Surname

Other Names

Candidate Signature

AQA

General Certificate of Education
Advanced Subsidiary Examination
January 2009

Human Biology   HBIO1

Unit 1   The body and its diseases

Thursday 8 January 2009   9.00 am to 10.30 am

For this paper you must have:
● a ruler with millimetre measurements.
You may use 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. Answers written in margins or on blank pages will not be marked.
● If you need extra space use page 22 for your answers.
● 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 reminded of the need for good English and clear presentation in your answers.
● Use accurate scientific terminology in all answers.

APW/Jan09/HBIO1

HBIO1

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

1 The diagram shows a section through a human heart. It is seen from the front.
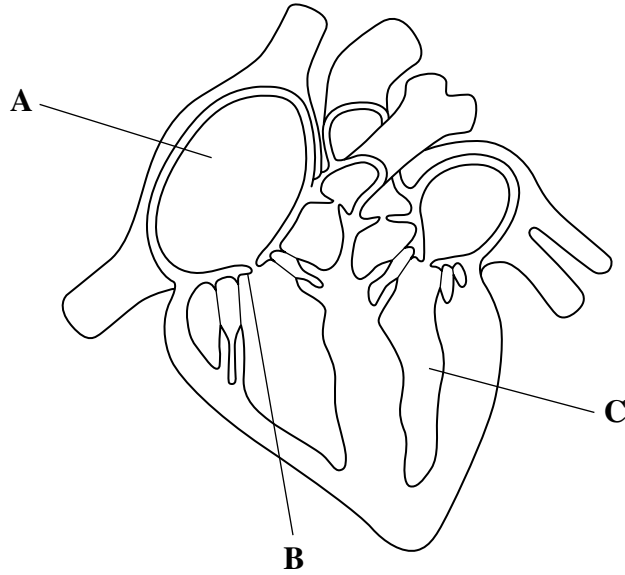
1 (a) Name

part **A** ....

part **B** ....

part **C** ....

(3 marks)

1 (b) Describe the role of each of the following in the production of a heart beat.

1 (b) (i) Atrioventricular node (AVN)

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(1 mark)

1 (b) (ii) Bundle of His and Purkyne fibres

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(2 marks)

2 The diagram shows a bacterium.
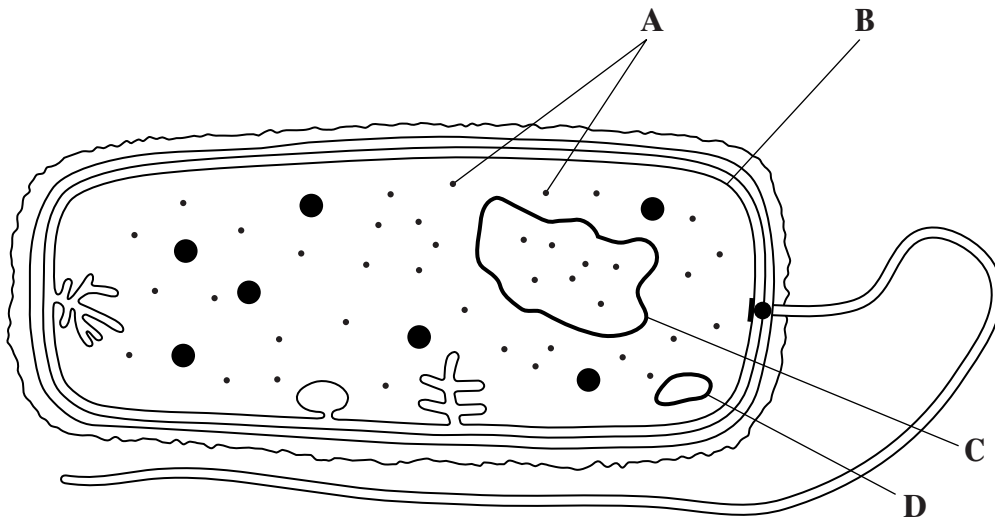
2 (a) Name

2 (a) (i) organelle **A** ....

(1 mark)

2 (a) (ii) structure **B** ....

(1 mark)

2 (b) Give **two** ways in which the structure of this bacterium is different from the structure of cells lining the alveoli of a human lung.

