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

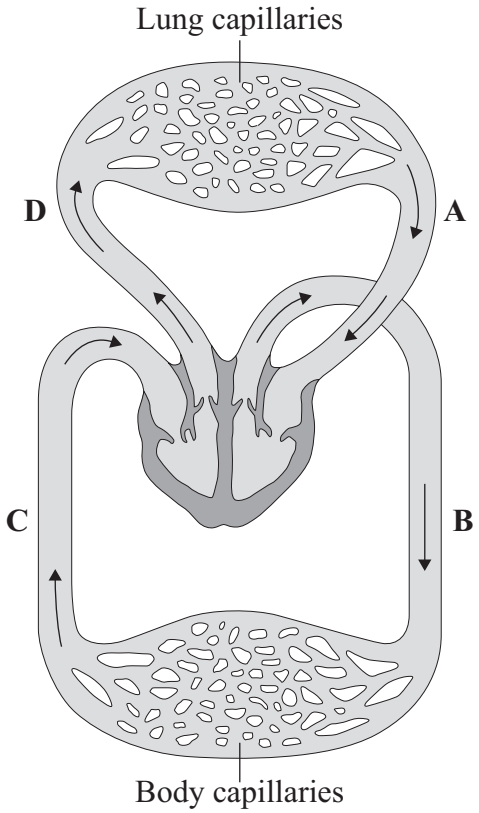
Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work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

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)

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)

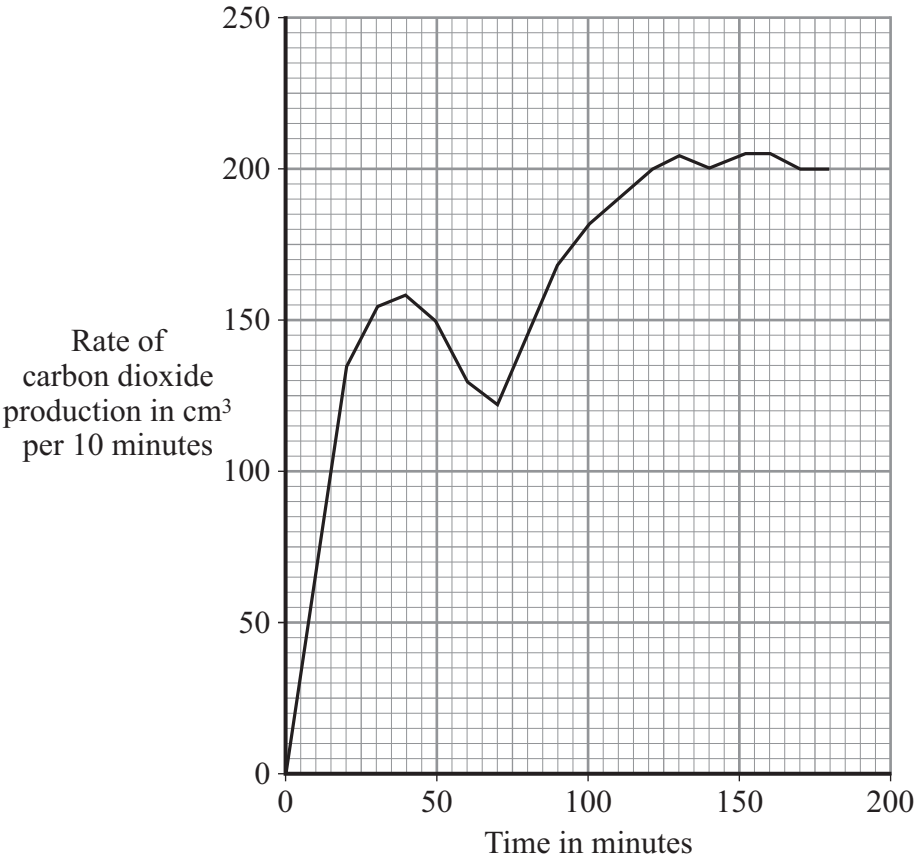
6

Turn over for the next question

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)

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

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.

