AQA GCSE BIOLOGY (4411)

BIOLOGY



EXAM QUESTION PACK

UNIT B3 HIGHER TIER BLY3H PAPERS

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For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2012

Biology

BLY3H

H

Unit Biology B3

Written Paper

Monday 21 May 2012 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.

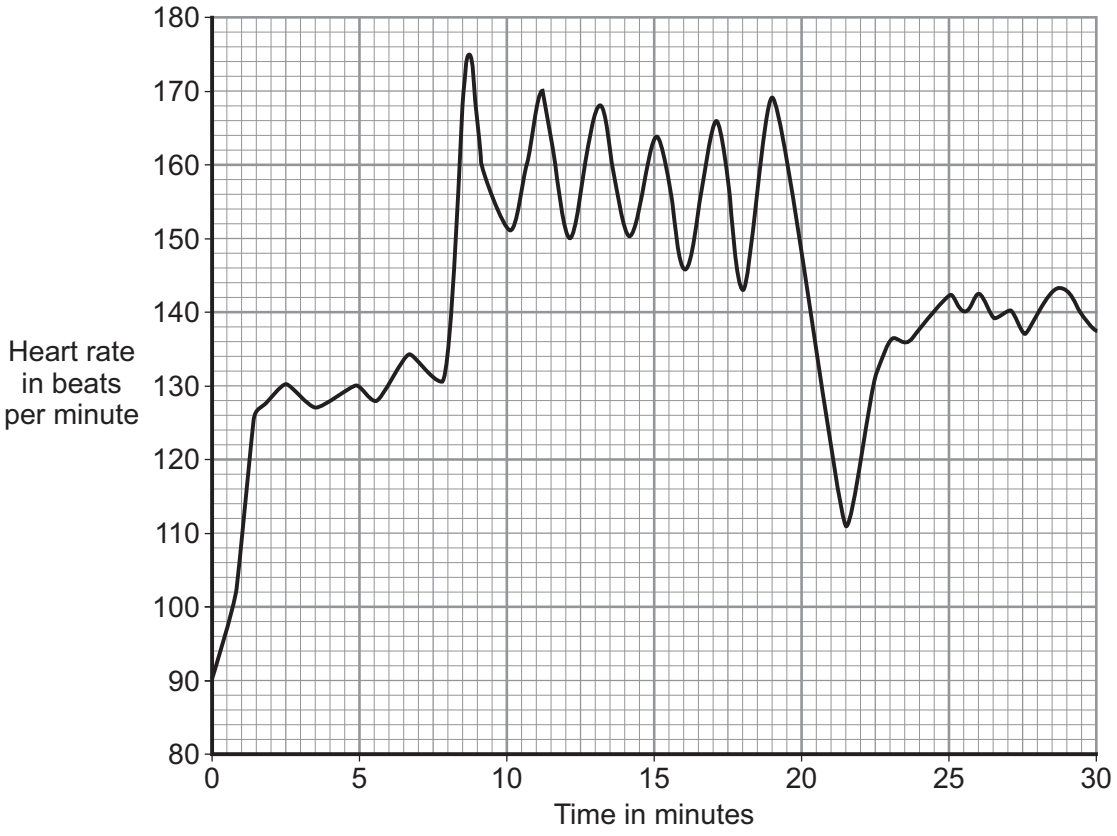
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Do not write outside the box

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

1 One type of training exercise involves alternating periods of walking and running.

The graph shows how an athlete's heart rate changed during one 30-minute training session.



1 (a) (i) The athlete ran 6 times during the 30-minute training session.

Describe the evidence for this in the graph.

.....

.....

(1 mark)

1 (a) (ii) Immediately after the final run, the athlete rested for a short time before he started to walk again.

For how many minutes did this rest last?

..... minutes

(1 mark)

Do not write outside the box

1 (b) The heart rate increases during exercise.

This increase in heart rate increases blood flow to the muscles.

Explain, as fully as you can, why this increase in heart rate is necessary.

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(4 marks)

6

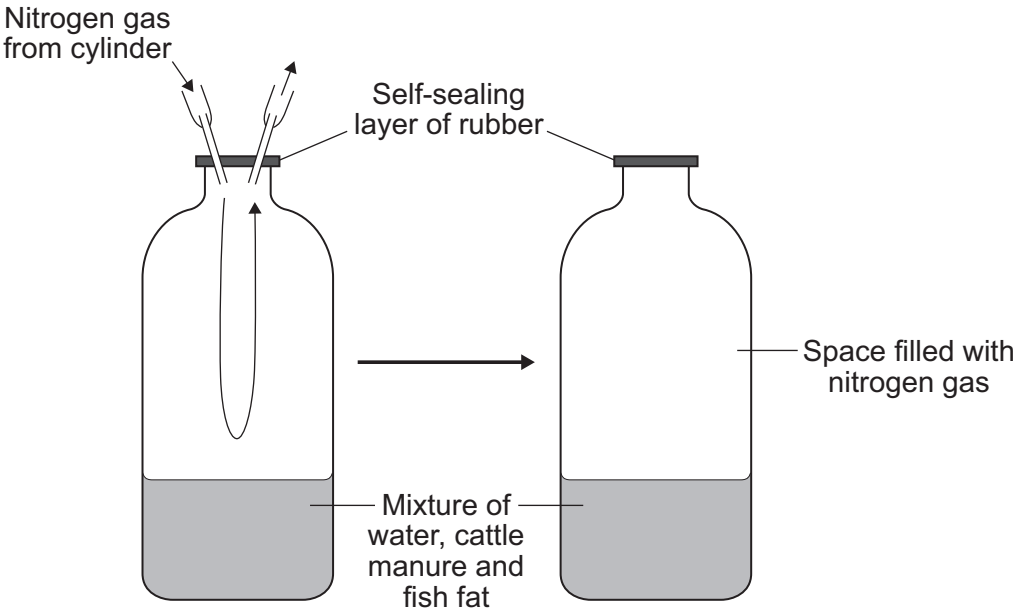
Turn over for the next question

Do not write outside the box

2 Norway has a large fishing industry. Norwegian scientists investigated the effect of adding waste fish fat to cattle manure to improve the production of biogas.

The scientists set up many jars containing different concentrations of fish fat added to the cattle manure. The air in each jar was removed and replaced with pure nitrogen gas.

The diagram shows how one of these jars was set up.



The scientists then kept all the jars in an incubator at 35 °C for 6 weeks.

2 (a) The scientists sealed each jar with a layer of rubber and replaced the air in the jars with nitrogen gas.

Explain why.

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.....

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(2 marks)

Do not write outside the box

2 (b) The scientists removed samples of gas from each jar at intervals over the 6 weeks.

The table shows some of the scientists' results.

Contents of jar	Yield of biogas in cm^3 per gram	Yield of methane in cm^3 per gram	Proportion of methane in the biogas
Cattle manure	426	256	0.60
Cattle manure + 2.5% fish fat	686	426	
Cattle manure + 5% fish fat	861	543	0.63
Cattle manure + 10% fish fat	999	630	0.63

2 (b) (i) The final column of the table shows the proportion of methane in the biogas.

Apart from the methane and the added nitrogen, name the other gas that makes up most of the rest of the biogas.

.....

(1 mark)

2 (b) (ii) Calculate the proportion of methane in the biogas when 2.5% fish fat was added to the manure.
Show clearly how you work out your answer.

.....

.....

Proportion of methane = ...

(2 marks)

2 (b) (iii) Describe the effects on biogas production of adding fish fat to cattle manure.

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.....

.....

(2 marks)

Question 2 continues on the next page

Turn over ▶

Do not write outside the box

2 (b) (iv) Olaf is a Norwegian farmer. Olaf's farm is 110 kilometres from the sea. He has a biogas generator on his farm. Olaf adds manure from his 50 cattle to his biogas generator.

Olaf decided **not** to add fish fat to his biogas generator.

Suggest **one** reason why.

.....

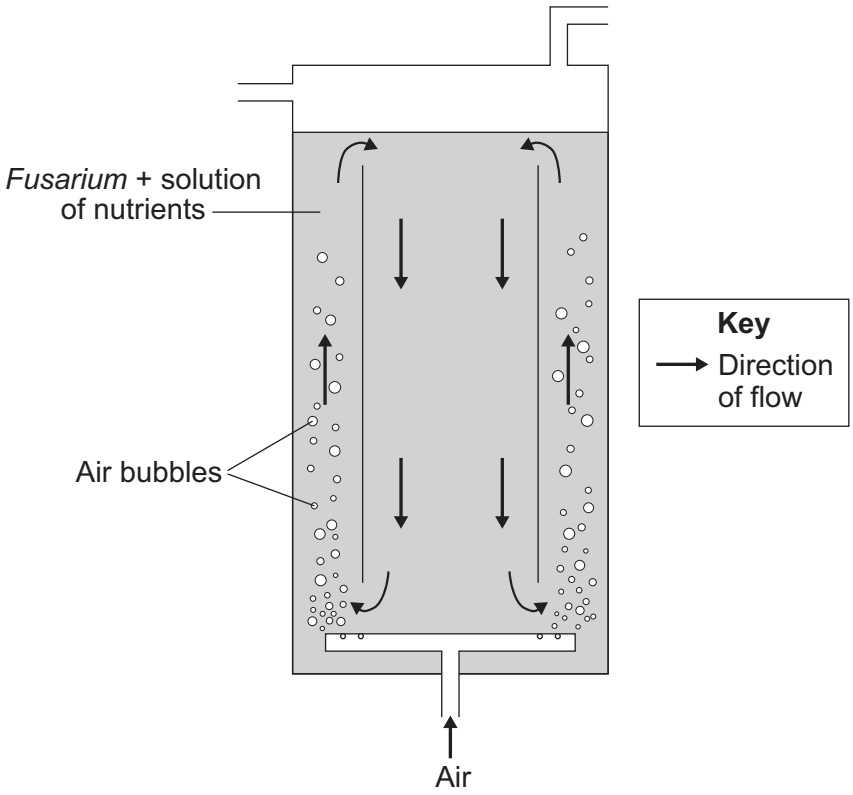
.....

(1 mark)

8

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3 The diagram shows a laboratory bench-top fermenter.
The fermenter was used for growing the fungus *Fusarium*.



3 (a) (i) The air bubbles supply the *Fusarium* with oxygen.

A process occurs in the *Fusarium* which uses oxygen.

Give the precise name of this process.

.....

(2 marks)

3 (a) (ii) The air bubbles also help to move the *Fusarium* around the fermenter.

It is useful to move the *Fusarium* around the fermenter.

Suggest **one** reason why.

.....

.....

(1 mark)

Question 3 continues on the next page

Do not write outside the box

3 (a) (iii) Another method of stirring the mixture in a fermenter is to use rotating paddles. *Fusarium* is made of long, branching fibres.

Rotating paddles are **not** used in a fermenter when growing *Fusarium*.

Suggest why.

.....

.....

(1 mark)

3 (b) *Fusarium* is used for making mycoprotein.

Read the information about some substances found in mycoprotein.

- Protein can be used for making cells and enzymes.
- Fats contain a lot of energy, but large amounts in the diet can cause circulatory problems.
- Dietary fibre helps to reduce the risk of colon cancer.

The table compares the composition of mycoprotein and chicken.

	Amount per 100 grams	
	Mycoprotein	**Chicken**
Energy in kilojoules	357.0	726.6
Protein in grams	11.5	30.9
Fat in grams	2.9	4.5
Cholesterol in milligrams	0.0	85.0
Dietary fibre in grams	5.9	0.0

Use data from the table and the information to answer these questions.

3 (b) (i) It would be better for a body builder to eat chicken instead of mycoprotein.

Give **one** reason why.

.....

.....

(1 mark)

Do not write outside the box

3 (b) (ii) A food manufacturer claims that it is healthier to eat mycoprotein than to eat chicken.

Explain **two** ways in which the information, and data from the table, support this claim.

1 .....

.....

2 .....

.....

(2 marks)

7

Turn over for the next question

Do not write outside the box

4 The table shows the concentrations of three mineral ions in the roots of a plant and in the water in the surrounding soil.

Mineral ion	Concentration in millimoles per kilogram	
	Plant root	Soil
Calcium	125	2.0
Magnesium	80	3.1
Potassium	250	1.2

4 (a) (i) The plant roots could **not** have absorbed these mineral ions by diffusion.

Explain why.

.....

.....

.....

.....

(2 marks)

4 (a) (ii) Name the process by which the plant roots absorb mineral ions.

.....

(1 mark)

4 (b) How do the following features of plant roots help the plant to absorb mineral ions from the soil?

4 (b) (i) A plant root has thousands of root hairs.

.....

.....

(1 mark)

Do not write outside the box

4 (b) (ii) A root hair cell contains many mitochondria.

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(2 marks)

4 (b) (iii) Many of the cells in the root store starch.

.....

.....

(1 mark)

7

Turn over for the next question

Do not write outside the box

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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5 Blood plasma is a solution of glucose, and many other substances, in water.

The urine of a healthy person contains water but does not contain glucose.

5 (a) Name **two** more substances found in the urine of a healthy person.

1 .....

2 .....

(2 marks)

5 (b) (i) Describe what happens to the glucose in the blood of a healthy person when the blood enters the kidney.

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(3 marks)

5 (b) (ii) A diabetic person's blood often contains a high concentration of glucose.

The urine of a diabetic person may contain glucose.

Suggest an explanation why.

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(2 marks)

7

Turn over for the next question

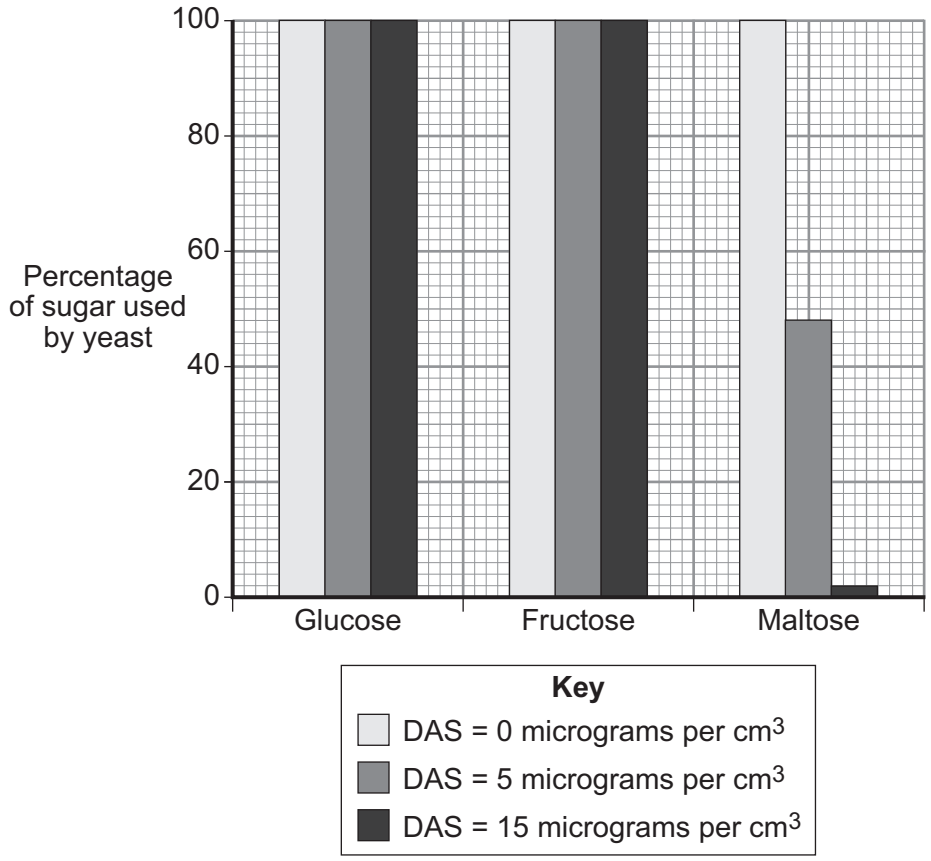
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6 Some species of fungi make a toxin called DAS. These fungi sometimes contaminate the tanks used for making beer from malt extract.

Scientists investigated the effect of DAS on yeast. They grew the yeast in a solution of malt extract. The malt extract is a mixture of sugars: it is mainly maltose with small amounts of glucose and fructose. A maltose molecule is two glucose molecules joined together.

The table and the graph show the scientists' results.

DAS concentration in micrograms per cm^3	Percentage of alcohol produced
0	4.01
5	2.53
15	0.10



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Do not write outside the box

6 (a) Use information from both the table and the graph to describe the effect of DAS on the fermentation of sugars by yeast.

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(4 marks)

6 (b) (i) Yeast cells cannot absorb maltose.

Suggest **one** reason why.

.....

.....

(1 mark)

6 (b) (ii) One effect of DAS is to stop the release of an enzyme from the yeast cells.
When the concentration of DAS was 0 micrograms per cm^3, the yeast cells were able to use all the maltose.

Suggest why the yeast cells were able to use all the maltose only when there was no DAS present.

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(3 marks)

Question 6 continues on the next page

Do not write outside the box

6 (c) Tanks should be sterilised and cleaned thoroughly before they are used for brewing beer. Sterilisation will kill the fungi that make DAS.

Give **two** reasons why a beer manufacturer would want to kill the fungi that make DAS.

Use information given earlier in this question.

1 .....

.....

2 .....

.....

(2 marks)

10

END OF QUESTIONS

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Version : 10/08/2012

General Certificate of Secondary Education

Biology 4411

BLY3H Unit Biology 3

Mark Scheme

2012 examination – June series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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Question 1

question	answers	extra information	mark
1(a)(i)	6 peaks in heart rate	accept 6 increases / spikes **or** goes very high 6 times allow heart rate increases each time he runs	1
1(a)(ii)	2.5 / 2½	allow 2 minutes 30 seconds do **not** accept 2.3 / 2:3 / 2.30	1
1(b)		more / faster / a lot **must** be stated at least once for full marks	
	(more) oxygen supplied / needed **or** (more) aerobic respiration	allow less anaerobic (respiration) **or** prevents oxygen debt	1
	(more) glucose / sugar / food supplied / needed	ignore feeding	1
	(more) energy needed / released	allow energy produced / made	1
	(more) carbon dioxide / heat / lactic acid removed (from muscles) **or** more cooling **or** less lactic acid formed		1
Total			**6**

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BLY3H

Question 2

question	answers	extra information	mark
2(a)	(biogas / methane is made) by fermentation / anaerobic respiration	accept reverse argument accept for **1** mark so no oxygen in jar **or** so oxygen can't enter **or** makes conditions anaerobic ignore references to keeping other microbes out ignore air	2
2(b)(i)	carbon dioxide	accept CO_2 / CO2 do **not** accept CO^2	1
2(b)(ii)	0.62 look for answer in table	correct answer with or without working gains **2** marks allow 62% for **2** marks but 62 for **1** mark if incorrect / no answer $\frac{426}{686}$ gains **1** mark	2
2(b)(iii)	(more fat → much) more biogas / methane (more fat →) only small increase in proportion / concentration / percentage of methane **or** approximately constant **or** no change above 5%	allow more implied by giving two numbers or a subtraction / division allow increases only from 0.60 to 0.63 **or** only changes by 0.03	1 1
2(b)(iv)	fat (too) expensive **or** fat (too) expensive to transport (from coast to farm)	accept any suitable reference to extra cost / effect on environment eg more pollution from transport	1
Total			**8**

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Question 3

question	answers	extra information	mark
3(a)(i)	aerobic respiration	ignore fermentation anaerobic respiration gains **1** mark aerobic fermentation gains **1** mark	1 1
3(a)(ii)	<u>better</u> mixing with / <u>more</u> absorption of <u>nutrients</u> / <u>oxygen</u>	ignore references to heat / temperature	1
3(a)(iii)	paddles would damage fibres of Fusarium **or** bubbles are more gentle	allow Fusarium could get tangled in the paddle ignore references to oxygen	1
3(b)(i)	chicken has higher / more protein (for making muscle) **or** chicken has higher / more energy	 allow 'produces' energy	1
3(b)(ii)	any **two** from: • mycoprotein has less fat – so less chance of heart disease / circulatory problems • mycoprotein has less / no cholesterol – so less chance of heart disease / circulatory problems • mycoprotein has more fibre – so less chance of (colon) cancer • mycoprotein has less energy – so less weight gain	 ignore fat linked to weight gain allow other correct effects of fibre eg prevent constipation **or** absorb less fat	2
Total			**7**

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Question 4

question	answers	extra information	mark
4(a)(i)	diffusion is down the concentration gradient	for a description of diffusion ignore along / across gradients	1
	to enter must go up / against the concentration gradient **or** concentration higher in the root / plant **or** concentration lower in the soil	accept by diffusion ions would leave the root	1
4(a)(ii)	active transport	allow active uptake	1
4(b)(i)	(root hairs →) large surface / area		1
4(b)(ii)	(aerobic) respiration	do **not** allow anaerobic	1
	releases / supplies / provides / gives energy	accept make ATP (for active transport) do **not** allow 'makes / produces / creates' energy	1
4(b)(iii)	starch is energy source / store (for active transport)	allow starch can be used in respiration do **not** allow 'makes / produces / creates' energy	1
Total			**7**

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Question 5

question	answers	extra information	mark
5(a)	any **two** from: • urea • ions / salt(s) / correct named example • second correct named example • hormones / named example • allow ammonia • allow creatinine • allow uric acid • allow bile pigment	allow 2 correctly named substances for **2** marks ignore water ignore minerals	2
5(b)(i)	glucose filtered (into kidney tubule) glucose reabsorbed **or** glucose taken back into blood all glucose taken back into blood / all reabsorbed	accept Bowman's capsule	1 1 1
5(b)(ii)	not all glucose reabsorbed because not enough time / length **or** too high a concentration in tubule / not enough carriers		1 1
Total			**7**

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Question 6

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>6(a)</td><td>DAS decreases percentage of alcohol produced

DAS has no effect on the use of glucose <u>and</u> fructose

the more DAS the less maltose is used

any reasonable manipulation of data eg

<table>
<tr><td></td><td></td><td>subtraction</td><td>% decrease</td></tr>
<tr><td rowspan="3">table</td><td>0 – 5</td><td>1.48</td><td>36.9%</td></tr>
<tr><td>5 – 15</td><td>2.43</td><td>60.6%</td></tr>
<tr><td>0 – 15</td><td>3.91</td><td>97.5%</td></tr>
<tr><td rowspan="2">graph</td><td>0 – 5</td><td></td><td>52%</td></tr>
<tr><td>0 – 15</td><td></td><td>98%</td></tr>
</table>
</td><td>allow numerical description of decrease eg from 4.01 to 0.10 at 15 μg or from 4.01 to 2.53 at 5 μg

allow halved at 5 μg
or
98 % inhibited at 15 μg</td><td>1

1

1

1</td></tr>
<tr><td>6(b)(i)</td><td>too large (to pass through cell membrane)</td><td></td><td>1</td></tr>
<tr><td>6(b)(ii)</td><td>able to break down maltose (outside the cell)

produces <u>glucose</u>

glucose / product is small enough to enter cell</td><td></td><td>1

1

1</td></tr>
</table>

Question 6 continues on the next page . . .

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BLY3H

Question 6 continued

question	answers	extra information	mark
6(c)	without DAS any **two** from: • more fermentation / more alcohol produced **or** otherwise DAS / fungi might reduce yield • so more maltose used (in beer) • so flavour of beer unaffected • so no toxins / poisons	 allow all (3) sugars are used ignore harmful / dangerous	2
Total			**10**

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Question	Mark
1	
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7	
TOTAL	

General Certificate of Secondary Education
Higher Tier
January 2012

Biology

BLY3H

Unit Biology B3

H

Written Paper

Tuesday 24 January 2012 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.

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Do not write outside the box

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

1 Some students investigated the best temperature for gas production by yeast.

The students set up the apparatus as shown in **Diagram 1**.

