

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

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>a ruler.</li> </ul> <p>You may use a calculator.</p>
---

Time allowed: 45 minutes

**Instructions**

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**

- The maximum mark for this paper is 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

**Advice**

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

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

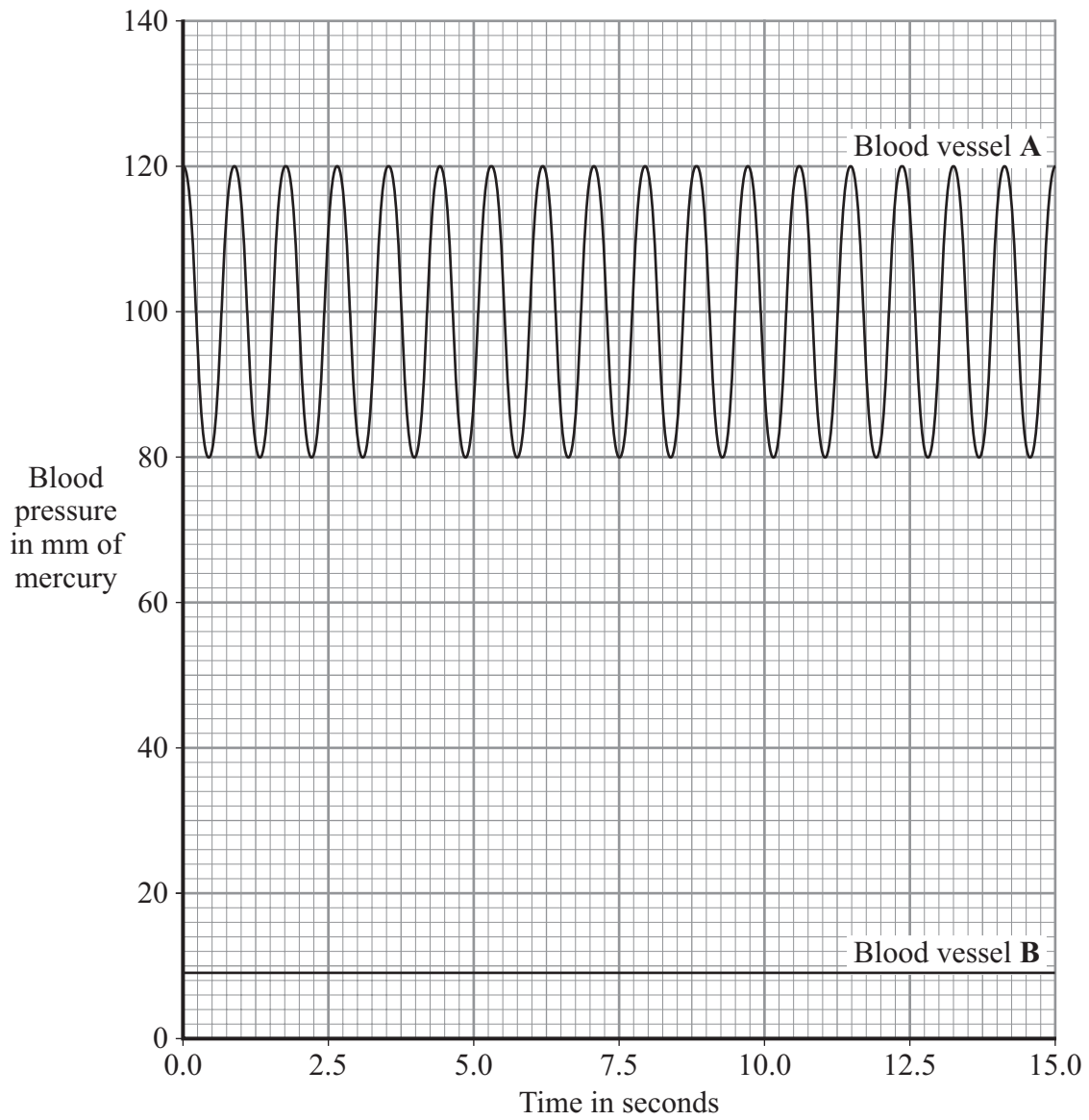


J U N O 9 B L Y 3 H O 1

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.



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 ►



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) .....



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) .....