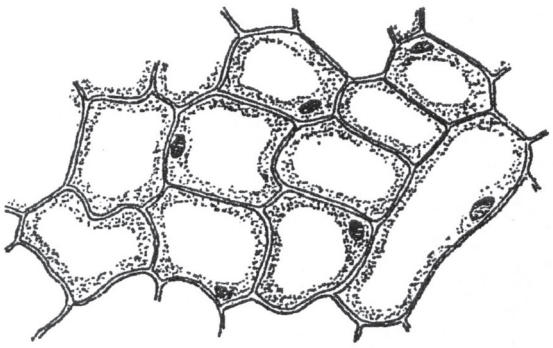
Time in hours	Mass of leaf + beaker in grams		
	Leaf A	Leaf B	Leaf C
0	50.00	55.01	51.99
1	49.99	54.95	51.90
3	49.97	54.90	51.85
5	49.95	54.86	51.80

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

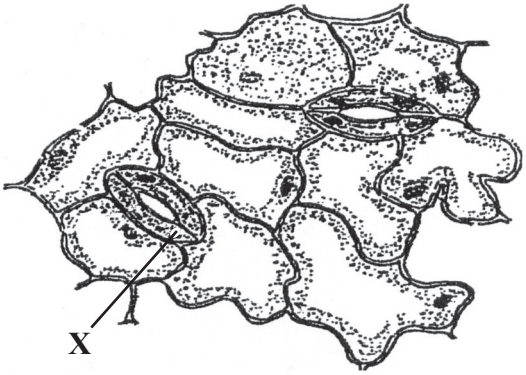
(1 mark)

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)

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

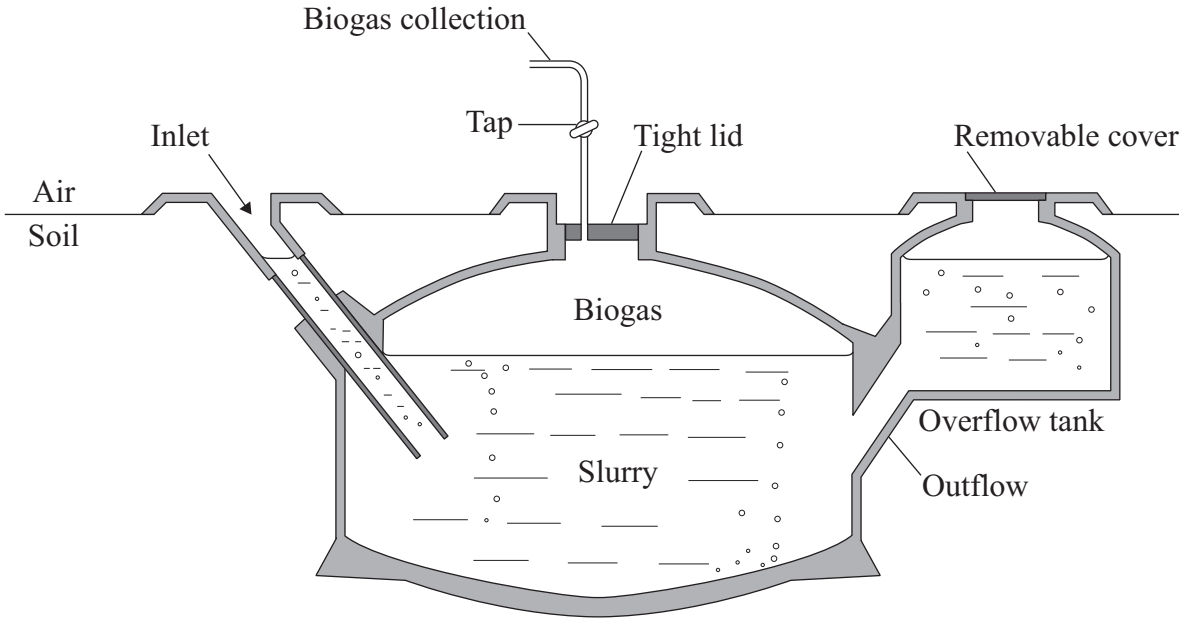
4 Biogas can be produced from waste materials that contain carbohydrates.

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.

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(2 marks)

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

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.

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.

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(1 mark)

7

Turn over for the next question

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)

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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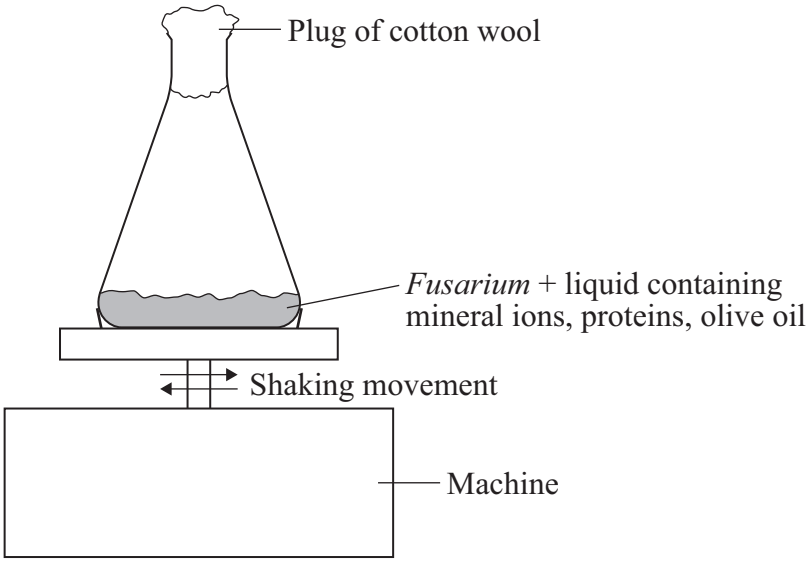
(4 marks)