Diagram 1

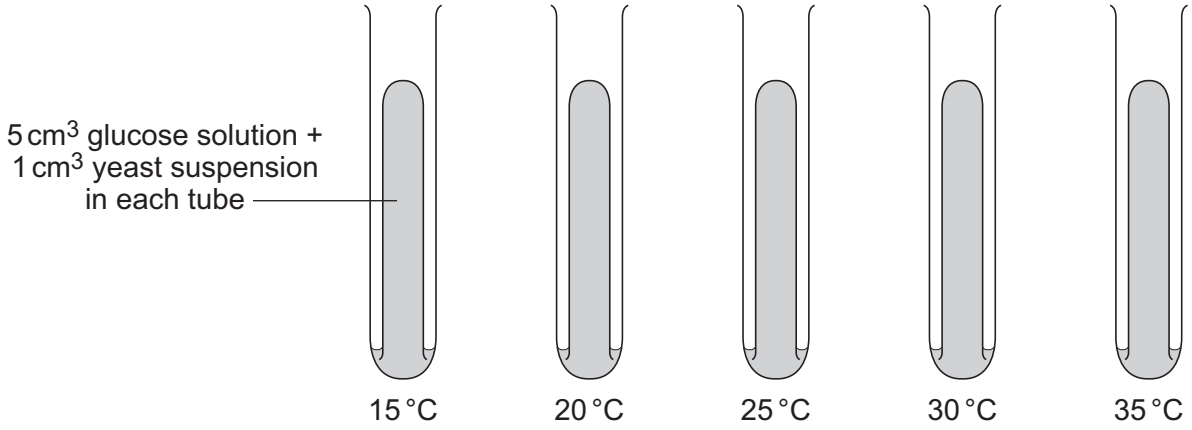
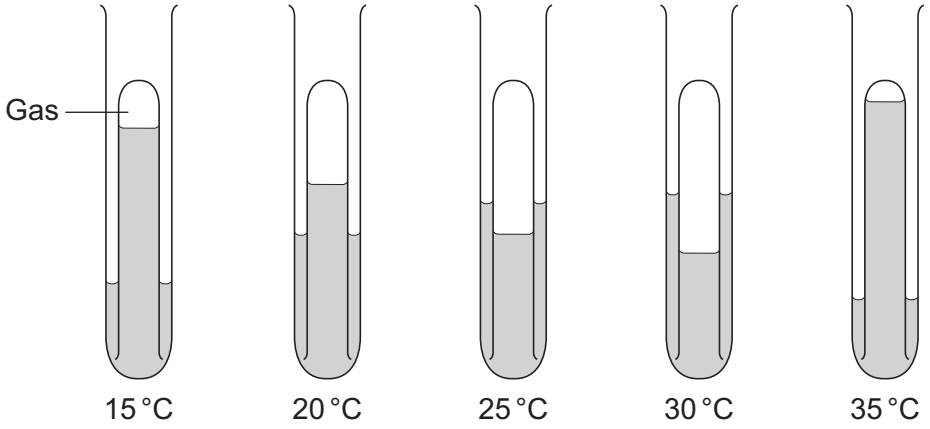


Diagram 2 shows the results after one hour.

Diagram 2



1 (a) In each apparatus the yeast produced a gas.

1 (a) (i) Name this gas.

.....

(1 mark)

Do not write outside the box

1 (a) (ii) Name the process which produces this gas.

.....

(1 mark)

1 (b) One student said that the best temperature for the yeast to produce the gas was 30 °C.

What is the evidence for this in **Diagram 2**?

.....

.....

(1 mark)

1 (c) A second student said that the investigation might not have produced reliable results.

1 (c) (i) What should the students do next to check the reliability of their results?

.....

.....

(1 mark)

1 (c) (ii) How would the students then know if their results were reliable?

.....

.....

(1 mark)

1 (d) A third student said that the investigation might not have produced an accurate value for the best temperature for gas production.

What should the students do next to check that 30 °C was an accurate value for the best temperature?

.....

.....

.....

.....

(2 marks)

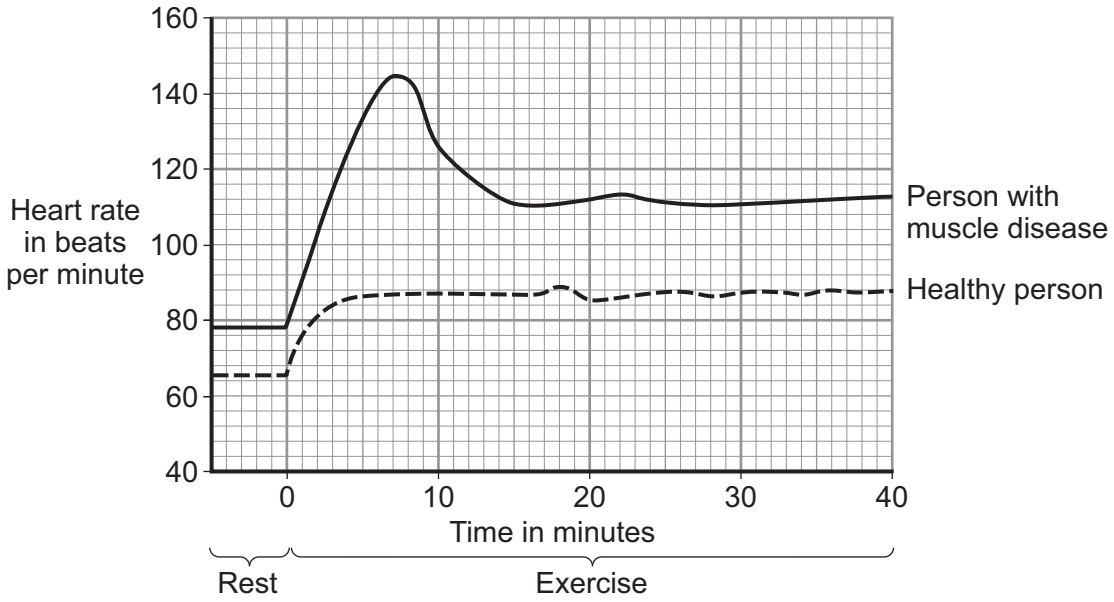
7

Turn over ▶

Do not write outside the box

2 Two people did the same amount of gentle exercise on an exercise cycle.
One person had a muscle disease and the other had healthy muscles.

The graph shows the effect of the exercise on the heart rates of these two people.



2 (a) Describe **three** ways in which the results for the person with the muscle disease are different from the results for the healthy person.

To gain full marks in this question you need to include data from the graph in your answer.

1 .....

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2 .....

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3 .....

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(3 marks)

Do not write outside the box

2 (b) The blood transports glucose to the muscles at a faster rate during exercise than when a person is at rest.

2 (b) (i) Name **one** other substance that the blood transports to the muscles at a faster rate during exercise.

.....

(1 mark)

2 (b) (ii) People with the muscle disease are not able to store glycogen in their muscles.

The results shown in the graph for the person with the muscle disease are different from the results for the healthy person.

Suggest an explanation for the difference in the results.

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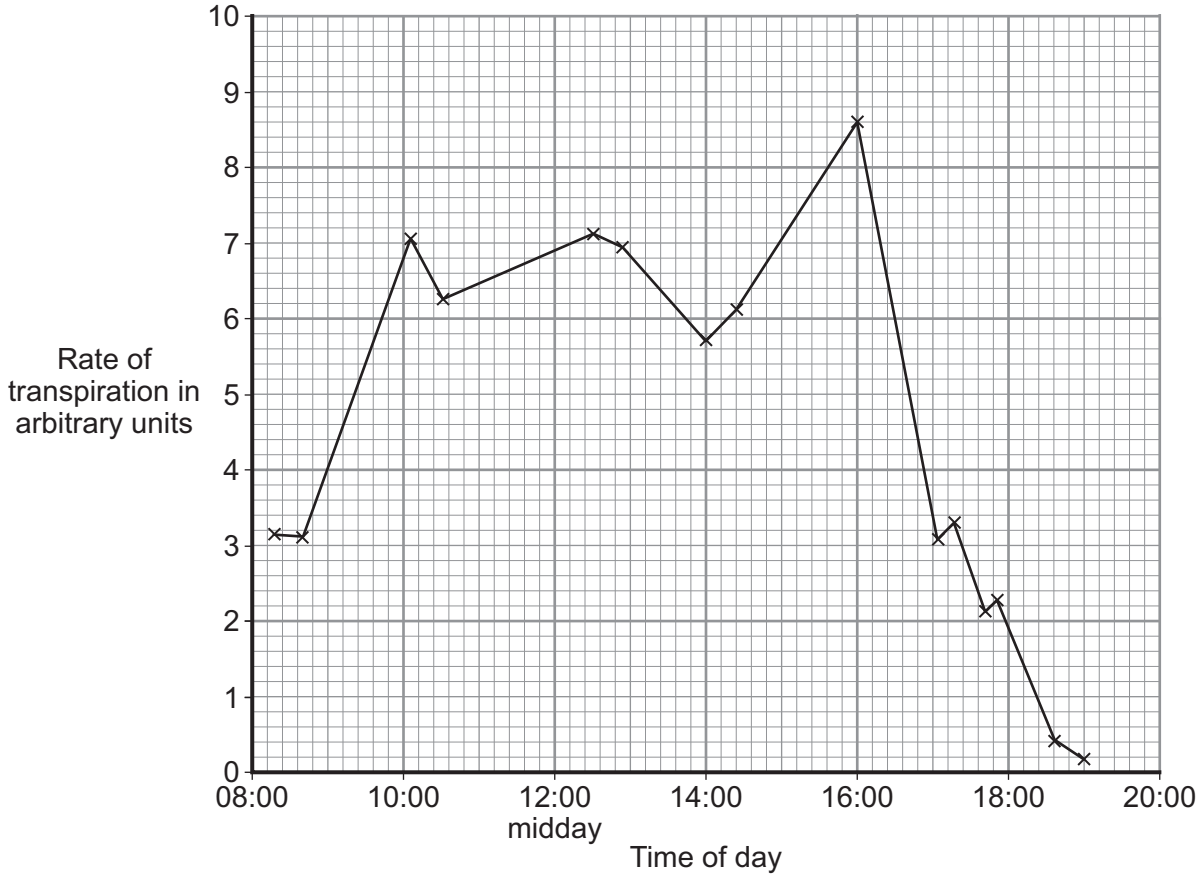
(3 marks)

7

Turn over for the next question

Do not write outside the box

3 The graph shows the rate of transpiration from a plant at different times of the day.



Transpiration occurs mainly in the leaves of a plant.

3 (a) (i) What is *transpiration*?

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(2 marks)

3 (a) (ii) Through which part of a leaf does most transpiration occur?

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(1 mark)

Do not write outside the box

3 (b) In this investigation, the rate of transpiration decreases between 16:00 hours and 19:00 hours.

3 (b) (i) Calculate the average rate of decrease per hour in the rate of transpiration over this time.

Show clearly how you work out your answer.

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Rate = ... arbitrary units per hour

(2 marks)

3 (b) (ii) Suggest **one** explanation for the decrease in the rate of transpiration between 16:00 hours and 19:00 hours.

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(2 marks)

7

Turn over for the next question

Do not write outside the box

4 Some scientists set up a biogas generator.

The table shows how the rate of biogas production and the composition of the biogas changed over the first 30 days.

Time in days	Rate of biogas production in cm^3 per hour	Composition of the biogas	
		Percentage of methane	Percentage of carbon dioxide
1	110	27	56
5	90	20	78
10	50	30	68
15	170	68	30
20	115	72	26
25	110	71	27
30	105	70	28

4 (a) (i) Name the process that produces the methane in biogas.

.....

(1 mark)

Do not write outside the box

4 (a) (ii) For the first 10 days, the gas released from the generator contained a high concentration of carbon dioxide. This was because there was air in the generator when it was first set up.

Explain why the presence of air results in a high concentration of carbon dioxide in the biogas.

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(3 marks)

4 (b) The scientists concluded that it would not be profitable to collect biogas from the generator until after about 20 days.

Use the data to explain why.

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(1 mark)

4 (c) The rate of biogas production slowed down towards the end of the investigation.

Suggest **one** reason why.

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(1 mark)

6

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ANSWER IN THE SPACES PROVIDED

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5 Yoghurt is made by the action of certain bacteria on milk.

5 (a) Describe fully how the action of bacteria on milk produces yoghurt.

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(3 marks)

5 (b) The action of the bacteria on the milk prevents other species of bacteria growing in the milk.

Suggest **one** reason why other bacteria cannot grow in this milk.

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.....

(1 mark)

4

Turn over for the next question

Do not write outside the box

6 Use your knowledge of how the kidney works to answer the following questions.

6 (a) Blood plasma contains mineral ions, glucose, urea and proteins.

Explain why urine contains mineral ions and urea, but **no** glucose or protein.

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(4 marks)

Do not write outside the box

6 (b) A man ate and drank the same amounts of the same substances and he did the same amount of exercise on two different days. On one of the two days the weather was hot and on the other day the weather was cold.

The man's urine contained a higher concentration of mineral ions and urea on the hot day than on the cold day.

Explain why.

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(4 marks)

8

Turn over for the next question

Do not write outside the box

7 One species of bacterium makes an enzyme that changes the sugar sucrose into complex carbohydrates. These complex carbohydrates are used in various foods, drugs and cosmetics.

Scientists wanted to develop a method for industrial production of the enzyme. They grew the bacteria in a fermenter. The scientists investigated the effects of four different culture media on production of the enzyme by the bacteria.

Table 1 gives details of the contents of the four culture media.

Table 1

Substance	Percentage concentration			
	Medium 1	**Medium 2**	**Medium 3**	**Medium 4**
Sucrose	2.0	2.0	2.0	2.5
Yeast extract	0.5	0.5	0.5	0.5
Peptone	0.5	0.5	0.5	0.5
Potassium phosphate	0.5	2.0	1.5	1.5
Sodium chloride	–	0.001	0.001	0.001
Manganese sulfate	–	0.002	–	–
Manganese chloride	–	–	0.001	0.001
Iron (II) sulfate	–	0.001	–	–
Calcium chloride	–	–	0.005	0.01
Magnesium sulfate	–	0.02	–	0.001

Table 2 shows the yield of enzyme in each medium.

Table 2

	Medium 1	**Medium 2**	**Medium 3**	**Medium 4**
Relative yield of enzyme	1.00	1.17	3.48	5.41

Do not write outside the box

7 (a) Give **two** variables that the scientists controlled in this investigation.

1 .....

2 .....

(1 mark)

7 (b) In this investigation, the scientists heated all the apparatus and growth media to 121 °C for 15 minutes before use.

Explain fully why this treatment was necessary.

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(2 marks)

7 (c) Evaluate the evidence that calcium ions are useful in production of the enzyme.

Use the information from **Tables 1** and **2**.

Remember to give a conclusion to your evaluation.

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(3 marks)

6

END OF QUESTIONS

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Version : 07/03/2012

General Certificate of Secondary Education

Biology 4411

BLY3H Unit Biology 3

Mark Scheme

2012 examination – January series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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BLY3H

Question 1

question	answers	extra information	mark
1(a)(i)	carbon dioxide	accept CO_2 / CO2 do **not** accept CO^2	1
1(a)(ii)	fermentation / respiration	ignore aerobic / anaerobic	1
1(b)	most / more gas (produced) **or** liquid level lowest	do **not** allow 'a lot' allow alternative descriptions ignore name of gas	1
1(c)(i)	repeat **or** compare with results of others	ignore reference to average or mean	1
1(c)(ii)	if reliable – get same / similar results **or** small range	allow same pattern but **not** pattern alone allow no anomalies ignore anomalies unqualified	1
1(d)	use smaller intervals around 30°C **or** between 25°C and 35°C	can be implied do **not** allow for temperatures below 25°C above 35°C ignore references to sensitivity or precision (of thermometer) NB do at 28°C, 30°C and 32°C = **2** marks	1 1
Total			**7**

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BLY3H

Question 2

question	answers	extra information	mark
2(a)	<u>person with muscle disease:</u> any **three** from: • higher resting rate **or** higher at start • when exercise starts / then increases more / more rapidly • peaks (then falls) • levels off <u>later</u> than healthy person • higher rate during exercise • greater range	allow reverse argument for healthy person NB all points are comparative except peak (point 3) allow use of **two** approximate figures as a comparison accept description eg rise …. fall if no other marks awarded allow **1** mark for 'it's higher'	3
2(b)(i)	oxygen	accept adrenaline accept O_2 do **not** accept O, O2 or O^2	1
2(b)(ii)	cannot release sugar / glucose (from glycogen) **or** cannot store glucose / sugar (as glycogen) need to receive glucose / sugar (from elsewhere) for energy / respiration / cannot store energy	 ignore oxygen ignore aerobic / anaerobic	1 1 1
Total			**7**

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BLY3H

Question 3

question	answers	extra information	mark
3(a)(i)	water loss	extra substance(s) cancel if transpiration stream described max **1** mark	1
	as a vapour / by evaporation	ignore stomata	1
3(a)(ii)	stomata / stoma / guard cells	ignore epidermis	1
3(b)(i)	2.8	correct answer with or without working gains **2** marks if answer incorrect: allow **1** mark for (8.6 - 0.2) ÷ 3 **or** 8.4 ÷ 3	2
3(b)(ii)	warmer at 16:00 / gets cooler	**or** reverse argument for 19.00	1
	faster diffusion / evaporation **or**	accept sun setting as equivalent to heat or light marking points	1
	lighter at 16:00 / gets darker (1) stomata open / more open (1) **or**	if no environmental factor still allow reason mark eg 'stomata close later in the day'	
	(more) windy at 16:00 / gets less windy (1) removal of (more) water vapour / steeper gradient (1) **or**		
	air is less humid at 16.00 (1) faster diffusion **or** steeper gradient (1)	allow rain at 19.00	
Total			**7**

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BLY3H

Question 4

question	answers	extra information	mark
4(a)(i)	anaerobic respiration **or** fermentation		1
4(a)(ii)	oxygen is present aerobic respiration occurs CO_2 from respiration	accept O_2 do **not** accept O, O2 or O^2 ignore anaerobic allow from fermentation	1 1 1
4(b)	high methane after this time	ignore CO_2	1
4(c)	organic matter / food / nutrients / named eg used up / reactants	allow too hot / accumulation of toxins / named do **not** allow products ignore energy	1
Total			**6**

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BLY3H

Question 5

question	answers	extra information	mark
5(a)	lactose / 'milk sugar' used	ignore glucose / galactose	1
	produces (lactic) acid / low pH		1
	causes milk to clot / owtte	allow denatures proteins	1
5(b)	(killed by) lactic acid / acid conditions / low pH		1
Total			**4**

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BLY3H

Question 6

question	answers	extra information	mark
6(a)	proteins are not filtered		1
	glucose is filtered and (re)absorbed	allow glucose (completely) reabsorbed	1
	ions are filtered and some (re)absorbed	allow some ions are reabsorbed	1
	urea is filtered [and some / none (re)absorbed]	allow some / no urea is reabsorbed	1
6(b)	more / a lot of sweating occurred	accept converse arguments for cold day	1
	more / a lot of water loss (by sweating)		1
	more / a lot of water reabsorption / more water absorption by the kidney		1
	lower volume of urine	allow less urine / less water in urine	1
Total			**8**

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Question 7

question	answers	extra information	mark
7(a)	any **two** from: • concentration / amount of yeast extract • concentration / amount of peptone • species of bacterium	any **two** for **1** mark allow type / kind of bacterium	1
7(b)	to kill (other) microorganisms / to sterilise to reduce competition for resources **or** to prevent formation of toxic by-products / named **or** otherwise reduced yield	allow named example allow destroyed ignore germs	1 1

Question 7 continues on the next page . . .

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BLY3H

Question 7 continued . . .

question	answers	extra information	mark
7(c)	Pro: any **one** from: • with Ca^{2+} / $CaCl_2$ present (media 3 and 4) → higher enzyme yield • higher Ca^{2+} / $CaCl_2$ → higher enzyme yield (in 4 cf 3) Con: any **one** from: • 4 also has higher sucrose – (could be effect of sucrose) • 3 and 4 also have extra Cl^- / $MnCl_2$ (could be effect of Cl^-) Conclusion with reason: eg Pro since enhanced effect with extra Ca^{2+} **or** Con since too many variables **or** Con since not enough evidence to be sure		1 1 1
			6

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2011

Biology

BLY3H

H

Unit Biology B3

Written Paper

Thursday 19 May 2011 1.30 pm to 2.15 pm

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.

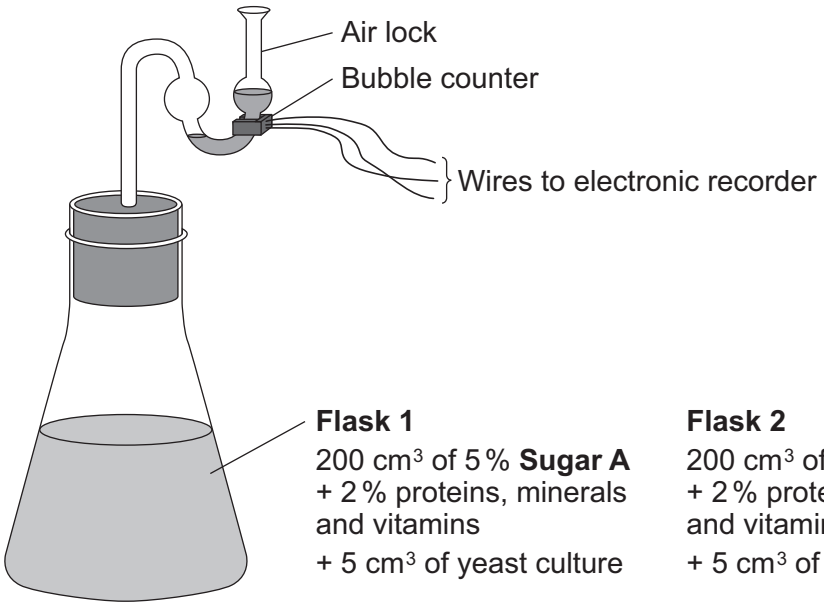
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Answer **all** questions in the spaces provided.

1 Some students wanted to investigate whether yeast could ferment two different types of sugar, **A** and **B**.

They set up two flasks, as shown in the diagram.



1 (a) (i) When setting up the flasks, it is important not to allow any other microorganisms to enter.

Describe **two** precautions that the students could have taken to prevent the growth of other microorganisms.

1 .....

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2 .....

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(2 marks)

1 (a) (ii) Each flask contained the same concentration of sugar.

Why was this important?

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(1 mark)

Do not write outside the box

1 (b) The yeast in each flask produced a gas. The gas escaped as bubbles through the liquid in the air lock. The experiment ran for 120 hours.

1 (b) (i) Name the gas produced by the yeast.....

(1 mark)

1 (b) (ii) Every time a bubble of gas passed from the flask through the air lock, the bubble counter sent an electrical signal to the recorder.

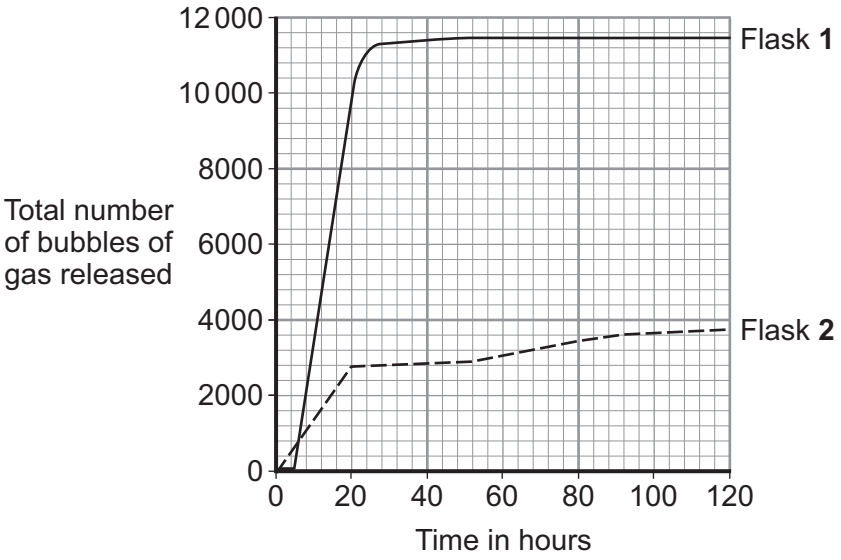
Give **one** advantage of using a bubble counter and electronic recorder instead of a person to count the bubbles.