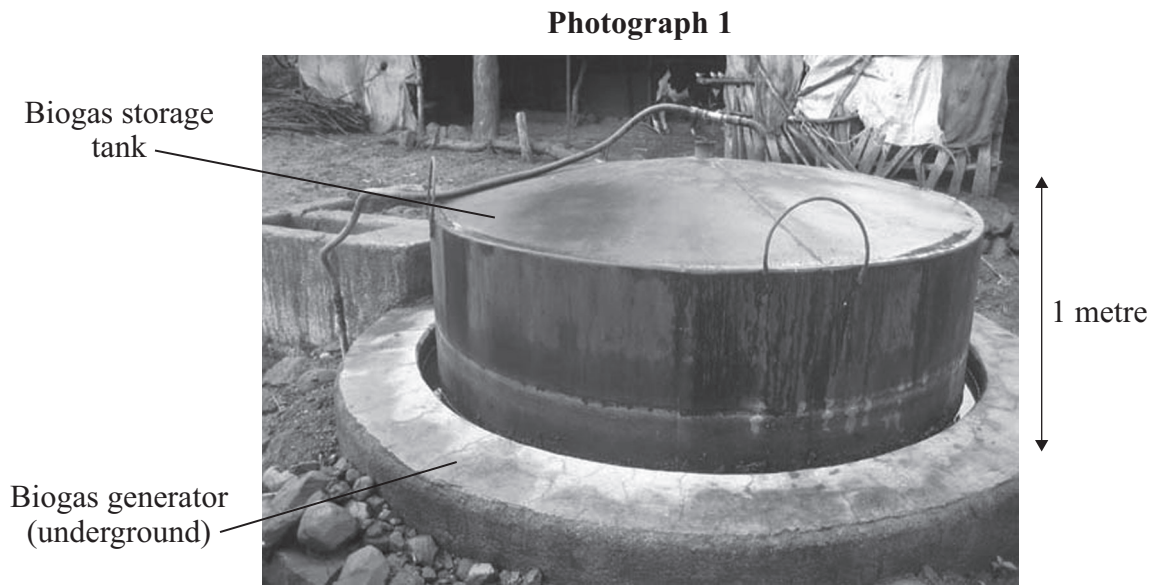
7

**Turn over for the next question**

**Turn over ▶**



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



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

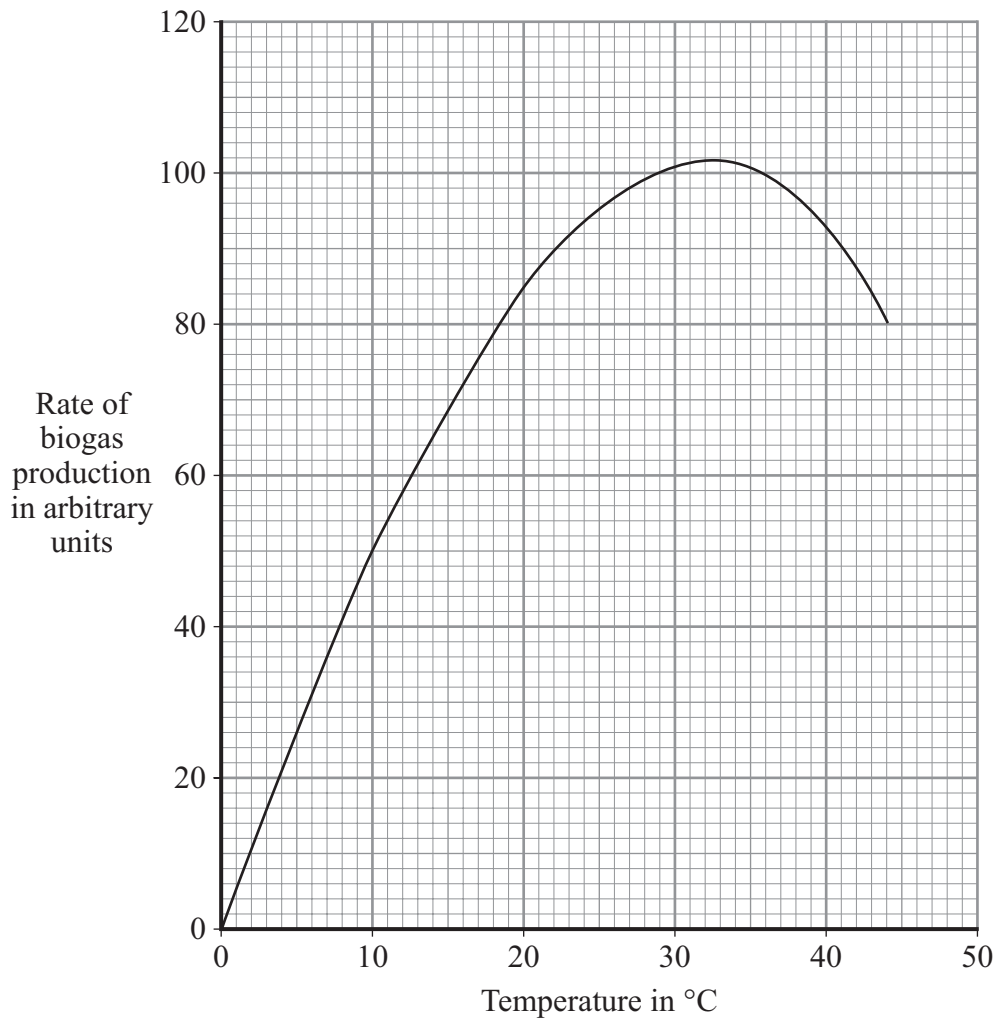
.....  
(1 mark)

