

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Secondary Education
June 2008

BIOLOGY
Unit Biology B3

Higher Tier

Wednesday 21 May 2008 1.30 pm to 2.15 pm

<p>You will need no other materials. You may use a calculator.</p>

Time allowed: 45 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.
- 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 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice

- In all calculations, show clearly how you work out your answer.

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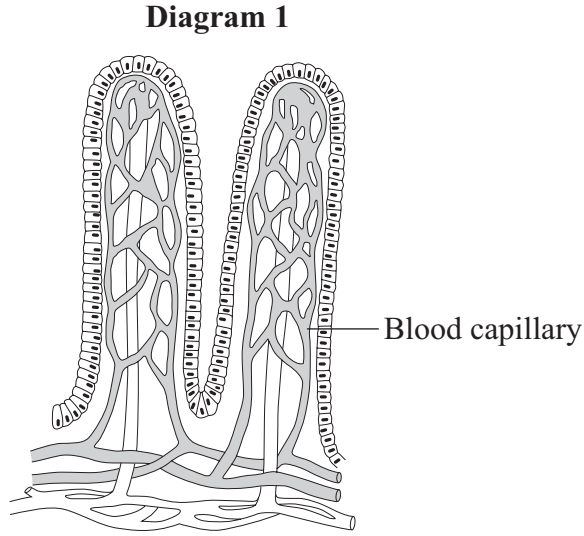


For Examiner's Use			
Question	Mark	Question	Mark
1		4	
2		5	
3		6	
		7	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			



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

1 **Diagram 1** shows two villi in the small intestine of a healthy person.



1 (a) Describe **two** features of the villi which help the small intestine to function.

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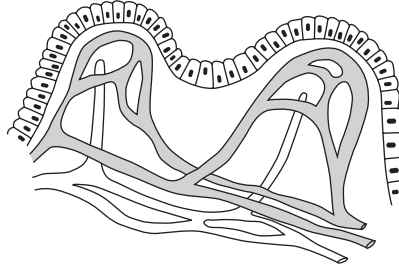
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(2 marks)



- 1 (b) **Diagram 2** shows two villi in the small intestine of a person with coeliac disease.

Diagram 2



- 1 (b) (i) How do the villi of the person with coeliac disease differ from those of a healthy person?

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(1 mark)

- 1 (b) (ii) Suggest how this difference might affect how well the small intestine functions.

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(1 mark)

4

Turn over for the next question

Turn over ▶



- 2 A group of students looked at stomata on four different species of plants, **A**, **B**, **C** and **D**. They estimated the number of stomata per cm^2 on the upper and lower surfaces of the leaves of the four species.

Their results are shown in the table.

Plant species	Estimated number of stomata per cm^2 of leaf surface	
	Upper surface of leaf	Lower surface of leaf
A	4000	28 000
B	0	800
C	8500	15 000
D	8000	26 000

- 2 (a) Which plant species probably lives in a dry region?

Explain the reason for your answer.

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(3 marks)

- 2 (b) All four species have more stomata on the lower surface of their leaves than on the upper surface.

Suggest how this could help the plants to survive better.

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(2 marks)



3 The table shows the amounts of energy used in running and in walking at different speeds by people of different body masses.

Activity	Energy used in kilojoules per hour			
	34 kg person	50 kg person	70 kg person	90 kg person
Running, 9 km per hour	1530	1850	2770	3700
Running, 11 km per hour	2140	2560	3860	5120
Running, 16 km per hour	2980	3570	5380	7140
Walking, 3 km per hour	530	670	1010	1340
Walking, 5 km per hour	740	880	1340	1760
Walking, 7 km per hour	1030	1240	1850	2480

3 (a) Describe **two** patterns you can see in the data.

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(2 marks)

3 (b) Our breathing rate is much higher when running than when walking.

Explain the advantage of this to the body.

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(3 marks)

5

Turn over ►



4 Yeast can ferment some types of sugar.

4 (a) Name **two** substances produced by yeast in fermentation.