7

Turn over for the next question

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)

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)

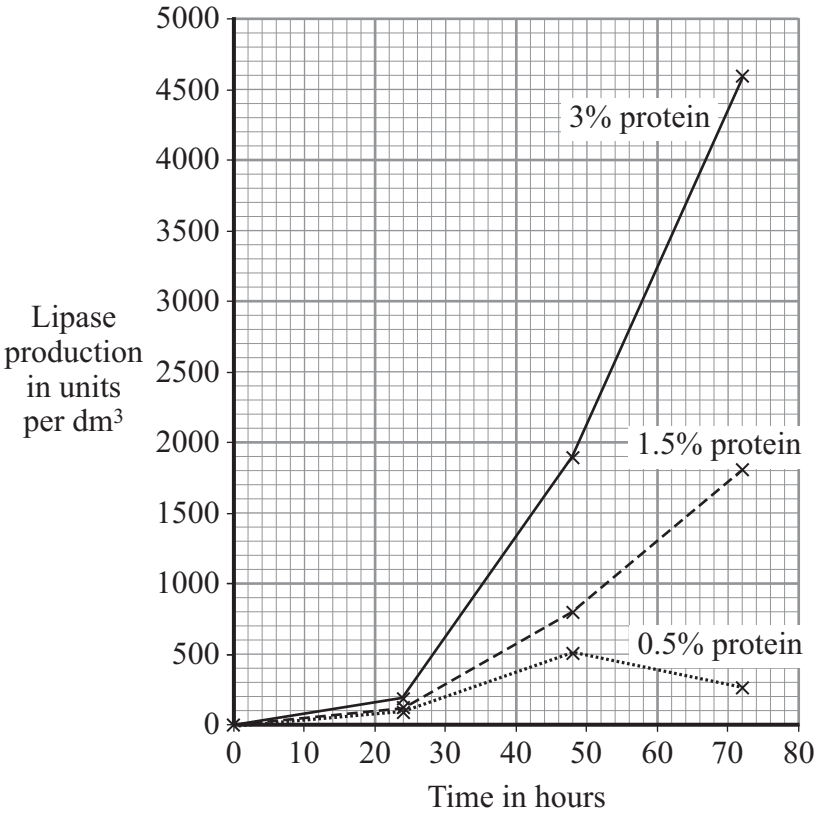
Question 7 continues on the next page

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

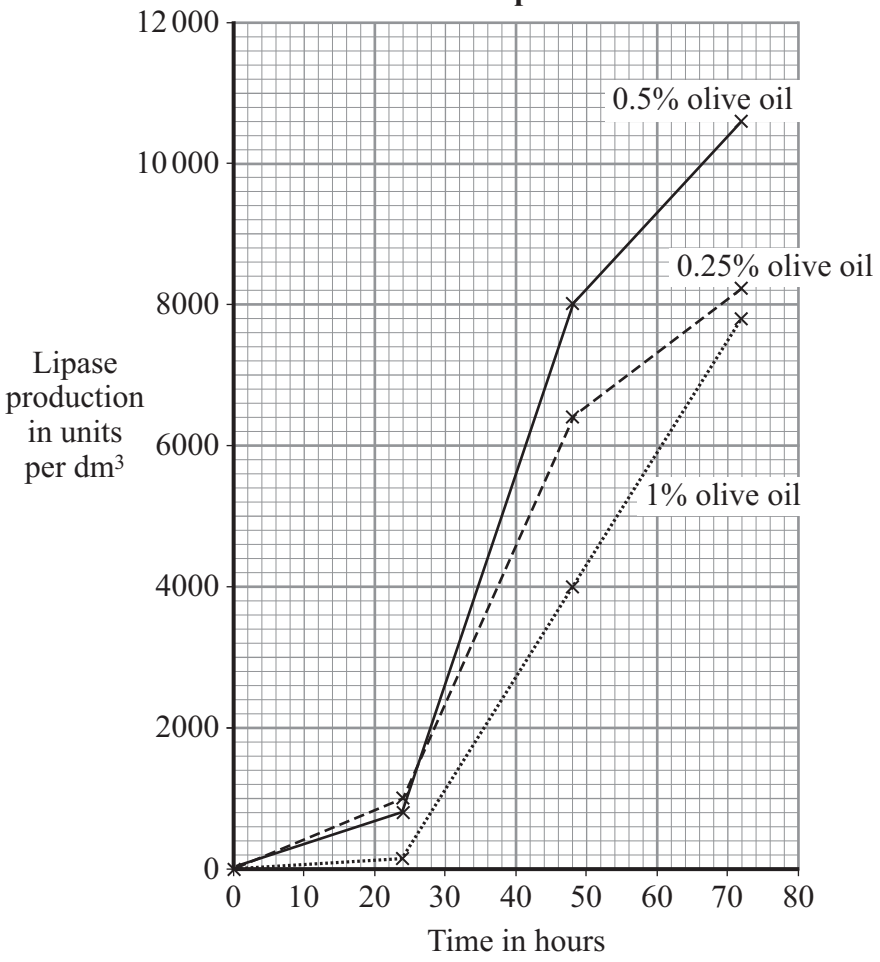
Graph 1 shows lipase production at three different concentrations of protein.

