

Please write clearly in block capitals.

Centre number

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# GCSE ADDITIONAL SCIENCE BIOLOGY

# H

Higher Tier Unit Biology B2

Friday 9 June 2017

Morning

Time allowed: 1 hour

### Materials

For this paper you must have:

- a ruler

You may use a calculator.

### 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 2 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.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
<b>TOTAL</b>	



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

1 There are many different types of cell in the human body.

1 (a) (i) Describe where epithelial cells are found in the human body.

[1 mark]

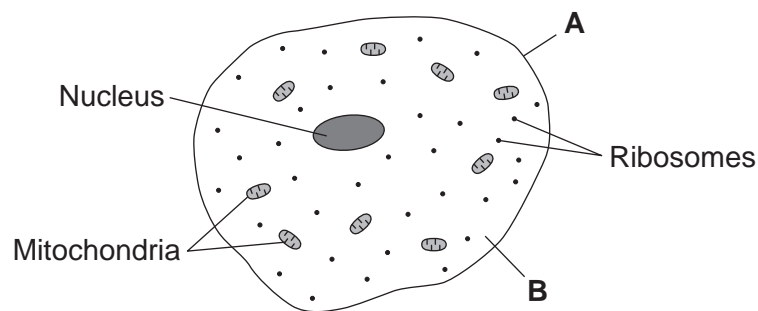
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1 (a) (ii) **Figure 1** shows an epithelial cell.

**Figure 1**



Name part **A** and part **B**.

[2 marks]

**A** \_\_\_\_\_

**B** \_\_\_\_\_

1 (b) What is the function of ribosomes?

[1 mark]

Tick (✓) **one** box.

Aerobic respiration

Digestion

Photosynthesis

Protein synthesis



**1 (c)** Carbon dioxide moves out of an epithelial cell by diffusion.

**[2 marks]**

What is diffusion?

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6

**Turn over for the next question**

**Turn over ►**



- 2 In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Figure 2 shows part of a plant called cross-leaved heath.

Figure 2



A student noticed that some areas of marshland contained cross-leaved heath plants and some areas did not.

The student made the following hypothesis:

'Soil pH affects the amount of cross-leaved heath plants that grow in an area.'

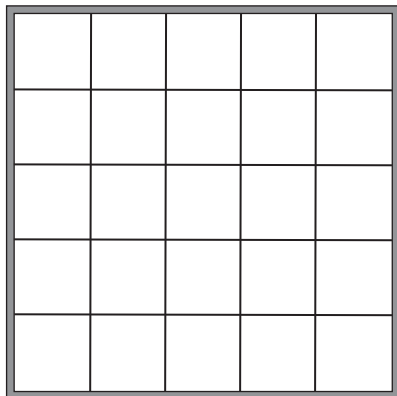
How could the student use apparatus, including the quadrat and pH meter shown in Figure 3, to find the range of pHs where the cross-leaved heath plants grew best?

You should include details of how the student could make sure the results are valid.

[6 marks]

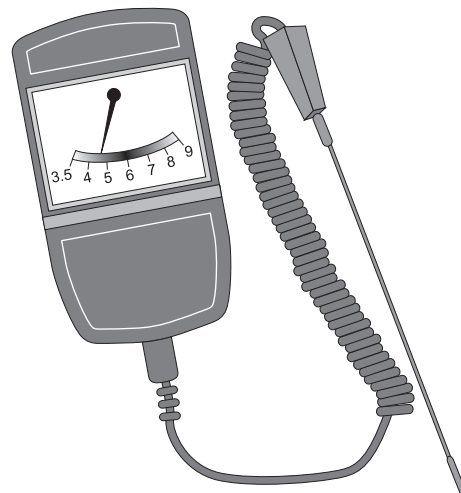
Figure 3

1 m x 1 m quadrat



Not to scale

Soil pH meter



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<b>6</b>

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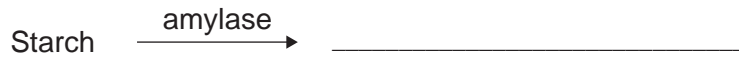
**Turn over ▶**



3 Amylase is an enzyme that breaks down starch.

3 (a) Complete the equation to show the breakdown of starch.

