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| Centre Number       |  |  |  |  |  | Candidate Number |  |  |  |  |
| Surname             |  |  |  |  |  |                  |  |  |  |  |
| Other Names         |  |  |  |  |  |                  |  |  |  |  |
| Candidate Signature |  |  |  |  |  |                  |  |  |  |  |



General Certificate of Education  
Advanced Subsidiary Examination  
June 2010

# Human Biology

## HBIO1

Unit 1 The body and its diseases

Tuesday 25 May 2010 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.
- 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 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               |      |



J U N 1 0 H B I O 1 0 1

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

- 1 (a)** Complete the table with a tick if the statement is true.

| Statement                        | Protein | Glycerol | Polysaccharide |
|----------------------------------|---------|----------|----------------|
| Contains amino acids             |         |          |                |
| Is a polymer                     |         |          |                |
| Formed by condensation reactions |         |          |                |

(3 marks)

- 1 (b)** Current dietary advice is to include plenty of fibre in our diet. Give **two** reasons why fibre is important in our diet.

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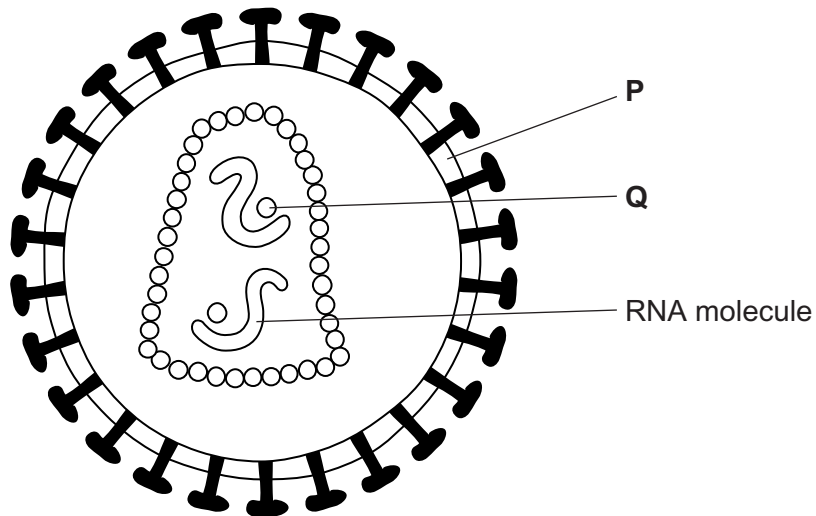
2 .....

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(2 marks)



- 2 The diagram shows a human immunodeficiency virus (HIV).



- 2 (a) (i) Name structure **P** and enzyme **Q**.

Structure **P** .....

Enzyme **Q** .....

(2 marks)

- 2 (a) (ii) What is the function of the RNA molecules in this virus?

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(1 mark)

- 2 (b) Describe how new viruses are produced after HIV has infected a T cell.

