

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	
8	
TOTAL	



General Certificate of Secondary Education  
Higher Tier  
June 2013

**Additional Science**  
Unit Biology B2

**BL2HP**

**Biology**  
Unit Biology B2

**H**

**Tuesday 14 May 2013 9.00 am to 10.00 am**

**For this paper you must have:**

- a ruler.

You may use a calculator.

**Time allowed**

- 1 hour

**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 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3(b) should be answered in continuous prose.  
In this question you will be marked on your ability to:
  - use good English
  - organise information clearly
  - use specialist vocabulary where appropriate.

**Advice**

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



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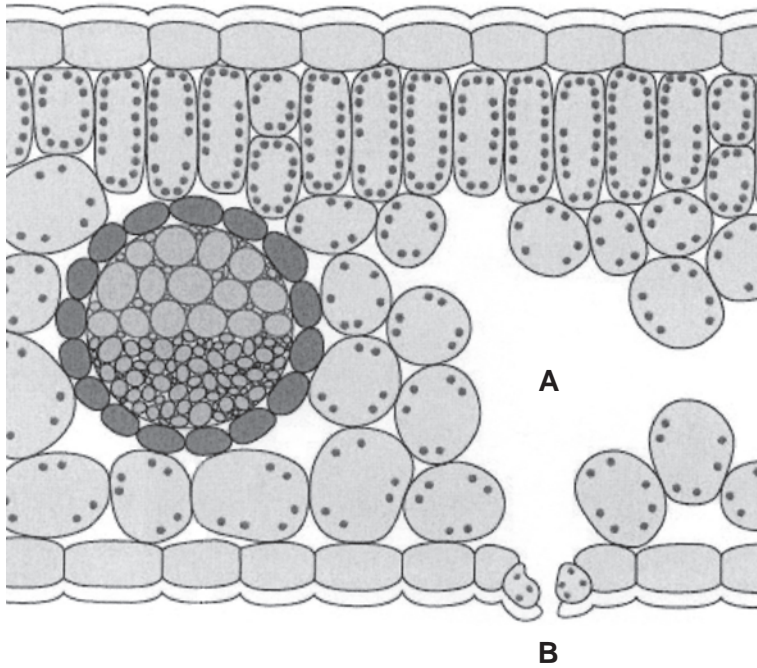
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ANSWER IN THE SPACES PROVIDED**



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

1 The diagram shows a section through a plant leaf.



1 (a) Use words from the box to name **two** tissues in the leaf that transport substances around the plant.

epidermis	mesophyll	phloem	xylem
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..... and ..... (1 mark)

1 (b) Gases *diffuse* between the leaf and the surrounding air.

1 (b) (i) What is *diffusion*?

.....  
.....  
.....  
..... (2 marks)

1 (b) (ii) Name **one** gas that will diffuse from point **A** to point **B** on the diagram on a sunny day.

..... (1 mark)

4

Turn over ▶



2 Some students were asked to investigate the distribution of clover in a field of grass. They noticed that the clover grew in patches amongst the grass.

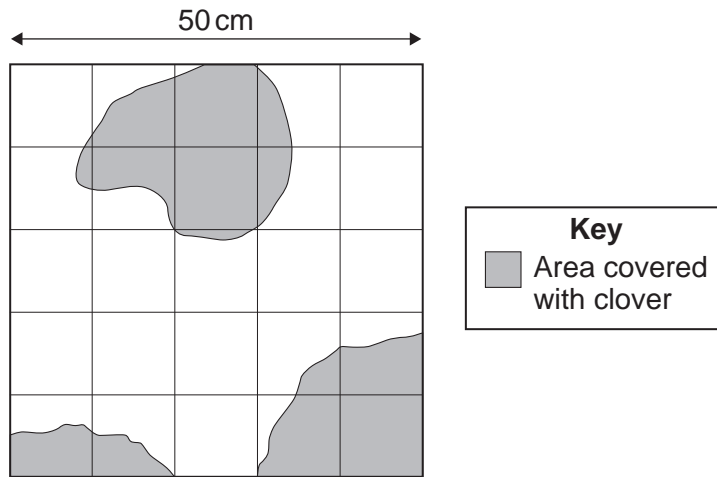
2 (a) The students decided to use quadrats.

