

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
January 2011

Human Biology

HBIO1

Unit 1 The body and its diseases

Tuesday 11 January 2011 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 will be marked on your ability to:
 - use good English
 - organise information clearly
 - use scientific terminology accurately.

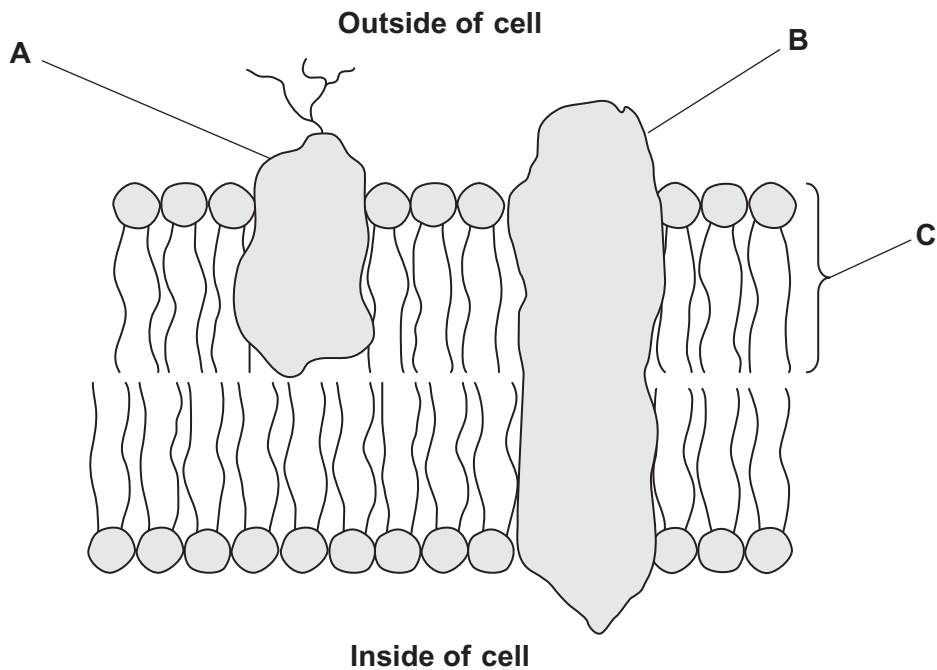
For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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6	
7	
8	
9	
10	
TOTAL	



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

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

- 1 The diagram shows the structure of a plasma membrane.



- 1 (a) Name
- protein **A**
- protein **B**
- molecule **C** (3 marks)

- 1 (b) Name **two** structures found in a prokaryotic cell that are **not** found in a human cell.
- 1
- 2 (2 marks)



- 2 (a)** Describe how HIV is replicated after it has entered a human cell.

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(4 marks)

(Extra space)

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- 2 (b)** The destruction of T-cells by HIV leads to the death of an infected person.
Explain how.

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(2 marks)

Turn over for the next question



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**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



3 (a) Describe **two** differences between active transport and facilitated diffusion.

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(2 marks)

3 (b) Explain why molecules of oxygen and carbon dioxide are able to diffuse across membranes.

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(2 marks)

3 (c) Explain why ventilation of the lungs increases the efficiency of gas exchange.

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(2 marks)

Turn over for the next question

6

Turn over ►



4 (a) What is an enzyme?