.....

.....

(1 mark)

1 (c) The graph shows the students' results.



1 (c) (i) Which sugar, **A** or **B**, does the yeast ferment better?

Draw a ring around your answer. **A** / **B**

Give **one** reason for your answer.

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(1 mark)

1 (c) (ii) What happened to gas production in **Flask 1** after 50 hours?

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(1 mark)

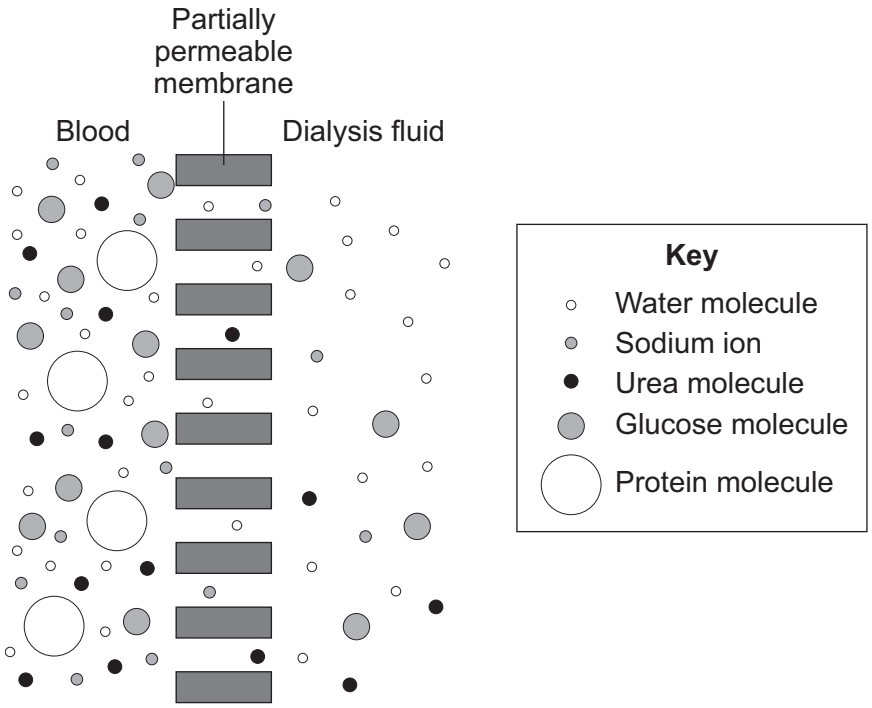
7

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2 Dialysis can be used to treat a person with kidney disease.

The diagram shows blood and dialysis fluid separated by a partially permeable membrane.



Blood plasma and dialysis fluid contain several substances dissolved in water.

The table shows the concentrations of some of these substances in dialysis fluid and in the blood plasma of a person with kidney disease immediately before dialysis.

Substance	Concentration of substance in grams per dm^3	
	Blood plasma of person with kidney disease	Dialysis fluid
Sodium ions	3.26	3.15
Urea	0.45	0.00
Glucose	0.90	0.99
Protein	60.00	0.00

2 (a) Protein molecules are **not** able to move from the blood to the dialysis fluid.
Use information from the diagram to explain why.

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(1 mark)

Do not write outside the box

2 (b) Urea molecules move from the blood into the dialysis fluid.

2 (b) (i) Give the name of this type of movement. .....

(1 mark)

2 (b) (ii) Why do the urea molecules move in this direction?

Use information from the table to help you to answer this question.

.....

.....

(1 mark)

2 (c) The concentration of sodium ions in the blood plasma will change during dialysis.

Suggest a value for the concentration of sodium ions in the plasma at the end of dialysis.

Use information from the table.

Concentration of sodium ions = ... grams per dm^3

(1 mark)

2 (d) For most patients a kidney transplant is better than continued treatment by dialysis.

2 (d) (i) Give **two** advantages of having a kidney transplant rather than treatment by dialysis.

1 .....

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2 .....

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(2 marks)

2 (d) (ii) Give **two** possible disadvantages of having a kidney transplant.

1 .....

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2 .....

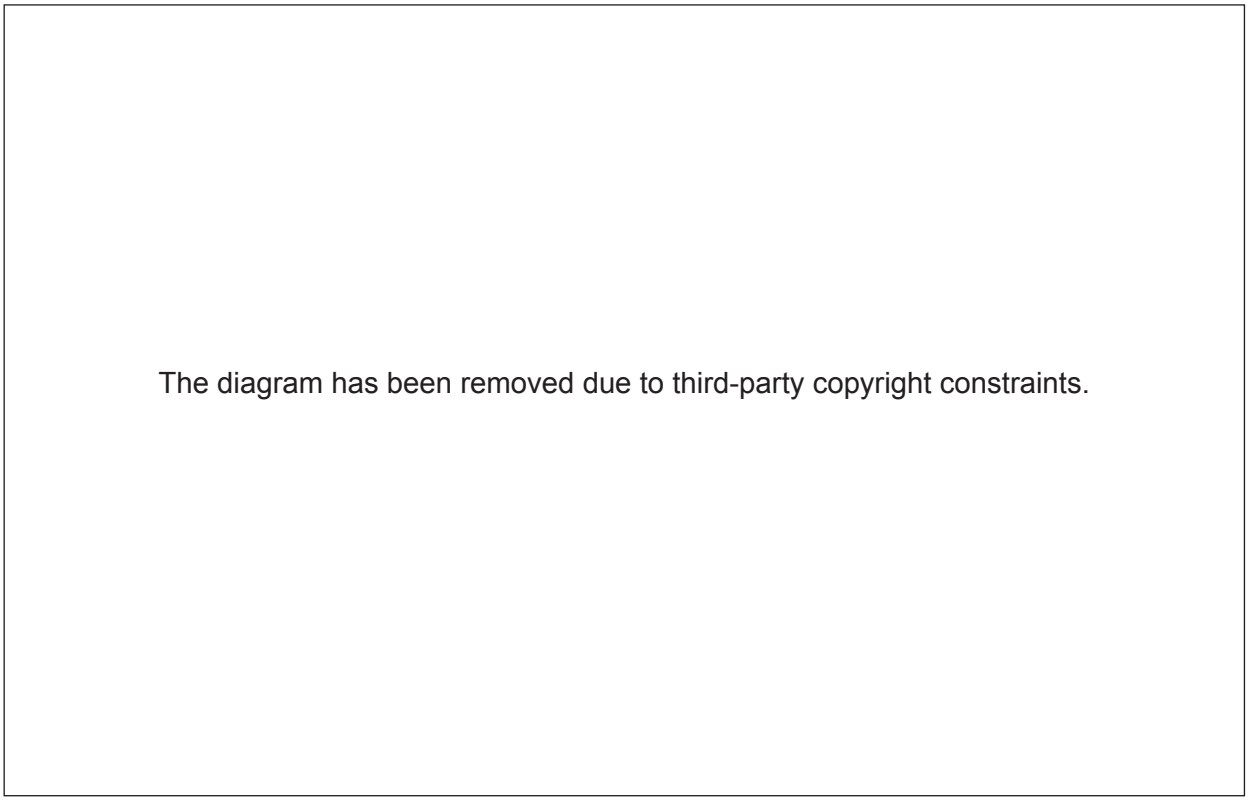
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(2 marks)

8

Do not write outside the box

3 The diagram shows part of a biogas generator. Organic matter flows through the generator, as shown in the diagram.



3 (a) The table shows the composition of the biogas produced by this generator.

Gas	Percentage
Carbon dioxide	27.0
Water vapour	2.0
Hydrogen sulfide	0.5
Ammonia	0.5
Gas **X**	

3 (a) (i) Name gas **X**. .....

(1 mark)

Do not write outside the box

3 (a) (ii) Calculate the percentage of gas **X** in the biogas.

Show clearly how you work out your answer.

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.....

Percentage of gas **X** = ... %

(2 marks)

3 (b) (i) Some biogas is pumped back in at the base of the generator. This biogas moves around inside the generator, as shown by the arrows in the diagram.

The movement of the biogas makes the breakdown of the organic matter more efficient.

Suggest how.

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(1 mark)

3 (b) (ii) Biogas is pumped into the generator rather than air.

Suggest **one** reason why.

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(1 mark)

3 (c) The biogas generator is usually kept underground in a large tank of water. The water can be heated to keep the temperature at 35 °C.

Explain why the biogas generator is kept at 35 °C.

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(2 marks)

7

Do not write outside the box

4 Oxygen is transported round the body by the blood.

Blood leaving the human lung can carry about 250 milligrams of oxygen per litre. However, only 7 milligrams of oxygen will dissolve in one litre of water at body temperature.

4 (a) Suggest an explanation for the difference.

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(2 marks)

4 (b) Blood leaving the skeletal muscles during exercise may contain only 30 milligrams of oxygen per litre.

Explain what causes the difference in oxygen concentration between the blood leaving the lungs and the blood leaving the skeletal muscles.

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(4 marks)

6

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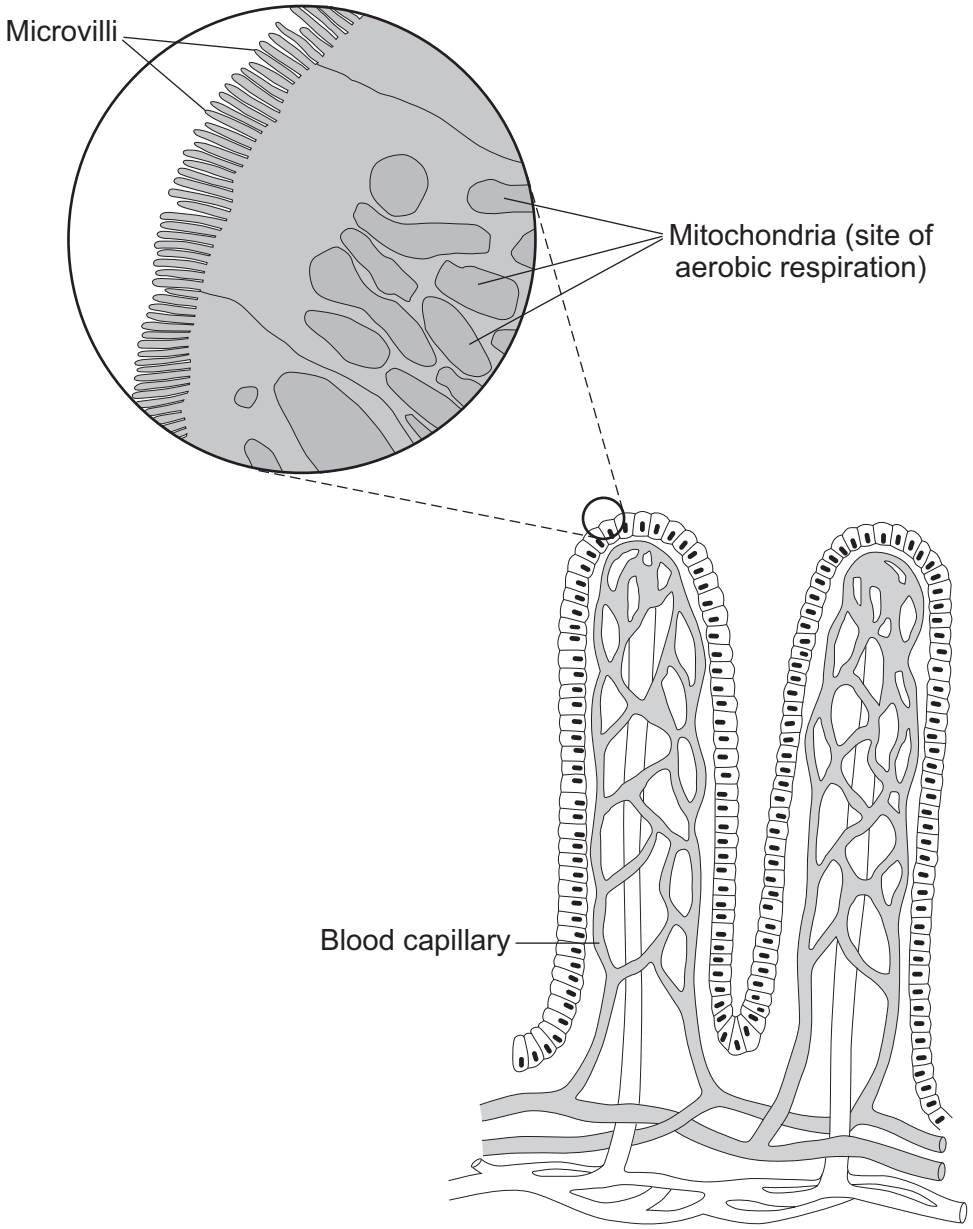
Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

5 The villi of the small intestine absorb the products of digestion.

The diagram shows two villi. It also shows parts of some of the surface cells of a villus, as seen with an electron microscope.



Do not write outside the box

Describe and explain how the villi are adapted to maximise the rate of absorption of the products of digestion.

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(5 marks)

5

Turn over for the next question

Do not write outside the box

6 (a) In industry, microorganisms are grown in fermenters to make useful products.

Name **one** useful product that can be made using microorganisms grown in a fermenter.

.....

(1 mark)

6 (b) Scientists grew one species of bacterium in a fermenter.
The scientists added glucose and other nutrients to the culture medium in the fermenter.

To study the growth of the bacteria, the scientists removed a 1 cm^3 sample of the culture medium from the fermenter once every 5 hours. They added a measured volume of water to dilute the sample by a known amount.

The scientists used two different methods to find the number of bacteria in each sample.

Method A

The scientists:

- added 0.1 cm^3 of the diluted culture to a Petri dish
- poured molten agar into the Petri dish and swirled the dish to mix the contents
- placed the Petri dish in an incubator at 35 °C for 24 hours
- counted the number of colonies of bacteria that had grown in the Petri dish.

Method B

The scientists:

- put some of the diluted sample into a special counting chamber on a microscope
- counted the number of bacteria found in a small volume of the diluted culture.

6 (b) (i) In each method, the scientists diluted the samples that they removed from the fermenter.

Why did they need to do this?

.....

.....

(1 mark)

Do not write outside the box

6 (b) (ii) In **Method A**, the scientists counted colonies of bacteria that had grown in a Petri dish. Explain how counting colonies helped the scientists to find the number of bacteria in a sample.

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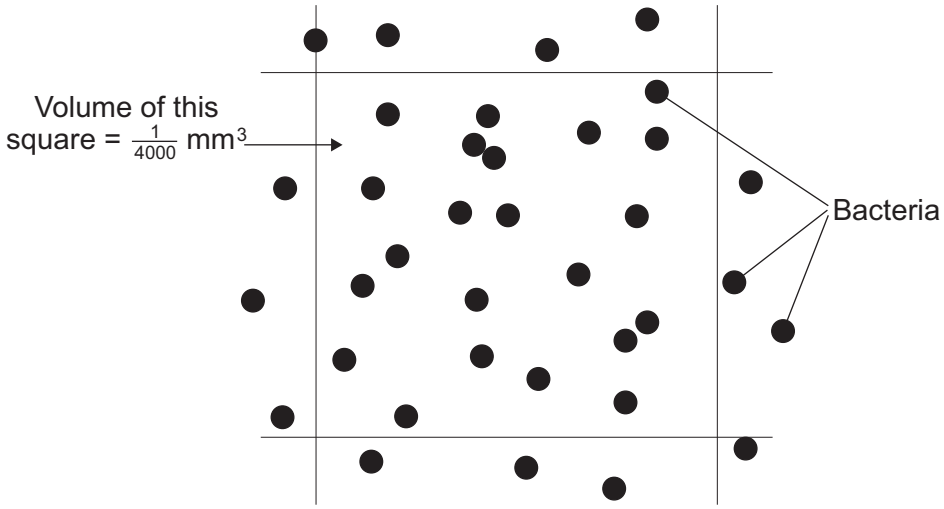
(2 marks)

6 (c) The scientists wanted to find the number of bacteria in a sample of culture medium by using **Method B**.

The sample of culture medium was diluted to $\frac{1}{100}$ of its original concentration.

The diluted sample was then placed in the counting chamber.

The diagram shows part of the counting chamber as seen under a microscope.



Complete the following calculations to find how many bacteria there were in 1 mm^3 of the undiluted sample of culture medium.

Use information from the diagram.

Number of bacteria in $\frac{1}{4000}$ mm^3 of **diluted** culture medium = ...

Number of bacteria in 1 mm^3 of **diluted** culture medium = ...

Number of bacteria in 1 mm^3 of **undiluted** culture medium = ...

(2 marks)

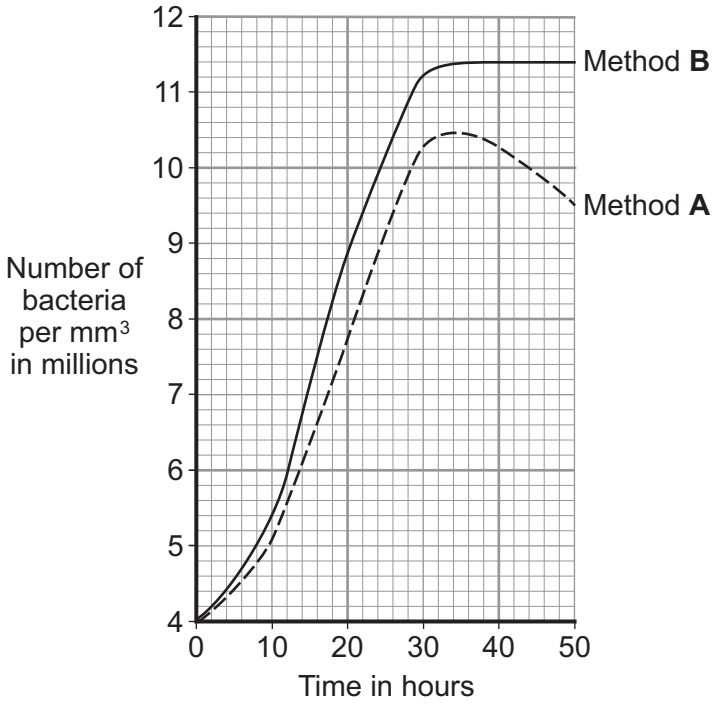
Question 6 continues on the next page

Turn over ▶

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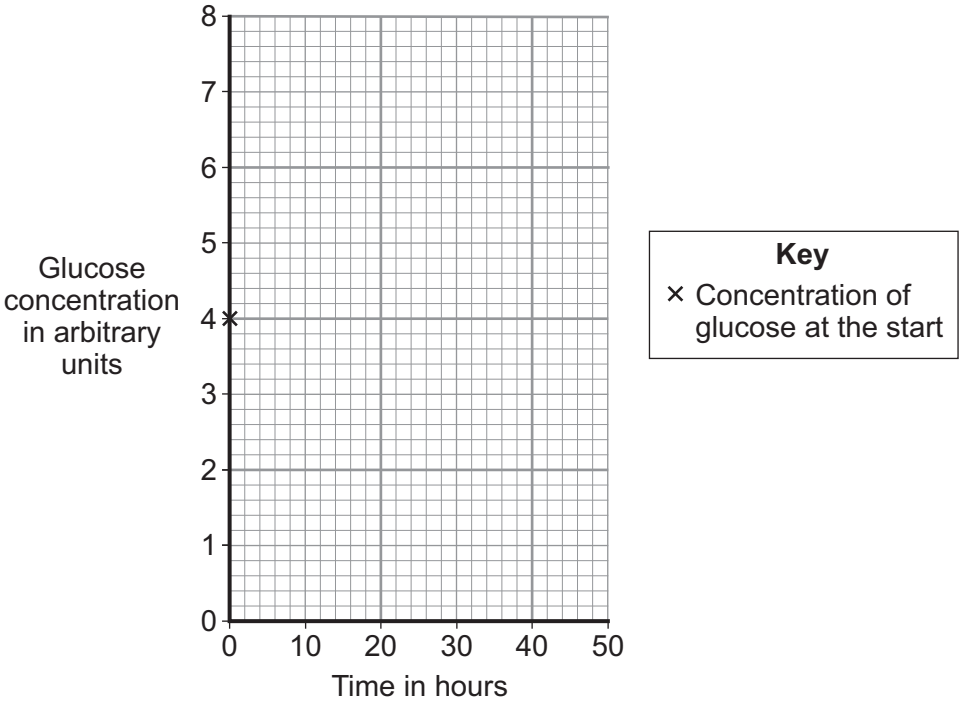
6 (d) The scientists grew the bacteria for 50 hours.
Graph 1 shows the scientists' results.

Graph 1



Graph 2 is not complete.
The concentration of glucose in the fermenter at the start of the investigation was 4 units.

Graph 2



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6 (d) (i) **On Graph 2**, draw a line to show how the glucose concentration would change over the 50 hours of the investigation.

(2 marks)

6 (d) (ii) Explain the shape of the growth curve that was obtained using **Method A**.

Use information from your answer to part (d)(i).

.....

.....

.....

.....

.....

.....

(3 marks)

6 (d) (iii) Why did **Method B** give higher values for the number of bacteria than **Method A**?

.....

.....