Describe how the students should decide where to place the quadrats to investigate the distribution of the clover.

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(2 marks)

2 (b) The diagram shows one of the quadrats the students used.



2 (b) (i) Estimate the number of squares of the quadrat covered with clover.

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.....

Number of squares = .....  
(1 mark)



2 (b) (ii) Describe how you worked out your answer to part (b)(i).

.....  
.....  
.....

(1 mark)

2 (b) (iii) Use your answer from part (b)(i) to calculate the percentage of the quadrat covered by the clover.

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Answer = ..... %  
(2 marks)

2 (c) Suggest **one** factor that could account for the distribution of the clover plants.

.....

(1 mark)

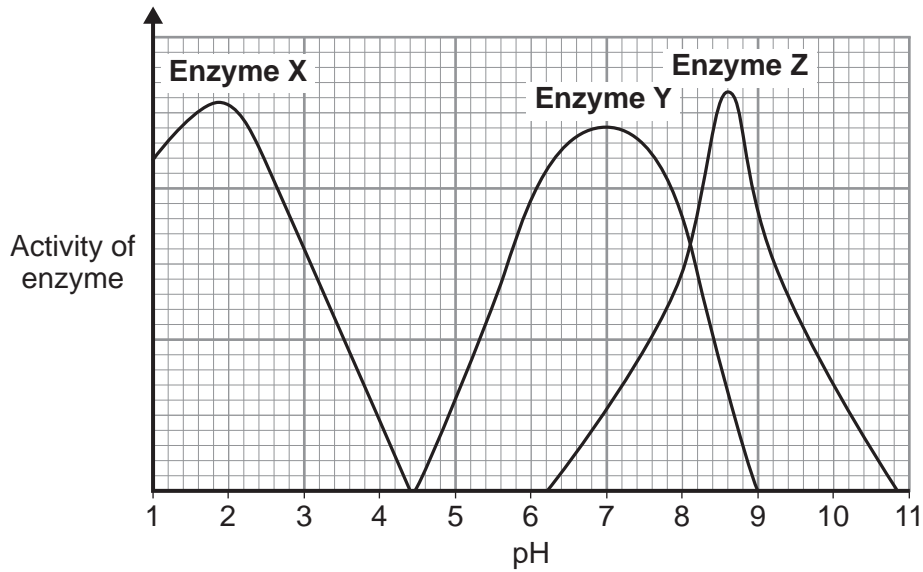
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Turn over for the next question

Turn over ►



- 3 (a)** The graph shows the effect of pH on the activities of three enzymes, **X**, **Y** and **Z**. These enzymes help to digest food in the human digestive system. Each enzyme is produced by a different part of the digestive system.



- 3 (a) (i)** What is the optimum (best) pH for the action of enzyme **Z**?

.....

(1 mark)

- 3 (a) (ii)** The stomach makes a substance that gives the correct pH for enzyme action in the human stomach.

Name this substance. ....

(1 mark)

- 3 (a) (iii)** Which enzyme, **X**, **Y** or **Z**, will work best in the human stomach?

.....

(1 mark)



**3 (b)** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Different parts of the human digestive system help to break down molecules of fat so that they can be absorbed into the body.

Describe how.

To gain full marks you should refer to:

- the enzyme and where the enzyme is produced
- the products of digestion
- any other chemicals involved.

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(6 marks)

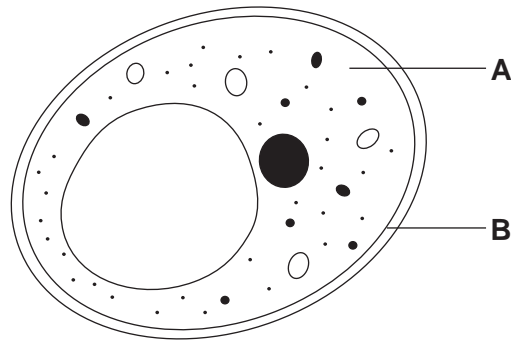
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Turn over ►



4 **Diagram 1** shows a yeast cell.

**Diagram 1**



4 (a) Name structures **A** and **B**.