[1 mark]

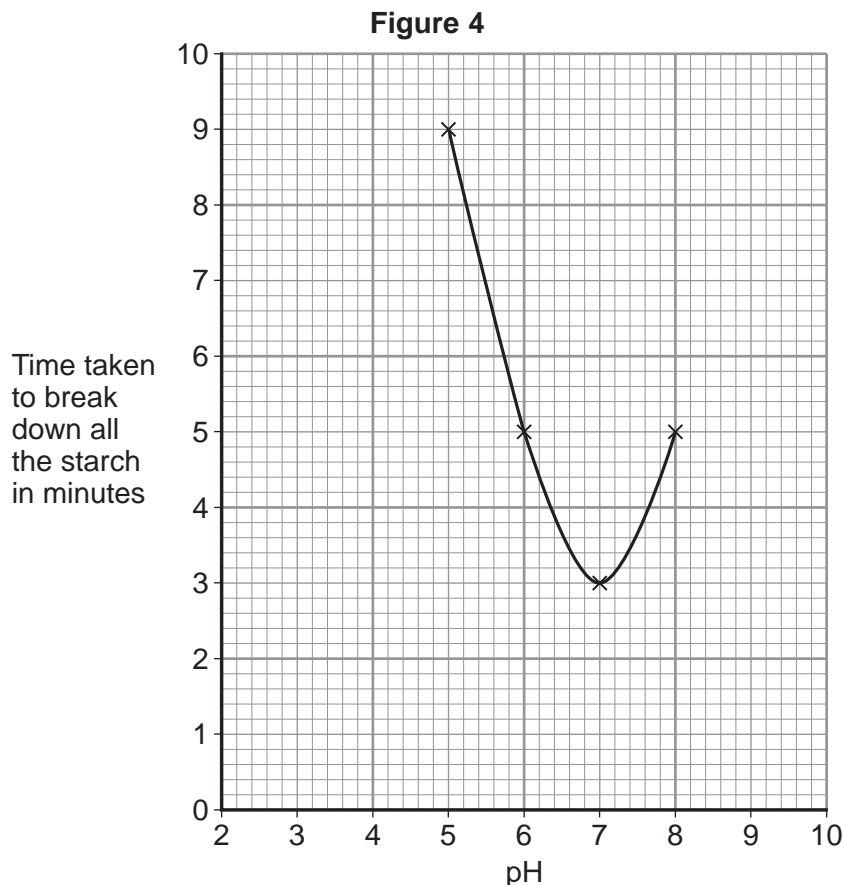


3 (b) Some students investigated the effect of pH on the activity of amylase.

The students:

- put 5 cm<sup>3</sup> of pH5 solution + 1 cm<sup>3</sup> of amylase solution into a test tube
- put 4 cm<sup>3</sup> of starch suspension into a second test tube
- left both test tubes at room temperature for 5 minutes
- mixed the contents of the two test tubes
- removed a small sample of the mixture at 1-minute intervals
- tested each sample for starch
- timed how long it took to break down all the starch
- repeated each of the above steps at pH6, pH7 and pH8.

Figure 4 shows the students' results.



**3 (b) (i)** Give **two** variables which were controlled in this investigation.

**[2 marks]**

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

**3 (b) (ii)** The students tested samples of the reaction mixture for starch.  
In each test, they added one drop of the reaction mixture to one drop of iodine solution on a white tile.

- Iodine solution = light brown colour
- Iodine solution + starch = dark blue colour

Predict the colour seen in the iodine test on the samples of the pH6 reaction mixture at 4 minutes and at 6 minutes.

**[1 mark]**

4 minutes \_\_\_\_\_

6 minutes \_\_\_\_\_

**3 (b) (iii)** The students concluded that amylase works best at pH7.  
This may **not** be a valid conclusion.

Suggest **two** improvements to the investigation that would increase the validity of the students' conclusion.

**[2 marks]**

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

**Question 3 continues on the next page**

**Turn over ►**



**3 (b) (iv)** The students repeated the investigation at pH3.

What result would you expect at pH3?

Give a reason for your answer.

**[2 marks]**

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4 Plants use carbon dioxide from the air in photosynthesis.

