

Centre Number						Candidate Number				
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Other Names										
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For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



General Certificate of Secondary Education
Higher Tier
January 2011

Biology

BLY3H

Unit Biology B3

H

Written Paper

Thursday 13 January 2011 9.00 am to 9.45 am

For this paper you must have:

- a ruler.
- You may use a calculator.

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. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- 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.



J A N 1 1 B L Y 3 H 0 1

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

- 1** The table shows the volume of blood flowing through different organs at three levels of exercise.

Organ(s)	Volume of blood flowing through organ(s) in cm ³ per minute		
	Light exercise	Moderate exercise	Heavy exercise
Gut	1 100	600	300
Kidneys	900	600	250
Brain	750	750	750
Heart muscles	350	750	1 000
Skeletal muscles	4 500	12 500	22 000
Skin	1 500	1 900	600
Other	400	500	100
Total	9 500	17 600	25 000

- 1 (a) (i)** Which organ has a constant flow of blood through it?

.....
(1 mark)

- 1 (a) (ii)** Which organ has the greatest reduction in the volume of blood supplied during heavy exercise compared with light exercise?

.....
(1 mark)

- 1 (a) (iii)** What proportion of the blood flows through the heart muscle during heavy exercise?

.....
(1 mark)



1 (b) The volume of blood flowing through the skeletal muscles increases greatly during exercise.

Give **two** ways in which the body brings about this increase.

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(2 marks)

1 (c) During exercise, the concentration of carbon dioxide in the blood increases.

Explain what causes this increase.

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(3 marks)

8

Turn over for the next question

Turn over ►

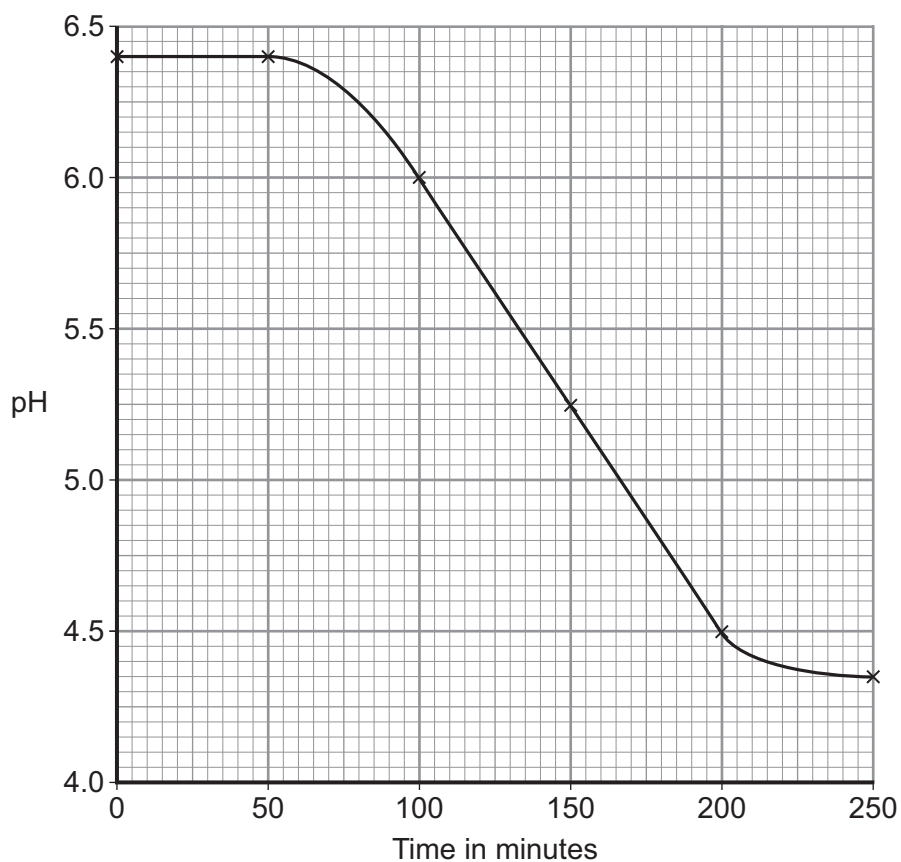


2 A student investigated the production of yoghurt.

The student:

- boiled 200 cm^3 of milk in a flask for 10 minutes
- let the milk cool to room temperature
- then added 20 cm^3 of 'yoghurt starter culture' (plain yoghurt which contains living bacteria)
- put the flask in a water bath at room temperature
- measured the pH of the yoghurt every 50 minutes.