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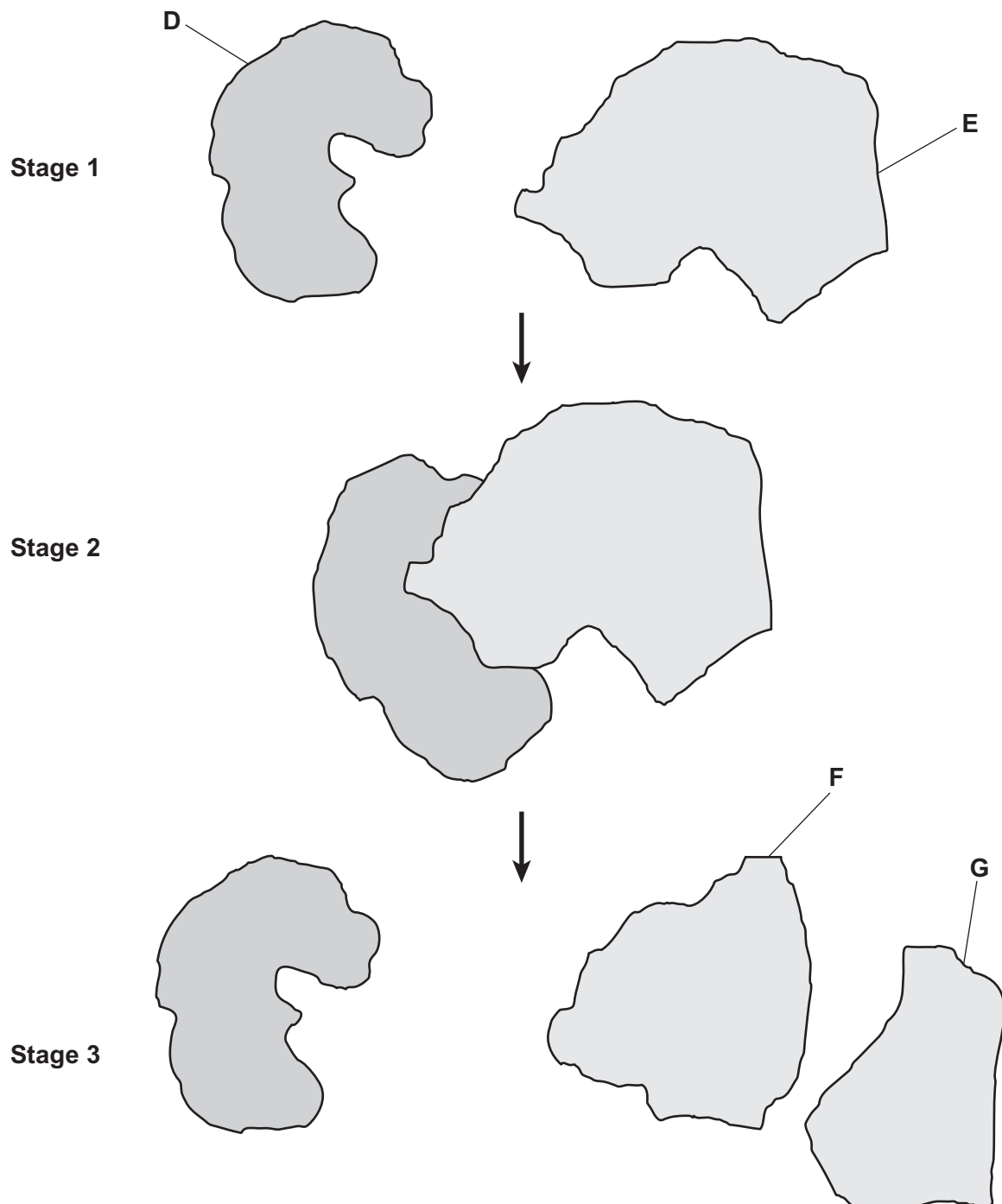
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(2 marks)

The diagram shows stages during an enzyme-catalysed reaction.



4 (b) Using the letters in the diagram, describe what is happening in this reaction.

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(Extra space) (3 marks)

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- 5 (a) The beating of the heart is myogenic.
Explain what this means.

