

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Secondary Education
January 2009



BIOLOGY
Unit Biology B3

BLY3H
H

Higher Tier

Monday 12 January 2009 9.00 am to 9.45 am

<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.

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



J A N O 9 B L Y 3 H O 1

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

1 (a) The table shows the effect of exercise on the action of one person's heart.

	At rest	During exercise
Heart rate in beats per minute	72	165
Volume of blood leaving the heart in each beat in cm ³	75	120
Heart output in cm ³ per minute	5400	

1 (a) (i) Calculate the heart output for this person during exercise.

Show clearly how you work out your answer.

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Answer = cm³ per minute
(2 marks)

1 (a) (ii) During exercise, more oxygen is carried to the working muscles.

Explain why this is helpful during exercise.

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(2 marks)



1 (b) Give **two** other changes in the body that help to increase the amount of oxygen delivered to the working muscles during exercise.

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(2 marks)

6

Turn over for the next question

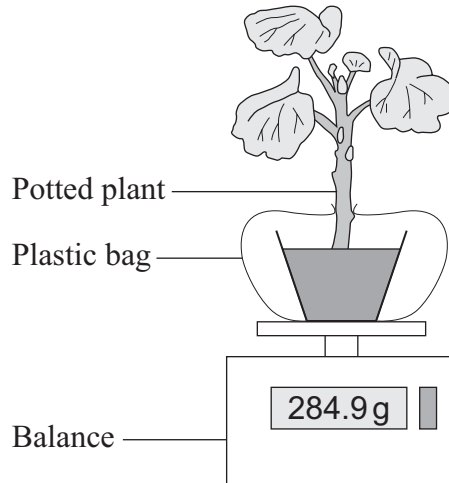
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- 2 (a) Name the process by which water is lost from plant leaves.

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(1 mark)

- 2 (b) Some students set up the apparatus shown in the diagram to measure the water loss from a potted plant.



The apparatus was placed in different environmental conditions:

- A in still air at 20 °C.
- B in still air at 25 °C.
- C in a wind at 20 °C.
- D in a wind at 25 °C.

Readings from the balance were recorded by a datalogger at 10-minute intervals.

The results are given in the table.

Time in minutes	Balance reading in grams			
	A	B	C	D
0	285.6	284.6	282.9	280.9
10	285.3	284.2	282.4	280.2
20	284.9	283.8	281.9	279.4
30	284.7	283.4	281.4	278.8



2 (b) (i) Under which conditions, **A**, **B**, **C** or **D**, was water lost most rapidly?

(1 mark)

2 (b) (ii) Explain, as fully as you can, why water was lost most rapidly under these conditions.

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(2 marks)

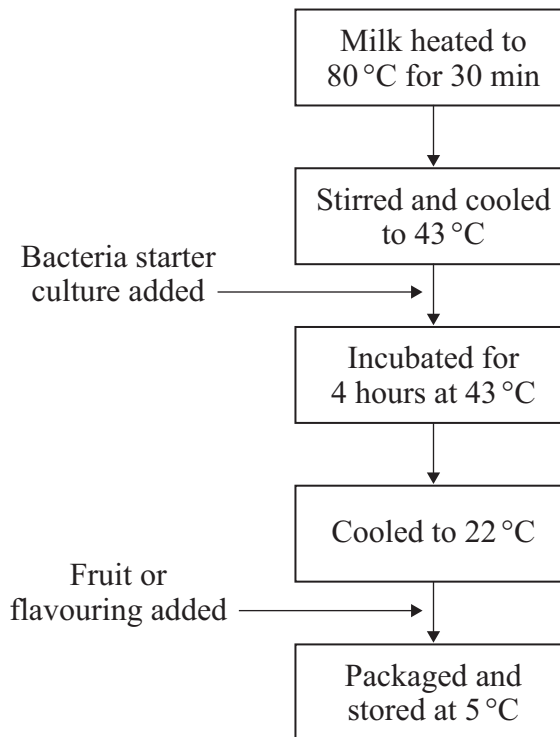
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3 The diagram shows how yoghurt is produced.



3 (a) After being heated to 80 °C, the milk is cooled to 43 °C.

Why is the milk cooled before the bacteria are added?

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(1 mark)

3 (b) The pH of milk falls from 6.7 to 4.0 when it is incubated with the bacteria.