(1 mark)

12

END OF QUESTIONS

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Version : 04/08/2011



General Certificate of Secondary Education

Biology 4411

BLY3H Unit Biology 3

Mark Scheme

2011 examination – June series

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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BLY3H

Question 1

question	answers	extra information	mark
1(a)(i)	any **two** from: • sterilise flask before use **or** method described • sterilise water / solution (before yeast added) • work near a flame • modification to air lock eg disinfectant / cotton wool filter	accept boil accept heat to kill organisms ignore heating unqualified sterilise unqualified = **1** mark	2
1(a)(ii)	any **one** from: • so can see the effect of different types of sugar • different concentrations give different rates / affect results • so only one variable / valid • concentration is a control variable	ignore fair test do **not** accept accurate / reliable / precise	1
1(b)(i)	carbon dioxide	accept CO_2 / CO2 ignore CO^2 / Co_2 / Co^2	1
1(b)(ii)	less likely to lose count / get tired **or** experiment lasts a long time **or** less chance of human error	ignore precise / accurate / reliable / valid	1
1(c)(i)	**A** – more gas / CO_2 produced	if **B** – no marks	1
1(c)(ii)	gas production <u>stopped</u> **or** <u>zero</u> rate **or** no more gas / bubbles produced	do **not** accept levelled off / constant	1
Total			**7**

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BLY3H

Question 2

question	answers	extra information	mark
2(a)	(protein molecules too) big **or** larger than pore size	allow cannot fit through the pores / hole / gaps	1
2(b)(i)	diffusion		1
2(b)(ii)	high to low concentration **or** high concentration in blood, low concentration in dialysis fluid **or** <u>down</u> concentration gradient **or** correct use of numbers	ignore along gradient / across gradient allow there is none in dialysis fluid	1
2(c)	any value between 3.15 and 3.25 (inclusive)		1
2(d)(i)	any **two** from: • kidney works all the time **or** dialysis works for short time **or** dialysis needs regular trips to hospital / regular treatment / long term treatment • kidney maintains correct concentration all the time **or** no build-up as between dialysis sessions • no need to regulate diet **or** correct example – eg low salt / low protein / low fluid intake as with dialysis • cheaper in the long term	ignore enables an active life accept kidney transplant is one off treatment	2

Question 2 continues on the next page

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Question 2 continued

question	answers	extra information	mark
2(d)(ii)	any **two** from: • rejection / described **or** need to use immunosuppressants **or** need to take drugs for life • susceptible to other infections • hazards of operation / anaesthetic • shortage of donors / match • high initial cost	allow may need later replacement	2
Total			**8**

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BLY3H

Question 3

question	answers	extra information	mark
3(a)(i)	methane	accept CH_4 / CH4 ignore CH^4 / Ch_4 / Ch^4	1
3(a)(ii)	70	correct answer with or without working if answer is in incorrect **or** no answer 100 – (27 + 2 + 0.5 + 0.5) gains **1** mark	2
3(b)(i)	allows (better) mixing of <u>microorganisms</u> and organic matter **or** to maintain temperature for enzyme action / chemical reaction / microorganisms	accept allows microorganisms to get at organic matter	1
3(b)(ii)	any **one** from: • need <u>anaerobic</u> conditions / respiration • prevent aerobic respiration • biogas made in <u>absence of O_2 / air</u> • less methane would be made with air • more CO_2 would be made with air	accept biogas made by fermentation	1
3(c)	<u>best</u> / <u>optimum</u> temperature for <u>named process</u> (in microorganisms) eg growth / reproduction / digestion / respiration / chemical / enzyme reactions / decomposition / breakdown of organic matter causes high (rate of) biogas production		1 1
Total			**7**

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BLY3H

Question 4

question	answers	extra information	mark
4(a)	blood has red (blood) cells / haemoglobin		1
	haemoglobin combines with / carries oxygen	ignore 'mix' **NB** Blood can form oxyhaemoglobin = **2** marks	1
4(b)	blood gains oxygen / becomes oxygenated (in the lungs)	idea of acquiring oxygen must be unambiguous	1
	blood loses oxygen to the muscles / cells		1
	because muscles are respiring (aerobically)		1
	to provide energy (for exercise)		1
Total			**6**

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BLY3H

Question 5

question	answers	extra information	mark
5	D – <u>many</u> microvilli (1) Ex – provide large surface area (1) D – <u>many</u> capillaries / <u>good</u> blood supply (1) Ex – maintain concentration / diffusion gradient **or** quickly removes food (1) D – thin wall / one cell thick surface / capillaries near surface (1) Ex – short distance for food to travel (1) D – <u>many</u> mitochondria (1) Ex – provide energy / ATP for active uptake / transport (1)	**five** points made max **3** descriptions max **3** explanations allow villi are thin ignore villi are one cell thick	max 5
Total			**5**

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BLY3H

Question 6

question	answers	extra information	mark
6(a)	any **one** suitable product: eg • penicillin / antibiotic / other named antibiotic • mycoprotein / described / quorn • lactic acid / yoghurt • enzymes • ethanol / alcohol / beer / wine • hormones / insulin / GH / somatotrophin • blood-clotting protein / factor VIII • methane / biogas • vaccines		1
6(b)(i)	otherwise too many colonies <u>to count</u> **or** too many bacteria <u>to count</u> **or** make it easier to count		1
6(b)(ii)	a colony is <u>many</u> bacteria **or** cannot see one bacterium each bacterium produces one colony		1 1

Question 6 continues on the next page

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Question 6 continued

question	answers	extra information	mark
6(c)	correct answer: 8 800 000 / 8.8 million / 8.8×10^6	correct answer gains **2** marks with or without 1st two lines if answer incorrect, 1 error in calculation eg 88 000 / 880 000 gains **1** mark **or** allow error carried forward from incorrect 1st line for **1** mark	2
6(d)(i)	on graph: line starts at x and decreases downward sloping s – shaped curve not reaching zero before 30 hours		 1 1
6(d)(ii)	(graph **A**) rises: because glucose <u>is used</u> for reproduction / growth / cell division / multiplication (graph **A**) falls: less / no glucose available **or** glucose is limiting causes some bacteria to die	 allow food for glucose must relate to previous point	 1 1 1
6(d)(iii)	method B counts living and dead bacteria / includes dead bacteria		1
Total			**12**

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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.

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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)

Do not write outside the box

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.

1 .....

.....

2 .....

.....

(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

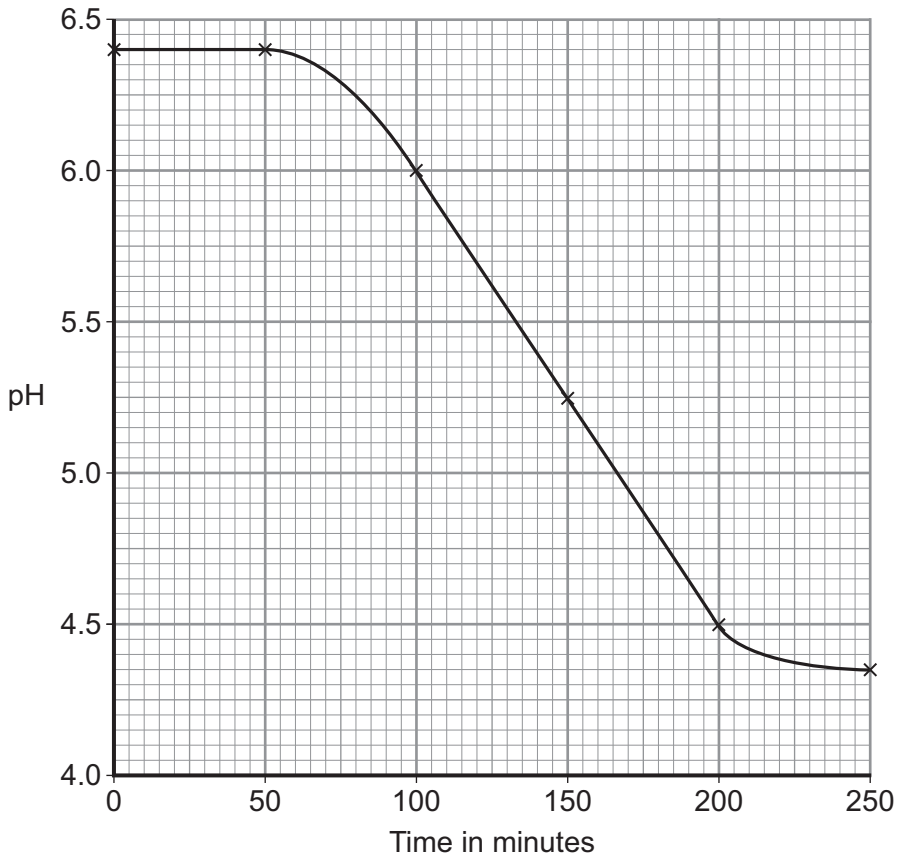
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2 A student investigated the production of yoghurt.

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.

.....

.....

(1 mark)

Do not write outside the box

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.

.....

.....

.....

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.

.....

.....
(1 mark)

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

.....

.....
(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.

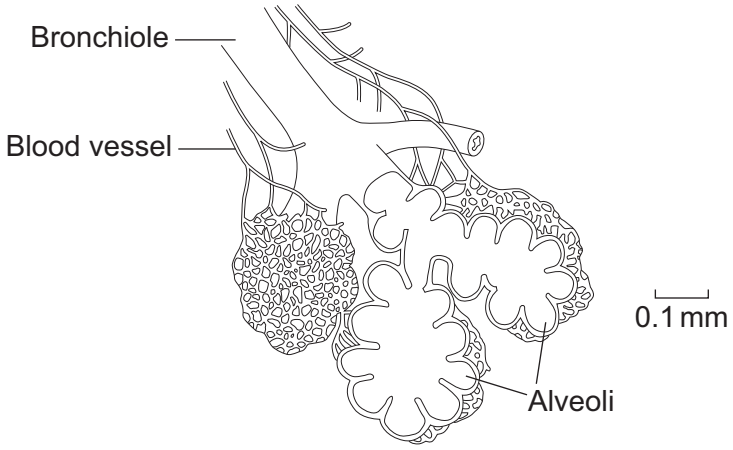
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(1 mark)

8

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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.

1 .....

.....

2 .....

.....

3 .....

.....

(3 marks)

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

.....

(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

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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.

$$\text{starch} + \text{water} \xrightarrow{\text{enzymes}} \text{glucose}$$

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.

$$\text{glucose} \xrightarrow{\text{enzymes}} \text{ethanol} + \text{carbon dioxide} (+ \text{energy})$$

Name this process.

.....

(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 ▶

Do not write outside the box

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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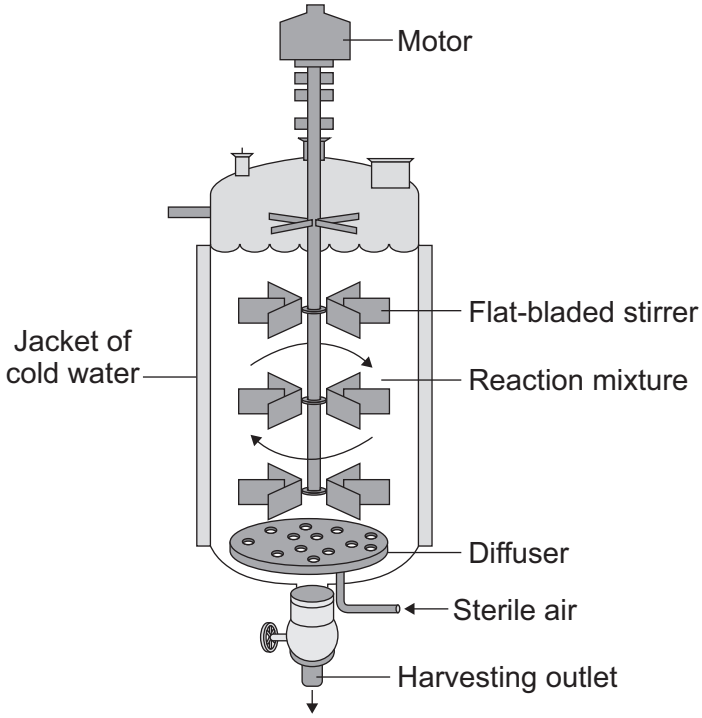
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(4 marks)

4

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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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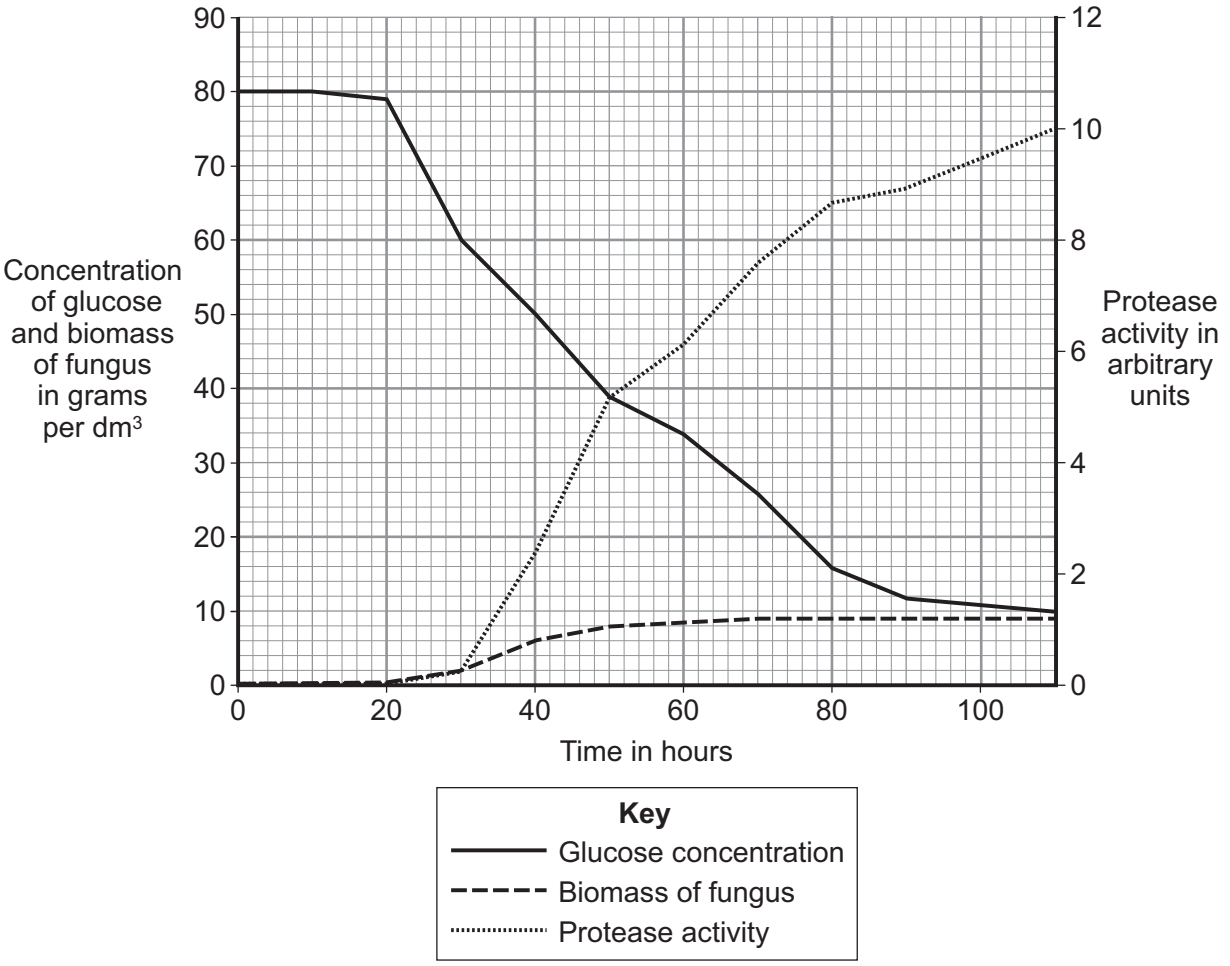
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(3 marks)

Question 6 continues on the next page

Do not write outside the box

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 dm^3.



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 dm^3 and using 60 grams of glucose per dm^3.

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 dm^3

Explain, in detail, why you chose this concentration.

.....

.....

.....

.....

(2 marks)

9

Turn over ▶

Do not write outside the box

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)

Do not write outside the box

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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Version : 28/02/2011



General Certificate of Secondary Education

Biology 4411

BLY3H Unit Biology 3

Mark Scheme

2011 examination – January series

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However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
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If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

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(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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BLY3H

Question 1

question	answers	extra information	mark
1(a)(i)	brain		1
1(a)(ii)	skin		1
1(a)(iii)	1/25 **or** 4% **or** 0.04 **or** 1 in 25 **or** 1:25 **or** 1 out of 25	allow $\frac{1000}{25000}$	1
1(b)	any **two** from: • increased / high heart rate / pulse rate • dilation / widening of <u>arteries / arterioles</u> (to skeletal muscles) **or** less blood flow to other organs • increased stroke volume / described	do **not** allow pumps more blood unqualified accept vasodilation unqualified do **not** accept reference to veins / capillaries	2
1(c)	<u>more</u> respiration / description **or** <u>more</u> energy required **or** to provide <u>more</u> energy	ignore references to breathing	1
	respiration / process described → CO_2	do **not** accept anaerobic respiration	1
	CO_2 <u>diffuses</u> into blood		1
Total			**8**

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BLY3H

Question 2

question	answers	extra information	mark
2(a)	to kill (other) (micro) organisms (in the milk) / to sterilise	allow germs ignore viruses allow destroy ignore pasteurise	1
2(b)(i)	0.015	award **2** marks for correct answer irrespective of working allow answer or use of 1.5 for **1** mark allow **1** mark for $\frac{(y_1 - y_2)}{100}$ but incorrect answer y-values may be incorrect **or** use of 6.0 **and** 4.5 but incorrect answer	2
2(b)(ii)	running out of substrate / sugar / food **or** (acid / low pH) denatures enzymes / proteins / kills bacteria	accept stops / slows enzymes / metabolism allow (acid / low pH) stops / slows bacteria working / growing	1
2(c)	lactic acid	 if incorrect acid allow **1** mark	1 1
2(d)(i)	25		1
2(d)(ii)	pathogens / harmful bacteria (might) grow (at 35 °C)	do **not** accept viruses	1
Total			**8**

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BLY3H

Question 3

question	answers	extra information	mark
3(a)	large surface / large area		1
	thin / short distance (from air to blood) / one cell thick / two cells thick		1
	good blood supply / many capillaries / capillary network / many blood vessels	ignore moist surface	1
3(b)(i)	diffusion	ignore gaseous exchange	1
3(b)(ii)	brings (more) oxygen / air into the lungs / alveoli		1
	keeps O_2 level high in alveoli **or** maintains concentration difference (between alveoli and blood) / keeps O_2 concentration in alveoli > O_2 concentration in blood gains **2** marks		1
Total			**6**

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BLY3H

Question 4

question	answers	extra information	mark
4(a)(i)	carbohydrase	allow correct named example eg amylase / maltase	1
4(a)(ii)	fermentation / <u>an</u>aerobic respiration	accept alcoholic fermentation	1
4(b)	any **three** from: • ethanol renewable / can be re-made **or** petrol non-renewable / can't be re-made • maize / plants / photosynthesis takes in <u>CO_2</u> • (ethanol) causes less increase / no increase in CO_2 concentration in the atmosphere **or** (ethanol) is carbon neutral • (ethanol) has less effect / no effect on climate / on global warming	accept converse for petrol ignore ethanol gives off less CO_2 accept converse for petrol accept correct reference to named pollutant / effect from petrol	3
Total			**5**

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BLY3H

Question 5

question	answers	extra information	mark
5	active transport needs energy **or** diffusion is <u>not</u> energy-dependent		1
	any **three** from: • (energy from) <u>aerobic respiration</u> • <u>more</u> respiration with $\underline{O_2}$ **or** <u>more</u> energy release with $\underline{O_2}$ • (aerobic) respiration / energy release occurs in mitochondria • xylose / other sugars absorbed by diffusion / not by active transport	do **not** allow anaerobic allow active transport is selective / specific **or** active transport can distinguish glucose and xylose	3
Total			**4**

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BLY3H

Question 6

question	answers	extra information	mark
6(a)	maintain / constant / suitable / optimum temperature **or** to prevent overheating	ignore to cool (= question)	1
	high temperature denatures enzymes / proteins / high temperature kills microorganisms / fungus	do **not** allow death of enzymes / denatures microorganisms	1
	microorganisms / fungus / respiration release energy	allow release heat	1
6(b)	any **four** from: • very little / no measurable fungus / biomass before 20 h • need fungus present to make protease enzyme **or** protease is a product from the fungus **or** protease not made until the fungus is made • protease not made until glucose is used • glucose needed for energy / respiration **or** glucose as material for growth / to make more fungus • equipment not sensitive enough to measure low concentrations	 allow spores take about 20 h to start growth allow protease increases as glucose decreases	4

Question 6 continues on the next page

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BLY3H

Question 6 continued

question	answers	extra information	mark
6(c)	40 (no mark) any **two** from: • (40) gives the highest yield / activity of enzyme per g glucose • (40) gives highest yield / activity of enzyme per g fungus produced. • (40) is more economic / saves money	if neither point made allow **1** mark for (40) gives the highest yield / activity of enzyme	2
Total			**9**

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BLY3H

Question 7

question	answers	extra information	mark
7(a)(i)	A		1
7(a)(ii)	(protein molecule is) too large to pass through the filter / cannot pass through the filter		1
7(b)	RBC is too big to / cannot pass through filter haemoglobin released when RBC bursts **or** haemoglobin inside RBC in a healthy person haemoglobin is small enough to / can pass through filter **or** haemoglobin diameter < pore diameter **or** haemoglobin <u>only</u> 5.5 nanometres		1 1 1
Total			**5**

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2010

Biology

BLY3H

Unit Biology B3

H

Written Paper

Friday 21 May 2010 9.00 am to 9.45 am

You will need no other materials.
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.

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Do not write outside the box

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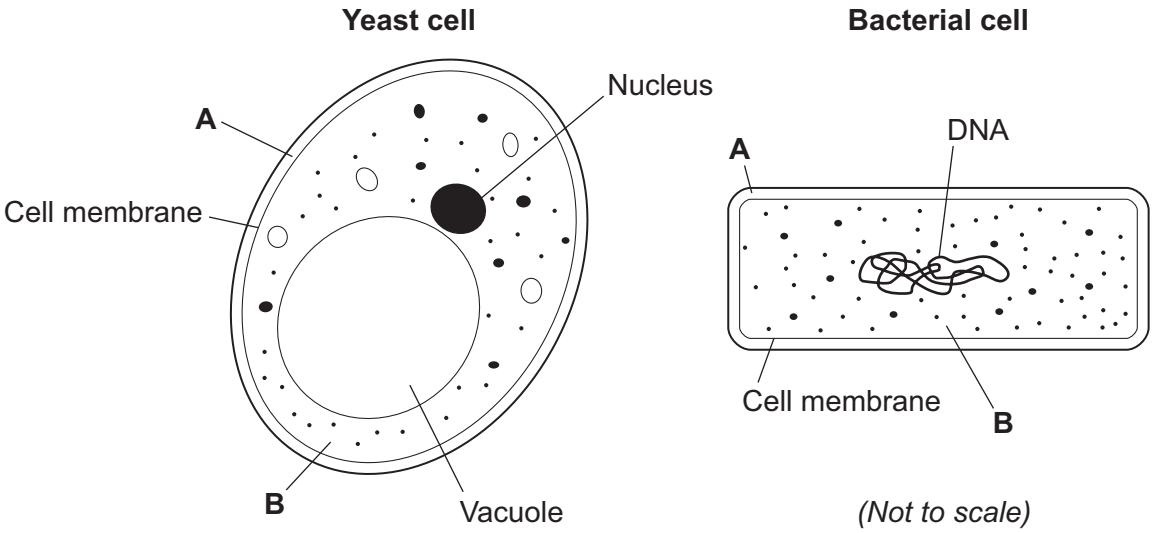
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ANSWER IN THE SPACES PROVIDED

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

1 Sourdough bread is light in texture and tastes slightly sour. It is made using two types of microorganism, a yeast and a bacterium. The bacterium can make acids such as lactic acid. This acid makes the bread taste sour.

1 (a) The diagrams show the structures of the yeast cell and the bacterial cell.



1 (a) (i) Both the yeast cell and the bacterial cell have structures **A** and **B**.

Name structures **A** and **B**.

A .....

B .....

(2 marks)

1 (a) (ii) The yeast cell and the bacterial cell have different shapes.

Give **one** other way in which the structure of the bacterial cell is different from the structure of the yeast cell.

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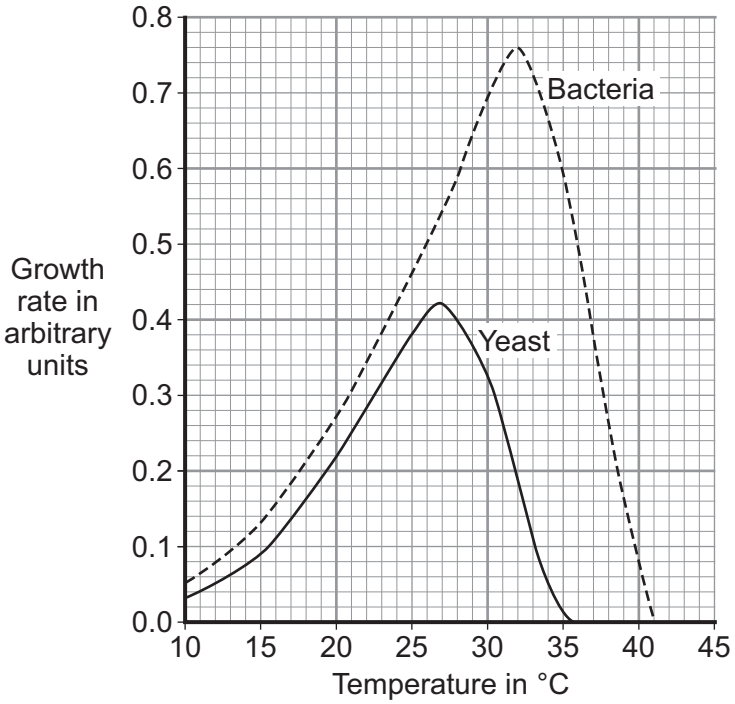
(1 mark)

Question 1 continues on the next page

Turn over ▶

Do not write outside the box

1 (b) The graph shows how the growth rates of the yeast and the bacteria change with temperature.