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(2 marks)

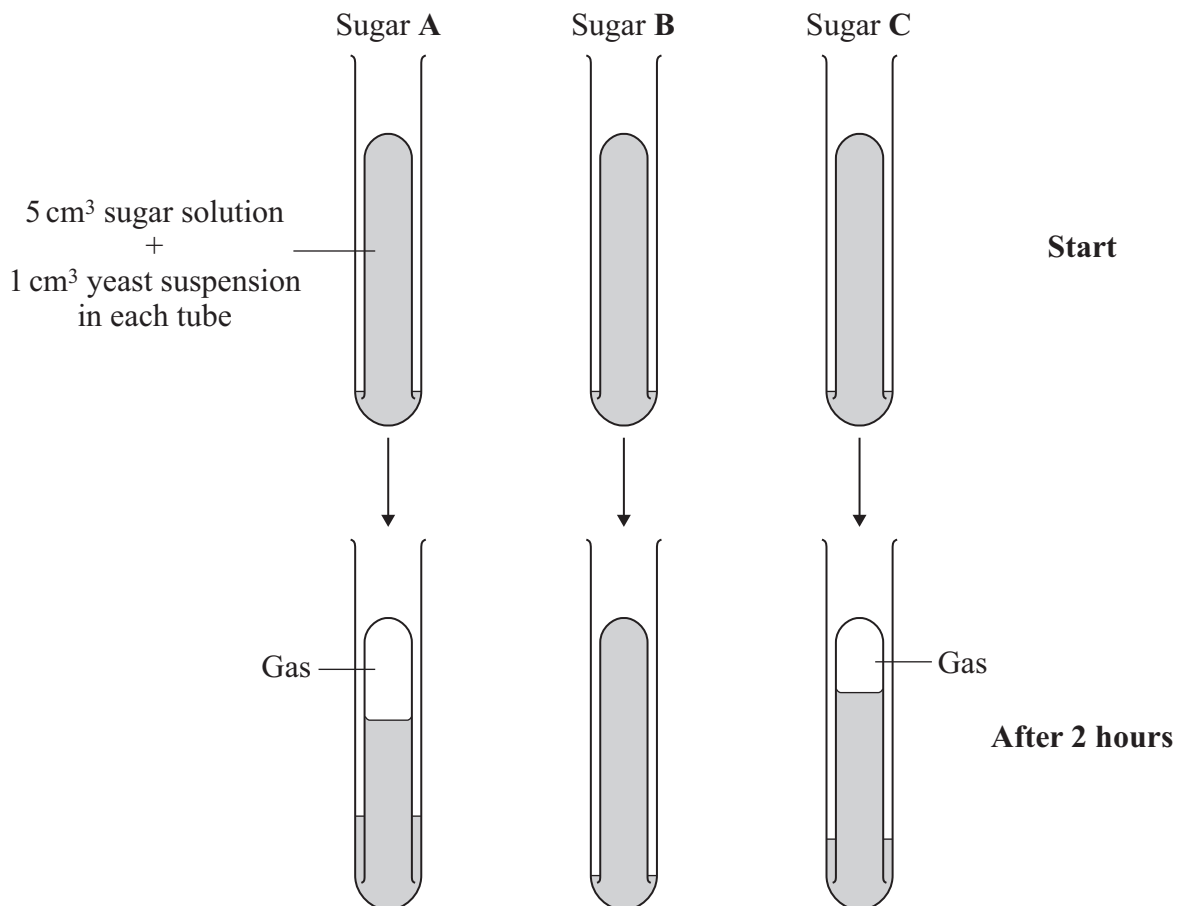
4 (b) A student investigated the fermentation of different types of sugar by yeast.

The student set up three sets of apparatus, as shown in the diagram.

She put a solution of a different type of sugar, **A** or **B** or **C**, into each apparatus.

She then placed all three sets of apparatus into a water bath at 30 °C for 2 hours.

The results are also shown in the diagram.



4 (b) (i) Give **two** variables that were controlled in this investigation.

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(2 marks)

4 (b) (ii) Which of the sugars, **A**, **B** and **C**, could the yeast ferment?

