

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
January 2013

Human Biology

HBIO1

Unit 1 The body and its diseases

Wednesday 09 January 2013 9.00 am to 10.30 am

For this paper you must have:

- a ruler with millimetre measurements
- a calculator.

Time allowed

- 1 hour 30 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

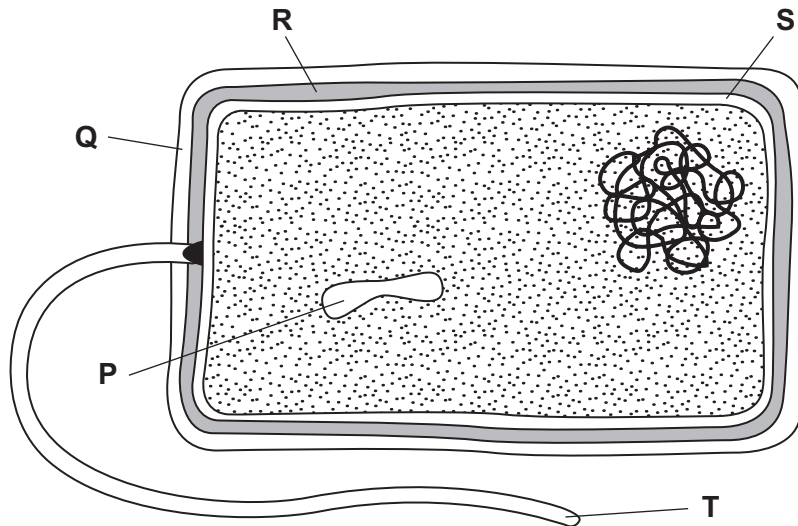
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You are expected to use a calculator where appropriate.
- You will be marked on your ability to:
 - use good English
 - organise information clearly
 - use scientific terminology accurately.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	



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

- 1 The drawing shows a prokaryotic cell.



- 1 (a) Complete the table with the letter that represents the structure being described.

Description	Structure
Controls the substances that enter or leave the cell	
Contains genes additional to those in the main loop of DNA	
Stops the cell bursting if it takes in water by osmosis	
Moves the bacterium around	

(4 marks)

- 1 (b) Name **two** cell structures that would be found in a ciliated cell from the respiratory epithelium of a human but **not** in a prokaryotic cell.

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(2 marks)



- 2 (a)** **Figure 1** shows some statements about biological molecules.
Complete **Figure 1** by putting a tick in each box where the statement is true.

Figure 1

Statement	Proteins	Fats	Glycogen
Digested by hydrolysis reactions			
Contain glycerol			
Contain amino acids			

(3 marks)

- 2 (b)** **Figure 2** shows information found on a packet of sultana bran breakfast cereal.

Figure 2

	Mass in 40 g of cereal with 125 cm ³ semi-skimmed milk / g	Guideline daily amount (GDA) for a typical adult / g	Percentage of GDA
Sugars	16.6	90	
Fat	2.8	70	4.0
Salt equivalent	0.5	6	8.3

- 2 (b) (i)** Complete the table by adding the value for percentage of GDA for sugars. Use the space below to show your working.

(2 marks)

- 2 (b) (ii)** Suggest **one** disadvantage of giving information about GDA on food packaging.

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(1 mark)



3 (a) The optimum pH for an enzyme was found to be pH7.

3 (a) (i) What is meant by the *optimum pH* of an enzyme?

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(1 mark)

3 (a) (ii) The enzyme's activity changes if the pH is raised to pH12. Explain why.