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

Graph 1



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

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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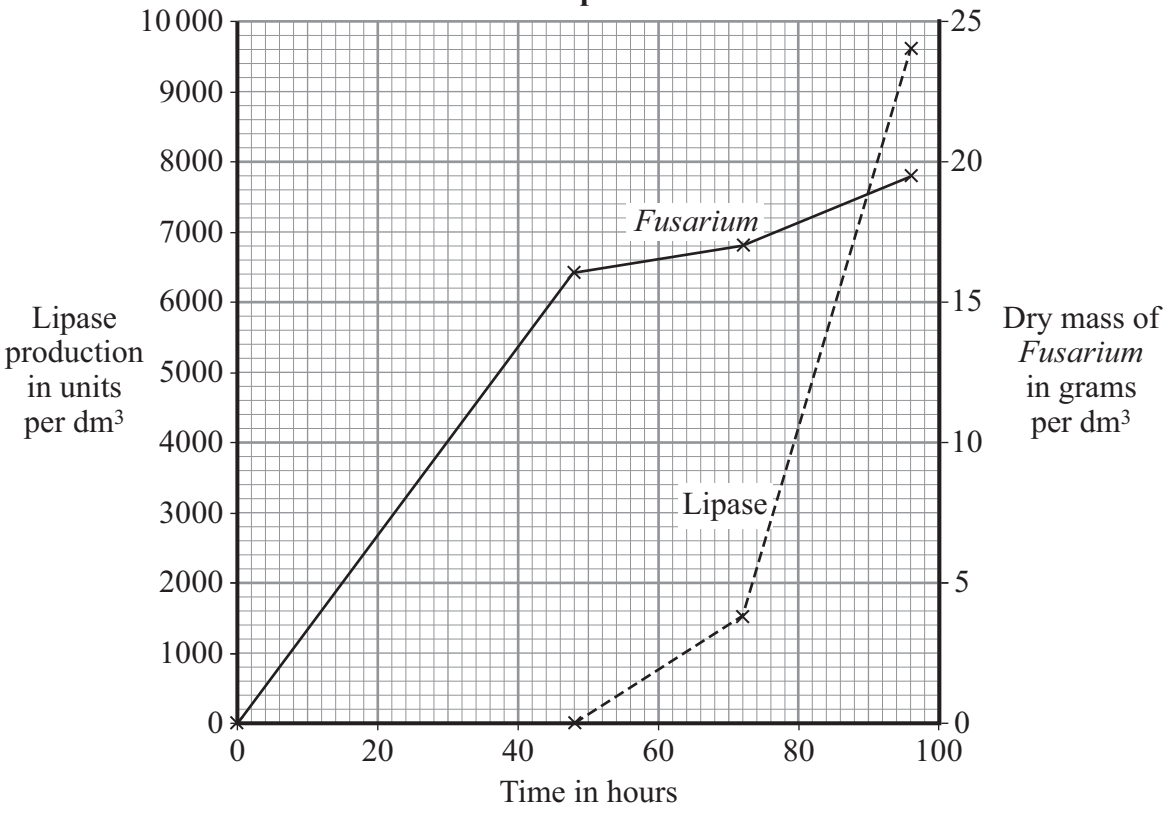
(2 marks)

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



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

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