3 (b) Name the process that produces biogas.

.....  
(1 mark)



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.

.....

.....

.....

.....

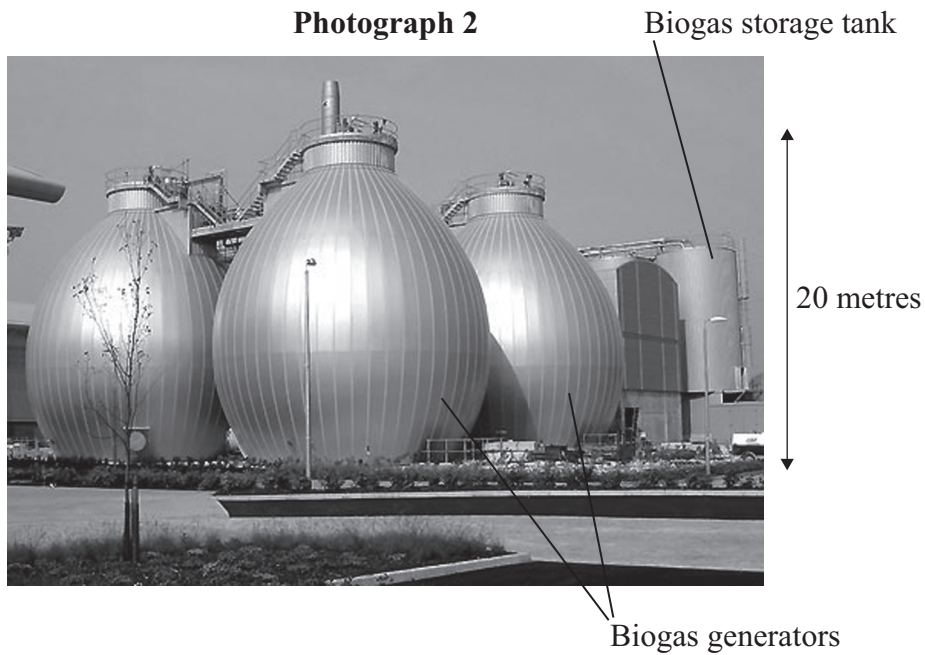
(2 marks)

Question 3 continues on the next page

Turn over ►



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



Temperatures at the UK sewage works vary between  $0^{\circ}\text{C}$  and  $25^{\circ}\text{C}$ .  
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)* .....





**Turn over for the next question**

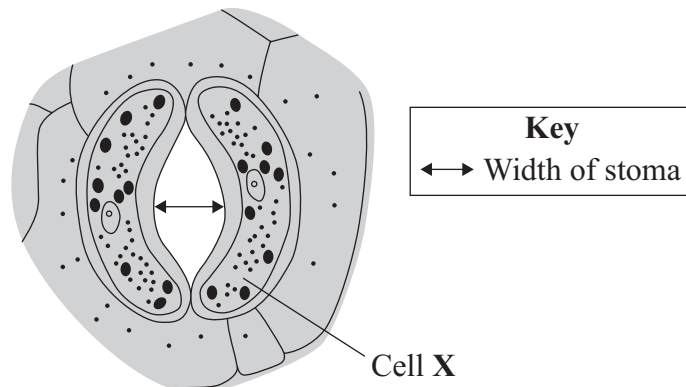
**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Turn over ►**



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



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

Explain how.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

(Extra space) .....

.....

.....

5

**Turn over for the next question**

**Turn over ►**



- 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 <sup>3</sup>
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.