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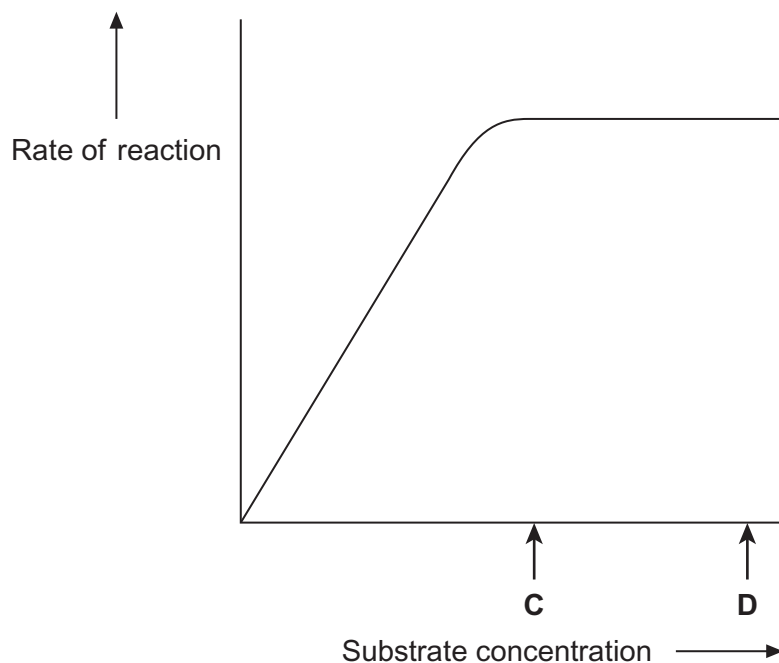
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(2 marks)



The graph shows the rate of an enzyme-catalysed reaction when the substrate concentration is increased.



3 (b) Describe and explain the rate of reaction between **C** and **D**.

Describe

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Explain

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(2 marks)

5

Turn over ►



4 (a) Describe how tissue fluid is formed.

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(3 marks)

4 (b) Seeds of the Mexican prickly poppy contain a toxin. If eaten by humans, this toxin causes a large drop in their blood protein concentration. This drop in blood protein concentration causes people to develop oedema. Explain why.

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(3 marks)



- 5 (a)** People with cystic fibrosis have faulty CFTR membrane proteins.
Suggest **one** reason why this faulty protein is unable to function.

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(1 mark)

- 5 (b)** People with cystic fibrosis have thick mucus in their respiratory tract and gut.
Use this information to explain why people with cystic fibrosis:

- 5 (b) (i)** have frequent lung infections

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(2 marks)

- 5 (b) (ii)** need to eat a highly nutritious, high-energy diet.

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(2 marks)

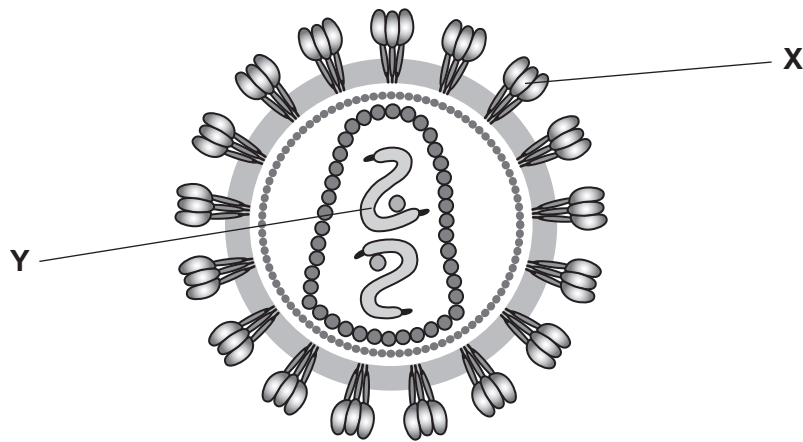
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Turn over for the next question

Turn over ►



- 6** The diagram shows the human immunodeficiency virus (HIV).



- 6 (a)** Name molecule Y.

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(1 mark)

- 6 (b)** Molecule X causes B-cells to produce antibodies. Describe how.

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(3 marks)



- 6 (c)** The ribosomes and endoplasmic reticulum become more active in a B-cell when it starts to produce antibodies. Explain why.

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(2 marks)

- 6 (d)** There are many different forms of molecule **X** on different HIV particles. This makes it difficult to develop a vaccine against HIV. Explain why.