Use evidence from the diagram to explain your answer.

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(2 marks)

6

Turn over for the next question

Turn over ►



- 5 The table shows the concentrations of some substances in one person's blood plasma, kidney filtrate and urine.

Substance	Concentration in grams per dm ³		
	Plasma	Filtrate	Urine
Water	900.0	900.0	950.0
Protein	78.0	0.0	0.0
Glucose	0.8	0.8	0.0
Amino acids	0.4	0.4	0.0
Urea	0.3	0.3	20.0
Sodium ions	2.8	2.8	3.5

- 5 (a) (i) Protein is **not** present in the filtrate.

Explain why.

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(1 mark)

- 5 (a) (ii) Glucose is filtered out of the blood by the kidney and is then completely reabsorbed back into the blood.

What is the evidence for this in the table?

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(2 marks)



5 (a) (iii) Glucose is reabsorbed into the blood by active transport.

Give **two** ways in which active transport differs from diffusion.

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(2 marks)

5 (b) The concentration of urea is much higher in the urine than in the filtrate.

Explain what causes this.

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(1 mark)

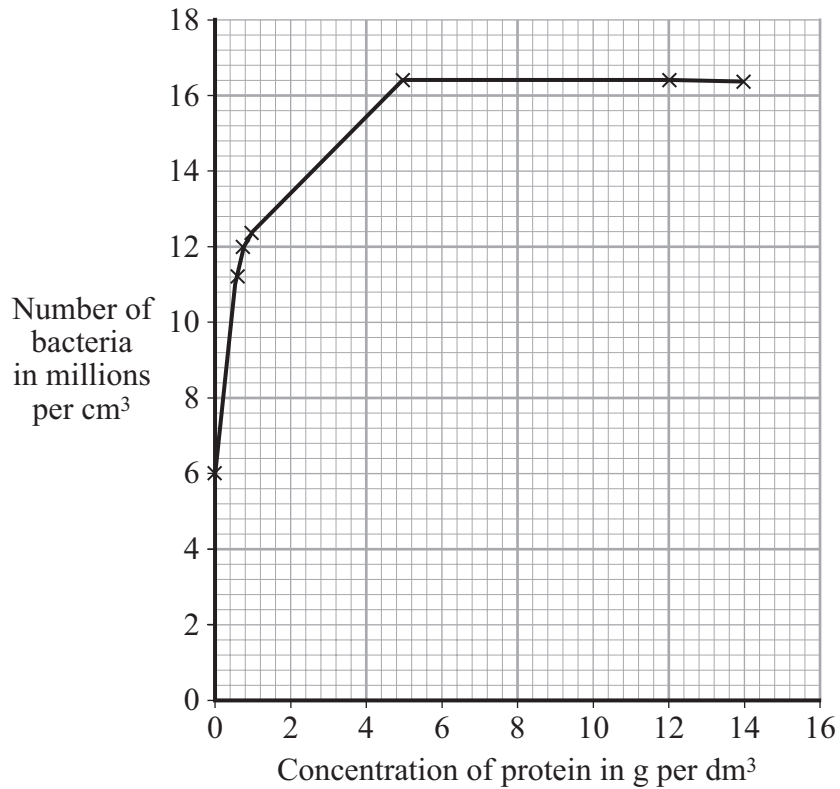
6

Turn over for the next question

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- 6 Microorganisms are grown in industrial fermenters. Before this is done, laboratory investigations are carried out to find the optimum growing conditions.
- 6 (a) The graph shows the effect of protein concentration on the growth of one species of bacterium after 12 hours in a broth culture.



6 (a) Describe and explain, as fully as you can, the effect of protein concentration on the number of bacteria.

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(5 marks)

6 (b) Bacteria of this species were grown in an industrial fermenter.

What concentration of protein would you recommend for use in the fermenter?

Explain the reasons for your answer.