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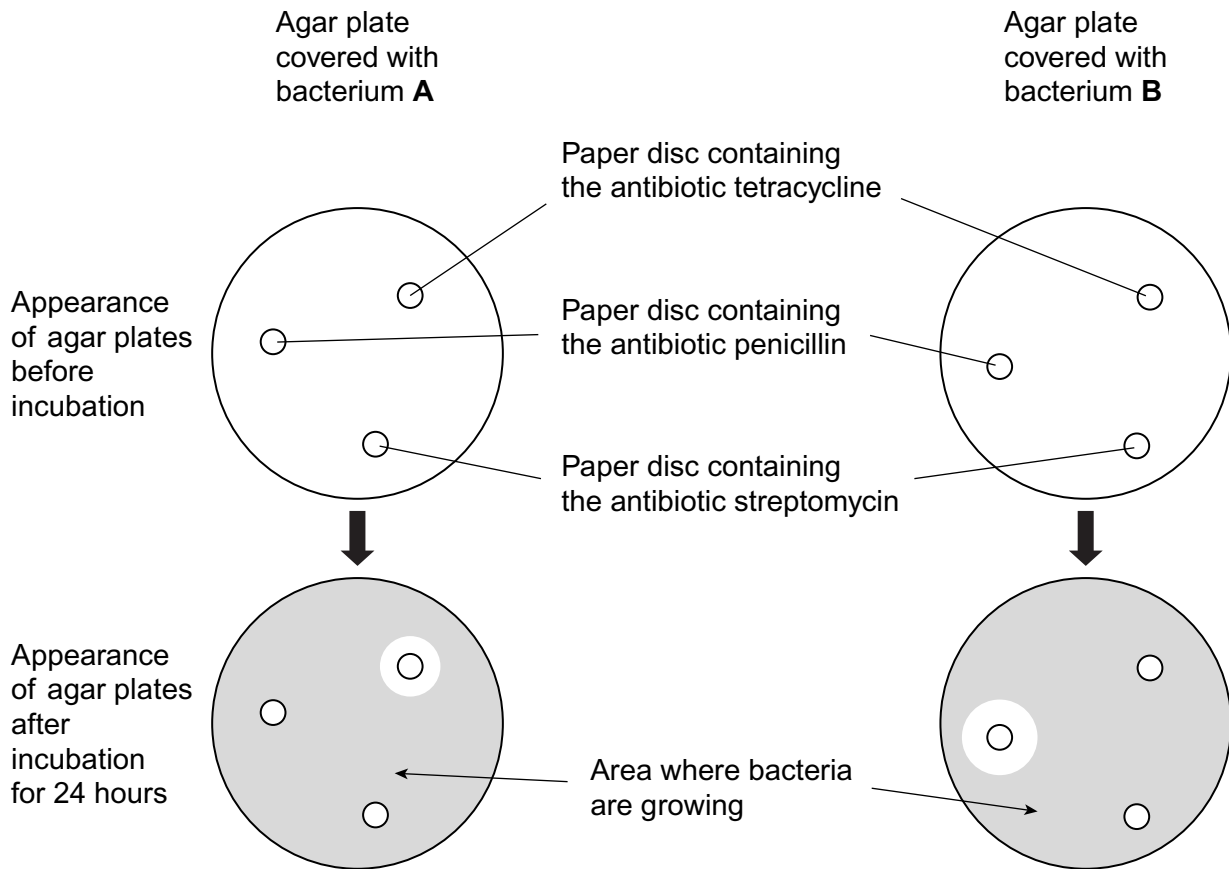
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- 3 A student was provided with two agar plates. She transferred a culture of bacterium **A** onto one plate and a culture of bacterium **B** to the second plate. She placed paper discs containing antibiotics on the surface of the agar. She then incubated the plates for 24 hours.

The diagram shows the agar plates before and after incubation.



- 3 (a)** The student used a pair of forceps to place the paper discs onto the surface of the agar.  
Explain why she passed the forceps through a Bunsen flame before and after each time she used them.

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(2 marks)

- 3 (b)** Explain the appearance of the agar plates after incubation.

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(4 marks)

(Extra space) .....

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- 4 (a) The structure of a plasma membrane is described as a fluid mosaic. Explain why.

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(2 marks)