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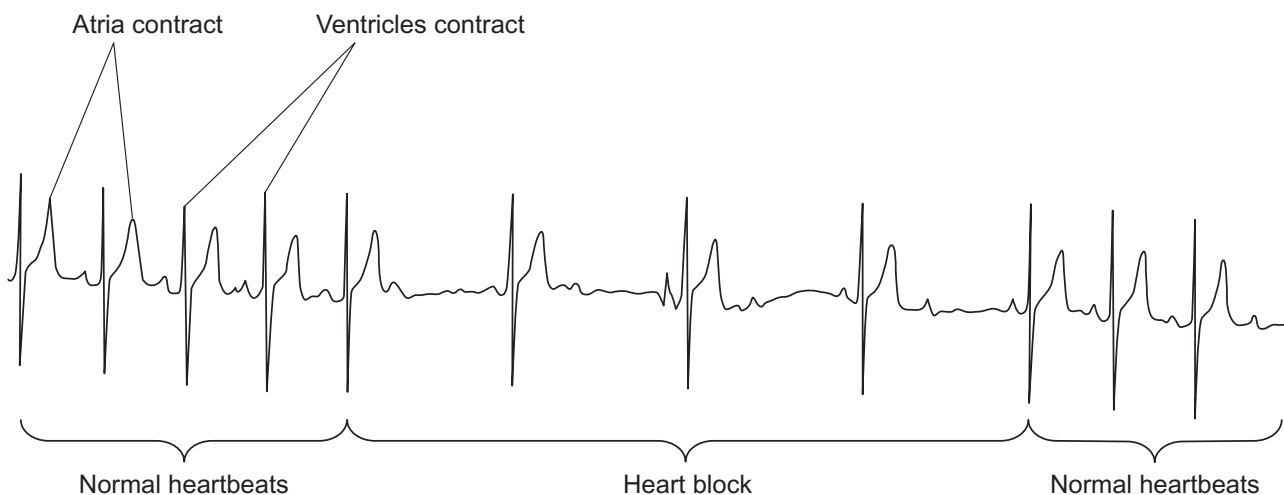
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(2 marks)

Some people have a condition called a *heart block*. This condition sometimes affects the beating of their heart. There are three types of heart block.

- First-degree heart block – the delay between contraction of the atria and production of electrical activity by the atrioventricular node (AVN) is too long.
- Second-degree heart block – not every contraction of the atria is followed by production of electrical activity by the AVN.
- Third-degree heart block – contraction of the atria is not followed by production of electrical activity by the AVN.

The recording below shows electrical activity of the heart of someone with a heart block. This recording was made over a period of 15 seconds.



5 (b) Explain which type of heart block this person has.

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(3 marks)

(Extra space)

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5 (c) Suggest how an artificial pacemaker could help this person.

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(2 marks)

Turn over for the next question

7

Turn over ►



6 (a) Describe how coronary by-pass surgery is used to treat coronary heart disease.

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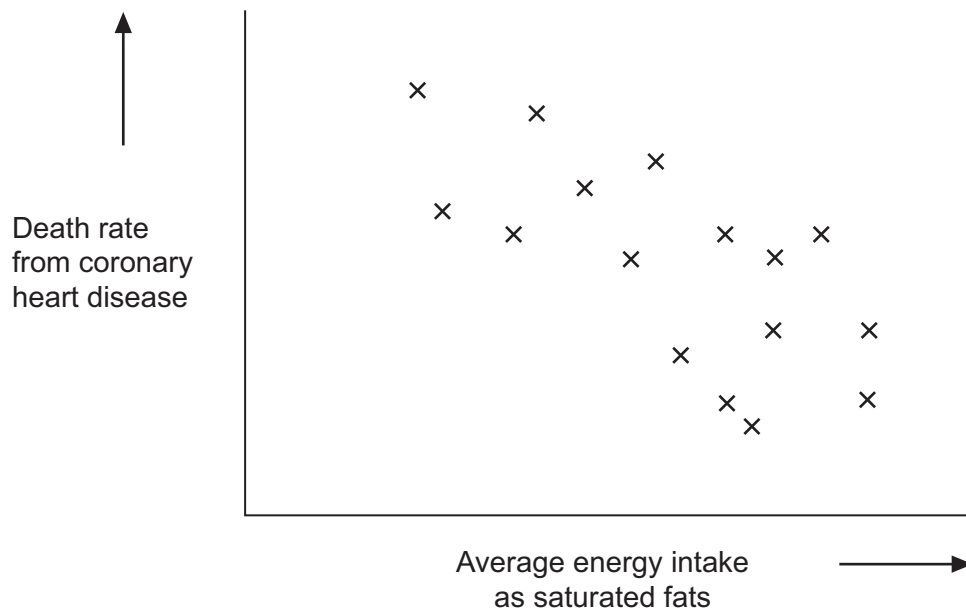
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(2 marks)

Scientists investigated the death rates from coronary heart disease in some European countries. They also investigated the average energy intake as saturated fats by people in the same countries.