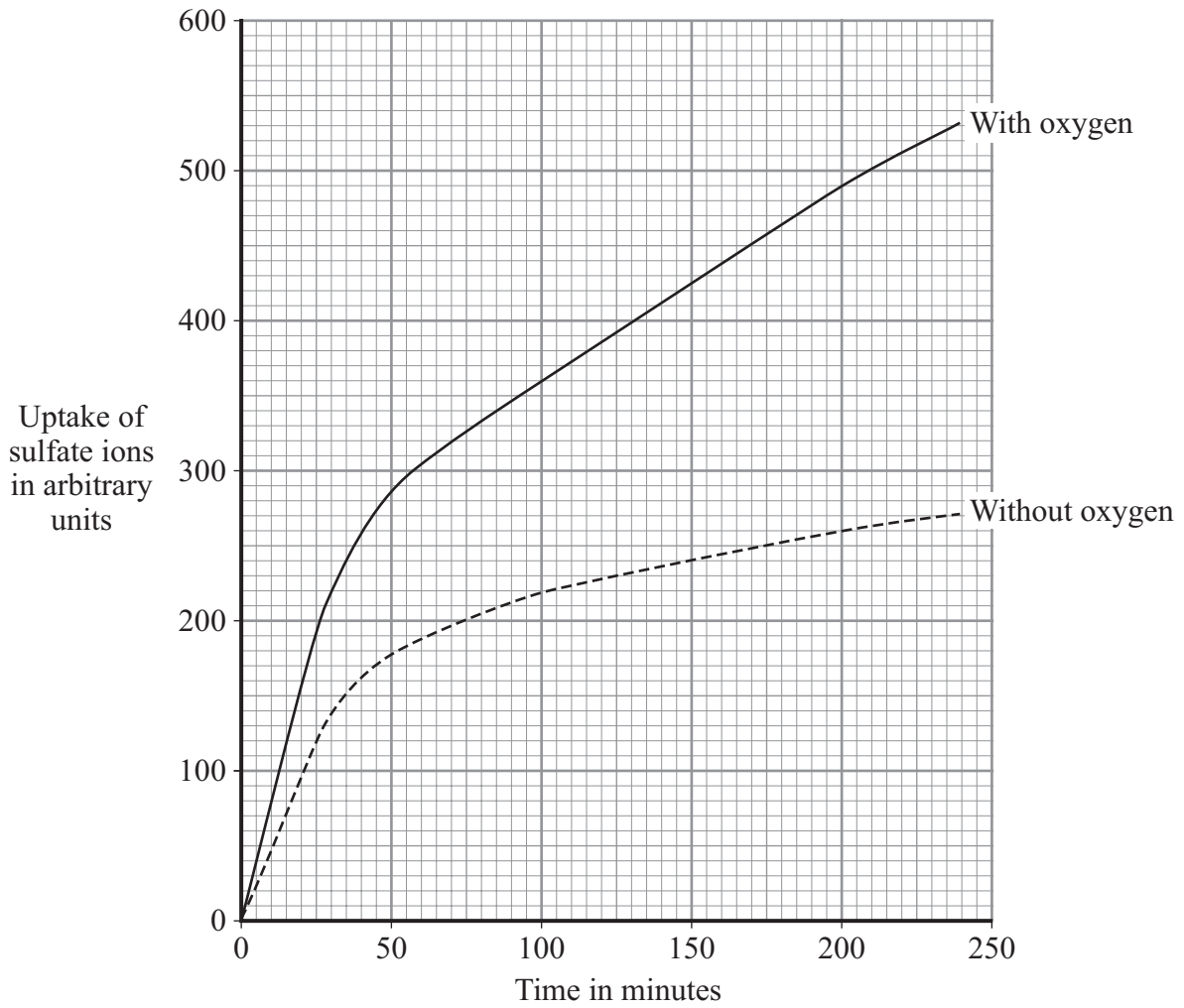
.....

.....

.....

Answer ..... arbitrary units  
(2 marks)





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

Explain how.

.....

.....

.....

.....

.....

.....

(3 marks)

(Extra space) .....