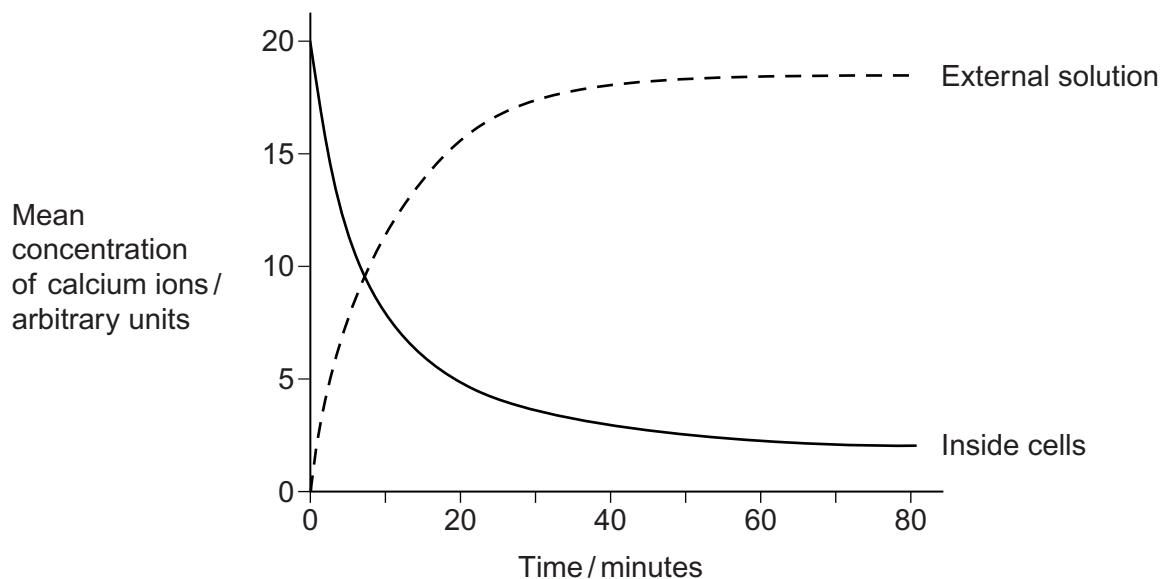
- 4 (b) Give **two** functions of proteins in plasma membranes.

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(2 marks)

Scientists investigated the movement of calcium ions across the plasma membrane of human cells. They placed human cells in a solution of calcium ions. At regular intervals, they measured the concentration of calcium ions in the external solution and the concentration of calcium ions inside the cells. Their results are shown in the graph.



- 4 (c) By what process did the calcium ions leave the cells after 10 minutes? Use evidence from the graph to support your answer.

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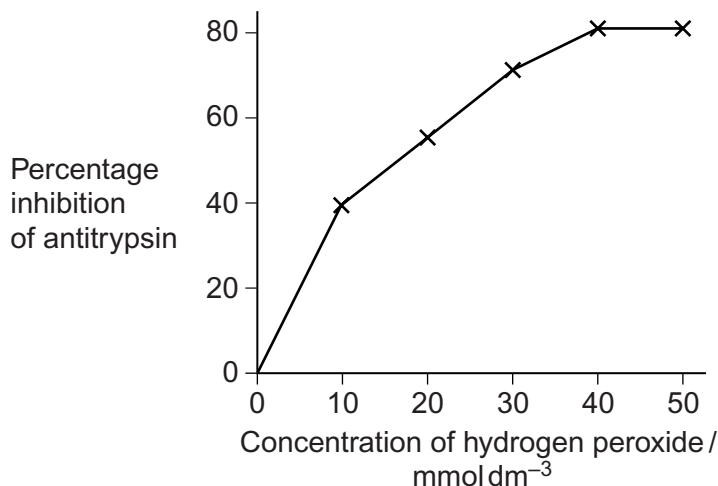
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(2 marks)



- 5** Alpha-1-antitrypsin is a protein that reduces the activity of enzymes that can damage lung tissue. Cigarette smoke contains hydrogen peroxide. Hydrogen peroxide reduces the activity of alpha-1-antitrypsin. Scientists investigated the effect of different concentrations of hydrogen peroxide on the activity of alpha-1-antitrypsin. The graph shows their results.



- 5 (a) (i)** Hydrogen peroxide reacts with two amino acids in alpha-1-antitrypsin. Explain how this reduces activity of the protein.

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(2 marks)

- 5 (a) (ii)** Explain the results shown in the graph.

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(2 marks)

- 5 (b)** Long-term smokers are often short of breath. Use this information to explain why.