The results are shown in the graph.



2 (a) The milk was boiled for 10 minutes before it was used.

Explain why this was necessary.

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(1 mark)



2 (b) (i) Use information from the graph to calculate the rate of fall in pH between 100 and 200 minutes.

Show clearly how you work out your answer.

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Answer = pH units per minute
(2 marks)

2 (b) (ii) Suggest **one** reason why the rate of fall in pH slowed down after 200 minutes.

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(1 mark)

2 (c) What substance causes the yoghurt to thicken after 200 minutes?

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(2 marks)

2 (d) The yoghurt would have been produced more quickly at 35°C.

2 (d) (i) What is the maximum temperature at which bacteria should be grown in a school laboratory?

..... °C
(1 mark)

2 (d) (ii) It is **not** safe to grow bacteria at 35 °C in a school laboratory.

Explain why.

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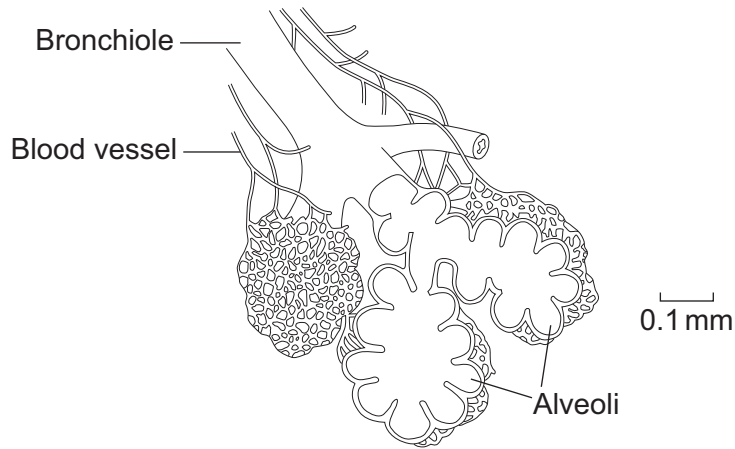
(1 mark)

8

Turn over ►



3 The human lung has about 80 million alveoli.
The diagram shows some alveoli in a human lung.



3 (a) Give **three** features of the alveoli that allow large amounts of oxygen to enter the blood.

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- 2
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- 3
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(3 marks)

3 (b) (i) Name the process by which oxygen passes from the air into the blood.

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(1 mark)

3 (b) (ii) Breathing allows large amounts of oxygen to enter the blood.

Explain how breathing does this.

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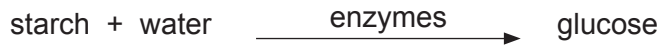
(2 marks)

6



4 (a) Ethanol can be produced from glucose.
The glucose is often made by the digestion of maize starch.

The equation shows the digestion of starch.



4 (a) (i) Name the type of enzyme that can be used to digest starch.

.....
(1 mark)

4 (a) (ii) The glucose can then be used by yeast in the following process.



Name this process.

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(1 mark)

4 (b) Ethanol, produced as described in part (a)(ii), can be used in car engines.

This is more environmentally friendly than using petrol.

Explain why.

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(3 marks)

5

Turn over ►



5 Read the following information about how the small intestine absorbs sugars.

- The blood absorbs glucose and some other sugars, like xylose, from the small intestine.
- Glucose molecules are the same size as xylose molecules, but glucose is absorbed more quickly than xylose.
- Experiments with pieces of intestine show that the uptake of oxygen by the intestine is 50% higher in the presence of glucose than in the absence of glucose. Xylose does not have this effect on the uptake of oxygen.
- The cells lining the small intestine have many mitochondria.