3 (b) (i) What causes this fall in pH?

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(2 marks)



3 (b) (ii) Give **one** way in which this fall in pH is useful in yoghurt production.

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(1 mark)

3 (c) Suggest why the yoghurt is stored at 5 °C.

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(1 mark)

5

Turn over for the next question

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4 Some students investigated the effect of pH on the growth of one species of bacterium.

They transferred samples of bacteria from a culture of this species to each of eight flasks. Each flask contained a solution of nutrients but at a different pH.

After 24 hours, the students measured the amount of bacterial growth.

4 (a) It was important that the flasks in which the bacteria grew were not contaminated with other microorganisms.

Describe **two** precautions the students should have taken to prevent this contamination.

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(2 marks)

4 (b) To see the effect of pH on the growth of the bacteria, other conditions should be kept constant.

Suggest **two** conditions which should have been kept constant for all eight flasks.

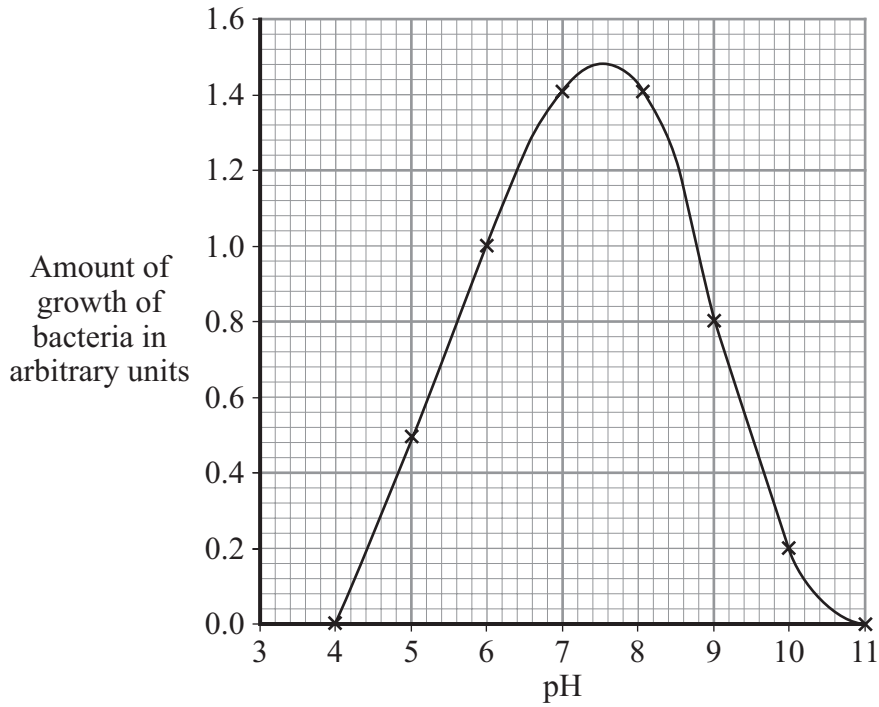
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(2 marks)



4 (c) The graph shows the results of the investigation.



4 (c) The students wanted to find the best pH for the growth of this species of bacterium.

4 (c) (i) Use the graph to estimate the pH at which the bacteria would grow best.

pH
(1 mark)

4 (c) (ii) What could the students do to find a more accurate value for the best pH for growth of the bacteria?

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(1 mark)

6

Turn over ►



5 Some scientists investigated the rates of absorption of different sugars by the small intestine.

In one experiment they used a piece of normal intestine.

In a second experiment they used a piece of intestine poisoned by cyanide. Cyanide is poisonous because it prevents respiration.

The results are shown in the table.

Sugar	Relative rates of absorption	
	Normal intestine	Intestine poisoned by cyanide
Glucose	1.00	0.33
Galactose	1.10	0.53
Xylose	0.30	0.31
Arabinose	0.29	0.29

5 (a) (i) Name **two** sugars from the table which can be absorbed by active transport.

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(1 mark)

5 (a) (ii) Use evidence from the table to explain why you chose these sugars.

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(3 marks)



5 (b) All of the sugars named in the table can be absorbed by diffusion.

Explain how information from the table provides evidence for this.