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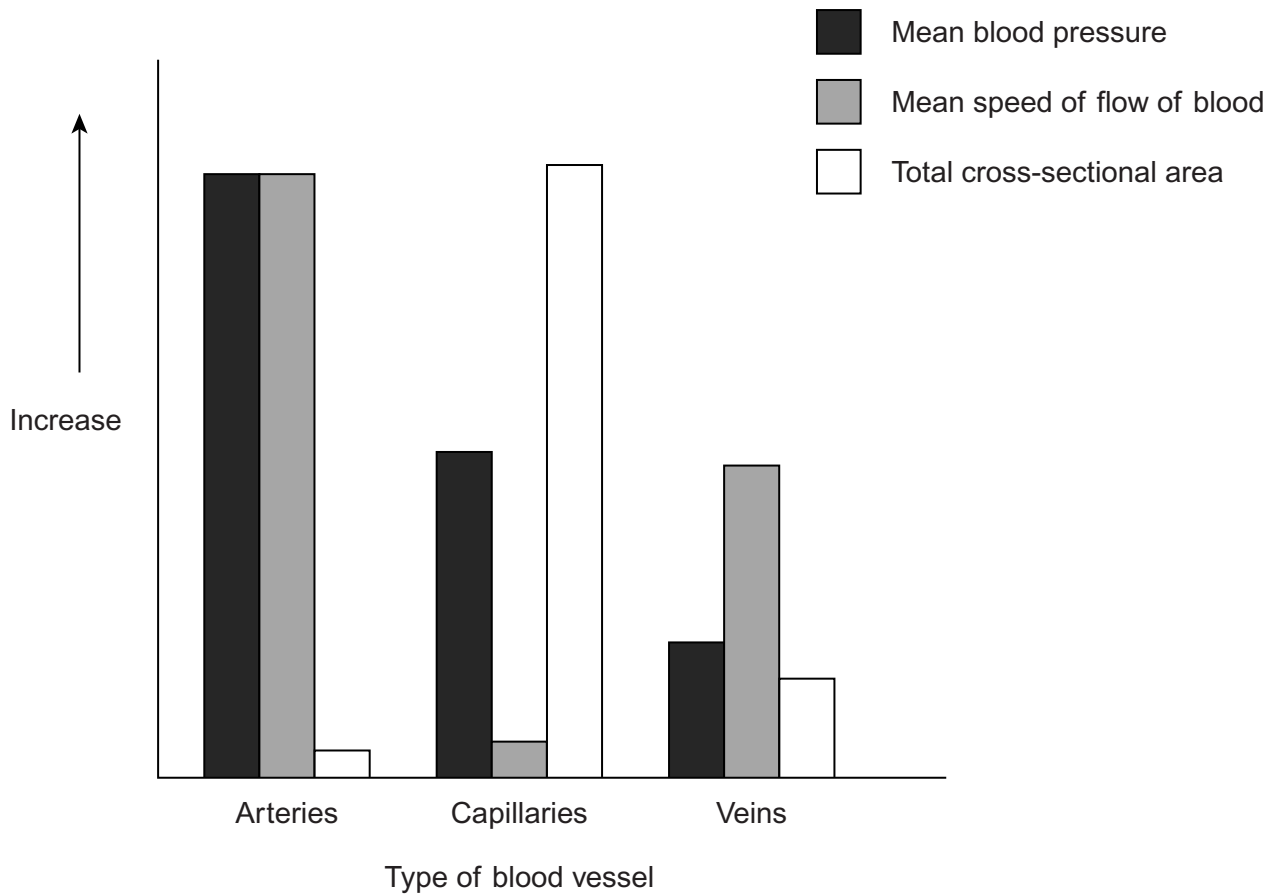
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(2 marks)



6 The graph shows some information about blood vessels.



6 (a) Atheroma is more likely to form in an artery than a vein. Use information from the graph to suggest why.

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(2 marks)

6 (b) Explain **one** advantage of the total cross-sectional area of the capillaries shown in the graph.

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(2 marks)





- 6 (c)** Use the information in the graph to explain why the mean speed of flow of blood is higher in veins than capillaries.

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(2 marks)

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**Turn over for the next question**

**Turn over ►**



7 (a) (i) Give **two** symptoms of *Salmonella* food poisoning.

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(2 marks)

7 (a) (ii) Food poisoning can occur if chicken meat contaminated with *Salmonella* is used to prepare a meal.

Give **two** ways that chicken meat can become contaminated with *Salmonella*.

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2 .....