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(2 marks)

8

Turn over for the next question

Turn over ►



7 (a) Explain why people with tuberculosis (TB):

7 (a) (i) have a persistent cough

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7 (a) (ii) absorb less oxygen per breath than a healthy person.

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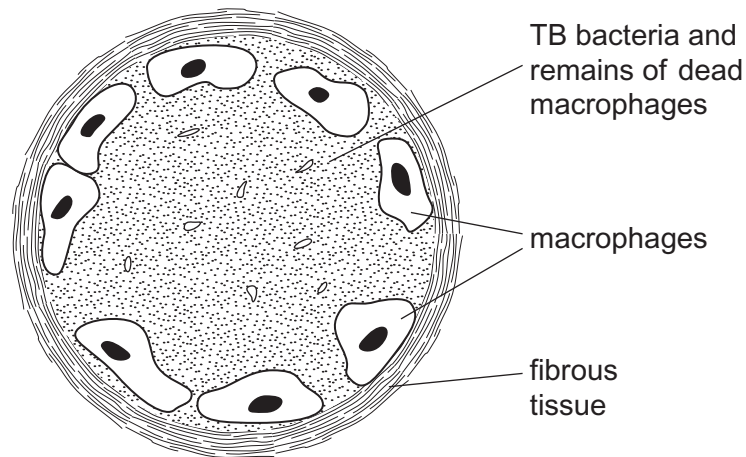
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(4 marks)



- 7 (b)** The diagram shows a tubercle from the lungs of a person with TB.



People with TB have to take antibiotics for several months. Use the information in the diagram to explain why.

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(3 marks)

- 7 (c)** The BCG vaccine contains antigens from the bacterium that causes TB. The vaccine results in immunity against TB.
Is this active or passive immunity? Explain your answer.

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(1 mark)



- 8** Scientists investigated the use of diet to treat people with type 2 diabetes. They recruited a group of volunteers who had just been diagnosed with type 2 diabetes. These volunteers were all eating a diet containing a lot of processed food.

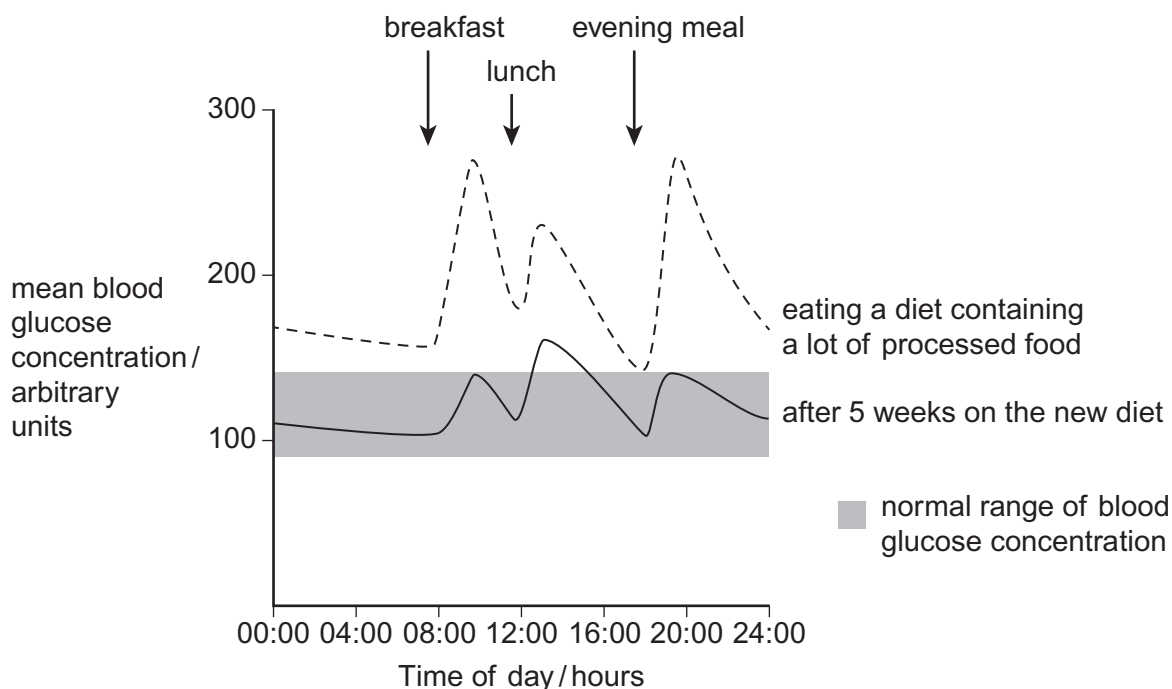
The scientists measured the blood glucose concentration of each volunteer over a 24-hour period.