7

Turn over ▶



- 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



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

Turn over ►



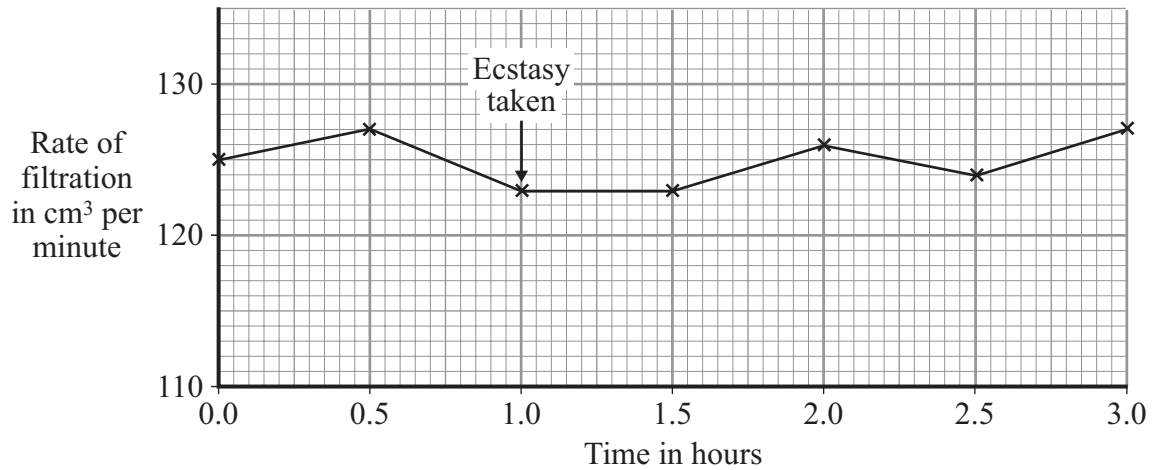
7 Taking the drug ecstasy affects the rate of urine flow from the kidneys.

**Graph 1** shows the rate of filtration by the kidneys of a healthy person.

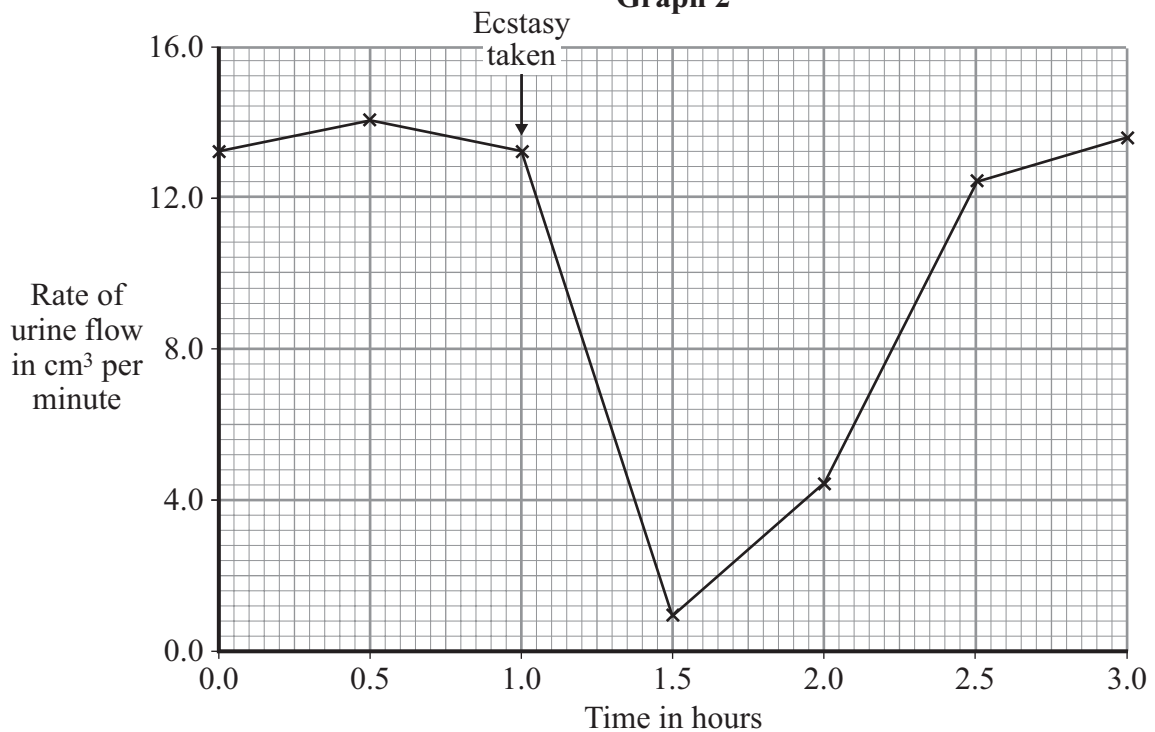
**Graph 2** shows the rate of urine flow from the kidneys of the same person.

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

**Graph 1**



**Graph 2**





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**



**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**



**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**



**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

ACKNOWLEDGEMENT OF COPYRIGHT-HOLDERS AND PUBLISHERS

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