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(2 marks)

Scientists investigated a way of reducing the number of chickens infected with *Salmonella*. They infected a large number of newly hatched chickens with *Salmonella* bacteria. They then divided the chickens at random into three groups, **W**, **X** and **Y**.

- Group **W** was given drinking water containing the sugar lactose.
- Group **X** was given drinking water containing the sugar mannose.
- Group **Y** was a control group.

They tested the chickens after ten days to see if they still had *Salmonella* bacteria in their guts.

Their results are shown in the table.

| Group                                      | Percentage of chickens with <i>Salmonella</i> bacteria in their gut 10 days after infection |
|--------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>W</b> Drinking water containing lactose | 53                                                                                          |
| <b>X</b> Drinking water containing mannose | 26                                                                                          |
| <b>Y</b> Control                           | 98                                                                                          |

7 (b) Suggest what group **Y** were given to drink. Give a reason for your answer.

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(2 marks)



- 7 (c)** The scientists concluded that adding sugar to the drinking water of newly hatched chickens would reduce the cases of food poisoning in humans. Evaluate this conclusion.

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(Extra space) ..... (3 marks)

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- 8** Deep vein thrombosis (DVT) may occur in patients who have had hip replacement surgery. Doctors investigated DVT in patients who underwent hip replacement surgery. All of the patients wore elastic stockings after surgery. The doctors divided the patients at random into two groups.
- Each person in group **J** was treated with a pump which squeezed the foot to stimulate blood flow in the veins.
  - Each person in group **K** was treated with a drug that inhibits blood clotting.
- The table shows some of their results.

| Group    | Number in group | Number of patients who developed a small blood clot | Number of patients who developed a large blood clot | Percentage of patients who developed DVT |
|----------|-----------------|-----------------------------------------------------|-----------------------------------------------------|------------------------------------------|
| <b>J</b> | 37              | 2                                                   | 1                                                   |                                          |
| <b>K</b> | 35              | 3                                                   | 9                                                   | 34.3                                     |

- 8 (a)** Complete the table to show the percentage of patients who developed DVT in group **J**. Use the space below to show your working.

(2 marks)

- 8 (b) (i)** Elastic stockings improve the flow of blood in the veins of the leg. Explain how.

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(2 marks)



- 8 (b) (ii)** The patients were divided *at random* into the two groups.  
Suggest how the doctors might have done this.

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 (1 mark)

- 8 (c)** Do these data support the use of the pump after hip replacement surgery?  
Give reasons for your answer.

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 (3 marks)

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8

Turn over for the next question

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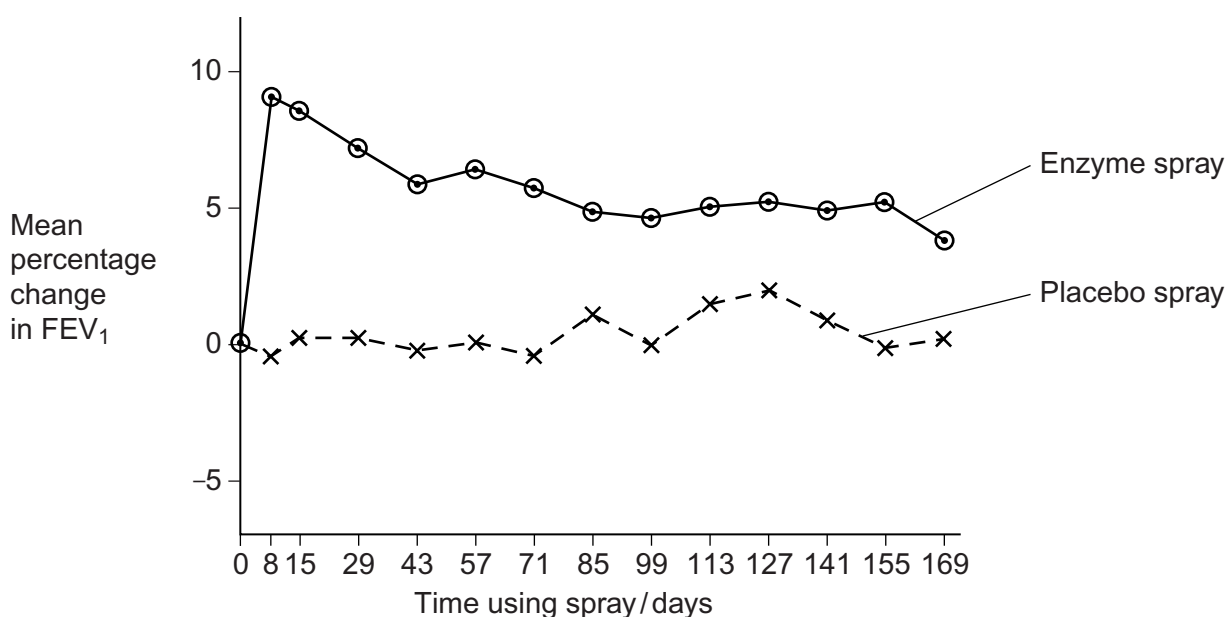