The graph shows their results.



6 (b) Describe the results.

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(2 marks)



- 6 (c)** Current dietary advice is to reduce the intake of saturated fats to reduce the risk of coronary heart disease.

One journalist concluded from these results that current dietary advice about saturated fats was not correct.

Suggest and explain **one** reason why the journalist's conclusion may have been wrong.

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(2 marks)

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Turn over for the next question

Turn over ►



- 7 (a)** People with cystic fibrosis have thick mucus which blocks the airways leading to their lungs.

Explain why people with cystic fibrosis have thick mucus.

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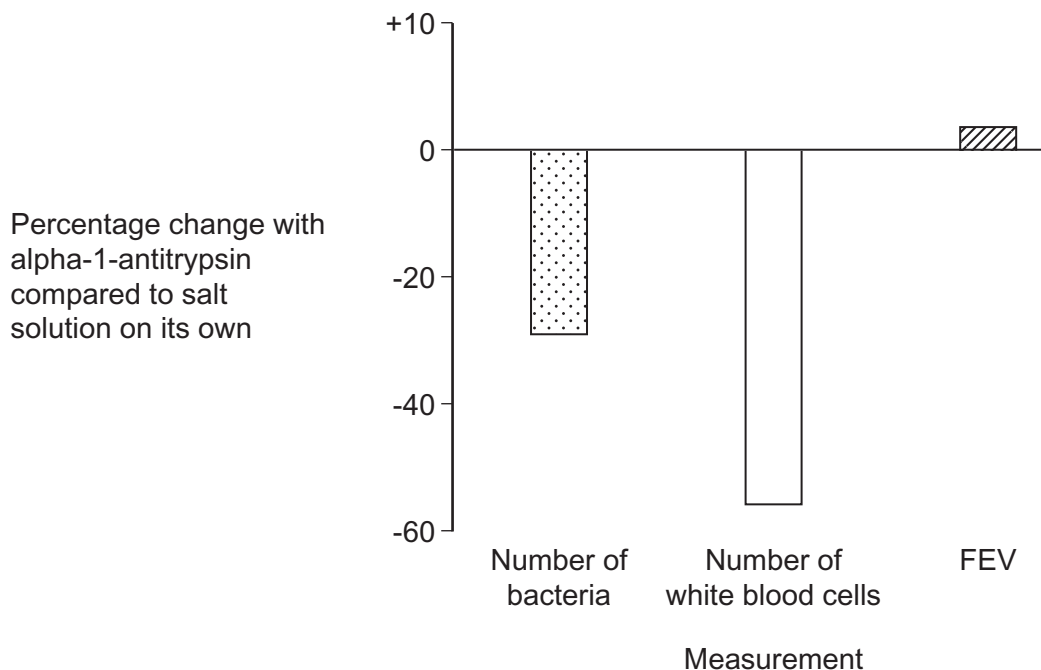
(3 marks)

Doctors investigated the effects of inhaling alpha-1-antitrypsin on patients with cystic fibrosis. They recruited volunteers with cystic fibrosis. These volunteers continued with their other treatments for cystic fibrosis during the investigation.

The volunteers first used an inhaler that produced a spray of salt solution. They used this inhaler for two weeks. At the end of the two weeks, the doctors measured the following.

- The number of bacteria in mucus from the patients' lungs.
- The number of white blood cells in the mucus from their airways.
- The forced expiratory volume (FEV). This is the maximum amount a person can breathe out in a single breath.

The patients then used a different inhaler that produced a spray containing alpha-1-antitrypsin in salt solution. They used this inhaler for four weeks. At the end of this time, the doctors repeated their measurements. They then calculated the percentage changes in the measurements. The graph shows their results.



