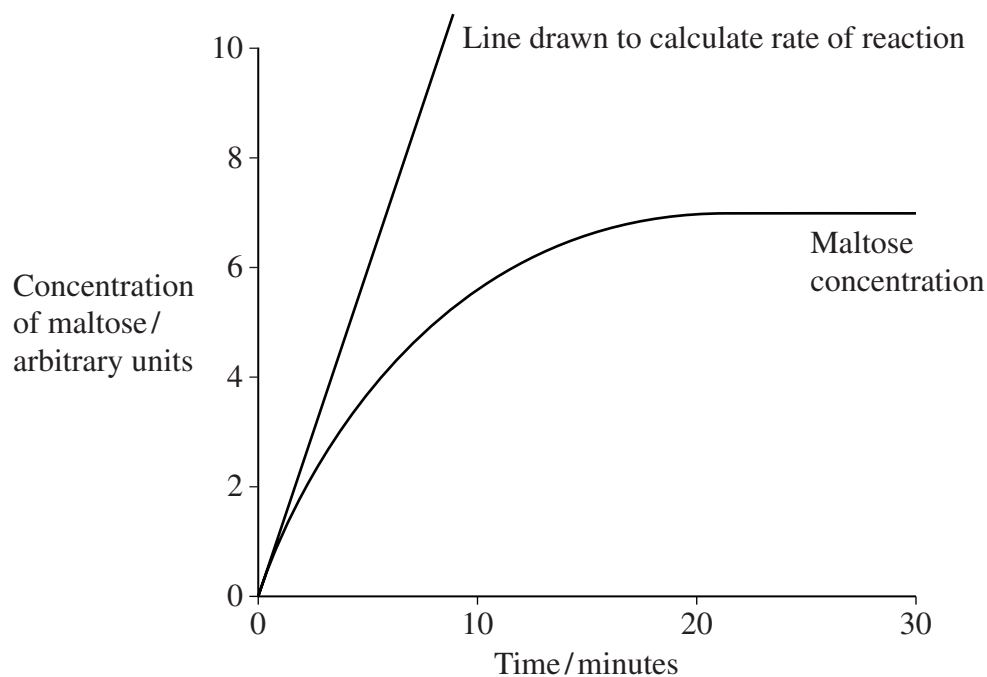


8 Amylase is an enzyme. It catalyses the reaction



Students mixed a starch solution with amylase. They recorded the concentration of maltose at intervals for 30 minutes. **Figure 1** shows their results.

Figure 1



8 (a) Describe how the concentration of maltose changed over the period shown in **Figure 1**.

.....

.....

.....

.....

(2 marks)



- 8** (b) (i) A straight line has been drawn on the graph in **Figure 1**. Explain how you could use this line to calculate the initial rate of the reaction.

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

- 8** (b) (ii) The rate of reaction was lower after 5 minutes than it was at the start. Explain why.

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(2 marks)

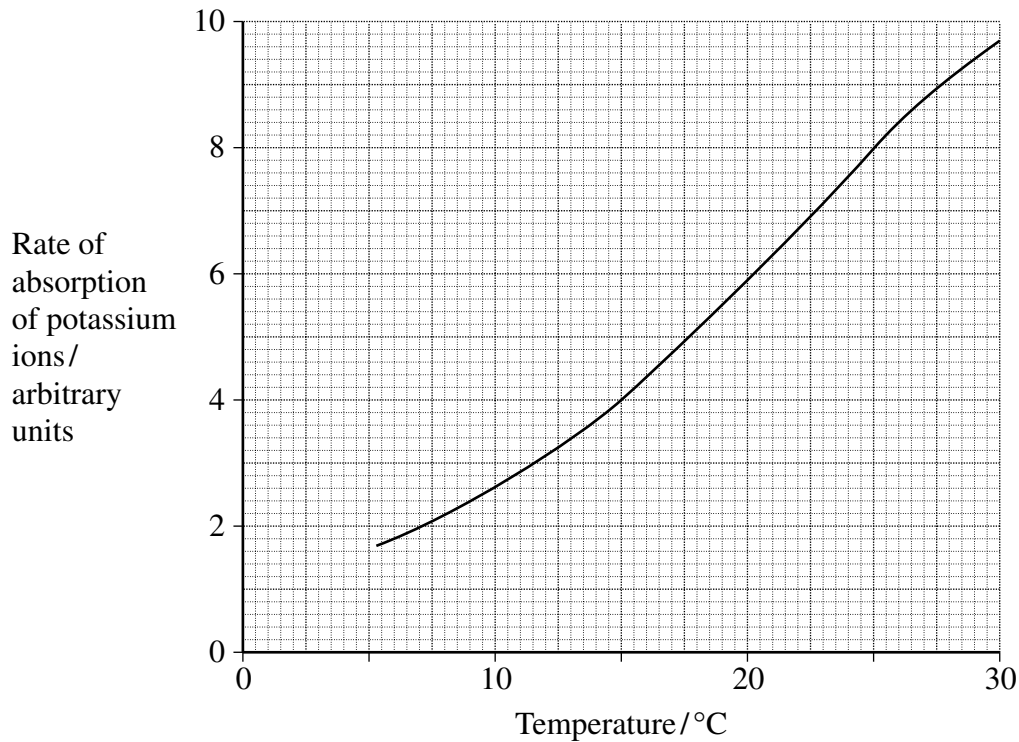
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- 8 (c) **Figure 2** shows the effect of temperature on the uptake of potassium ions by barley roots.

Figure 2



The temperature coefficient (Q_{10}) is calculated from the equation

$$Q_{10} = \frac{\text{Rate at } (t + 10) \text{ } ^\circ\text{C}}{\text{Rate at } t \text{ } ^\circ\text{C}}$$

Where t = temperature.

- 8 (c) (i) Use **Figure 2** to calculate the temperature coefficient for the uptake of potassium ions by barley roots when $t = 15$. Show your working.

Answer (2 marks)



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