The scientists then gave the volunteers a different diet. The new diet:

- contained no processed food
- contained little starch but was high in fibre.

After five weeks on the new diet, the scientists measured the blood glucose concentration of each volunteer over another 24-hour period.

The graph shows the mean blood glucose concentration of the volunteers whilst they were eating the two different diets.



- 8 (a)** At the start of the investigation, the scientists measured the blood glucose concentration of the volunteers while they were eating their diet containing a lot of processed food. Why was this important?

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(1 mark)



- 8 (b)** Describe the effect of the new diet on the mean blood glucose concentration of the volunteers.

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(2 marks)

- 8 (c)** Explain the effect of the new diet on the mean blood glucose concentration of the volunteers.

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(2 marks)

- 8 (d)** A journalist saw these results. He suggested that the investigation showed that diet could be used as a successful treatment for type 2 diabetes. Give **two** reasons why this suggestion might not be valid.

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(2 marks)

7

Turn over ►



9 (a) Describe how betablockers are effective in the treatment of heart disease.

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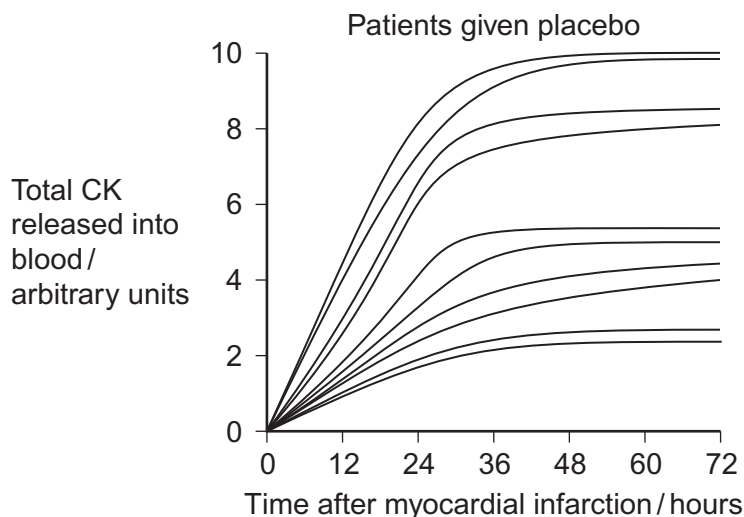
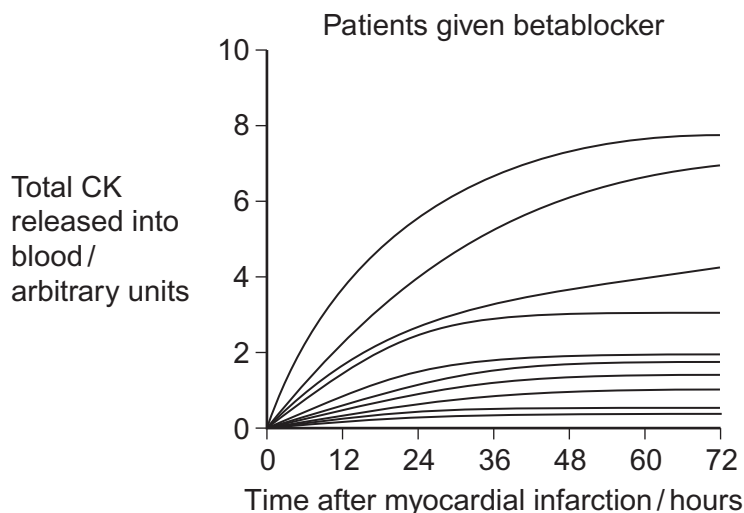
(2 marks)

9 (b) CK is an enzyme normally found only inside heart muscle cells. Following a myocardial infarction, CK is also found in the blood.

