Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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10	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2013

Human Biology HBIO1

Unit 1 The body and its diseases

Tuesday 21 May 2013 1.30 pm to 3.00 pm

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.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- 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.

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

1 (a) (i) Enzymes are proteins. They are large molecules made from a long chain of monomers.
Name the type of monomer from which proteins are made.

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(1 mark)

1 (a) (ii) Name **one** factor that affects the rate of an enzyme-controlled reaction.

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(1 mark)

1 (b) Amylase will digest starch but will **not** digest cellulose.
Explain why.

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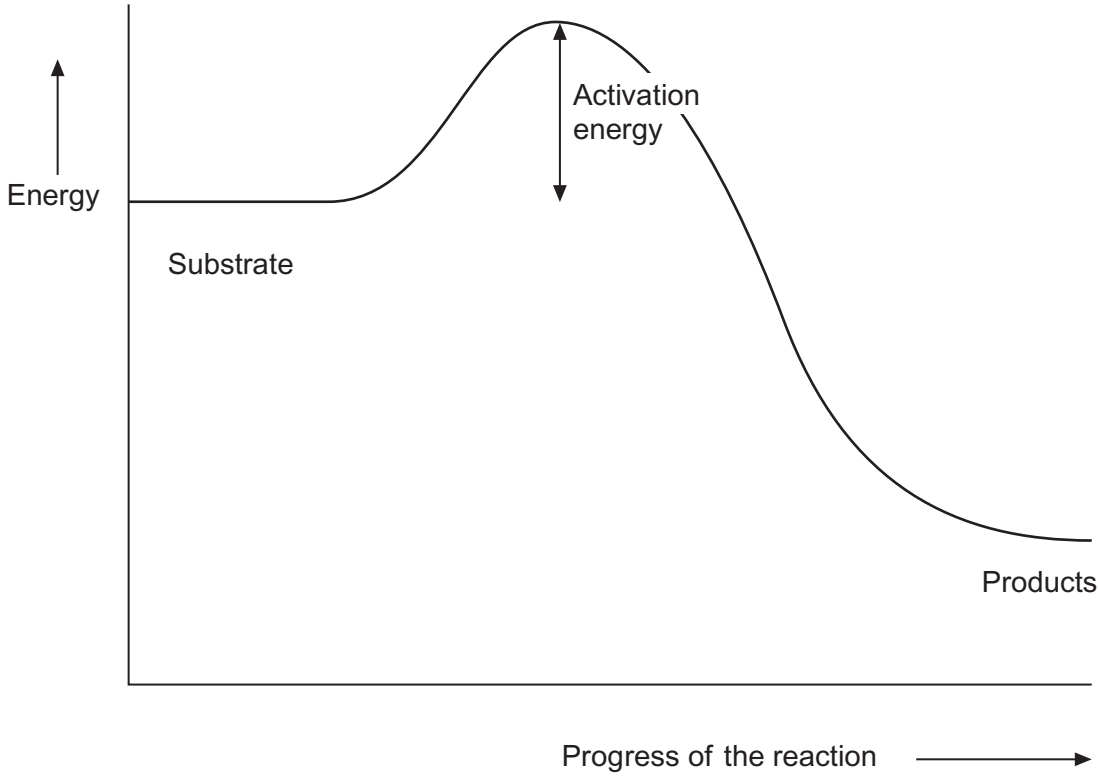
(2 marks)

1 (c) **Figure 1** shows the energy changes during a reaction when the enzyme is **not** present.

Figure 1



1 (c) Sketch a curve on **Figure 1** to show the energy changes for this reaction when the enzyme **is** present.

(2 marks)

6

Turn over for the next question

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2 (a) Describe the role of each of the following parts of a cell in producing mucus.

Ribosome.....

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Vesicle .....

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(2 marks)

2 (b) People with cystic fibrosis have thick mucus lining the respiratory tract.
Explain why.

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(3 marks)

(Extra space) .....

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5

Turn over for the next question

3 (a) Complete the table with the names of the biological molecules being described.