Explain how this information provides evidence that glucose is absorbed by the small intestine using *active transport*.

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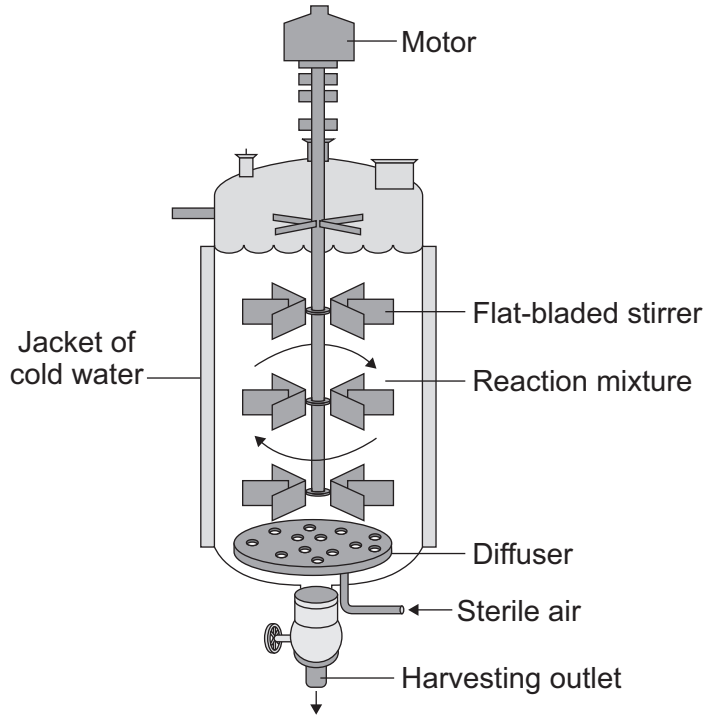
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(4 marks)

4



- 6 The diagram shows a fermenter.
This fermenter can be used to grow a fungus which makes a protease enzyme.



- 6 (a) Explain, in detail, why the fermenter needs to be surrounded by a jacket of cold water.

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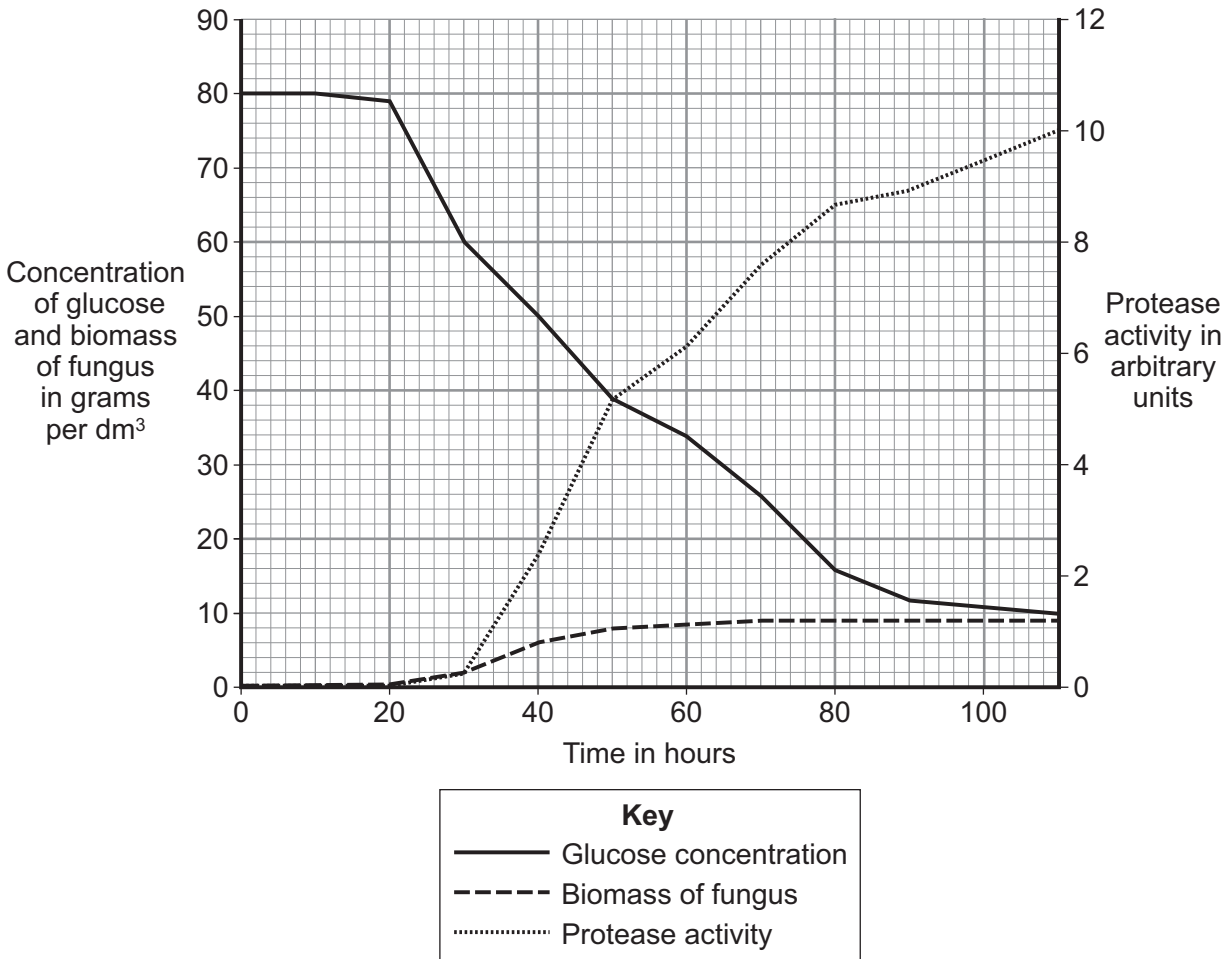
(3 marks)