- 7 (b)** The doctors asked the patients to use the inhaler containing only salt solution before using the inhaler containing alpha-1-antitrypsin in salt solution.

Explain why.

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(1 mark)

- 7 (c)** The doctors concluded that alpha-1-antitrypsin could reduce damage to the lungs of people with cystic fibrosis.

Use information from the graph to explain why they made this conclusion.

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(2 marks)

- 7 (d)** The doctors did not expect that the alpha-1-antitrypsin would increase the FEV of the patients during this investigation.

Suggest why they thought this.

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(2 marks)



8 (a) Describe how tuberculosis is spread from one person to another.

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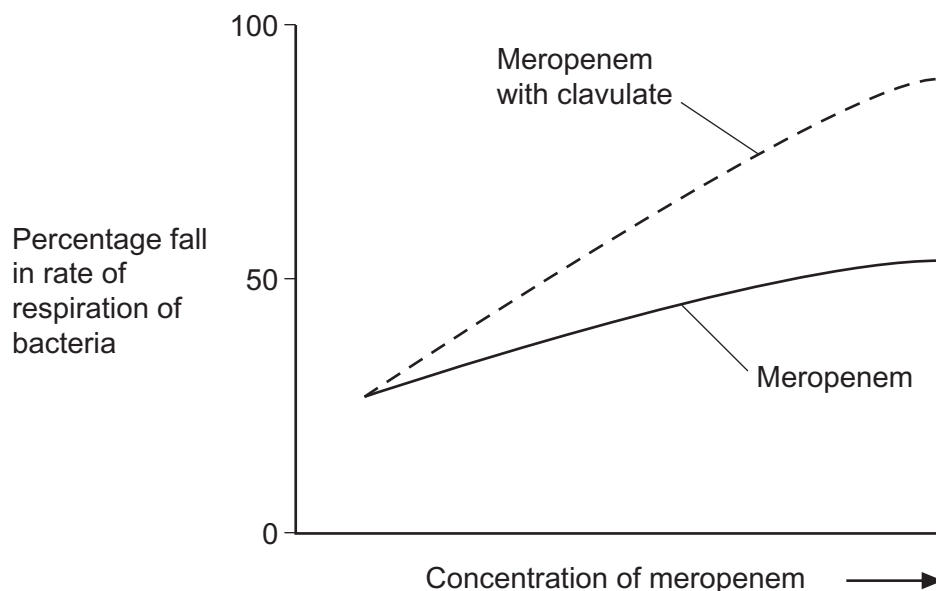
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(2 marks)

The antibiotic, meropenem, is not very effective against the bacterium that causes tuberculosis. Scientists investigated whether a substance called clavulate could make meropenem more effective against tuberculosis.

The scientists grew the tuberculosis-causing bacterium on nutrient agar jelly in Petri dishes. They added different concentrations of meropenem to some of the Petri dishes.

To the other Petri dishes they added the same concentrations of meropenem together with clavulate. They measured the percentage fall in the rate of respiration of the bacteria in each Petri dish after two weeks of treatment. The graph shows their results.



- 8 (b)** Suggest why the scientists measured the fall in the rate of respiration of the bacteria in the cultures as a percentage.

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(2 marks)

- 8 (c)** The scientists concluded that these results showed that clavulate made meropenem more effective in killing the tuberculosis-causing bacterium.

Evaluate this conclusion.

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(2 marks)

- 8 (d)** The tuberculosis-causing bacterium produces an enzyme called β -lactamase that breaks down meropenem. Clavulate binds to this enzyme and this stops the enzyme working.

Suggest why this stops the enzyme working.

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(2 marks)

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Turn over ►



- 9** Doctors use Zevalin to kill cancerous B-cells. Zevalin is a monoclonal antibody which has a highly radioactive substance called yttrium attached to it. The antibody binds to the surface of B-cells and the radioactivity kills the cells.

- 9 (a)** Only B-cells are killed by Zevalin.

Explain why.