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(2 marks)

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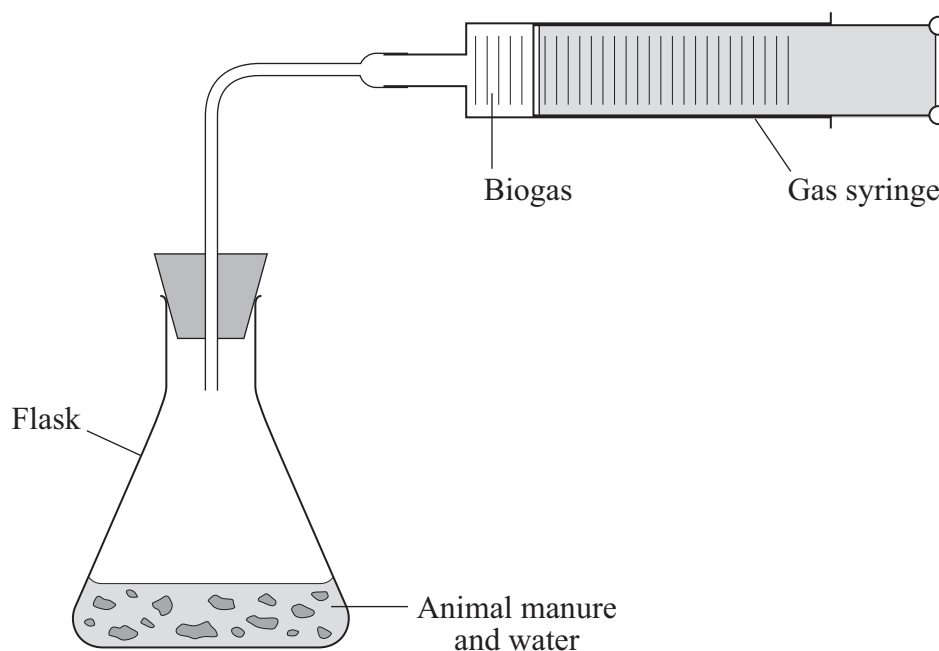
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6 Some students investigated the production of biogas from animal manure.

They used the apparatus shown in the diagram.



In their first investigation, the students collected the biogas in the gas syringe.

The table shows the percentage composition of the biogas.

Gas	Percentage composition
Methane	55
Carbon dioxide	40
Water vapour	5

6 (a) To make the biogas a more efficient fuel, the percentages of two of the gases in the table should be reduced.

Which **two** gases should these be?

1

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(1 mark)



6 (b) The students then used the apparatus for a second investigation.

They bubbled oxygen through some fresh manure and water for one hour.
They then set up the apparatus again and collected a second sample of biogas in the gas syringe.

Predict the effect of this procedure on the composition of the second sample of biogas.

Explain your answer.

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(4 marks)

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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.

 (2 marks)

7 (b) Substance **B** is **not** found in the urine of a healthy person.
 Suggest an explanation for this.

 (2 marks)



7 (c) 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)

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Turn over for the next question

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8 Read the following passage carefully.

Petrol is a mixture which includes small amounts of nitrogen and sulfur compounds. Gasohol, a blend of ethanol with petrol, can be used in most car engines.

Brazil is the world's leading producer of gasohol, using mainly ethanol from sugar cane. Other countries make use of maize or various crop wastes, such as shoots and leaves. Ethanol evaporates more readily than petrol. It releases 23.5 megajoules of energy per litre compared with 34.8 megajoules for petrol. Burning either petrol or ethanol releases carbon dioxide and water vapour into the air. But using gasohol reduces emissions of carbon monoxide and hydrocarbons. The hydrocarbons from exhaust fumes sometimes react with sunlight to form 'photochemical smog'.

Opponents of the use of ethanol in motor fuel claim that it increases emissions of oxides of nitrogen from cars, but this effect has not been observed by air quality monitoring. Opponents also claim that ethanol takes more energy to produce than it releases. But other scientists report that making ethanol from sugar cane yields 8 units of energy for each unit used in production, while ethanol from maize gives 1.34 units.

Evaluate the scientific basis for and against the blending of ethanol with petrol. Use information from the passage and your own knowledge of biology. Remember to give a conclusion to your evaluation.

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(5 marks)

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END OF QUESTIONS