Question 6 continues on the next page

Turn over ►



6 (b) Scientists investigated the effect of glucose concentration on the growth of the fungus and on the production of the protease enzyme. The graph shows the results when the glucose concentration in the fermenter at the start was 80 grams per dm³.



There was no measurable amount of protease activity in the reaction mixture until after 20 hours.

Suggest an explanation for this.

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(4 marks)

6 (c) The scientists repeated the investigation using 40 grams of glucose per dm³ and using 60 grams of glucose per dm³.

The table shows all of their results.

Concentration of glucose in grams per dm ³	Yield of fungus biomass in grams per gram of glucose consumed	Protease activity in arbitrary units per gram of glucose consumed	Protease activity in arbitrary units per gram of fungus biomass produced
40	0.09	0.83	8.93
60	0.11	0.22	1.92
80	0.13	0.14	1.11

The scientists plan to set up the fermenter for commercial production of the protease enzyme.

Which concentration of glucose should they use in the fermenter?

..... grams per dm³

Explain, in detail, why you chose this concentration.

.....

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(2 marks)

9

Turn over ►



- 7 Urine consists of water, ions and other substances such as urea.
Urine is formed in the kidney by filtering the blood.
The diameter of the pores in the filter is about 6 nanometres.

The table shows the diameters of the molecules of some of the substances in the blood.

Substance	Diameter of molecule in nanometres
A	10 to 20
B	1.0
C	0.6
D	0.5
E	0.2

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

- 7 (a) (i) Which substance, **A**, **B**, **C**, **D** or **E**, is protein?

(1 mark)

- 7 (a) (ii) Explain why protein is **not** found in the urine of a healthy person.

.....
.....

(1 mark)



7 (b) Haemolytic anaemia is a disease in which some of the red blood cells burst open.

Small amounts of haemoglobin may be found in the urine of a person suffering from haemolytic anaemia.

The diameter of a haemoglobin molecule is 5.5 nanometres.

Haemoglobin is **not** found in the urine of a healthy person, but can be found in the urine of a person with haemolytic anaemia.

Explain why.

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(3 marks)

5

END OF QUESTIONS



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