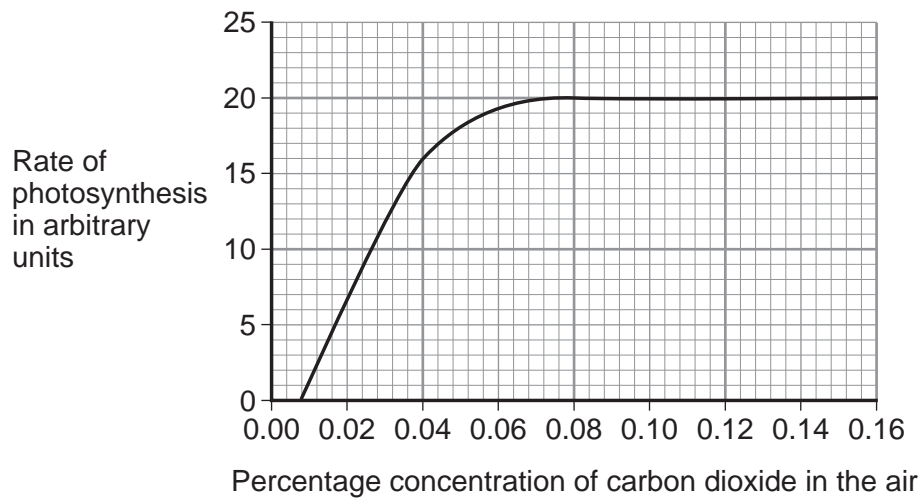
4 (a) Write the word equation for the process of photosynthesis.

[2 marks]

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4 (b) **Figure 5** shows the effect of the concentration of carbon dioxide on the rate of photosynthesis in tomato plants at 20 °C.

**Figure 5**



4 (b) (i) The concentration of carbon dioxide in the air is normally 0.04%.

What is the rate of photosynthesis in the tomato plants at 0.04% carbon dioxide?

[1 mark]

Rate = \_\_\_\_\_ arbitrary units

4 (b) (ii) A farmer grows tomato plants in a large greenhouse.

He plans to increase the carbon dioxide concentration in the air in his greenhouse to 0.08%.

Calculate the **percentage** increase in the rate of photosynthesis of the tomato plants when the carbon dioxide concentration is increased from 0.04% to 0.08%.

[1 mark]

Use information from **Figure 5**.

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Percentage increase = \_\_\_\_\_ %



**4 (b) (iii)** Explain why the farmer would **not** use a concentration of carbon dioxide higher than 0.08%.

[2 marks]

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**4 (b) (iv)** The farmer increases the concentration of carbon dioxide in the air.

Give **two** other ways that the farmer could increase the rate of photosynthesis of the tomato plants.

[2 marks]

1 \_\_\_\_\_

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2 \_\_\_\_\_

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**Turn over for the next question**

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5 Scientists investigated the effect of drinking glucose solution during long-distance athletic events.

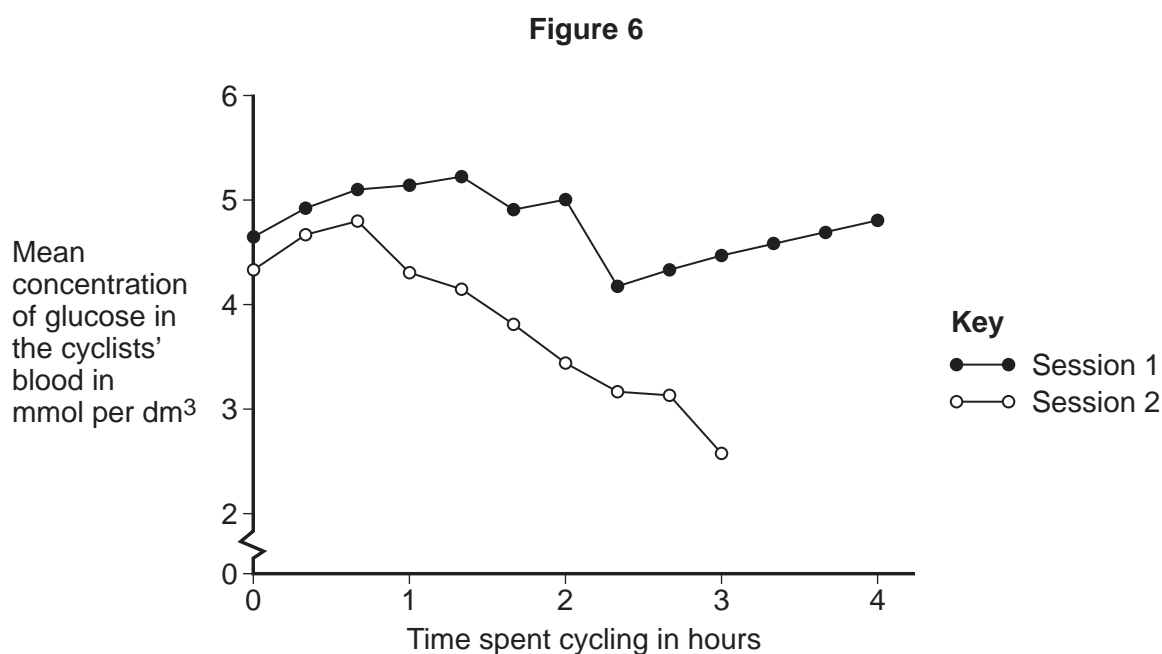
The scientists selected seven racing cyclists.