1 ....

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(2 marks)

2 (c) Structures **C** and **D** are made of the same type of biological molecule. They have a similar function.

What is the function of **C** and **D**?

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(1 mark)

5

Turn over ▶

*Areas outside
the box will
not be scanned
for marking*

3 (a) A protein has a tertiary structure.

Name **two** types of bond that hold the tertiary structure together.

1 ....

2 ....

(2 marks)

3 (b) Name the type of reaction involved in the breakdown of a protein into amino acids.

....

(1 mark)

3 (c) A student used paper chromatography to separate the amino acids in a mixture. The results are shown on the chromatogram.

Solvent front

X

**Position of original
spot of mixture**

Origin line
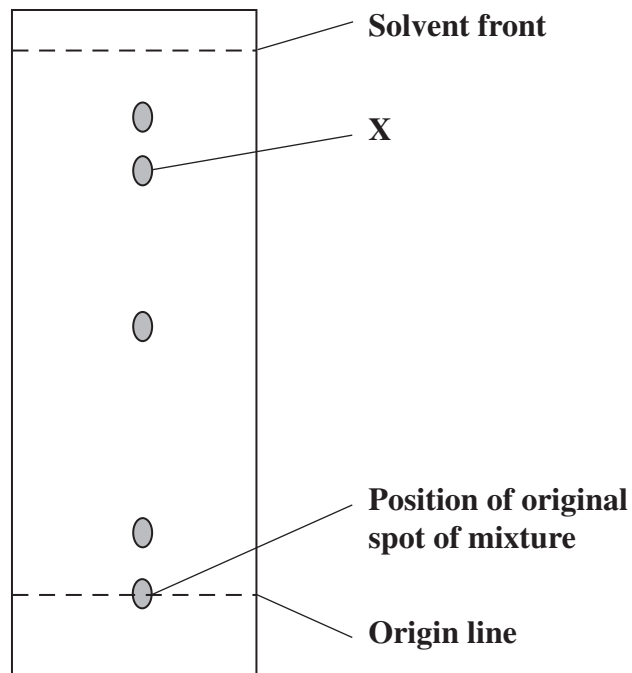
The table shows the Rf values for some amino acids.

Amino acid	Rf value
Histidine	0.13
Glycine	0.28
Glutamic acid	0.33
Tyrosine	0.64
Valine	0.78
Leucine	0.86

Use the chromatogram and the information in the table to identify the spot labelled **X** on the chromatogram. Show how you arrived at your answer.

Name of amino acid .... *(3 marks)*

6

Turn over for the next question

Turn over ▶

4 (a) Describe the *induced fit model* of enzyme action.

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(2 marks)

4 (b) The graph shows the effect of temperature on the rate of an enzyme-controlled reaction.
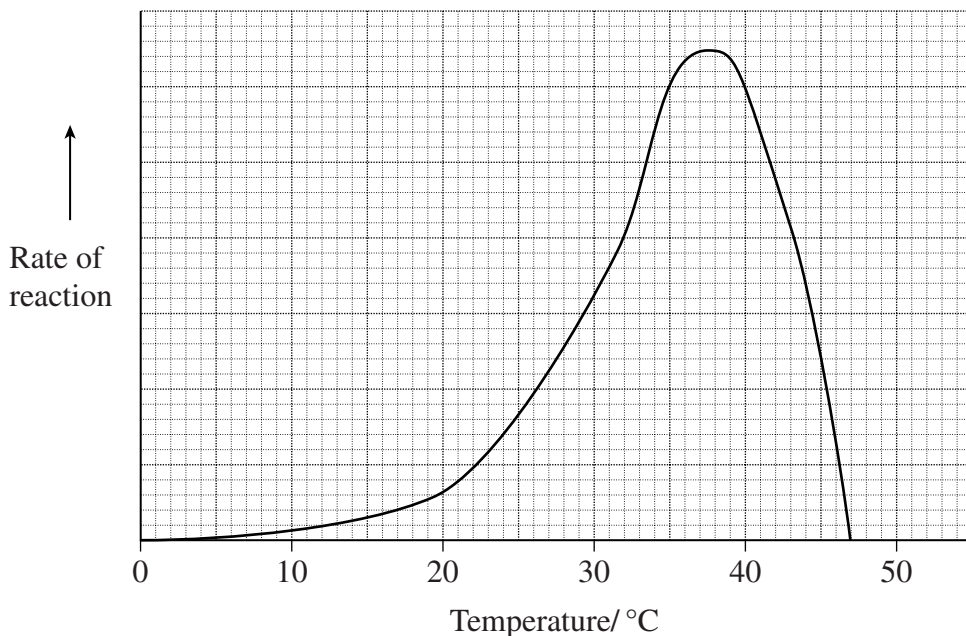
Explain the shape of the curve between 0 °C and 30 °C.

