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Surname		Other Names	
Centre Number			Candidate Number					
Candidate Signature								

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General Certificate of Education
June 2005
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

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

Monday 6 June 2005 Morning Session

In addition to this paper you will require:
- a ruler with millimetre measurements.

You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** the 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 75.
- Mark allocations are shown in brackets.
- You will be assessed on 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.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
8			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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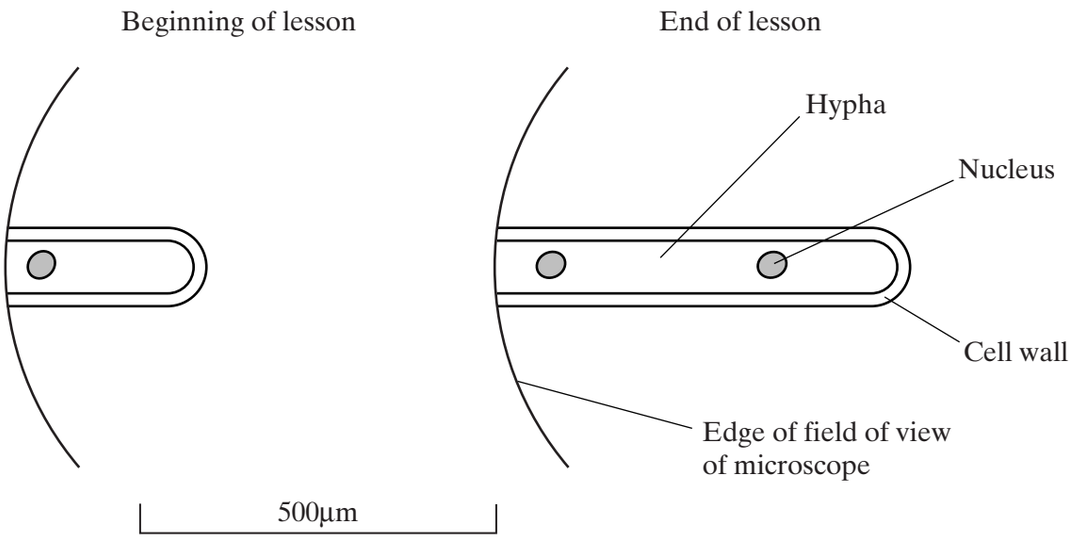
Answer **all** questions in the spaces provided.

1 Moulds belong to a group of organisms called fungi. When mould is examined with a microscope it is seen to consist of long, colourless threads called hyphae.

A student investigated the growth of fungal hyphae. The diagram shows part of a hypha seen under a microscope at the beginning of a lesson and again at the end of the lesson.



(a) Give **one** piece of evidence from the diagram that fungi are eukaryotic.

.....

.....

(1 mark)

(b) (i) By how much had the hypha grown during the lesson? Show your working.

Answer: .....µm

(2 marks)

(ii) Explain how you could use your answer to calculate the rate of growth of this hypha.

.....

.....

(1 mark)

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(c) Under the microscope, small granules were seen in the hypha. Describe how you could show that these granules consisted of starch.

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(2 marks)

6

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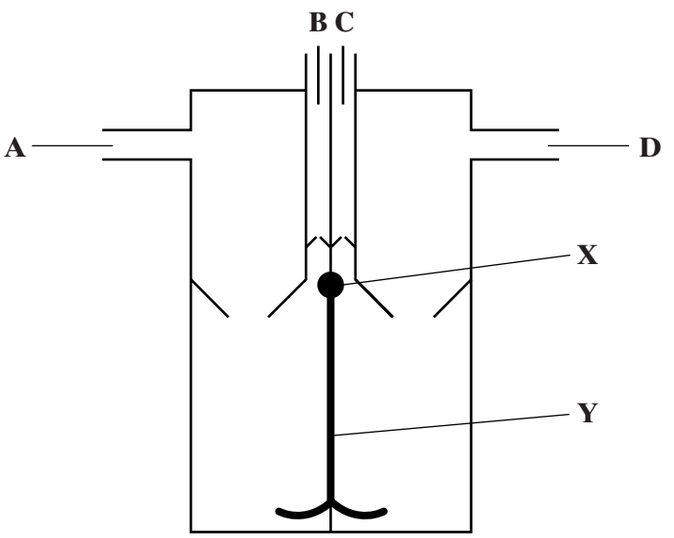
2 The diagram shows a human heart seen from the front.



(a) (i) Which **one or more** of vessels **A** to **D** contains oxygenated blood?

.....

(1 mark)

(ii) During a cardiac cycle, the pressure of the blood in vessel **C** is higher than the pressure of the blood in vessel **B**. Explain what causes this difference in pressure.

.....