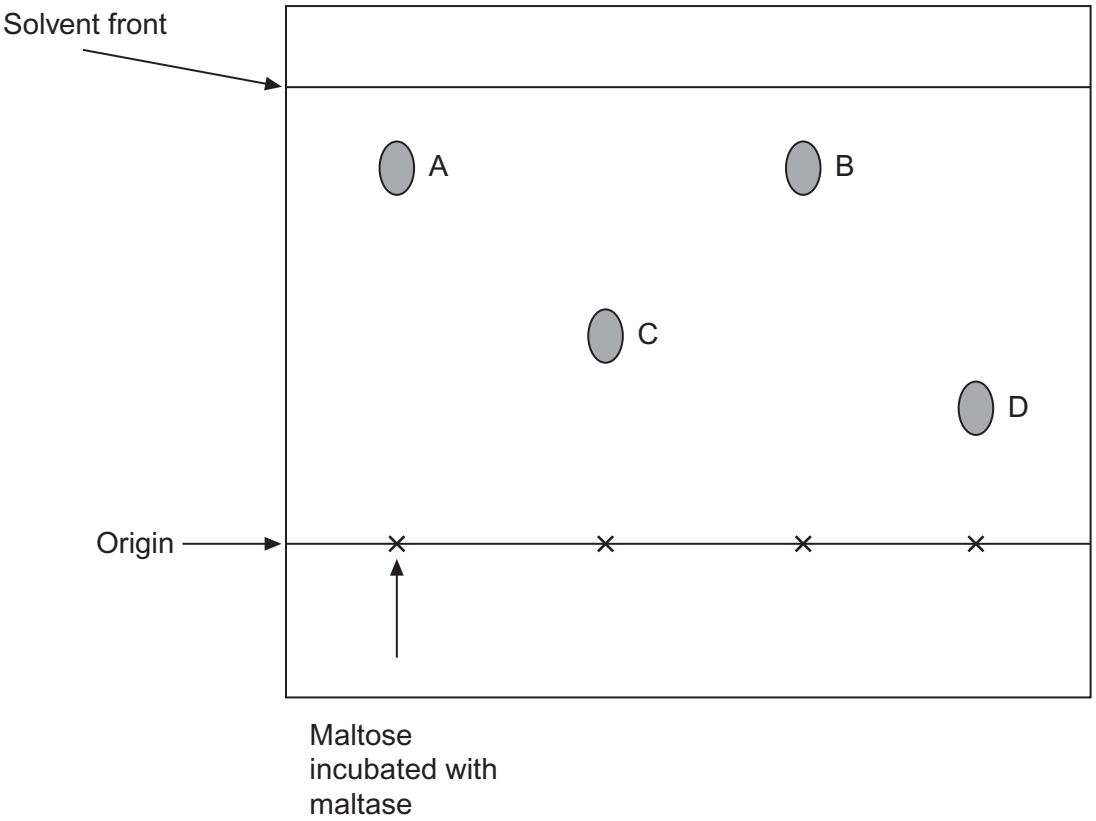
Description of biological molecule	Name of molecule
Has a tertiary structure held together by hydrogen bonds, ionic bonds and disulfide bridges	
A polysaccharide that gives a positive result when tested with iodine in potassium iodide solution	
Made of glycerol and fatty acids	

(3 marks)

3 (b) A student mixed a solution of maltose with the enzyme maltase. Maltase hydrolyses maltose. She incubated the mixture at 37 ºC for an hour. She then applied a spot of this solution to a cross marked on the origin on a piece of chromatography paper. She added spots of maltose, sucrose and glucose solutions to three further crosses marked on the origin, not necessarily in that order.

Figure 2 shows the results after the chromatogram had been run in a solvent and the resulting spots had been located.

Figure 2



3 (b) (i) Identify the substance in spot **B**.

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(1 mark)

3 (b) (ii) Explain your answer.

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(2 marks)

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Turn over for the next question

4 (a) What are *monoclonal* antibodies?

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(2 marks)

4 (b) (i) In one type of breast cancer, the cancerous cells have too many HER-2 receptors on their plasma membranes. These receptors bind to hormones normally found in the body and this causes the cells to divide too rapidly.

Herceptin is a monoclonal antibody used to treat this type of breast cancer. It binds to HER-2 receptors.