**A** .....

**B** .....

(2 marks)

4 (b) Yeast cells can respire anaerobically.

The equation for anaerobic respiration in yeast is:



Give **one** way in which anaerobic respiration in yeast cells is different from anaerobic respiration in human muscle cells.

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.....

(1 mark)

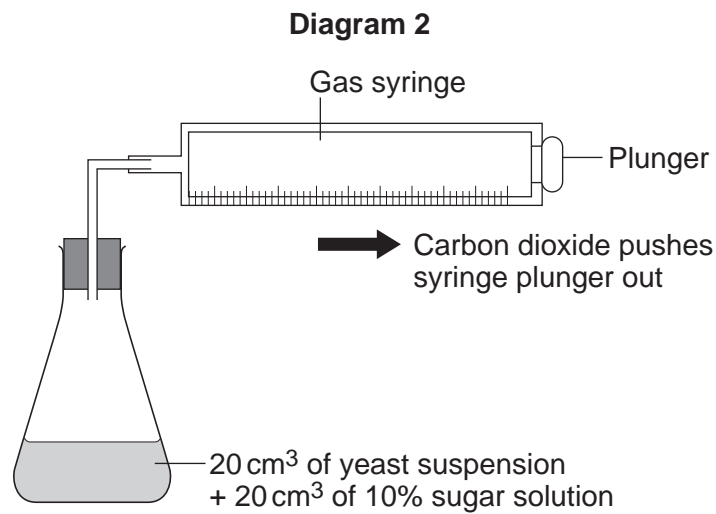




- 4 (c)** Yeast can use other types of sugar instead of glucose.  
Some scientists investigated the effect of three different types of sugar on the rate of anaerobic respiration in yeast.

The scientists:

- used the apparatus shown in **Diagram 2** with glucose sugar
- kept the apparatus at 20 °C
- repeated the investigation with fructose sugar and then with mannose sugar
- repeated the investigation with water instead of the sugar solution.



- 4 (c) (i)** Give **two** control variables the scientists used in this investigation.

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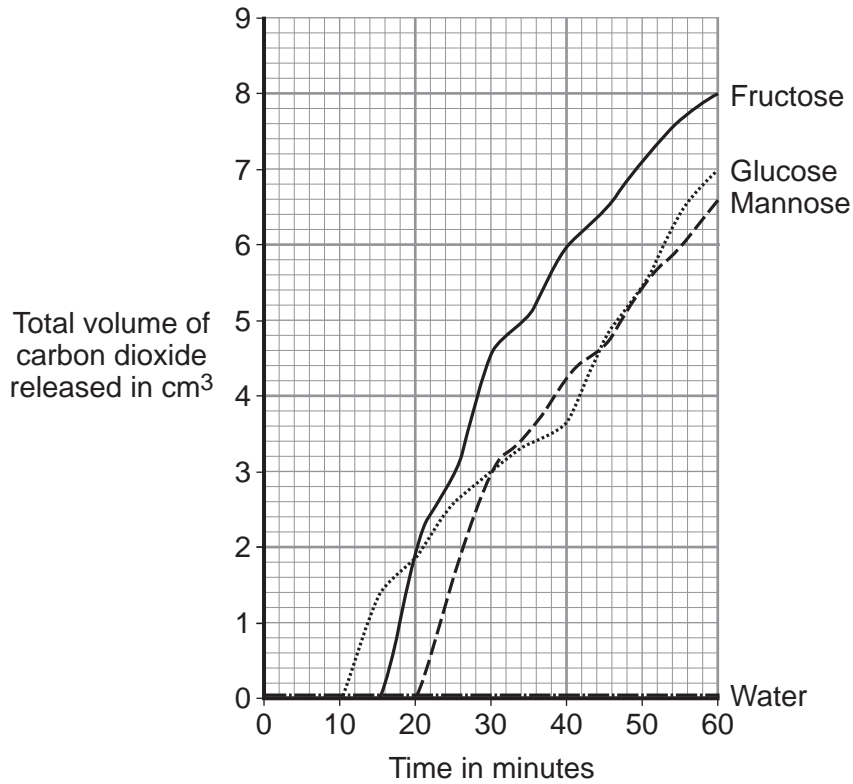
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**Question 4 continues on the next page**

**Turn over ►**



4 (c) (ii) The graph shows the scientists' results.