1 (b) (i) Sourdough bread rises fastest at 27 °C.

Explain why.

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(2 marks)

1 (b) (ii) The bread has a sourer taste if it rises at 32 °C.

Explain why.

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(2 marks)

Do not write outside the box

1 (b) (iii) The growth rate of the yeast is unaffected by pH in the range 3.5 to 7.0 pH units.

Why is this useful in the production of sourdough bread?

.....

.....

(1 mark)

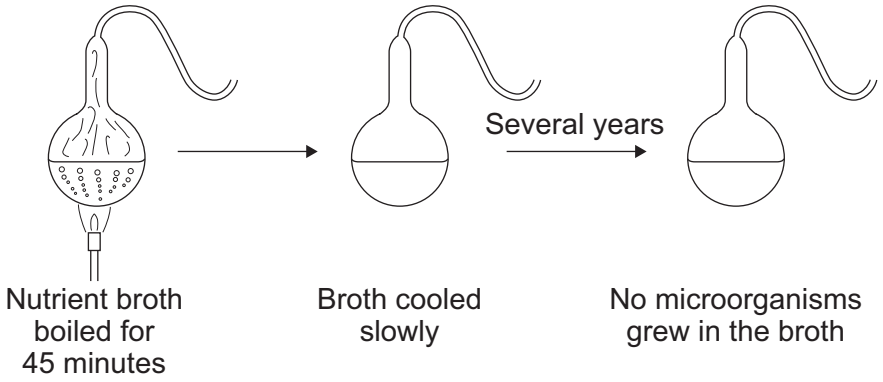
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Turn over for the next question

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2 **Diagram 1** shows some details of an investigation carried out by Louis Pasteur.

Diagram 1



2 (a) (i) Why did Pasteur boil the nutrient broth?

.....

.....

(1 mark)

2 (a) (ii) Because of the shape of the flask, no microorganisms grew even after several years.

Explain why.

.....

.....

(1 mark)

2 (b) Pasteur repeated the investigation several times.

Why is it useful to repeat a scientific investigation several times?

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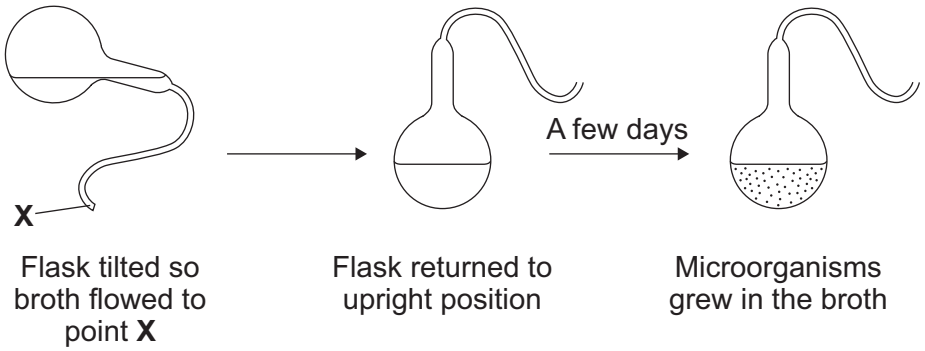
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(1 mark)

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2 (c) After several years, some of Pasteur's flasks were tilted so that the broth flowed to point **X**, as shown in **Diagram 2**. The flasks were then returned to the upright position and left for a few days.

Diagram 2



Microorganisms grew in the broth.

Explain why.

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(2 marks)

2 (d) Complete the sentence.

This investigation provides evidence for the theory of ..... .

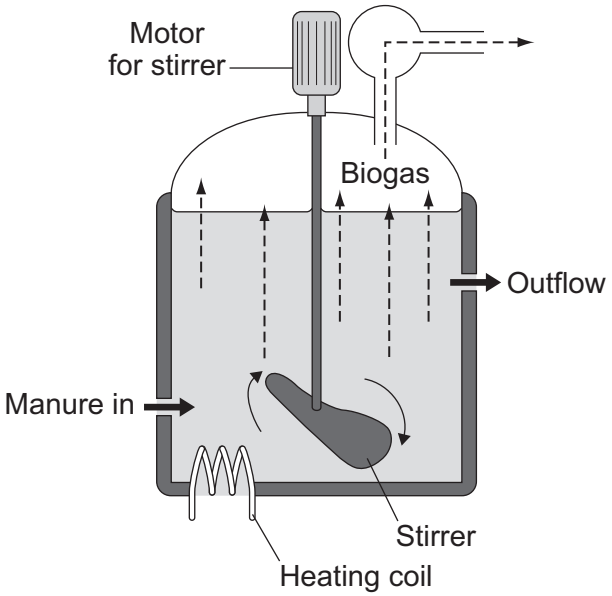
(1 mark)

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3 The diagram shows one type of *anaerobic* digester. This is used to produce biogas.



3 (a) (i) What does *anaerobic* mean?

.....

.....

(1 mark)

3 (a) (ii) The concentration of solids fed into this digester must be kept very low.

Suggest **one** reason why.

.....

.....

(1 mark)

3 (a) (iii) This digester is more expensive to run than some other simpler designs of biogas generator.

Suggest **one** reason why.

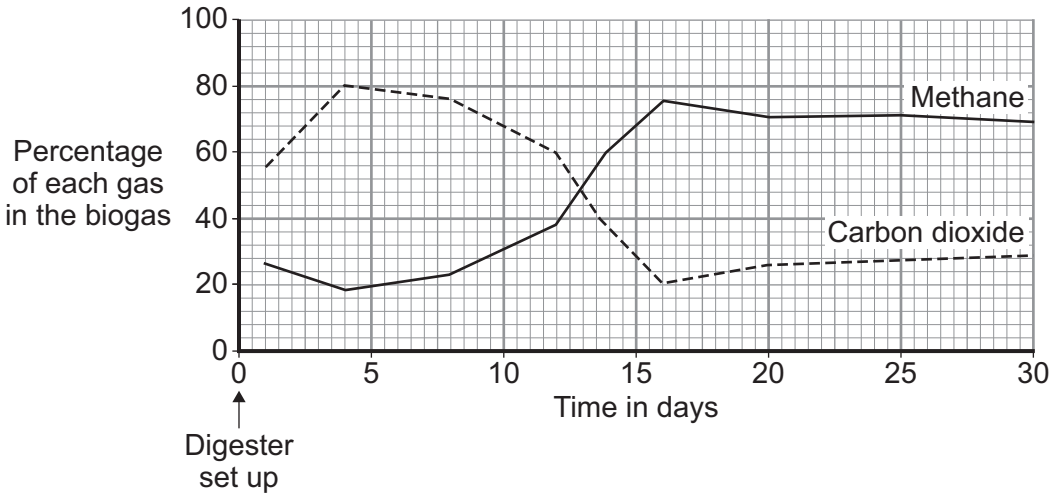
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(1 mark)

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3 (b) The graph shows how the composition of the biogas produced by the digester changed over the first 30 days after the digester was set up.



Use information from the graph to answer the following questions.

3 (b) (i) Describe how the percentage of carbon dioxide changed over the 30 days.

.....

.....

.....

.....

.....

.....

(3 marks)

3 (b) (ii) On which day was the best quality biogas produced? .....

(1 mark)

3 (c) Four days after the digester was first set up, the biogas contained a high percentage of carbon dioxide.

Suggest an explanation for this.

.....

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(2 marks)

9

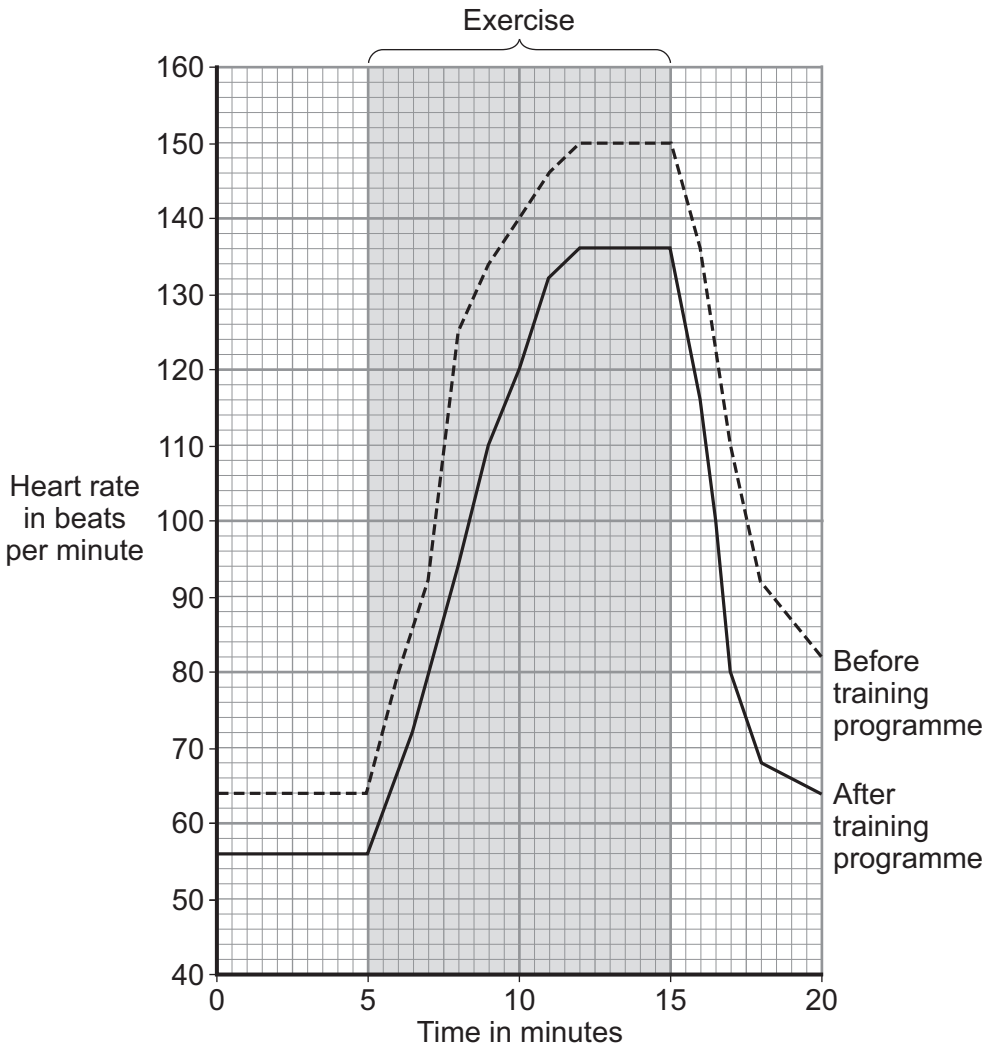
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4 An athlete carried out a 6-month training programme.

Graph 1 shows the effect of the same amount of exercise on his heart rate before and after the training programme.

Graph 1



4 (a) (i) Use **Graph 1** to find the heart rate of the **trained** athlete 5 minutes after the start of the exercise.

Heart rate = ... beats per minute

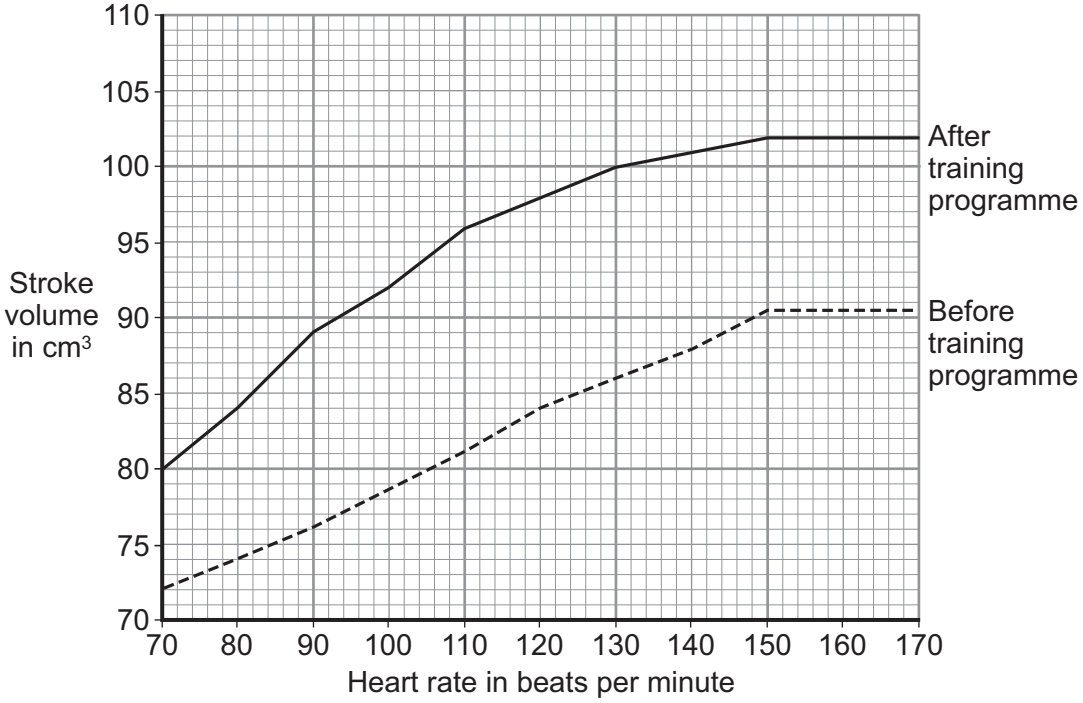
(1 mark)

The stroke volume of the heart is the volume of blood pumped out of the left side of the heart in one heart beat.

Graph 2 shows the relationship between the stroke volume and the heart rate before and after the athlete did the training programme.

Do not write outside the box

Graph 2



4 (a) (ii) The *cardiac output* is defined as

cardiac output = heart rate × stroke volume

Calculate the cardiac output of the **trained** athlete 5 minutes after the start of the exercise. Use your answer to part (a)(i), and information from **Graph 2**.

Show clearly how you work out your answer.

.....

.....

Cardiac output = ... cm^3 blood per minute

(2 marks)

4 (b) **Graph 1** shows that, for the same amount of exercise, the heart of the trained athlete was beating more slowly than it did before the training programme.

Use information from **Graph 2** to explain why.

.....

.....

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(2 marks)

Question 4 continues on the next page

Turn over ▶

Do not write outside the box

4 (c) An increased cardiac output will provide more oxygen and more glucose to the working muscles.

Explain how this helps the athlete during exercise.

.....

.....

.....

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.....

(4 marks)

9

Do not write outside the box

5 Describe, as fully as you can, how ethanol-based fuels are produced from plant materials.

You should name **at least one** enzyme used in this process.

.....

.....

.....

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(4 marks)

4

Turn over for the next question

Do not write outside the box

6 Diffusion and active transport take place in healthy kidneys.

6 (a) Explain what is meant by:

6 (a) (i) diffusion.....

.....

.....

.....

(2 marks)

6 (a) (ii) active transport .....

.....

.....

.....

(2 marks)

6 (b) Describe, as fully as you can, how urine is produced by the kidneys.

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(5 marks)

9

END OF QUESTIONS

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Version: 09/08/2010

General Certificate of Secondary Education

Biology 4411

BLY3H Unit Biology 3

Mark Scheme

2010 Examination – June Series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Marking Guidance for Examiners

GCSE Science Papers

1. General

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3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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BLY 3H

Question 1

question	answers	extra information	mark
1(a)(i)	A = (cell) wall B = cytoplasm	ignore cellulose	1 1
1(a)(ii)	any **one** from • bacterial cell / it has no nucleus • DNA free in cytoplasm • has no vacuole / no vesicles	 accept has DNA instead of a nucleus but **not** just has DNA allow no mitochondria ignore size ignore strands of DNA	1
1(b)(i)	yeast grows best / better / well **or** optimum temperature for yeast / more yeast present CO_2 made(by yeast) **or** respires / respiration (by yeast)	allow yeast works best / better / well allow fermentation (ignore anaerobic/aerobic)	1 1
1(b)(ii)	bacterium grows best / better / well / more bacteria present **or** optimum temperature for bacterium (lactic) acid made (by bacterium)	ignore micro organism / microbes allow works / respires best / better / well (ignore anaerobic/aerobic) do **not** allow wrong acid	1 1
1(b)(iii)	bread still rises (in acid conditions) **or** no need to control / monitor pH		1
Total			**8**

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BLY 3H

Question 2

question	answers	extra information	mark
2(a)(i)	to kill (micro)organisms / bacteria / microbes **or** to sterilise	allow get rid of organisms etc allow kill germs	1
2(a)(ii)	(micro)organisms / they could not enter (the broth / flask) **or** (micro)organisms / they get trapped / stuck (in the bend)	apply list principle to air	1
2(b)	(more) reliable **or** to check if anomalous / consistent (same every time)	do **not** allow precise / accurate / valid / fair	1
2(c)	any **two** from: • microorganisms now enter (the broth / flask) • microorganisms from air / bend / neck / x • food / nutrients / energy source for microorganisms (in broth)	ignore oxygen / air	2
2(d)	biogenesis		1
Total			**6**

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BLY 3H

Question 3

question	answers	extra information	mark
3(a)(i)	without <u>oxygen</u>	ignore reference to air	1
3(a)(ii)	otherwise difficult to stir / to pump / to transfer	allow prevent 'clogging' owtte	1
3(a)(iii)	need to stir / pump / heat		1
3(b)(i)	rises then falls then levels / slight rise quantitative descriptor eg to 80% / max. on day 4 / min. on day 16	 accept other valid quantitative descriptor allow accuracy ± $\frac{1}{2}$ small square	1 1 1
3(b)(ii)	16 (15.5 to 16.4)		1
3(c)	oxygen present (CO_2 produced) by <u>aerobic</u> respiration **or** not much <u>anaerobic</u> respiration **or** not much methane / CH_4 produced		1 1
Total			**9**

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BLY 3H

Question 4

question	answers	extra information	mark
4(a)(i)	120		1
4(a)(ii)	11 760 **or** correct answer from candidate's answer to (a)(i)	correct answer with or without working if answer incorrect 120 × 98 **or** candidate's answer to (a)(i) × corresponding SV gains **1** mark if candidate uses dotted line / might have used dotted line(bod) in (a)(i) **and** (a)(ii) no marks for (a)(i) but allow full ecf in (a)(ii) eg 140 x 88 = 12320 gains **2** marks	2
4(b)	trained athlete has higher stroke volume / more blood per beat same volume blood expelled with fewer beats **or** for same heart rate more blood is expelled		1 1

Question 4 continues on the next page

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Question 4 continues

question	answers	extra information	mark
4(c)	increased aerobic respiration **or** decreased anaerobic respiration	allow correct equation for aerobic respiration accept don't have to respire anaerobically	1
	increased energy supply / need		1
	less lactic acid formed **or** to breakdown lactic acid **or** less O_2-debt		1
	can do more work **or** can work harder / faster / longer **or** less fatigue / cramp / pain	accept muscle contraction for work	1
Total			**9**

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BLY 3H

Question 5

question	answers	extra information	mark
5	use of carbohydrase	accept correct named example eg amylase / maltase / sucrase. If protease / lipase also given only accept carbohydrase if linked to correct substrate / product	1
	any **three** from:	but max 2 if methane production	3
	• conversion of starch to sugar / maltose / glucose **or** sugar / sucrose to glucose / fructose	apply list principle	
	• digestion	accept hydrolysis	
	• fermentation / anaerobic respiration	ignore fermenter	
	• distillation		
	• mixing with petrol		
Total			**4**

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BLY 3H

Question 6

question	answers	extra information	mark
6(a)(i)	movement of atoms / molecules / ions	accept particles allow dissolved substances ignore reference to membranes	1
	(substance) moves from high to low concentration	allow down the gradient ignore across / along / with a gradient	1
6(a)(ii)	any **two** from: • movement of molecules / ions	accept particles allow dissolved substances this point <u>once</u> only in (a)(i) and (a)(ii)	2
	• from low to high concentration	allow up / against the gradient ignore across / along / with a gradient	
	• requires energy / respiration	accept requires ATP	

Question 6 continues on the next page

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BLY 3H

Question 6 continues

question	answers	extra information	mark
6(b)	• **<u>filtration</u>** of blood **or** described re small (molecules) through / large not	ignore diffusion	1
	max **four** from:		4
	• **<u>reabsorption</u>** / substances taken back into blood		
	• (reabsorption) of <u>all</u> of the sugar / glucose		
	• (reabsorption) of <u>some</u> of ions / of ions <u>as needed</u> by body		
	• (reabsorption) *of* <u>some</u> *of* water / of water <u>as needed</u> by the body		
	• urea present in urine	accept urea not reabsorbed	
	• reabsorption of water by <u>osmosis</u> / <u>diffusion</u> ***or*** reabsorption of sugar / ions by <u>active transport</u>		
Total			**9**

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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 2010

Biology

BLY3H

Unit Biology B3

H

Written Paper

Thursday 14 January 2010 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. 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 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.

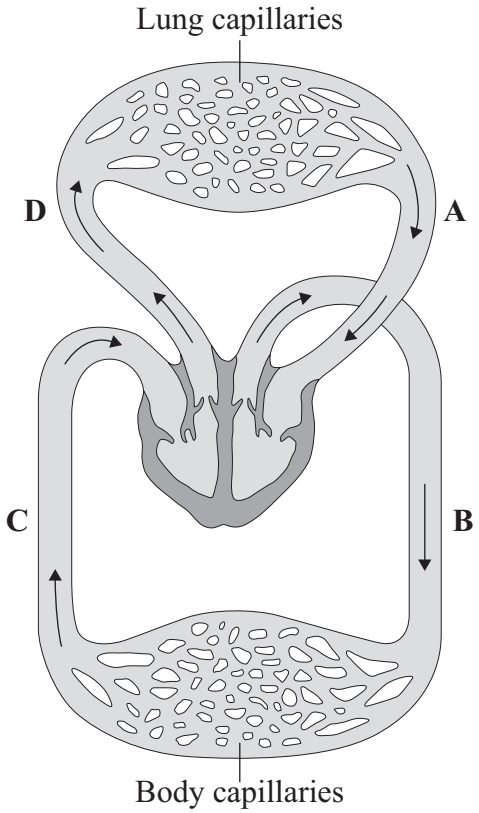
Advice
- In all calculations, show clearly how you work out your answer.

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Areas outside the box will not be scanned for marking

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

1 The diagram shows the human circulation system.



1 (a) (i) Give the letter of **one** blood vessel that is an artery. ☐

(1 mark)

1 (a) (ii) Give the letter of **one** blood vessel that carries oxygenated blood. ☐

(1 mark)

Areas outside the box will not be scanned for marking

1 (b) During exercise, the heart rate increases.

Explain, as fully as you can, why this increase is necessary.