Suggest how herceptin is effective in treating breast cancer.

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(2 marks)

4 (b) (ii) Herceptin cannot be used to treat all cases of breast cancer.
Suggest why.

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(1 mark)

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5 A student went into a supermarket to buy a chicken, bacon and lettuce sandwich. She found two different sandwiches available.
Some information from the packaging is shown in the table below.

'Light choices' sandwich					**Standard sandwich**				
Energy / kJ	Sugar / g	Fat / g	Saturated fat / g	Salt / g	Energy / kJ	Sugar / g	Fat / g	Saturated fat / g	Salt / g
1420	5	8	3	1.8	2290	3	28	6	3
A serving contains the following percentage (%) of your guideline daily amount					A serving contains the following percentage (%) of your guideline daily amount				
17	6	11	13	30	28	3	41	26	50

5 (a) The student chose the 'light choices' sandwich because she thought it was the healthier option.
Use the data in the table to:

5 (a) (i) explain **one** piece of evidence that supports her decision

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(2 marks)

5 (a) (ii) explain **one** piece of evidence that does **not** support her decision.

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(2 marks)

5 (b) The table states that 3 g of saturated fat is 13% of your guideline daily amount.
Calculate how many grams of saturated fat there are in your guideline daily amount.
Show your working.

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(2 marks)

6

6 (a) Explain the importance of the following during the cardiac cycle.

6 (a) (i) When impulses reach the atrioventricular node (AVN), there is a short time delay before impulses travel down the bundle of His.

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(1 mark)

6 (a) (ii) Impulses pass down the bundle of His to the base of the ventricles.

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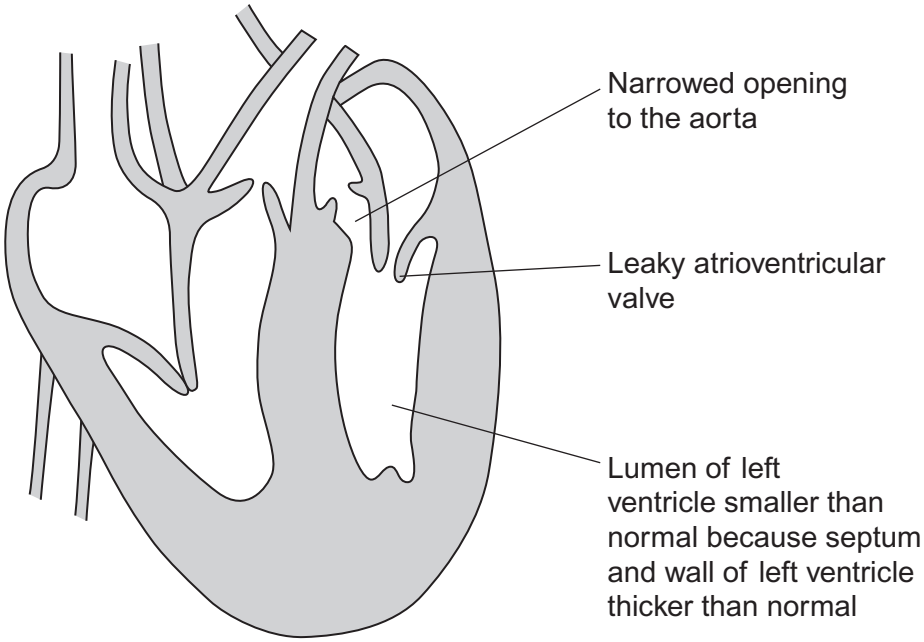
(2 marks)

6 (b) **Figure 3** shows some of the features of a heart condition called hypertrophic cardiomyopathy (HC).

Figure 3



6 (b) (i) People with HC have difficulty in supplying enough blood to their tissues.
Use information from **Figure 3** to explain why.

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(3 marks)

(Extra space) .....

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6 (b) (ii) Some people with HC get angina when they exercise. This angina is associated with the thicker than normal muscle of the wall of the left ventricle.
Suggest how thicker muscle might lead to angina.

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(2 marks)

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Turn over for the next question

7 (a) Some sports drinks are isotonic. What does *isotonic* mean?