.....

(1 mark)

(b) What does the diagram suggest about the pressure in the atria compared to the pressure in the ventricles at the stage in the cardiac cycle represented in the diagram? Explain your answer.

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(2 marks)

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(c) Parts **X** and **Y** are involved in coordinating the heart beat. Name

(i) part **X**; .....
(1 mark)

(ii) part **Y**. .....
(1 mark)

(d) The wave of electrical activity which coordinates the heart beat is delayed slightly at part **X**. It then passes along part **Y** to the base of the ventricles.

Explain the importance of

(i) the slight delay at part **X**;

.....

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.....
(2 marks)

(ii) the electrical activity being passed to the base of the ventricles.

.....

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(2 marks)

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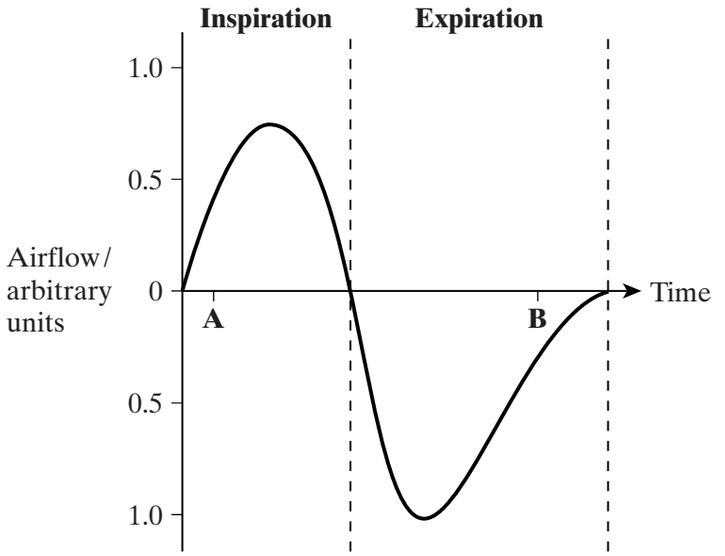
3 The graph shows airflow into and out of the lungs during a normal breath.



(a) (i) How will the concentration of carbon dioxide in the airflow differ at times **A** and **B**?

.....

.....

(1 mark)

(ii) Describe the role of diffusion in producing this difference.

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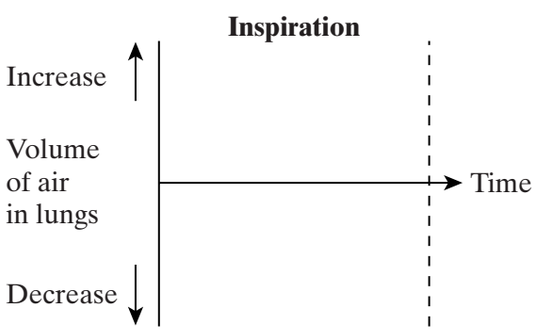
(2 marks)

(b) Use information from the graph to sketch a curve on the axes below to show how the volume of air in the lungs changes during inspiration.



(2 marks)

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(c) The intercostal muscles are between the ribs. In normal breathing, describe the part played by the intercostal muscles

(i) during inspiration;

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(3 marks)

(ii) during expiration.

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(1 mark)

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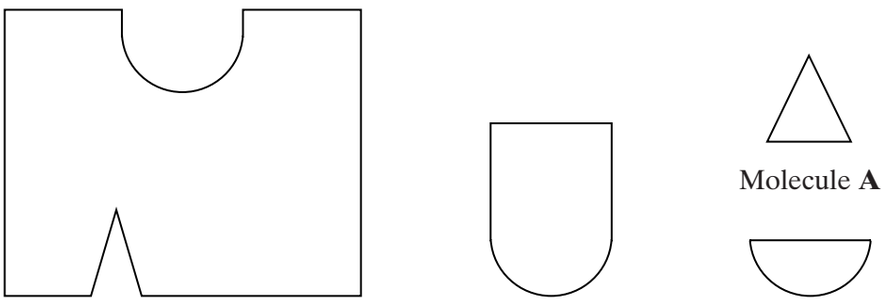
4 (a) The diagrams represent an enzyme, its substrate and two other molecules, **A** and **B**.



Enzyme Substrate

The addition of a non-competitive inhibitor will prevent the formation of an enzyme-substrate complex. Draw a labelled diagram based on relevant molecules selected from the diagram above to explain how this occurs.

(2 marks)

(b) A decrease in temperature decreases the kinetic energy of molecules in a solution. Explain how a decrease in temperature decreases the rate of an enzyme-controlled reaction.

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(2 marks)

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(c) Urea breaks hydrogen bonds. Explain how the addition of urea would affect the rate of an enzyme-controlled reaction.