- 9** Forced expiratory lung volume ( $FEV_1$ ) is the volume of air forced out of the lungs in the first second when breathing out.

Doctors divided a large number of patients with cystic fibrosis (CF) into two groups. The patients were aged between 5 and 20 years old.

- Group **L** inhaled a spray containing an enzyme every day. This enzyme reduces the thickness of mucus in the airways.
- Group **M** inhaled a placebo spray every day. This was the same spray, but without the enzyme.

The doctors measured the  $FEV_1$  of each patient regularly over 169 days. They calculated the mean percentage change in  $FEV_1$  for each group. The graph shows their results.



- 9 (a) (i)** Describe the effect of the enzyme treatment on forced expiratory lung volume ( $FEV_1$ ).

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(2 marks)



**9 (a) (ii)** Explain the effect of the enzyme treatment on forced expiratory lung volume (FEV<sub>1</sub>).

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**9 (b)** Explain why the changes in FEV<sub>1</sub> were expressed as percentages.

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**9 (c)** The age range of the patients in this study was wide. Explain **one** disadvantage of this.

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**Turn over for the next question**

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**10** Read the following passage.

Coronary heart disease kills more than 7 million people every year. Most myocardial infarctions are linked to atheroma formation in the walls of arteries. Scientists are investigating ways to prevent the formation of atheroma.

Low-density lipoprotein (LDL) is one factor that can increase the development of atheroma. Scientists investigated the effects of injecting the protein from low density lipoprotein into mice. These mice developed less atheroma than uninjected mice and their existing atheroma plaques stopped growing. Blood tests on the injected mice showed the presence of antibody specific to LDL in their blood. The protein from LDL had acted as an antigen, causing the production of this antibody. These results led the scientists to suggest that mice could be vaccinated against atheroma formation and heart disease.

The scientists tested their idea by injecting another group of mice with antibody specific to LDL. They did not think that injecting this antibody would give long-term protection against atheroma formation. The results suggested, however, that in the short term, the antibody injection was almost as effective as an existing vaccination against atheroma formation. The scientists concluded that injections of protein from LDL could be used to prevent atheroma formation in humans.

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

- 10 (a) (i)** A poor diet increases the probability of developing coronary heart disease. Give **two** other lifestyle factors that increase the probability of developing coronary heart disease.

1 .....

2 .....  
(2 marks)





**10 (a) (ii)** Describe how atheroma may cause myocardial infarction. (line 2)

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(4 marks)

(Extra space) .....

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**10 (b) (i)** Explain why the antibody was specific to LDL. (lines 9–10)

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(2 marks)

**Question 10 continues on the next page**

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(6 marks)



- 10 (c) (i)** The scientists did not think that injecting antibodies specific to LDL would give long-term protection against atheroma formation. (lines 15–16)  
Explain why.

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(2 marks)

- 10 (c) (ii)** The scientists concluded that injecting humans with protein from LDL could be used to prevent the development of atheroma (lines 19–20).  
Evaluate this statement.

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(4 marks)

(Extra space) .....

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20

**END OF QUESTIONS**



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ANSWER IN THE SPACES PROVIDED**