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(2 marks)

7 (b) Students recruited 30 athletes of the same age and sex to investigate the effects of isotonic drinks.
The athletes ran 5 km. After 2.5 km they were given water to drink. The students recorded the time taken by each athlete to finish the 5 km run.
The athletes were then divided into two groups, **P** and **Q**, so that the mean time for the athletes to run 5 km in each group was almost the same.
Two weeks later, all the athletes ran the same 5 km run again. After 2.5 km, the athletes in group **P** were given water to drink, but those in group **Q** were given an isotonic sports drink. The students found the mean time taken for each group to finish the run.
The mean times to finish the 5 km runs for each group are shown in **Table 1**.

Table 1

Group	Run and drink given	Mean time to finish 5 km run / minutes
P	First run (water)	21
	Second run (water)	20
Q	First run (water)	21
	Second run (isotonic drink)	17

7 (b) (i) Suggest the scientific question (hypothesis) the students were investigating.

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(1 mark)

7 (b) (ii) The students decided **not** to divide the athletes into groups **P** and **Q** at random at the start of the investigation.
Explain why.

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(2 marks)

7 (c) Suggest **one** explanation for the results shown in **Table 1**.

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(2 marks)

7

Turn over for the next question

8 Doctors investigated the relationship between fat intake in the diet and fat in the faeces of patients with cystic fibrosis. All of the patients were taking capsules containing digestive enzymes before meals.

The doctors measured:

- the fat intake per day of each patient
- the fat content of each patient's faeces.

Some of their results are shown in **Table 2**

Table 2

Patient	Age (years)	Mean fat intake /g day $^{-1}$	Mean fat content of faeces /g day $^{-1}$
1	18	54	6
2	18	85	7
3	16	124	15
4	15	133	28
5	9	92	9
6	9	66	5
7	8	85	6
8	7	93	17
9	7	64	9
10	7	88	7

8 (a) The patients were taking capsules containing digestive enzymes before meals. Explain why.

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(2 marks)

8 (b) The doctors used these data to calculate the percentage of total fat absorbed by a patient.
Explain how they would do this.

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(2 marks)

8 (c) In studies of this type, doctors include patients of different ages.
Explain why.

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(2 marks)

8 (d) Data about fat intake and fat in faeces can be useful to a doctor prescribing enzyme capsules for a patient with cystic fibrosis.
Explain how.

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(2 marks)

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Turn over for the next question

9 (a) What is a myocardial infarction?

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(3 marks)

(Extra space) .....

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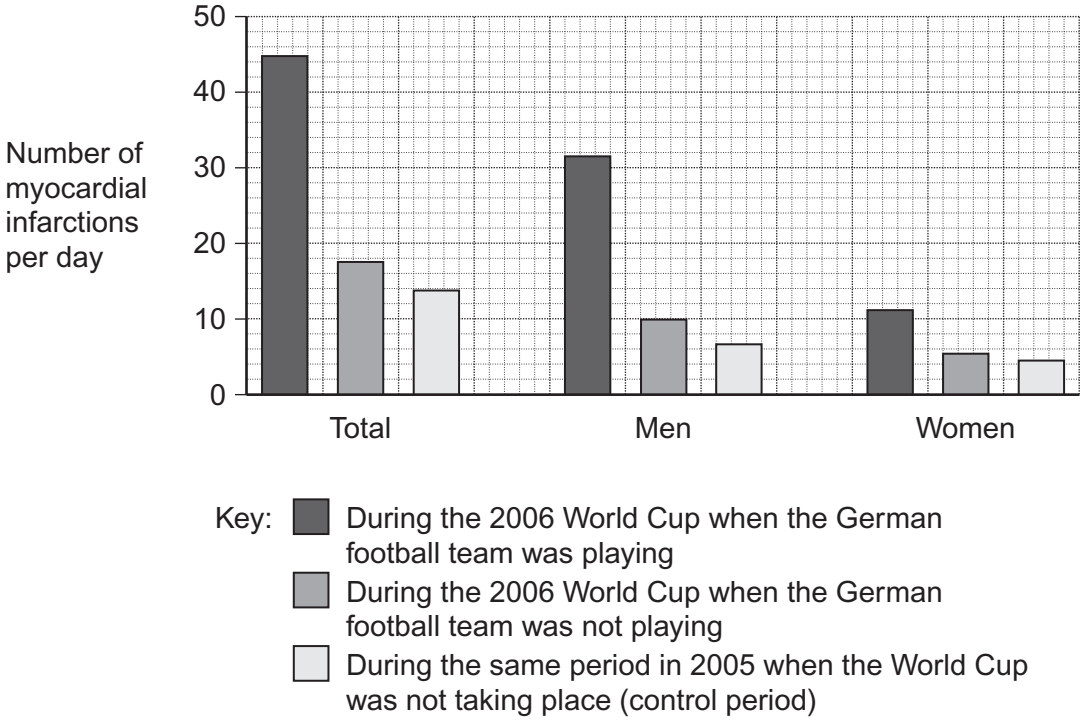
9 (b) Doctors investigated the number of myocardial infarctions that occurred in a city in Germany during the 2006 Football World Cup. The doctors compared the number of myocardial infarctions per day:

- during the 2006 World Cup when the German football team was playing
- during the 2006 World Cup when the German football team was not playing
- during the same period in 2005 when the World Cup was not taking place (control period).

Figure 4 shows their results.

Figure 4



9 (b) (i) Describe the results of the investigation.

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(2 marks)

9 (b) (ii) A journalist who saw this research suggested that all football fans should be given beta-blockers before important football matches.
Evaluate this suggestion.

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(4 marks)

(Extra space) .....

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Turn over for the next question

10 Read the following passage.

The bacteria that cause tuberculosis (TB) can usually be killed by antibiotics. Recently, strains of TB bacteria have been found which cannot be killed by any antibiotics. These antibiotic-resistant TB bacteria are particularly dangerous to people infected with human immunodeficiency virus (HIV) who have developed acquired immunodeficiency syndrome (AIDS).

Scientists have discovered an enzyme called GlgE which is found only in bacteria. This enzyme catalyses a reaction that converts a disaccharide sugar, trehalose, into substances called alpha-glucans. Alpha-glucans are part of the structure of the cell wall of bacteria.

Scientists working on a new treatment for TB have found a substance that inhibits GlgE. They have tested this substance on TB bacteria growing on culture medium in Petri dishes and in mice infected with TB bacteria. They found that the cell walls of the bacteria were damaged and the bacteria died.

Use information from the passage and your own knowledge to answer the following questions.

10 (a) Give **two** ways in which antibiotics kill bacteria (lines 1 to 2).

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(2 marks)

10 (b) Describe the symptoms of tuberculosis **and** explain how the infection progresses to cause these symptoms.

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(6 marks)

(Extra space) .....

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Question 10 continues on the next page

10 (c) Antibiotic-resistant TB bacteria are particularly dangerous to people infected with HIV who have developed AIDS (lines 4 to 6).
Explain why.

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(3 marks)

(Extra space) .....

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10 (d) Trehalose is a disaccharide. The reaction that forms trehalose from two monosaccharides involves the loss of water.

10 (d) (i) Name the type of reaction that forms trehalose.

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(1 mark)

10 (d) (ii) The monosaccharides used to make trehalose have the formula $C_6H_{12}O_6$.
Use this information to write a formula for trehalose (line 9).

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(2 marks)

10 (e) The GlgE enzyme is found only in bacteria (lines 7 to 8). Explain why this is important in developing a treatment for TB.

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(1 mark)

10 (f) When the cell wall is damaged, bacteria are killed (lines 15 to 16).
Explain why.

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(2 marks)

10 (g) The scientists tested the substance that inhibits GlgE enzyme on TB bacteria growing on culture medium in Petri dishes and in mice infected with TB bacteria (lines 13 to 15).
Explain why it was important to carry out these tests in mice.

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(1 mark)

10 (h) The substance that inhibits the GlgE enzyme is similar in shape to trehalose.
Suggest how this substance inhibits the enzyme.

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(2 marks)

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END OF QUESTIONS

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