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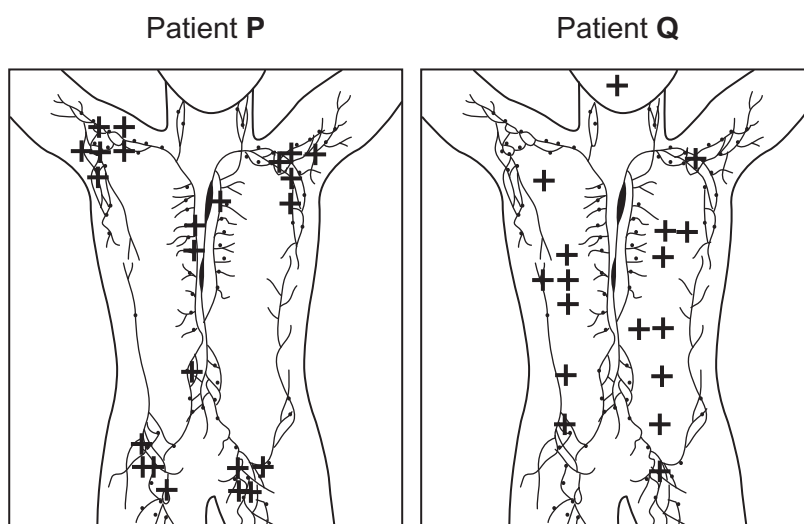
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(2 marks)

The cancerous B-cells are found mainly in the lymphatic system of patients.

Before treating any patient with Zevalin containing yttrium, doctors test the patient with a different form of Zevalin. This form has radioactive indium attached to the antibody instead of yttrium. The radioactivity from indium is strong enough for doctors to detect but not strong enough to kill a patient's cells.

The diagram shows the lymphatic systems of two patients, **P** and **Q**, after being given Zevalin with indium. The crosses (+) show where indium was detected.



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(3 marks)

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(2 marks)

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(2 marks)

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10 Read the passage.

Current dietary advice is that a healthy diet should be high in fruit and vegetables and low in salt and fat.

When you eat more salt, you retain more water in your body and this increases your blood pressure. The higher your blood pressure during childhood, the higher it will be when you become an adult. High blood pressure accelerates atheroma formation. Due to their high salt diet, many young children are showing early signs of atheroma formation. A meal of a burger and chips may contain up to 4.2 g of salt. This is more than the recommended 3 g daily maximum for a child. 5

Many studies show that drinking fizzy drinks containing the disaccharide, sucrose, is what makes children obese. The more salt they eat, the thirstier these children get and the more fizzy drinks they drink. In one study, this extra intake was estimated to give an extra energy intake of 1160 joules per day. An extra energy intake of 32 300 joules produces approximately 1 kg of body fat. As a result, children on high salt diets who drink fizzy drinks put on mass unless they exercise to compensate. 10 15

500 cm³ of a fizzy drink may contain more than 13 teaspoons of sucrose. Some children drink fruit juices instead of fizzy drinks. A 170 cm³ serving of orange juice contains 3 teaspoons of monosaccharide, fructose. Vegetables such as cabbage and carrots contain very little sucrose or fructose. 20

10 (a) Other than its high salt content, explain **two** ways in which a meal of a burger and chips could be unhealthy. (Line 8)

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(4 marks)



- 10 (b)** Suggest how retaining more water in the body increases blood pressure.
(Lines 3 and 4)

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(2 marks)

- 10 (c)** Explain how high blood pressure accelerates atheroma formation. (Lines 5 and 6)

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(4 marks)

- 10 (d)** Calculate how much mass a child would gain in a week if their extra energy intake through fizzy drinks was 1160 joules per day. (Line 13)
Show your working.

Mass gained kg
(2 marks)

Question 10 continues on the next page

Turn over ►



10 (e) Sucrose is a disaccharide. (Lines 10 and 11)

What is a disaccharide?

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(2 marks)

10 (f) Having read this information, one nutritionist suggested that the advice to eat a diet high in fruit and vegetables should be changed to leave out the references to fruit. (Line 1)

Evaluate this suggestion.

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(6 marks)

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END OF QUESTIONS