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

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5

Turn over ▶

*Areas outside
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5 Doctors investigated babies who were bottle-fed with baby-formula milk and suffered from colic. Colic is a condition that affects the gut and makes babies cry.

Each mother was given two solutions to add to her baby's milk. One solution contained the enzyme lactase, the other did not. The mother did not know which solution contained lactase. The mother added one of the solutions to her baby's milk for a week and recorded how long it cried each day. The mother then used the other solution for the second week.

The table shows the results.

	Mean crying time / hours day^{-1}
Milk with lactase	1.43
Milk without lactase	2.57

5 (a) Suggest an explanation for the results.

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(2 marks)

5 (b) The mothers were not told which solution contained lactase.

Suggest **one** reason why.

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(1 mark)

5 (c) Suggest **one** variable the doctors would have to control in this study to make it a fair test. Explain your answer.

Variable ....

Explanation ....

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(2 marks)

5 (d) The doctors concluded that adding lactase to milk was, '*A major breakthrough for babies with colic*.'

Evaluate the evidence for this conclusion.

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(3 marks)

(Extra space) ....

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8

Turn over ▶

6 (a) Explain why people with cystic fibrosis (CF) produce thick mucus.

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(3 marks)

(Extra space) ....

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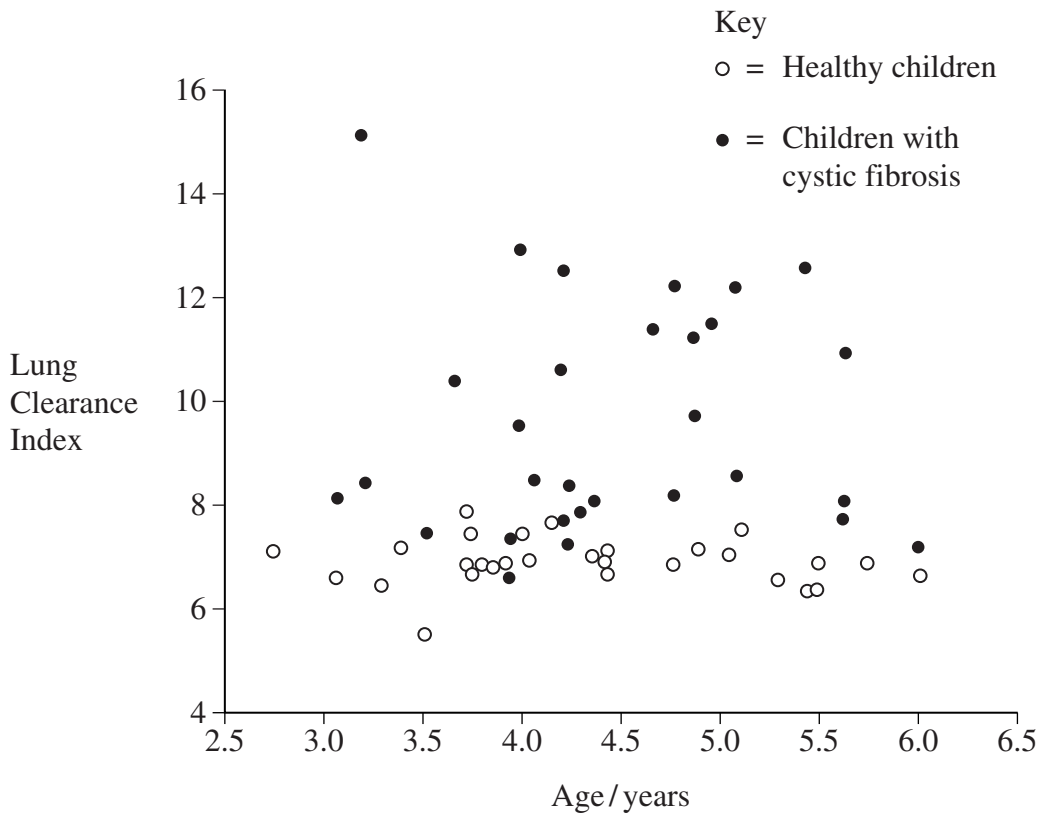
6 (b) The *Lung Clearance Index* (LCI) measures how efficiently the lungs are ventilated. A high LCI shows that the lungs are not ventilated efficiently.