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(3 marks)

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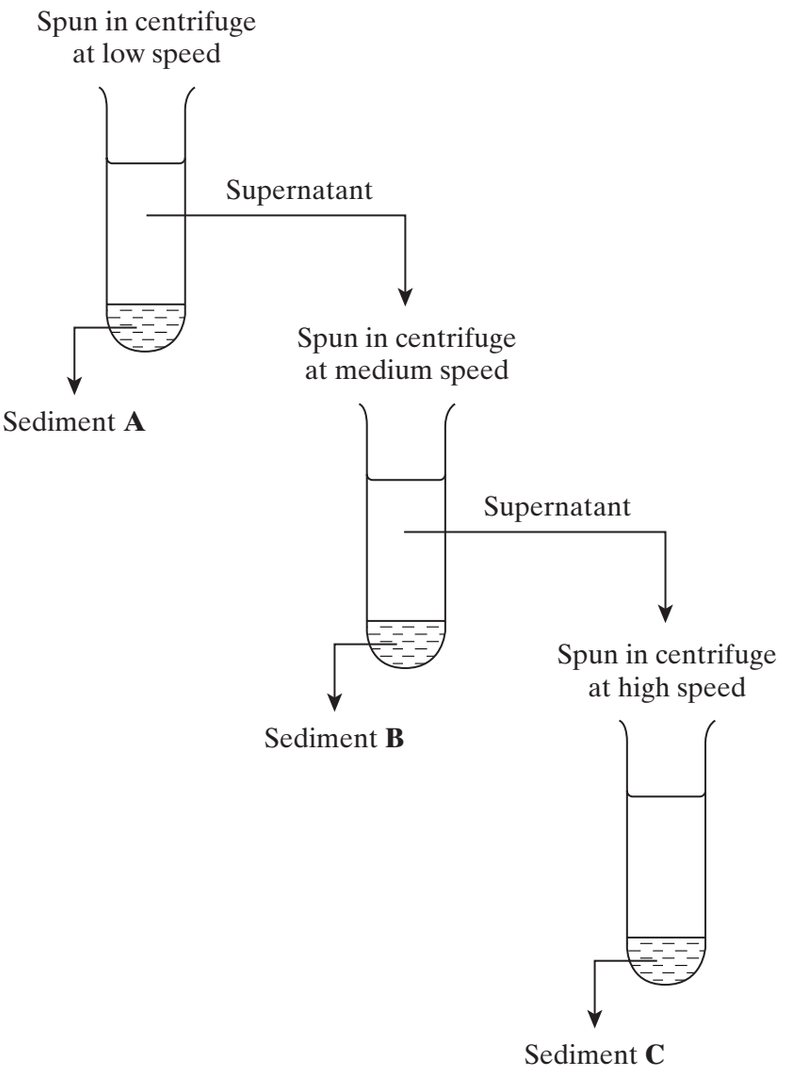
5 Liver was ground to produce a homogenate. The diagram shows how fractions containing different cell organelles were produced from the filtered homogenate.



(a) Explain why the homogenate was filtered before spinning at low speed in the centrifuge.

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(2 marks)

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(b) The main organelles present in sediment **B** were mitochondria. Suggest the main organelles present in

(i) sediment **A**; .....
(1 mark)

(ii) sediment **C**. .....
(1 mark)

(c) What property of cell organelles allows them to be separated in this way?

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(1 mark)

(d) Explain why the organelles in sediment **C** could be seen with a transmission electron microscope but not with an optical microscope.

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(2 marks)

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6 The table shows the relative thickness of layers in the walls of an artery and a vein.

Layer in wall	Thickness/μm	
	Artery	**Vein**
Endothelium	20	20
Smooth muscle	490	240
Elastic tissue	370	240
Connective tissue	120	120

(a) Explain why a vein may be described as an organ.

.....

.....

(1 mark)

(b) (i) Use information from the table to suggest the thickness of a capillary wall. Give the reason for your answer.

.....

.....

(1 mark)

(ii) The diameter of the artery was 4 mm. Calculate the diameter of the lumen of this artery. Show your working.

Answer .....

(2 marks)

(c) Explain how the elastic tissue in the wall helps to even out the pressure of blood flowing through the artery.

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(2 marks)

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7 Read the following passage.

Straw consists of three main organic substances – cellulose, hemicellulose and lignin. Cellulose molecules form chains which pack together into fibres. Hemicellulose is a small molecule formed mainly from five-carbon (pentose) sugar monomers. It acts as a cement holding cellulose fibres together. Like hemicellulose, lignin is a polymer, but it is not a carbohydrate. It covers the cellulose in the cell wall and supplies additional strength. In addition to these three substances, there are small amounts of other biologically important polymers present.