From this information, a company decided to use fructose to produce alcohol and **not** mannose or glucose.

Explain the reason for the company's choice.

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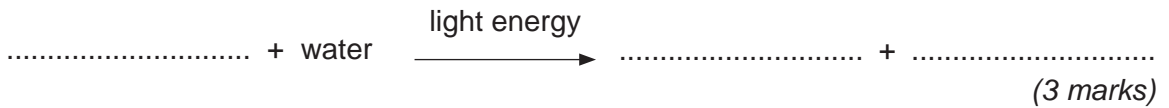
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(2 marks)

7
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5 (a) Complete the equation for photosynthesis.



5 (b) The rate of photosynthesis in a plant depends on several factors in the environment. These factors include light intensity and the availability of water.

Describe and explain the effects of **two other** factors that affect the rate of photosynthesis.

You may include one or more sketch graphs in your answer.

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(5 marks)

8
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Turn over ►



**6** A certain gene codes for the production of an enzyme called 'HEXA'.  
  
One human genetic disorder causes damage to nerve cells in the brain.  
This disorder is caused by a small change in the DNA of the HEXA gene.  
People with this disorder make a changed HEXA enzyme that does not work.

**6 (a)** Explain how a change in the DNA of the HEXA gene can result in the production of a changed HEXA enzyme that does not work.

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(3 marks)

**6 (b)** The gene coding for the HEXA enzyme is found on chromosome number 15.

**6 (b) (i)** How many chromosomes are there in the nucleus of a human nerve cell? .....  
(1 mark)

**6 (b) (ii)** A boy had the changed HEXA gene on the chromosome number 15 that he inherited from his father.  
The changed HEXA gene coded for a HEXA enzyme that does not work.  
The boy did **not** develop the genetic disorder.

Explain why the boy did **not** develop the genetic disorder.

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(2 marks)



**6 (b) (iii)** The boy grew up and got married.

A blood test showed that his wife had also inherited the same changed HEXA gene.

There is a 1 in 4 chance that this couple's first child will have the genetic disorder.

Use a genetic diagram to explain why.

Use the following symbols in your explanation:

**H** = allele for making the normal HEXA enzyme

**h** = allele for making a HEXA enzyme that does not work.

(3 marks)

9

**Turn over for the next question**

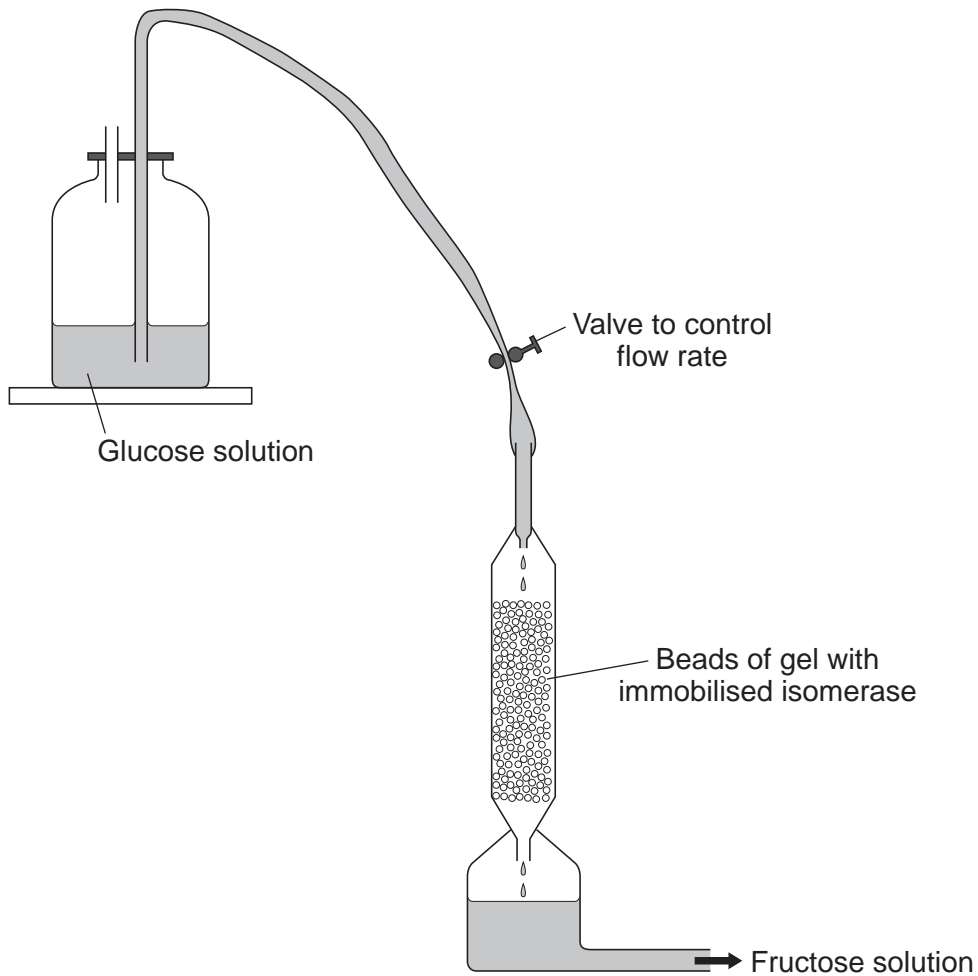
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7 Isomerase is an enzyme which can change glucose into fructose. Fructose is often used instead of glucose in products like slimming foods.