Doctors measured the LCI of healthy children and children with cystic fibrosis. The results are shown on the graph.

Key

o = Healthy children

● = Children with cystic fibrosis

Lung Clearance Index

Age / years

6 (b) Describe and explain the results.

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(4 marks)

(Extra space) ....

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7

Turn over for the next question

Turn over ▶

7 (a) Explain how *Salmonella* causes food poisoning.

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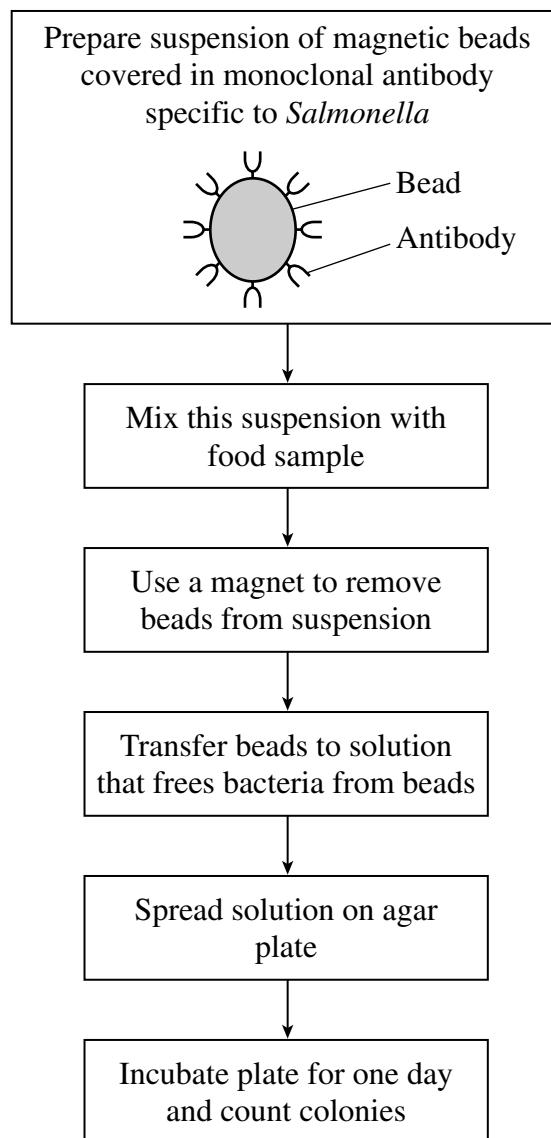
(2 marks)

7 (b) There may be many species of bacteria on food. It is important to be able to test food to see whether or not it is contaminated with *Salmonella*. The diagram shows a method for isolating and growing any *Salmonella* present in food.

Prepare suspension of magnetic beads covered in monoclonal antibody specific to *Salmonella*

Bead

Antibody

Mix this suspension with food sample

Use a magnet to remove beads from suspension

Transfer beads to solution that frees bacteria from beads

Spread solution on agar plate

Incubate plate for one day and count colonies

7 (b) (i) This method allows only *Salmonella* bacteria to be isolated from a food sample.

Explain how.

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(1 mark)

7 (b) (ii) This method allows the number of *Salmonella* bacteria in a food sample to be estimated.

Explain how.

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(2 marks)

7 (b) (iii) Describe **two** aseptic techniques a technician would use to prevent contamination of the agar plate with unwanted bacteria.

1 ....

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2 ....

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(2 marks)

7

Turn over for the next question

Turn over ▶

14

*Areas outside
the box will
not be scanned
for marking*

8 (a) What is the *Glycaemic Index* of a food?