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(4 marks)

6

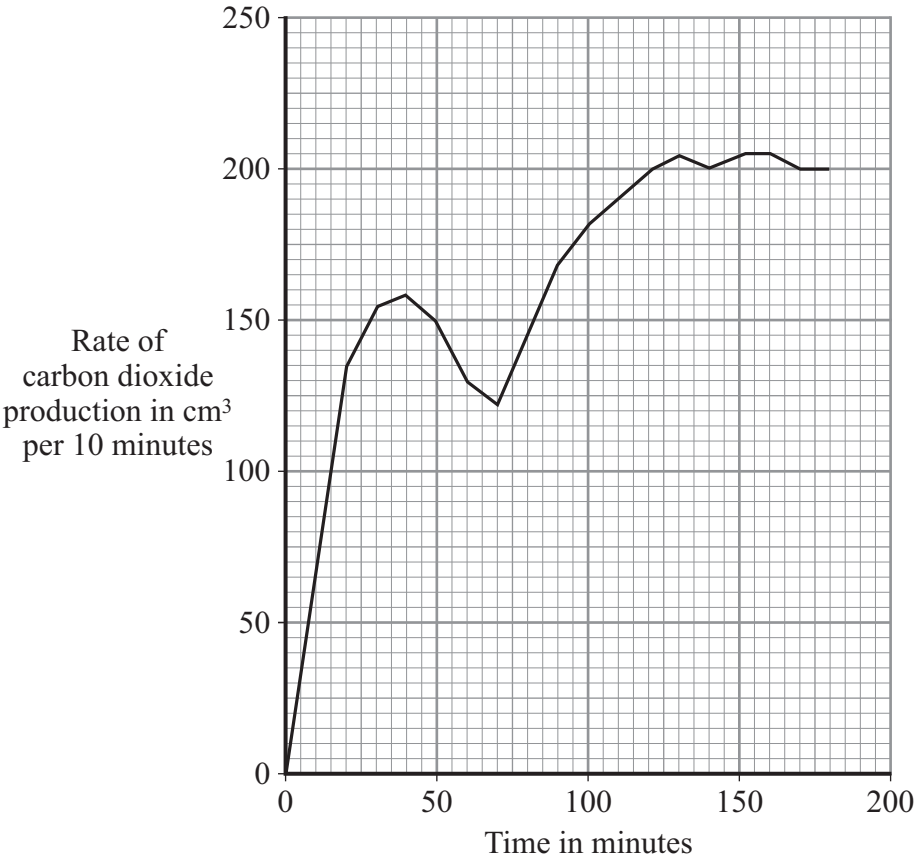
Turn over for the next question

Areas outside the box will not be scanned for marking

2 Bread dough contains flour, sugar, water and yeast. Yeast makes the dough rise.

Some scientists measured the production of carbon dioxide by yeast in bread dough at 35ºC.

The results are shown in the graph.



2 (a) Over the first 70 minutes, the rate of carbon dioxide production increased at first and then decreased.

Explain why the rate decreased towards the end of this period.

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(2 marks)

Areas outside the box will not be scanned for marking

2 (b) The flour contains starch and enzymes similar to those in germinating barley grains.

Use this information to suggest an explanation for the increase in the rate of carbon dioxide production after 70 minutes.

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(3 marks)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

3 A student removed three similar leaves from a plant. The student spread petroleum jelly (a waterproofing substance) on some of the leaves, as follows:

Leaf A: on the lower surface
Leaf B: on the upper surface
Leaf C: none.

The student placed each leaf in a separate beaker. He weighed each beaker at intervals. The results are shown in the table.

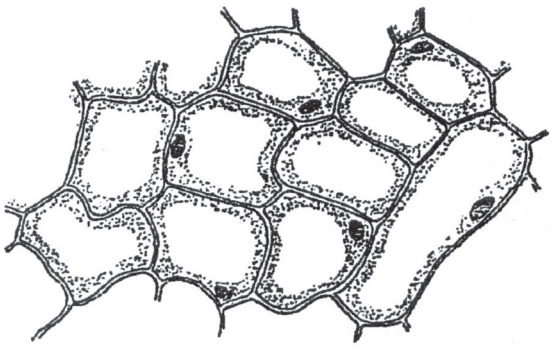
Time in hours	Mass of leaf + beaker in grams		
	Leaf A	Leaf B	Leaf C
0	50.00	55.01	51.99
1	49.99	54.95	51.90
3	49.97	54.90	51.85
5	49.95	54.86	51.80

3 (a) Which leaf, **A**, **B** or **C**, lost most water? ☐

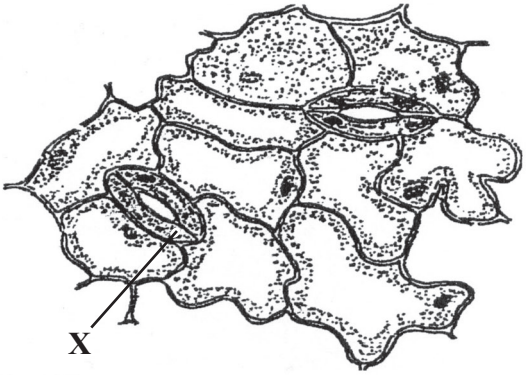
(1 mark)

3 (b) The diagram shows the appearance of the upper and lower surfaces of one of the leaves under a microscope.

Upper surface of leaf



Lower surface of leaf



3 (b) (i) Name cell **X**.....

(1 mark)

Areas outside the box will not be scanned for marking

3 (b) (ii) The petroleum jelly had a greater effect when it was spread on the lower surface than when it was spread on the upper surface.

Use information from the diagram to explain why.

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(2 marks)

4

Turn over for the next question

Areas outside the box will not be scanned for marking

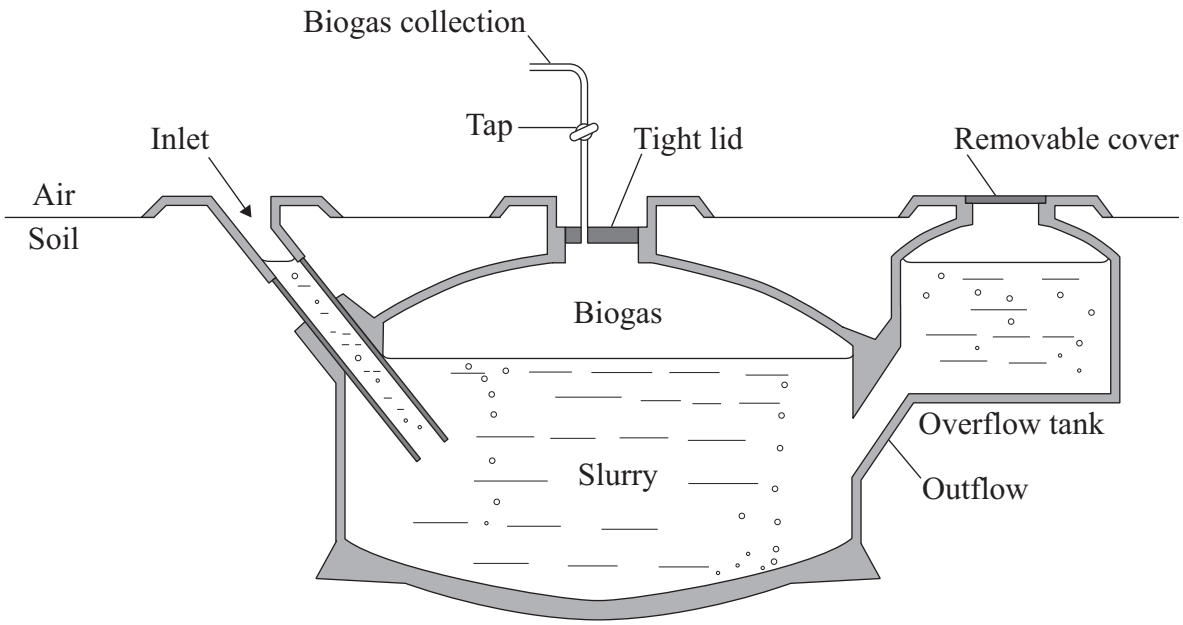
4 Biogas can be produced from waste materials that contain carbohydrates.

4 (a) Complete the sentence.

The main fuel gas present in biogas is ..... .

(1 mark)

4 (b) The diagram shows one type of biogas generator.



4 (b) (i) Suggest **two** advantages of having the biogas generator underground.

1 .....

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2 .....

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(2 marks)

Areas outside the box will not be scanned for marking

4 (b) (ii) It is important that the level of liquid in the inlet and in the overflow tank is above that of the slurry.

Explain why.

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(1 mark)

4 (c) Temperatures in the UK are usually between 0°C and 25°C.

At a sewage works in the UK, some of the biogas produced from sewage sludge is burned and is used to heat water. The hot water is then pumped through metal pipes which pass back through the biogas generator.

Explain why this would be helpful in biogas production.

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(2 marks)

6

Turn over for the next question

Areas outside the box will not be scanned for marking

5 Lactic acid production during exercise affects an athlete's performance.

5 (a) Explain why lactic acid is produced during exercise.

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(2 marks)

5 (b) Scientists investigated the effects on the body of intermittent exercise and continuous exercise. In intermittent exercise, the athlete rests between each exercise period.

During each exercise period the athlete ran as fast as he possibly could for the whole of the exercise period.
Each experiment ended when the athlete was exhausted and could run no further.

The table shows the results.

The data for intermittent exercise is not reproduced here due to third-party copyright constraints.

Areas outside the box will not be scanned for marking

5 (b) (i) Describe the effect of the different exercise and rest periods on the distance the athlete was able to run.

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(2 marks)

5 (b) (ii) Suggest an explanation for the trend in the data for final blood lactic acid concentration.

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(2 marks)

5 (b) (iii) In experiment **1**, the athlete took in oxygen at the highest rate possible for him.

Suggest **one** feature of the internal structure of the lungs that might limit the rate at which oxygen can be taken into the body.

.....

.....

(1 mark)

7

Turn over for the next question

Areas outside the box will not be scanned for marking

6 A person had diseased kidneys.

The table shows the concentrations of dissolved substances in this person's urine.

Substance	**Concentration in grams per dm^3**
Protein	6
Glucose	0
Amino acids	0
Urea	21
Mineral ions	19

6 (a) One of the substances found in this person's urine would **not** be found in the urine of a healthy person.

6 (a) (i) Name this substance. .....

(1 mark)

6 (a) (ii) Explain why this substance would **not** be found in the urine of a healthy person.

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(2 marks)

Areas outside the box will not be scanned for marking

6 (b) A person with diseased kidneys may be treated by dialysis.

Explain how dialysis treatment restores the concentrations of dissolved substances in the blood to normal levels.

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(4 marks)

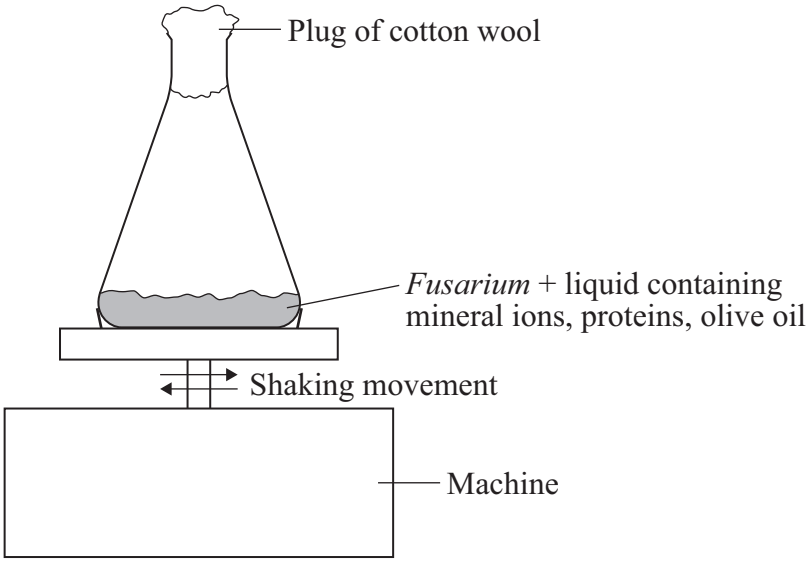
7

Turn over for the next question

Areas outside the box will not be scanned for marking

7 Lipase is an enzyme used in biological detergents. It catalyses the digestion of fats and oils.

Scientists investigated the production of lipase by the fungus, *Fusarium*.
The scientists made up different liquids containing mineral ions, proteins and olive oil.
They mixed 90 cm^3 of one of these liquids with a *Fusarium* culture in a flask.
The flask was then shaken on a machine throughout the investigation, as shown in the diagram.



The scientists carried out two investigations.

- In each investigation, 10 cm^3 of a high concentration of *Fusarium* was used.
- In **Investigation 1**, they varied the concentration of protein.
- In **Investigation 2**, they varied the concentration of olive oil.
- In each investigation, they measured the amount of lipase produced in each flask over 72 hours.
- They repeated each investigation three times.

7 (a) (i) The shaking movement mixed the liquid and the *Fusarium*.

Suggest **one** further reason why the flasks were shaken throughout the investigations.

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(1 mark)

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Areas outside the box will not be scanned for marking

7 (a) (ii) The high concentration of *Fusarium* in each flask increased the rate of lipase production.

Suggest **one** other reason why a high concentration of *Fusarium* was used.

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(1 mark)

Question 7 continues on the next page

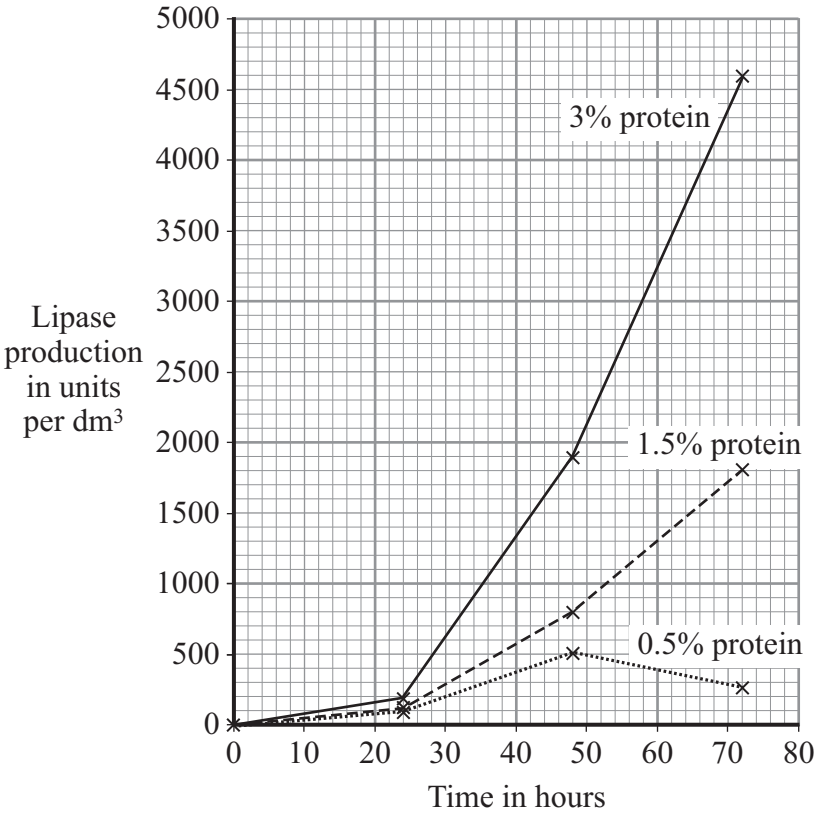
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7 (b) Graphs **1** and **2** show the results of the two investigations.

Graph 1 shows lipase production at three different concentrations of protein.

Graph 2 shows lipase production at three different concentrations of olive oil.

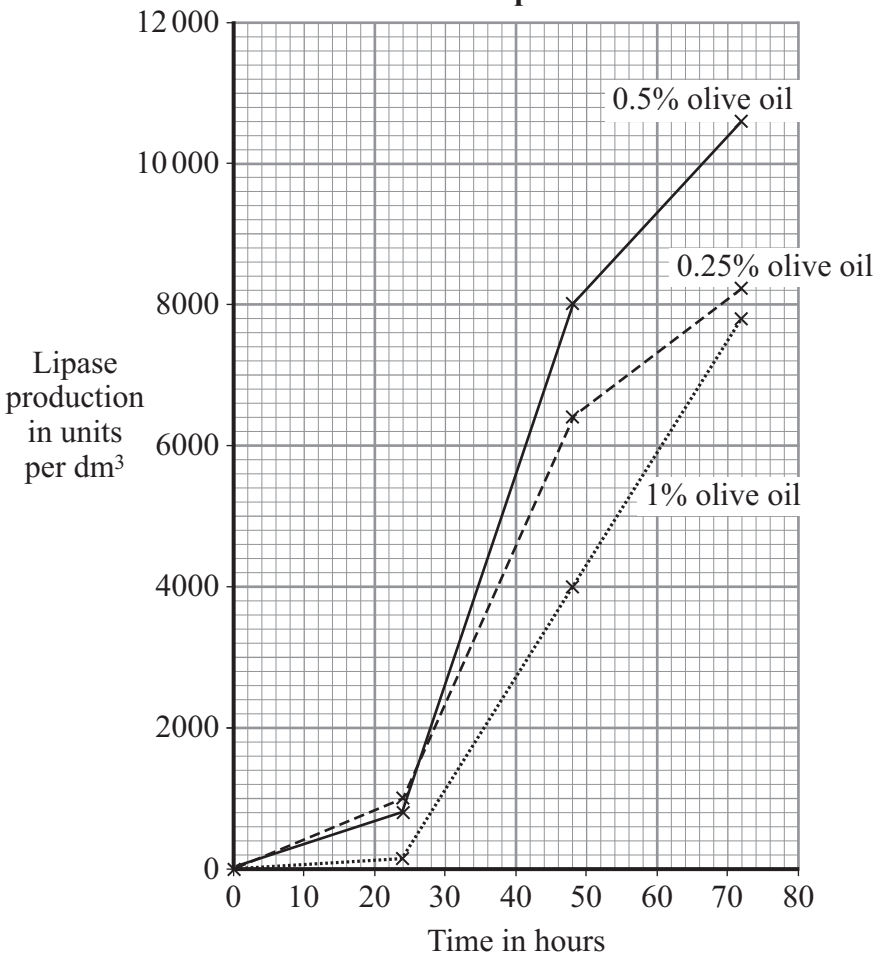
Graph 1



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Graph 2



7 (b) (i) From **Graph 2**, calculate the maximum rate of lipase production per hour.

Show clearly how you work out your answer.

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Answer =.....units of lipase per dm^3 per hour
(2 marks)

Question 7 continues on the next page

Turn over ▶

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7 (b) (ii) Each point plotted on **Graphs 1** and **2** is the mean of three values.

The scientists published only the mean results in their scientific paper. They did not include the actual measured values.

Why would it have been better to have included the actual measured values?

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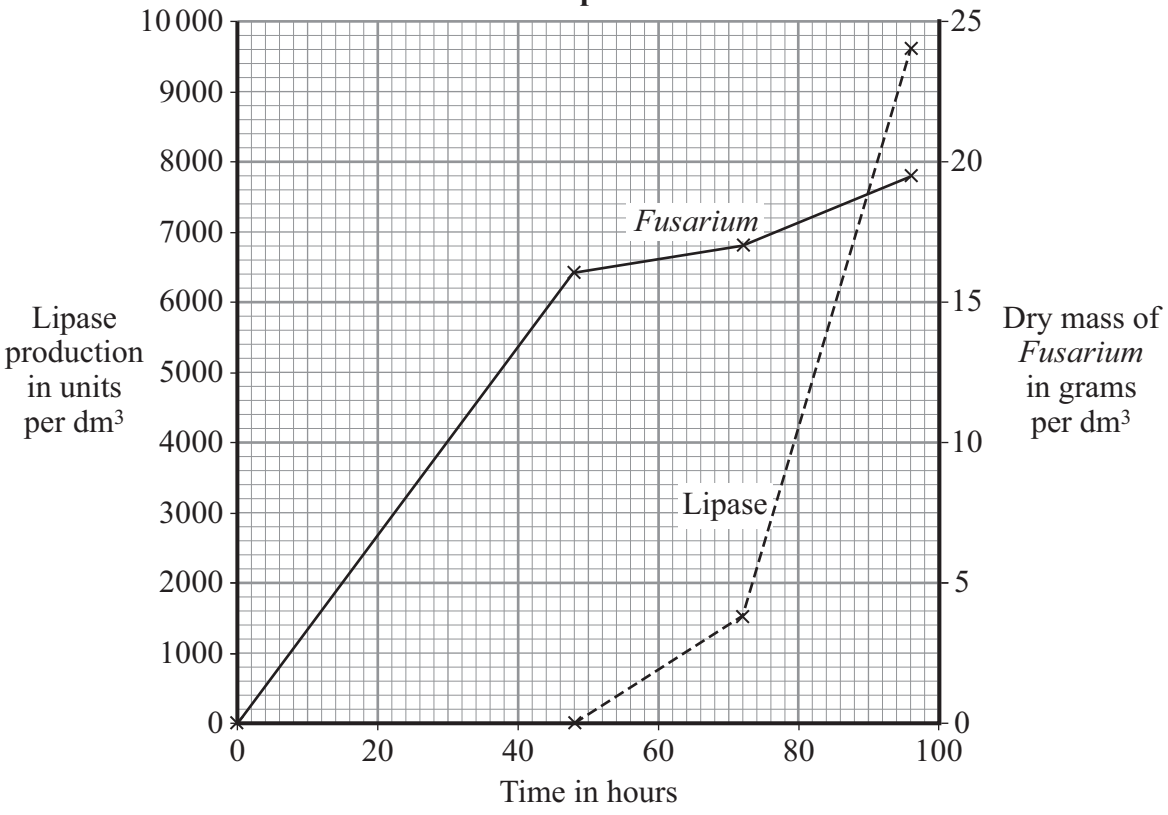
.....

(2 marks)

7 (c) The scientists then carried out **Investigation 3**.
They used the results of **Investigations 1** and **2** to provide optimum concentrations of protein and olive oil. They measured the dry mass of the *Fusarium* and the amount of lipase produced over 96 hours.

The results of **Investigation 3** are shown in **Graph 3**.

Graph 3



Areas outside the box will not be scanned for marking

7 (c) (i) Use information from **Graph 3** to describe the relationship between the growth of *Fusarium* and the production of lipase.

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(2 marks)

7 (c) (ii) Suggest an explanation for this relationship.