In industry, isomerase is often 'immobilised' within beads of gel. The beads are placed in a glass column. The isomerase stays attached to the beads and a solution of glucose is allowed to flow between the beads in the column.

The diagram shows how immobilised isomerase is used.



7 (a) An alternative method of changing glucose into fructose would be to mix a solution of the isomerase with the glucose solution in a large container. Suggest **two** advantages of using isomerase immobilised in a column of beads.

- 1 .....
- .....
- 2 .....
- .....

(2 marks)



**7 (b)** A manufacturer investigated the effect of using different flow rates of glucose solution on the rate of fructose production.

The table shows the results.

Flow rate in dm <sup>3</sup> per minute	Rate of fructose production in mg per minute
1	150
2	325
3	480
4	608
5	650
6	650
7	650

The manufacturer decides to use a flow rate of 5 dm<sup>3</sup> per minute.

Suggest why the manufacturer chose this flow rate.

.....

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(2 marks)

**7 (c)** Fructose is a much sweeter sugar than glucose.

Explain why manufacturers of slimming foods may wish to use fructose as a sweetener instead of glucose.

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(2 marks)

6
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Turn over ►



8 The photographs show the flowers of two closely-related species of plant.

Species A



Species B



The drawings show chromosomes from one cell in the root of each plant during cell division.

Species A



Species B



8 (a) The drawings show that each chromosome has two strands of genetic material.

8 (a) (i) How does a chromosome become two strands?

.....

.....

(1 mark)





**8 (a) (ii)** Explain why each chromosome must become two strands before the cell divides.

.....  
.....  
.....  
.....

(2 marks)

**8 (b)** For sexual reproduction, the plants produce gametes.

**8 (b) (i)** Name the type of cell division that produces gametes. ....  
(1 mark)

**8 (b) (ii)** How many chromosomes would there be in a gamete from each of these two plant species?

**Species A**                       **Species B**

(1 mark)

**8 (b) (iii)** It is possible for gametes from **Species A** to combine with gametes from **Species B** to produce healthy offspring plants.

How many chromosomes would there be in each cell of one of the offspring plants?

(1 mark)

**Question 8 continues on the next page**

**Turn over ►**



8 (c) (i) Look back at the information at the start of the question and the information from part (b).

What evidence from these two pieces of information supports the belief that **Species A** and **Species B** evolved from a common ancestor?

.....  
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.....  
.....

(2 marks)

8 (c) (ii) For successful gamete production to take place, chromosomes that contain the same genes must pair up.

The drawings showing the chromosomes of **Species A** and of **Species B** are repeated below.



The offspring plants cannot reproduce sexually.

Suggest an explanation for this.

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(2 marks)

END OF QUESTIONS

10



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