Scientists investigated whether betablockers could reduce damage to the heart caused by a myocardial infarction. They recruited 20 patients who had just suffered a myocardial infarction and divided them into two equal groups at random.

- They gave the patients in one group tablets containing betablockers.
- They gave the patients in the other group placebo tablets without betablockers.

At regular intervals, the doctors measured the concentration of CK in the patients' blood. The results for each patient are shown in the graphs below.



- 9 (b) (i)** Suggest a reason for the differences in the total CK released into the blood of the 10 patients who were given the placebo tablets.

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(2 marks)

- 9 (b) (ii)** CK continues to be released for up to 2 days after a myocardial infarction. Suggest an explanation for this.

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(1 mark)

- 9 (c)** One of the doctors suggested that everyone who has suffered a myocardial infarction should be treated with betablockers. Use these results to evaluate this suggestion.

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(4 marks)



- 10** We have many different kinds of bacteria in our guts. Most of these bacteria are harmless, and some are even beneficial. 1
- If the community of harmless bacteria in the gut changes, a person is more likely to become ill. For example, a person may eat food containing *Salmonella*. This can lead to food poisoning with abdominal pain and diarrhoea. One way to kill these pathogenic bacteria is to take a course of antibiotics. These antibiotics are not specific to pathogenic bacteria. For this reason, doctors only prescribe antibiotics for severe cases of *Salmonella* food poisoning. 5
- Clostridium difficile* is a bacterium that causes severe diarrhoea. Like MRSA, it has become resistant to most of the commonly used antibiotics. Hospital staff treating patients with *C. difficile* have to take precautions so they do not pass the infection on to the other patients. 10
- Doctors can treat people with *C. difficile* using a faecal transplant. A sample of faeces is obtained from a healthy relative who lives in the same house. The faeces are liquidised in a salt solution and the suspension is introduced into the patient's gut using a tube. 15
- Sixteen patients with *C. difficile* infections were given a faecal transplant. Some time after the transplant, faecal samples from fourteen of these patients were tested for the presence of *C. difficile*. These samples showed that the infection had been treated successfully. The other two patients did not supply faecal samples but reported that they had no more diarrhoea. Doctors are now considering further use of faecal transplants to treat *C. difficile* infections that cannot be treated successfully with antibiotics. 20

10 (a) (i) Some bacteria in the gut are beneficial (line 2). Give **one** benefit of these bacteria.

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(1 mark)



- 10 (a) (ii)** Doctors only prescribe antibiotics for severe cases of *Salmonella* food poisoning (lines 8–9). Suggest why doctors only prescribe antibiotics for severe cases of *Salmonella* food poisoning.

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(2 marks)

(Extra space)

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- 10 (b)** Describe how a person becomes infected with *Salmonella* bacteria and how the bacterium leads to the symptoms of food poisoning (lines 4–5).

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(6 marks)

(Extra space)

Question 10 continues on the next page

Turn over ►



- 10 (c) (i)** Hospital staff treating patients with *C. difficile* in hospitals have to take precautions so that they do not pass the infection on to other patients (lines 11–13). Suggest **three** precautions that they take.

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(3 marks)

(Extra space)

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- 10 (c) (ii)** Suggest how a faecal sample from a patient can be used to show that a *C. difficile* infection has been treated successfully (lines 20–21).

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(3 marks)

(Extra space)

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END OF QUESTIONS



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ANSWER IN THE SPACES PROVIDED**

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