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(2 marks)

10

END OF QUESTIONS

There are no questions printed on this page

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Version : 09/03/2010

General Certificate of Secondary Education

Biology 4411

BLY3H Unit Biology 3

Mark Scheme

2010 examination – January series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Dr Michael Cresswell Director General

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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Question 1

question	answers	extra information	mark
1(a)(i)	B **or** D		1
1(a)(ii)	A **or** B		1
1(b)	any **four** from: • increased blood (flow) • (more) oxygen supplied **or** aerobic respiration • (more) glucose / sugar / food supplied • (higher rate of) respiration • (more) energy needed / released • (more) carbon dioxide <u>removed</u> • (muscles) doing (more) work **or** muscles contracting • remove heat / cooling • remove lactic acid **or** less lactic acid formed	more / faster must be implied at least once for full marks ignore reference to breathing allow less anaerobic (respiration) **or** and prevents oxygen debt ignore feeding allow made	4
Total			**6**

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BLY3H

Question 2

question	answers	extra information	mark
2(a)	sugar / named eg / energy supply / respiration	allow aerobic respiration	1
	decreasing / less	allow running out	1
		if no other marks awarded allow less oxygen / starch / food **or** toxins produced for **1** mark	
2(b)	any three from: • starch → sugar / named eg **or** more sugars • by enzyme • (sugar can be used) by yeast • in respiration / respiration increases	NB yeast respires faster = **2** marks	3
Total			**5**

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Question 3

question	answers	extra information	mark
3(a)	C		1
3(b)(i)	guard (cell)		1
3(b)(ii)	water movement / transpiration through stomata / pores / holes / (region) X **or** petroleum jelly blocks / covers stomata / pores / holes / X stomata / pores / holes / X found on lower surface		1 1
Total			**4**

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BLY3H

Question 4

question	answers	extra information	mark
4(a)	methane / CH_4	allow CH^4 / CH4 / H4C	1
4(b)(i)	any **two** from: • less visual impact • less heat loss **or** (better) insulated **or** temperature will be less variable / keeps warm / keeps cool **or** easier to maintain optimum temperature • withstand pressure build-up • ease of adding material / slurry	ignore reference to smell	2
4(b)(ii)	any **one** from: • to keep anaerobic • to prevent oxygen / air entering • to prevent biogas escaping • to maintain pressure / to allow removal of biogas		1
4(c)	any **two** from: • to maintain optimum temperature • to speed up production of biogas **or** reference to faster microbial action / named microbial process • UK temperature is low/below 25 ºC • self sufficient / sustainable	ignore to keep warm if reference to specific temperature accept any value in range 26 – 40 ºC as optimum UK temperature is below optimum = **2** marks	2
Total			**6**

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Question 5

question	answers	extra information	mark
5(a)	insufficient / no oxygen available for (just) aerobic <u>respiration</u> **or** <u>respires</u> anaerobically		1 1
5(b)(i)	any **two** from: • can run further if intermittent exercise / rest breaks in exercise **or** continuous exercise is worst • runs further with shorter exercise • runs further with shorter rests • 10 s exercise + 5 s rest → can run furthest		2
5(b)(ii)	any **two** from: • longer rest period enables (more) oxygen content (of muscles) to be replenished • enables (more) aerobic respiration **or** less / no anaerobic respiration • enables breakdown / removal of lactic acid **or** oxygen debt paid off		2
5(b)(iii)	surface area (of alveoli / number of alveoli / air sacs) **or** width of bronchioles / bronchi	ignore rate / depth of breathing allow size if qualified eg volume / 'space'/ description of vital capacity accept width of air tubes	1
Total			**7**

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Question 6

question	answers	extra information	mark
6(a)(i)	protein		1
6(a)(ii)	(protein molecules too) large cannot pass through filter **or** can't leave blood **or** can't pass into kidney tubule / named part	 NB holes in the filter are too small = **2** marks	1 1
6(b)	any **four** from: • use of partially permeable membrane **or** only small molecules can pass through membrane • dialysis fluid has 'ideal' concentrations of solutes • diffusion of waste substances out of blood **or** waste passes from <u>high to low concentration</u> • reference to equilibrium (between plasma & dialysis fluid)	 allow correct named example accept named example – eg urea accept reference to counterflow to maintain concentration gradient	4
Total			**7**

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Question 7

question	answers	extra information	mark
7(a)(i)	to mix in oxygen / air **or** to allow aerobic respiration / prevent anaerobic	allow stops olive oil separating out	1
7(a)(ii)	so *Fusarium* not limiting **or** so can see effect of protein / oil (concentration)		1
7(b)(i)	300	correct answer with or without working = **2** marks $\frac{(8000-800)}{24}$ **or** $\frac{7200}{24}$ if one error only eg **or** $\frac{8000-1000}{24}$ allow **1** mark	2
7(b)(ii)	cannot tell how accurate / precise / reliable the values are **or** there may be a wide range results may overlap with values for other conditions **or** may not be significantly different from other conditions	do **not** allow – to make it more accurate / precise / reliable allow suitable reference to anomalies	1 1

Question 7 continues on the next page...

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BLY3H

Question 7 continued

question	answers	extra information	mark
7(c)(i)	description:	each point made must compare *Fusarium* growth **and** lipase production	
	Fusarium grows (mainly) before lipase production starts	allow correct use of figures	1
	as *Fusarium* growth slows lipase production speeds up		1
7(c)(ii)	explanation: any **two** from: • need sufficient growth of *Fusarium* before it can release / make / produces (detectable) lipase • initial *Fusarium* growth uses protein (from reaction mixture) **or** protein more important than lipid for *Fusarium* growth • later *Fusarium* growth uses lipid / oil (from reaction mixture)	allow no lipase production until 'nutrients' used up / limiting	2
Total			**10**

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

For Examiner's Use

General Certificate of Secondary Education
June 2009

BIOLOGY
Unit Biology B3

BLY3H

H

Higher Tier

Wednesday 20 May 2009 1.30 pm to 2.15 pm

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. 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		3	
2		4	
		5	
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		7	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

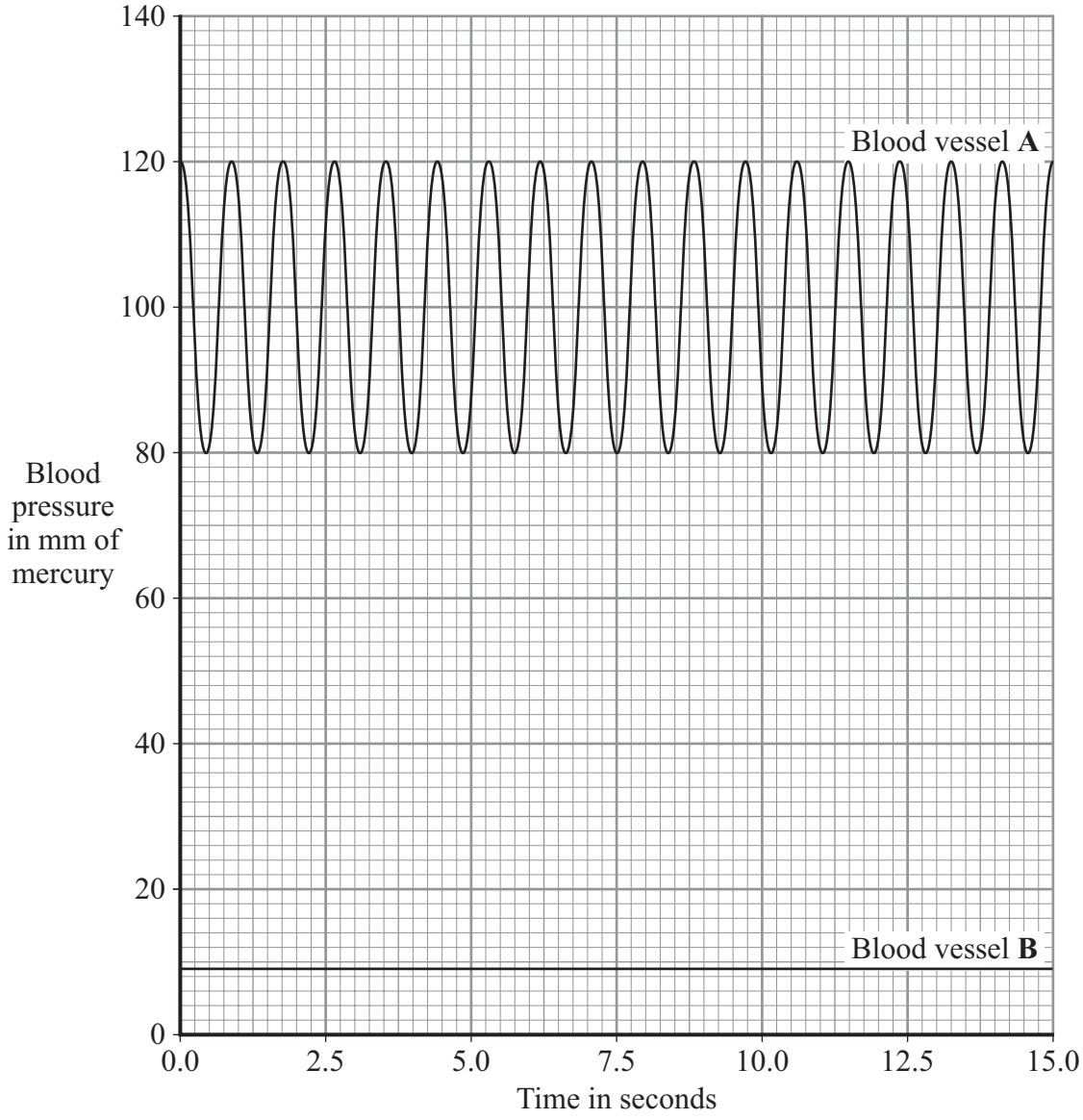
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Areas outside the box will not be scanned for marking

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

1 The heart pumps blood around the body. This causes blood to leave the heart at high pressure.

The graph shows blood pressure measurements for a person at rest.
The blood pressure was measured in an artery and in a vein.



Areas outside the box will not be scanned for marking

1 (a) Which blood vessel, **A** or **B**, is the artery?

Blood vessel .....

Give **two** reasons for your answer.

Reason 1 .....

.....

Reason 2 .....

.....

(2 marks)

1 (b) Use information from the graph to answer these questions.

1 (b) (i) How many times did the heart beat in 15 seconds? .....

(1 mark)

1 (b) (ii) Use your answer from part (b)(i) to calculate the person's heart rate per minute.

.....

.....

Heart rate = ... beats per minute

(1 mark)

1 (c) During exercise, the heart rate increases. This supplies useful substances to the muscles and removes waste materials from the muscles at a faster rate.

1 (c) (i) Name **two** useful substances that must be supplied to the muscles at a faster rate during exercise.

1 .....

2 .....

(2 marks)

1 (c) (ii) Name **one** waste substance that must be removed from the muscles at a faster rate during exercise.

.....

(1 mark)

7

Turn over ▶

Areas outside the box will not be scanned for marking

2 Three students each prepared a flask of yoghurt.

- They used equal volumes of the same type of milk.
- They added equal amounts of a 'yoghurt starter culture' (plain yoghurt which contains living bacteria).
- They then placed the three flasks in a water bath at 25 °C.
- They measured the pH of their yoghurt at 50-minute intervals using a pH meter.

The table shows their pH measurements.

Time in minutes	**pH**			
	Flask 1	**Flask 2**	**Flask 3**	**Mean**
0	6.4	6.4	6.5	6.4
50	6.3	6.4	6.5	6.4
100	5.9	6.1	6.3	6.1
150	5.0	5.5	5.7	5.4
200	4.6	5.8	4.9	5.1
250	4.3	4.6	4.6	4.5

2 (a) (i) Give **two** variables that were controlled in this investigation.

1 .....

2 .....

(2 marks)

2 (a) (ii) Why was it helpful to do the investigation three times and to calculate mean values?

.....

.....

(1 mark)

2 (a) (iii) The students chose to use a pH meter rather than pH indicator papers.

Explain why.

.....

.....

(1 mark)

(Extra space) .....

Areas outside the box will not be scanned for marking

2 (b) One of the results in the table appears to be anomalous.

Which result is this?

.....

.....

(1 mark)

2 (c) The students noticed that, after 200 minutes, their yoghurts began to thicken.

What caused this?

.....

.....

.....

.....

(2 marks)

(Extra space) .....

7

Turn over for the next question

Areas outside the box will not be scanned for marking

3 **Photograph 1** shows a biogas generator on a farm in India.

Photograph 1



3 (a) Name the fuel gas present in biogas.

.....

(1 mark)

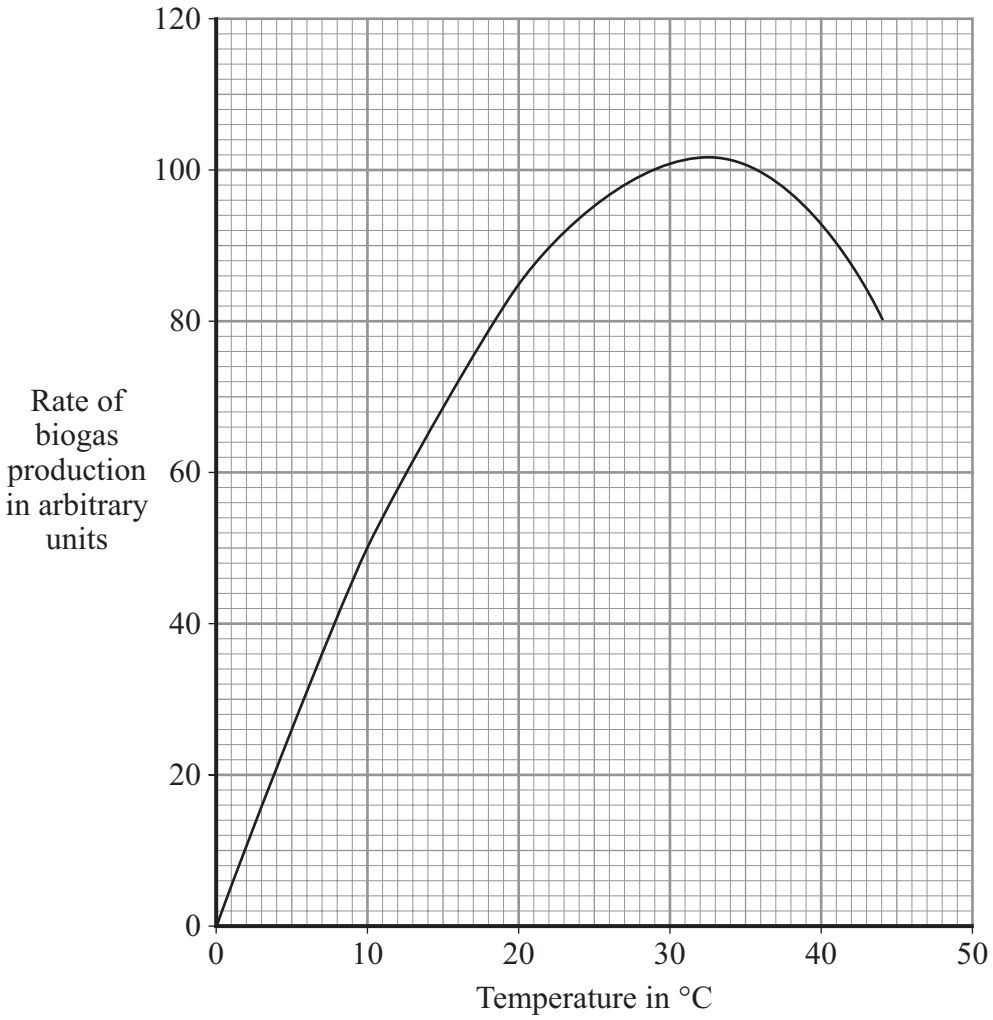
3 (b) Name the process that produces biogas.

.....

(1 mark)

Areas outside the box will not be scanned for marking

3 (c) The graph shows the effect of temperature on the rate of biogas production.



3 (c) (i) What is the best temperature for biogas production? .....°C

(1 mark)

3 (c) (ii) In India, daytime temperatures can sometimes be higher than 40 °C.
It is useful to place the biogas generator underground.

Use information from the graph to suggest why.

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(2 marks)

Question 3 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

3 (d) **Photograph 2** shows a set of three biogas generators built at a sewage works in the UK in 2004.

Photograph 2



Temperatures at the UK sewage works vary between 0 °C and 25 °C.
The UK biogas generator has concrete walls, 60 cm thick.

How does the thickness of the walls affect the rate of biogas production?

Give a reason for your answer.

.....

.....

.....

.....

(2 marks)

(Extra space) .....

7

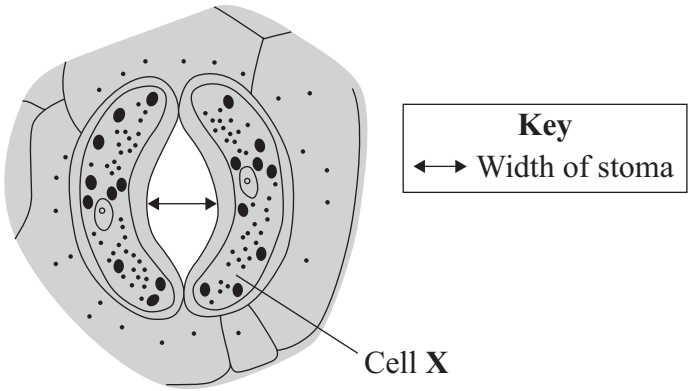
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ANSWER IN THE SPACES PROVIDED

Areas outside the box will not be scanned for marking

4 Plant leaves have many stomata.

The diagram shows a stoma.



4 (a) Name cell **X** .....

(1 mark)

4 (b) The table shows the mean widths of the stomata at different times of the day for two different species of plant.
Species **A** normally grows in hot, dry deserts.
Species **B** grows in the UK.

	Time of day in hours	Mean width of stomata as a percentage of their maximum width	
		Species A	Species B
Dark	0	95	5
	2	86	5
	4	52	6
Light	6	6	40
	8	4	92
	10	2	98
	12	1	100
	14	0	100
	16	1	96
	18	5	54
Dark	20	86	6
	22	93	5
	24	95	5

Areas outside the box will not be scanned for marking

The data in the table show that species **A** is better adapted than species **B** to living in hot, dry deserts.

Explain how.

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(4 marks)

(Extra space) .....

.....

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5

Turn over for the next question

Areas outside the box will not be scanned for marking

5 (a) The concentration of sulfate ions was measured in the roots of barley plants and in the water in the surrounding soil.

The table shows the results.

	Concentration of sulfate ions in mmol per dm^3
Roots of barley plants	1.4
Soil	0.15

Is it possible for the barley roots to take up sulfate ions from the soil by diffusion?

Draw a ring around your answer. **Yes / No**

Explain your answer.

.....

.....

.....

.....

(2 marks)

5 (b) Some scientists investigated the amounts of sulfate ions taken up by barley roots in the presence of oxygen and when no oxygen was present.

The graph on the opposite page shows the results.

5 (b) (i) The graph shows that the rate of sulfate ion uptake between 100 and 200 minutes, **without** oxygen, was 0.4 arbitrary units per minute.

The rate of sulfate ion uptake between 100 and 200 minutes, **with** oxygen, was greater.

How much greater was it? Show clearly how you work out your answer.

.....

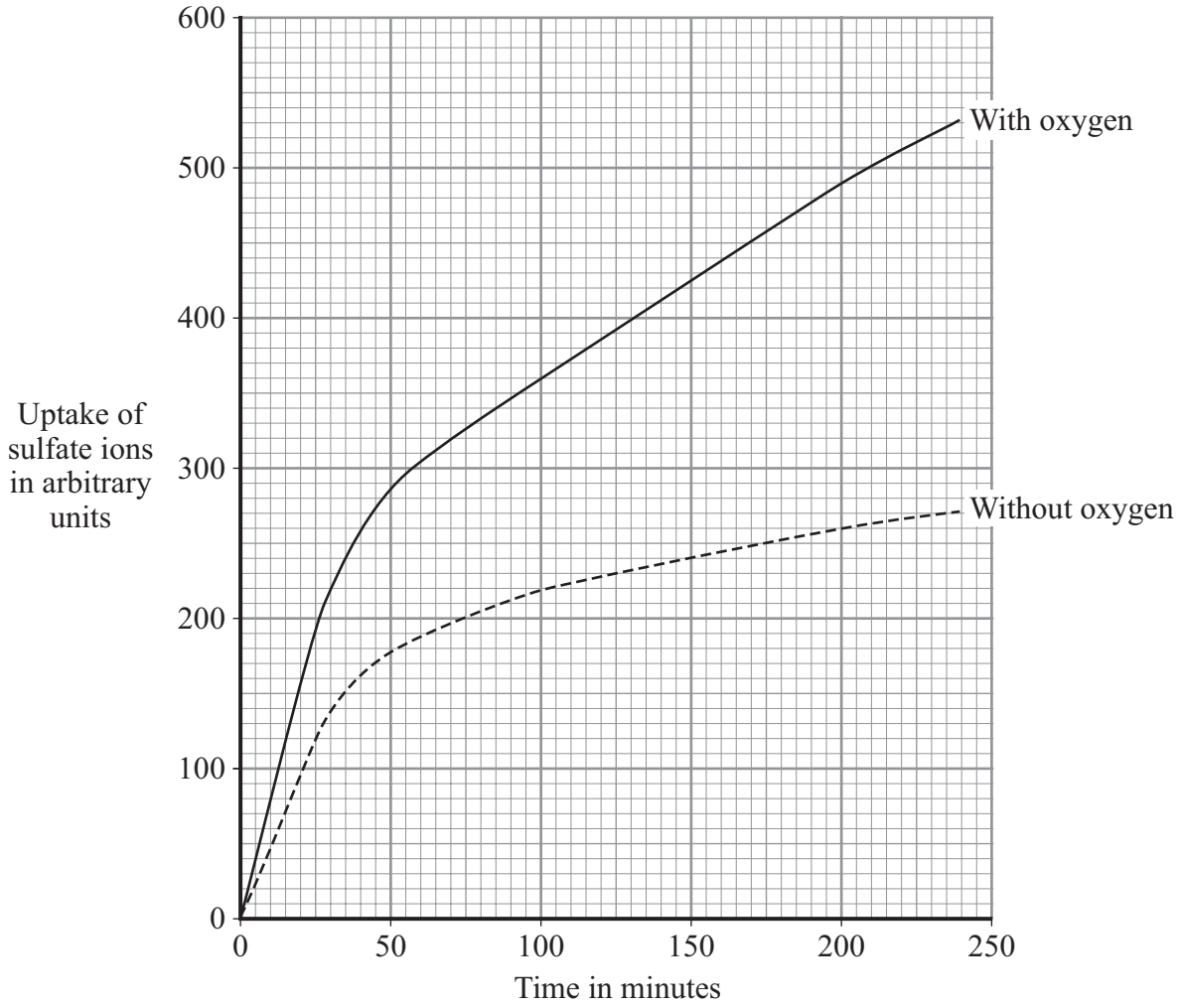
.....

.....

Answer ..... arbitrary units

(2 marks)

Areas outside the box will not be scanned for marking



5 (b) (ii) The barley roots were able to take up more sulfate ions with oxygen than without oxygen.

Explain how.

.....

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.....

.....

(3 marks)

(Extra space) .....

7

Turn over ▶

Areas outside the box will not be scanned for marking

6 Microorganisms are often used in the industrial production of useful substances.

The fungus, *Penicillium chrysogenum*, can be used to make an enzyme that digests the sugar sucrose. When it is growing in a medium containing sucrose, the fungus releases this enzyme into the surrounding solution.

6 (a) Explain why it is useful to the fungus to release the enzyme into the surrounding solution.

.....

.....

.....

.....

.....

(2 marks)

6 (b) Before setting up an industrial fermenter, laboratory-scale investigations are carried out to find the best conditions to use.

A manufacturer investigated the effect of changing several factors on the amount of enzyme produced by the fungus.

The results are shown in the table.

Condition	**Concentration of enzyme produced in arbitrary units**		
	24 hours	**72 hours**	**120 hours**
Amount of fungus added as %			
1	9.0	28.8	44.4
5	7.2	54.0	60.0
25	6.0	66.0	62.4
Aeration rate in arbitrary units			
0.5	9.0	36.0	45.8
1.0	7.2	54.0	60.0
2.0	10.8	43.2	52.8
Sucrose concentration at start as %			
4	7.2	54.0	60.0
8	3.0	29.7	48.3
12	0	54.0	21.6

Areas outside the box will not be scanned for marking

The manufacturer decided to use the following conditions:

- amount of fungus = 5%
- aeration rate = 1.0 arbitrary units
- time = 72 hours.

Suggest an explanation for each of the following.

6 (b) (i) The manufacturer decided to add 5% fungus rather than 25%.

.....

.....

.....

.....

(2 marks)

(Extra space) .....

6 (b) (ii) The concentration of enzyme produced at an aeration rate of 2.0 arbitrary units was less than the concentration at an aeration rate of 1.0 arbitrary units.

.....

.....

.....

.....

(2 marks)

(Extra space) .....