The other main component of straw is water. Water content is variable but may be determined by heating a known mass of straw at between 80 and 90 °C until it reaches a constant mass. The loss in mass is the water content.

Since straw is plentiful, it is possible that it could be used for the production of a range of organic substances. The first step is the conversion of cellulose to glucose. It has been suggested that an enzyme could be used for this process. There is a difficulty here, however. The lignin which covers the cellulose protects the cellulose from enzyme attack.

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

(a) (i) Give **one** way in which the structure of a hemicellulose molecule is similar to the structure of a cellulose molecule.

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(1 mark)

(ii) Complete the table to show **two** ways in which the structure of a hemicellulose molecule differs from the structure of a cellulose molecule.

Hemicellulose	Cellulose
.....	.....
.....	.....
.....	.....
.....	.....

(2 marks)

(b) Name **one** biologically important polymer, other than those mentioned in the passage, which would be found in straw.

.....

(1 mark)

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(c) Explain why the following steps were necessary in finding the water content of straw:

(i) heating the straw *until it reaches constant mass* (line 9);

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(1 mark)

(ii) not heating the straw above 90 °C (line 9).

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(2 marks)

(d) A covering of lignin protects cellulose from enzyme attack (line 14). Use your knowledge of the way in which enzymes work to explain why cellulose-digesting enzymes do not digest lignin.

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(2 marks)

QUESTION 7 CONTINUES ON THE NEXT PAGE

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(e) Describe the structure of a cellulose molecule and explain how cellulose is adapted for its function in cells.

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(6 marks)

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8 (a) Discs of carrot were placed in a solution containing potassium ions (K^+). The concentration of oxygen in air bubbled through the solution was changed and the rates of respiration and uptake of potassium ions were measured. The results are shown in the table.

Concentration of oxygen / %	Rate of respiration / arbitrary units	Rate of uptake of potassium ions / arbitrary units
2.7	31	29
12.2	69	72
20.8	90	80

Describe and explain the link between oxygen concentration, rate of respiration and rate of uptake of potassium ions.

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(4 marks)

QUESTION 8 CONTINUES ON THE NEXT PAGE

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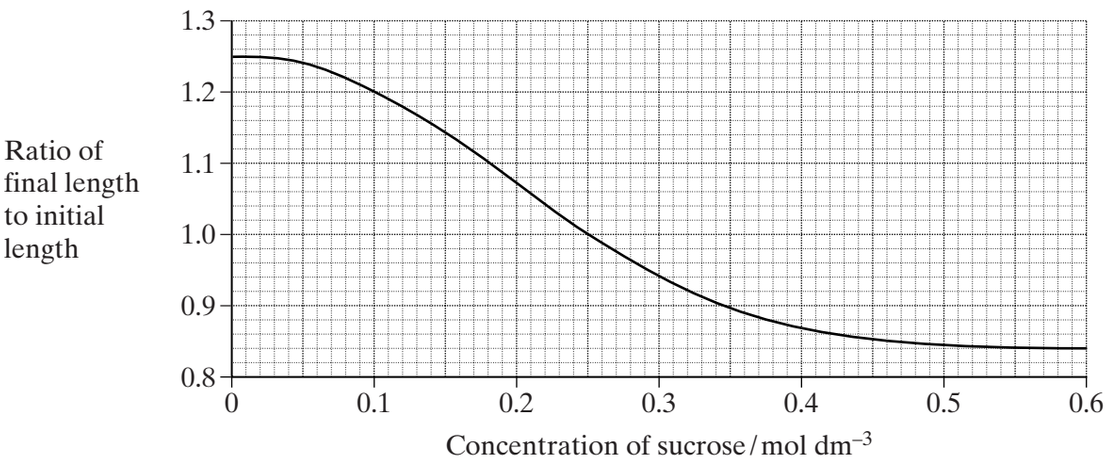
(b) Cylinders of potato were cut using a cork borer. Their initial lengths were measured. Each cylinder was then put in a different concentration of sucrose solution for 12 hours. The graph shows the changes in length of the potato cylinders in the different sugar solutions.



(i) In what concentration of sucrose did the length of the potato cylinder remain the same?

.....

(1 mark)

(ii) The initial length of the potato cylinder in the solution of concentration 0.1 mol dm^{-3} was 90 mm. Calculate its final length. Show your working.

Final length = ... mm

(2 marks)

(iii) Explain the change in length which occurs in a sucrose solution of concentration 0.5 mol dm^{-3}.

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(2 marks)

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(c) Describe the part played by the hydrostatic pressure of the blood and by osmosis in the formation and reabsorption of tissue fluid.

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(6 marks)

15

END OF QUESTIONS

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THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

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