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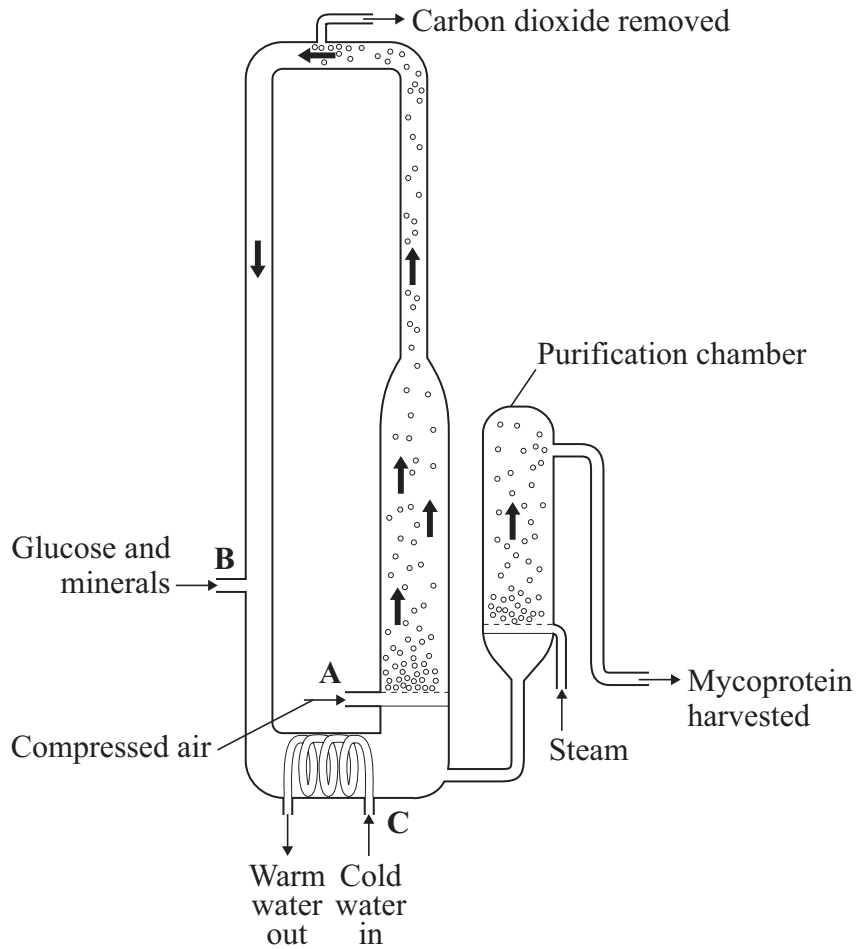
(3 marks)

8

Turn over ►



7 The diagram shows a fermenter. This fermenter is used for growing the fungus *Fusarium* which is used to make mycoprotein.



7 (a) Bubbles of air enter the fermenter at A.

Give **two** functions of the air bubbles.

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- 2
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(2 marks)



7 (b) Glucose is added to the fermenter at **B**.

Explain why glucose is added.

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(1 mark)

7 (c) The fermenter is prevented from overheating by the cold water flowing in through the heat exchanger coils at **C**.

Explain what causes the fermenter to heat up.

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(1 mark)

7 (d) It is important to prevent microorganisms other than *Fusarium* from growing in the fermenter.

7 (d) (i) Why is this important?

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(1 mark)

7 (d) (ii) Suggest **two** ways in which contamination of the fermenter by microorganisms could be prevented.

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(2 marks)

Question 7 continues on the next page

Turn over ►



- 7 (e) Human cells cannot make some of the amino acids which we need. We must obtain these amino acids from our diet.

The table shows the amounts of four of these amino acids present in mycoprotein, in beef and in wheat.

Name of amino acid	Amount of amino acid per 100 g in mg			Daily amount needed by a 70 kg human in mg
	Mycoprotein	Beef	Wheat	
Lysine	910	1600	300	840
Methionine	230	500	220	910
Phenylalanine	540	760	680	980
Threonine	610	840	370	490

A diet book states that mycoprotein is the best source of amino acids for the human diet.

Evaluate this statement.

Remember to include a conclusion in your evaluation.

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(4 marks)

11

END OF QUESTIONS



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