6

Turn over for the next question

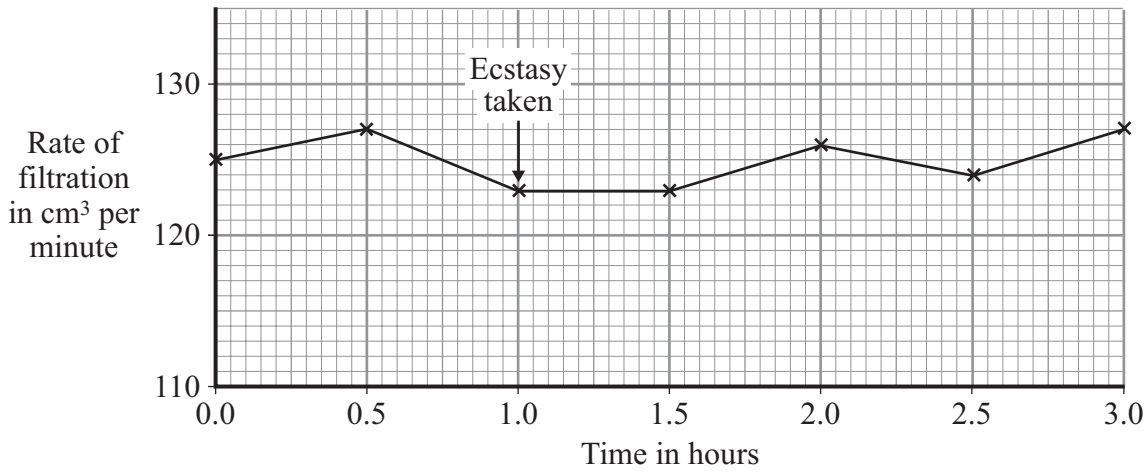
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7 Taking the drug ecstasy affects the rate of urine flow from the kidneys.

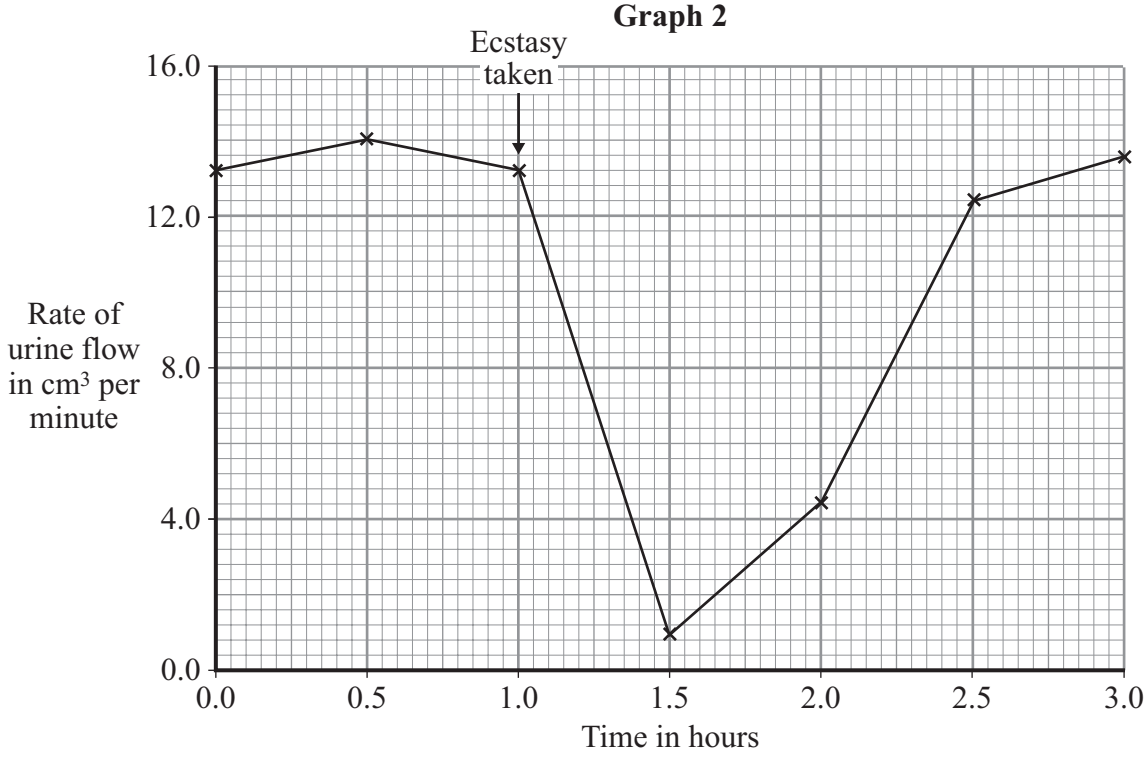
Graph 1 shows the rate of filtration by the kidneys of a healthy person.
Graph 2 shows the rate of urine flow from the kidneys of the same person.

One hour after the first measurement, the person took ecstasy.

Graph 1



Graph 2



Areas outside the box will not be scanned for marking

7 (a) Describe the effect of taking ecstasy on

7 (a) (i) the rate of filtration

.....

.....

(1 mark)

7 (a) (ii) the rate of urine flow.

.....

.....

(1 mark)

7 (b) Use information from the graphs and your understanding of how the kidney works to answer the following questions.

7 (b) (i) Suggest an explanation for the change in the rate of urine flow after the person took ecstasy.

.....

.....

.....

.....

(2 marks)

(Extra space) .....

7 (b) (ii) After a person has taken ecstasy, the concentration of ions in the blood changes.

Suggest an explanation for this.

.....

.....

.....

.....

(2 marks)

(Extra space) .....

6

END OF QUESTIONS

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Question 3 Indian biogas generator, © engINdia, http://home2.btconnect.com/engindia, 2005

Question 3(d) Reading biogas generators, image courtesy of Black and Veatch Ltd

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Version 1.0: 21.07

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Biology 4411

BLY3H Unit 3 Biology

Mark Scheme

2009 examination – June series

STEMUP.CO.UK

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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BLY3H

Question 1

question	answers	extra information	mark
1(a)	A	no mark – can be specified in reason part if B given = no marks throughout if unspecified plus two good reasons = 1 mark	
	high(er) pressure in A	allow opposite for B do not accept 'zero pressure' for B	1
	pulse / described in A	accept fluctuates / 'changes' allow reference to beats / beating ignore reference to artery pumping	1
1(b)(i)	17		1
1(b)(ii)	68	accept correct answer from candidate's (b)(i) x 4	1
1(c)(i)	oxygen / oxygenated blood	allow adrenaline ignore air	1
	glucose / sugar	extra wrong answer cancels eg sucrose / starch / glycogen / glucagon / water allow fructose as an alternative to glucose ignore energy ignore food	1

Question 1 continues on the next page…

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BLY3H

Question 1 Continued

question	answers	extra information	mark
1(c)(ii)	carbon dioxide / CO_2 / lactic acid	allow CO2 / CO^2 ignore water	1
Total			**7**

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BLY3H

Question 2

question	answers	extra information	mark
2(a)(i)	any **two** from: • volume / amount of milk • type of milk • amount / volume of starter culture / yoghurt / bacteria • type of starter culture • temperature / 25°C • time <u>interval</u> / every 50 minutes	allow heat ignore ' time' unqualified	2
2(a)(ii)	(more) reliable / (more) representative / typical **or** detect / allow for / reduce effect of / anomalies / errors	do **not** accept accurate / precise / true ignore fair / valid	1
2(a)(iii)	(greater) accuracy of measurement **or** (greater) sensitivity **or** (more) precise / exact **or** can detect smaller changes	accept converse for pH papers allow paper obscured by yoghurt ignore vague answers eg clear / definite do **not** accept words such as reliable / valid	1
2(b)	flask 2 at 200 minutes / 5.8		1
2(c)	lactic acid production	 allow decrease in pH ignore extras	1 1
Total			**7**

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BLY3H

Question 3

question	answers	extra information	mark
3(a)	methane	accept CH_4 / CH4 / CH^4 extras cancel	1
3(b)	**anaerobic** respiration **or** fermentation	ignore decay / decomposition / digestion do **not** allow aerobic	1
3(c)(i)	in range 32 – 33		1
3(c)(ii)	keep cool(er) **or** keep below 40 (°C) **or** insulate from heat high(er) / optimum rate of biogas production **or** rate decreases at higher temperatures **or** works more efficiently	allow keep at optimum temperature if (c)(i) < 40 allow correct reference to rate of enzyme action eg high temperature would denature enzyme owtte	1 1
3(d)	increases rate / high rate insulates / keeps warm	allow 'works better' allow maintains optimum temperature	1 1
Total			**7**

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BLY3H

Question 4

question	answers	extra information	mark
4(a)	guard (cell)	ignore stoma / stomata	1
4(b)	<u>Species A :</u> • stomata open in dark / at night **or** close in light / in day • stomata closed during warm(est) period **or** open when cool(er) • heat (energy) / warmth increases evaporation / transpiration • reduces water loss / evaporation / transpiration	allow converse points for species B must give explicit link between heat and transpiration ignore photosynthesis	 1 1 1 1
Total			**5**

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BLY3H

Question 5

question	answers	extra information	mark
5(a)	No	no mark if yes max 1 for correct statement	
	diffusion is down the concentration gradient	accept by diffusion ions would leave the root	1
	to enter must go up / against the concentration gradient **or** concentration higher in the root **or** concentration lower in the soil		1
5(b)(i)	0.9 **or** 3.25	for correct answer with or without working if answer incorrect 1.3 **or** their rate – 0.4 gains 1 mark **or** 130 – 40 **or** 90 gains 1 mark	2
5(b)(ii)	(uptake) by active transport		1
	requires energy		1
	more energy from aerobic respiration **or** more energy when oxygen is present		1
Total			**7**

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BLY3H

Question 6

question	answers	extra information	mark
6(a)	sucrose → smaller (molecules) **or** it gives simple sugars / glucose / fructose (products) can be absorbed / taken in	 if answer refers to digestion, assume reference is to products	1 1
6(b)(i)	only small increase in yield at 25% **or** not much difference in yield at 25% extra cost / less economic if using 25% fungus		1 1

Question 6 continues on the next page…

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BLY3H

Question 6 Continued

question	answers	extra information	mark
6(b)(ii)	any sensible suggestion plus explanation eg • increased oxygen → increased respiration rate • less substrate available for making enzyme / toxic product made **or** • more respiration occurs which releases heat (1) • (increase in temperature) reduces amount of enzyme(1) **or** • anomalous result(1) • suggestion why eg zero error on instrument (1) **or** • initial aeration limiting factor (1) • later something else is limiting (1) **or** • 1.0 optimum fungus growth (1) • higher concentrations oxygen becomes toxic / inhibits growth of fungus (1) **or** • aeration at 2.0 too vigorous / damages fungus (1) • less fungus remains to make enzyme (1) **or** • higher aeration causes cooling (1) • less growth / enzyme production if cooler (1) **or** • air contaminated with microorgamisms (1) • microorganism compete **or** make toxin (1)	suggestion explanation must mention heat or temperature	1 1
Total			**6**

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BLY3H

Question 7

question	answers	extra information	mark
7(a)(i)	no effect / little effect		1
7(a)(ii)	reduced	ignore reference to <u>later</u> increase	1
7(b)(i)	<u>more</u> (re)absorption **or** more (material) taken into blood of water	do not allow if extra incorrect reference to filtration made allow **only** if linked to reabsorption do **not** accept water if in a list of substances	1 1
7(b)(ii)	ions in blood diluted **or** concentration of ions decreases increased water reabsorption **or** more water present in blood	 do not allow if extra incorrect reference to filtration made accept sensible alternative suggestion eg reabsorption of ions disrupted	1 1
Total			**6**

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

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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

You will need no other materials.
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. 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.

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- 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			

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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.

.....

.....

.....

.....

Answer = ... cm^3 per minute

(2 marks)

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

Explain why this is helpful during exercise.

.....

.....

.....

.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

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

1 .....

.....

2 .....

.....

(2 marks)

6

Turn over for the next question

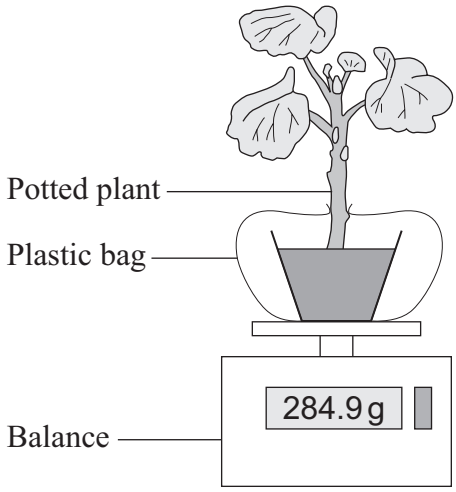
Areas outside the box will not be scanned for marking

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

.....

(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

Areas outside the box will not be scanned for marking

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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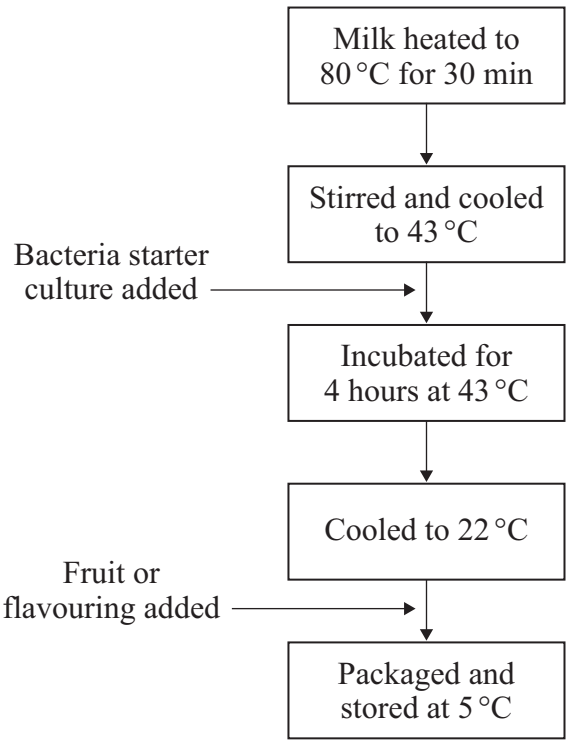
(2 marks)

4

Turn over for the next question

Areas outside the box will not be scanned for marking

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)

Areas outside the box will not be scanned for marking

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.

.....

.....

(1 mark)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

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.

1 .....

.....

2 .....

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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.

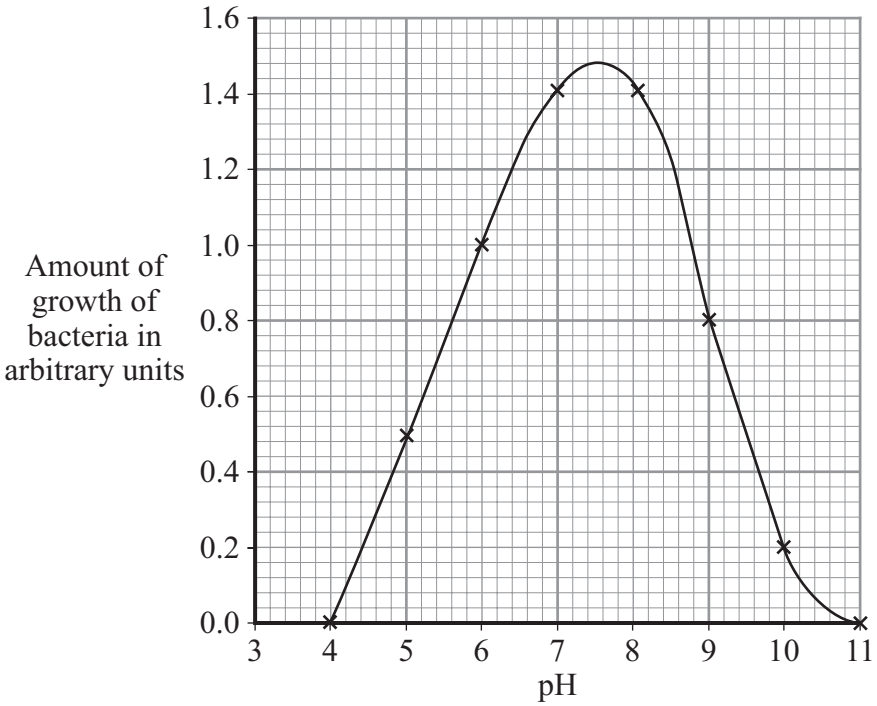
1 .....

2 .....

(2 marks)

Areas outside the box will not be scanned for marking

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?

.....

.....

(1 mark)

6

Turn over ▶

Areas outside the box will not be scanned for marking

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.

	Relative rates of absorption	
Sugar	**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.

1 .....

2 .....

(1 mark)

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

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(3 marks)

Areas outside the box will not be scanned for marking

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)

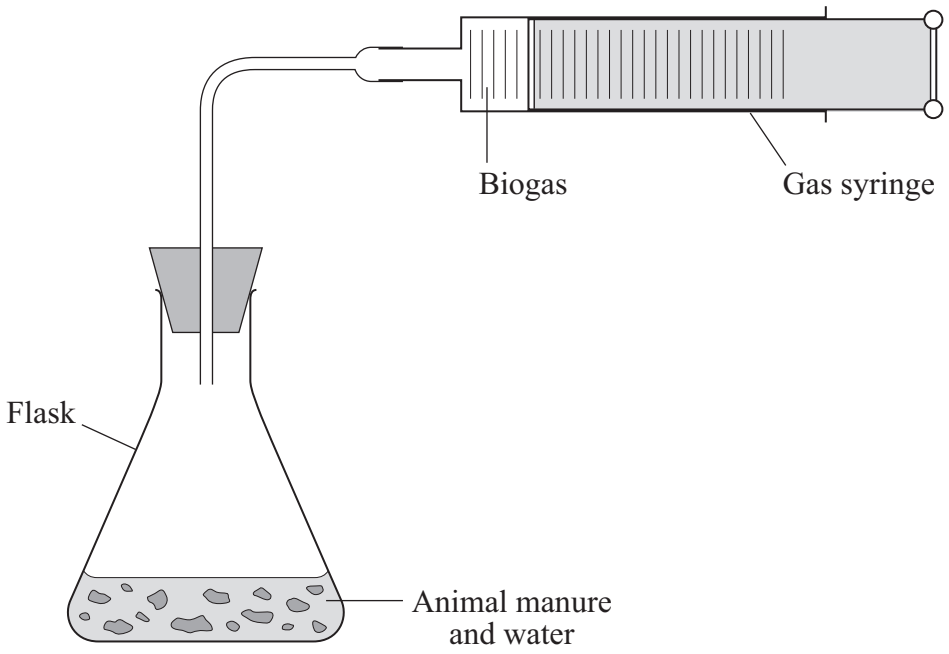
6

Turn over for the next question

Areas outside the box will not be scanned for marking

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 .....

2 ..... *(1 mark)*

Areas outside the box will not be scanned for marking

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)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

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.

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(2 marks)

7 (b) Substance **B** is **not** found in the urine of a healthy person.

Suggest an explanation for this.

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(2 marks)

Areas outside the box will not be scanned for marking

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)

8

Turn over for the next question

Areas outside the box will not be scanned for marking

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)

5

END OF QUESTIONS

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Version 1: 0109

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Biology 4411

BLY3H Unit Biology 3

Mark Scheme

2009 examination – January series

STEMUP.CO.UK

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
1(a)(i)	19 800	for correct answer ignore working or lack of working 165 × 120 but no answer / wrong answer = **1** mark (ignore extras)	2
1(a)(ii)	any **two** from: • for respiration • energy released • prevents anaerobic respiration • prevents build-up of lactic acid	 ignore oxygen debt allow energy produced	2
1(b)	any **two** from: • increased breathing rate • increased depth of breathing **or** deep breathing • dilation of arteries / vasodilation • blood diverted from elsewhere	 } more breathing is max **1** mark ignore increase in heart rate allow heavier breathing do **not** allow harder breathing allow blood vessels dilate do **not** allow veins / capillaries dilate ignore name of organ	2
Total			**6**

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
2(a)	transpiration / evaporation / diffusion	ignore osmosis	1
2(b)(i)	D		1
2(b)(ii)	any **two** from: • more / faster diffusion **or** evaporation **or** transpiration • molecules move faster • maintains concentration gradient **or** keeps water concentration low in the air **or** brings in more dry air **or** removes damp air / water		2
Total			**4**

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
3(a)	prevents denaturation / change / damage of proteins / enzymes **or** prevents bacteria being killed / destroyed	allow protein is 'destroyed' do **not** allow 'bacteria denatured' **or** 'protein killed'	1
3(b)(i)	any **two** from: • anaerobic respiration • lactic (production) • acid (produced)	 do **not** allow 'bacteria are acidic' allow max **1** mark if incorrect named acid	2
3(b)(ii)	any **one** from: • thickens / clots / solidifies (milk) • kills other microorganisms **or** prevents other microbes growing • preserves yoghurt **or** prevents yoghurt going off **or** makes yoghurt last longer **or** keeps it fresh • reference to (improved) flavour	 allow reference to germs	1
3(c)	reduce / prevent growth / reproduction of microorganisms **or** to prevent decay **or** to preserve it **or** to keep it fresh **or** to prevent it becoming <u>too</u> sour	allow reference to germs ignore curdling	1
Total			**5**

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
4(a)	any **two** from: • sterilise / kill microorganisms • method of sterilisation eg apparatus / media sterilised in oven / autoclave • pass flask mouth / pipette tip / loop / test tube mouth through flame • work near a flame • minimise opening of flask / test tube **or** hold non-vertical	 ignore 'cleaning' / 'disinfect' ignore 'germs' allow pressure cooker / boiling water allow idea of sealing / covering **or** prevent entry of air	2
4(b)	any **two** from: • temperature • concentration / amount of nutrients / ions • type of nutrient • volume / amount of solution • amount of bacteria added • agitation **or** amount of oxygen	 ignore references to time / type of bacterium	2
4(c)(i)	7.5	accept in range 7.4 – 7.6	1
4(c)(ii)	use more pH values around / close to pH 7.5 / between 7 and 8		1
Total			**6**

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
5(a)(i)	glucose **and** galactose		1
5(a)(ii)	any **three** from: Evidence: • absorption reduced by cyanide • absorb faster (than other sugars) Explanation: • active transport needs <u>energy</u> • less / no <u>energy</u> available / released if cyanide is there **or** less / no <u>energy</u> if no / less respiration	 allow converse allow <u>energy</u> produced ignore cyanide prevents respiration	3
5(b)	all / the sugars / they can be absorbed <u>when gut poisoned</u> / <u>with cyanide</u> **or** <u>when no respiration</u> (diffusion) does not need an <u>energy</u> supply		1 1
Total			**6**

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
6(a)	carbon dioxide **and** water vapour	either order	1
6(b)	less methane		1
	because less anaerobic respiration		1
	more CO_2	ignore water	1
	because (more) aerobic respiration		1
Total			**5**

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
7(a)(i)	**A**		1
7(a)(ii)	(protein) molecule is large cannot pass through filter	ignore letters (protein is) too big to get through the filter = **2** marks	1 1
7(b)	**B** is taken back into the blood **or B** is reabsorbed reabsorbed completely **or** reabsorbed after filtration		1 1
7(c)	RBC is too big to pass through filter Haemoglobin is inside red blood cells **or** haemoglobin released when red blood cell bursts Haemoglobin is small enough to pass through filter **or** haemoglobin diameter < pore diameter		1 1 1
Total			**8**

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
8	any **four** from:		4
	Points for Ethanol:	max **3** marks	
	• renewable fuel **or** carbon neutral **or** uses plant waste	allow petrol is non renewable	
	• less CO / hydrocarbons / SO_2 / NOx emissions	less named emission	
	• details of what emissions do eg CO is toxic / hydrocarbons cause smog / SO_2 / NO_x causes acid rain		
	Points against Ethanol:	max **3** marks	
	• releases less energy		
	• so need to burn more		
	• more fuel loss due to evaporation		
	• need to burn fuel to grow and process crop plants		
	• reduces (land use for) food crops / causes deforestation		
	Debatable points:		
	• claimed to increase NO_x emissions – but this not observed by air quality monitoring		
	• takes more energy to produce than it releases – but sugar cane yields 8:1 / maize yields 1.34:1		
	Conclusion:		
	sensible conclusion for **or** against ethanol substantiated by information from passage	**must** reach conclusion using information from the passage	1
Total			**5**