In two separate sessions, the cyclists pedalled stationary bicycles at a constant speed until they could not continue.

- **Session 1:** the cyclists drank 60 grams of glucose per hour in an energy drink.
- **Session 2:** a week later, the same cyclists drank a placebo drink that tasted the same but did **not** contain glucose.

The scientists measured the concentration of glucose in the cyclists' blood at intervals during each of the two sessions.

Figure 6 shows the results.



5 (a) In each session, the cyclists did not know whether they were drinking the glucose drink or the placebo.

Why was this important?

[2 marks]

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**5 (b) (i)** The scientists concluded that drinking glucose during a race would improve athletic performance.

Evaluate the validity of the method used in this investigation and the evidence for the scientists' conclusion.

**[4 marks]**

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**5 (b) (ii)** During both sessions, the cyclists' heart rates and breathing rates were much higher than at rest.

Describe how increased heart rate, increased breathing rate and increased blood glucose concentration would improve athletic performance.

**[4 marks]**

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<b>10</b>



**6** Alkaptonuria (AKU) is a rare, inherited condition. A person with AKU produces brownish-black urine. Further health problems develop later in life.

**6 (a)** The allele that causes AKU is on chromosome number 3.  
The allele is recessive.

**6 (a) (i)** How many chromosomes are there in most human cells?

**[1 mark]**

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**6 (a) (ii)** What are alleles?

**[1 mark]**

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**6 (a) (iii)** What does recessive mean?

**[1 mark]**

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**Question 6 continues on the next page**

**Turn over ►**



**6 (b)** Two parents, who do **not** have AKU, have a child with AKU.

These two parents are heterozygous.

**6 (b) (i)** What does heterozygous mean?

[1 mark]

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**6 (b) (ii)** Draw a genetic diagram to find the probability that the parents' next child will have AKU.

[4 marks]

You should identify in your diagram any children with AKU.

Use the following symbols: **N** = allele for **not** having AKU (non-AKU)  
**n** = allele for AKU

Probability of having a child with AKU = \_\_\_\_\_





**6 (c)** The parents do not want to have another child with AKU.

A genetic counsellor tells the parents that this would be possible if they use IVF followed by embryo screening.

The procedure is:

1. several eggs from the woman are fertilised in a glass dish using sperm cells from the man (IVF)
2. each fertilised egg divides to form an embryo
3. at the 16-cell stage, one cell is removed from each embryo and the cell's DNA is tested (embryo screening)
4. one embryo, which does not have the recessive allele for AKU, is placed in the woman's uterus to develop into a baby
5. some of the other embryos may be frozen and stored.

In **Steps 2** and **3**, a 16-cell embryo is produced by cell division of the original fertilised egg cell.

**6 (c) (i)** Name the type of cell division in **Step 2**.

[1 mark]

\_\_\_\_\_

**6 (c) (ii)** How many cell divisions are needed to make 16 cells from one cell?

[1 mark]

\_\_\_\_\_

**6 (d)** Some people have ethical objections to embryo screening.

**6 (d) (i)** Suggest **one** ethical objection to embryo screening.

[1 mark]

\_\_\_\_\_  
\_\_\_\_\_

**6 (d) (ii)** Suggest **one** reason in favour of embryo screening.

[1 mark]

\_\_\_\_\_  
\_\_\_\_\_

12

Turn over for the next question

Turn over ►



7 There are nearly 9 million species of organisms alive on Earth today.

7 (a) (i) What is a species?

[2 marks]

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7 (a) (ii) How do fossils provide evidence that species alive today have evolved from simpler organisms?

[2 marks]

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7 (b) **Figure 7** shows three species of flightless birds that are alive today.

Each of the three species lives on a different continent.

**Figure 7**

**Rhea**  
(South America)



**Emu**  
(Australia)



**Ostrich**  
(Africa)



Many scientists now believe that each of these species evolved from an ancestral species of bird that could fly. This happened after the extinction of the dinosaurs, about 65 million years ago. Many of the dinosaurs were meat eaters.

Although these three birds are different species, they have many features in common.

Suggest how these different species of flightless birds might have evolved to have many features in common.

**[6 marks]**

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**END OF QUESTIONS**



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