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(2 marks)

8 (b) The table shows mean values for the major features of a normal diet and a low glycaemic index (LGI) diet each day.

Feature of diet	Mean values (± Standard Deviation)	
	Normal diet	LGI diet
Glycaemic Index	59.7 (± 1.5)	52.1 (± 1.9)
Energy content / kJ day^{-1}	9125 (± 1318)	9159 (± 632)
Energy from carbohydrates %	54.8 (± 2.2)	50.6 (± 3.6)
Energy from fats %	28.5 (± 2.2)	31.9 (± 3.5)
Fibre / g day^{-1}	13.5 (± 2.1)	22.3 (± 2.1)
Protein / g day^{-1}	13.8 (± 1.1)	15.4 (± 0.8)

What is the evidence from the table that the LGI diet contains more plant material but the same amount of meat as the normal diet?

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(3 marks)

(Extra space) ....

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8   (c)   Scientists investigated the effects of an LGI diet on blood glucose concentrations. They recorded the blood glucose concentrations of healthy volunteers for one week on their normal diets and for a second week on an LGI diet.

The graph shows the effects of the normal diet and the LGI diet on the mean blood glucose concentration of the volunteers during one day.
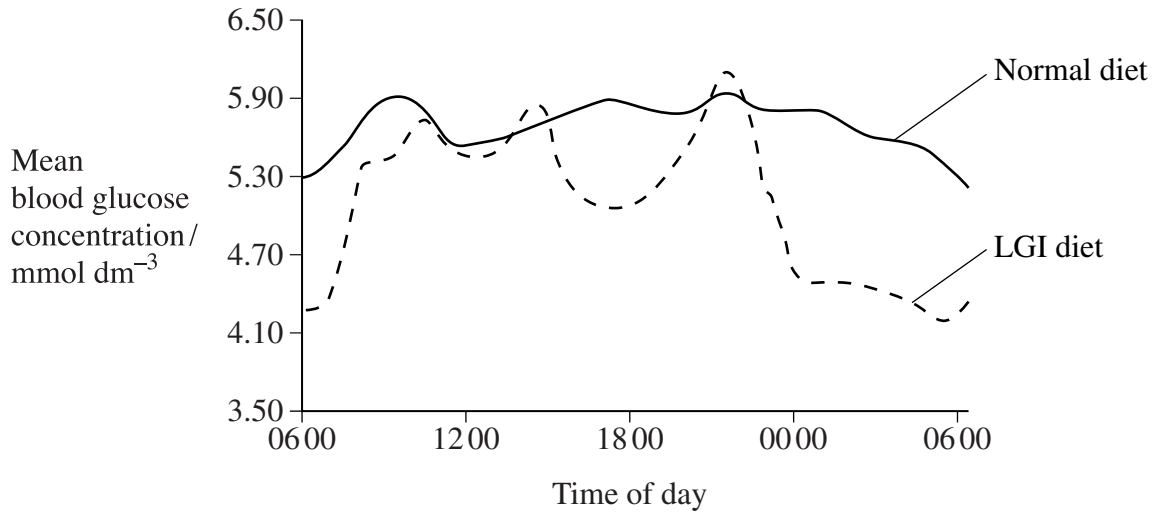
8   (c)   (i)   Describe the effect on mean blood glucose concentration of the LGI diet compared to the normal diet.

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(2 marks)

8   (c)   (ii)   Suggest **one** reason for the effect of the LGI diet on blood glucose concentration.

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(1 mark)

8

Turn over ▶

9 (a) Describe how atheroma forms in the wall of an artery.

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(3 marks)

(Extra space) ....

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9 (b) A protein found in blood increases the risk of developing atheroma. Scientists measured the amount of this protein in the blood of volunteers. They also calculated the *Body Mass Index* (BMI) and *Waist to Hip Ratio* (WHR) for each volunteer. A high BMI or WHR is usually linked to obesity. The graphs show the results and lines of best fit. The scientists found a correlation between the amount of this protein and both BMI and WHR.

Amount of the atheroma-causing protein in blood/ arbitrary units

Body Mass Index ⟶   Waist to Hip Ratio ⟶
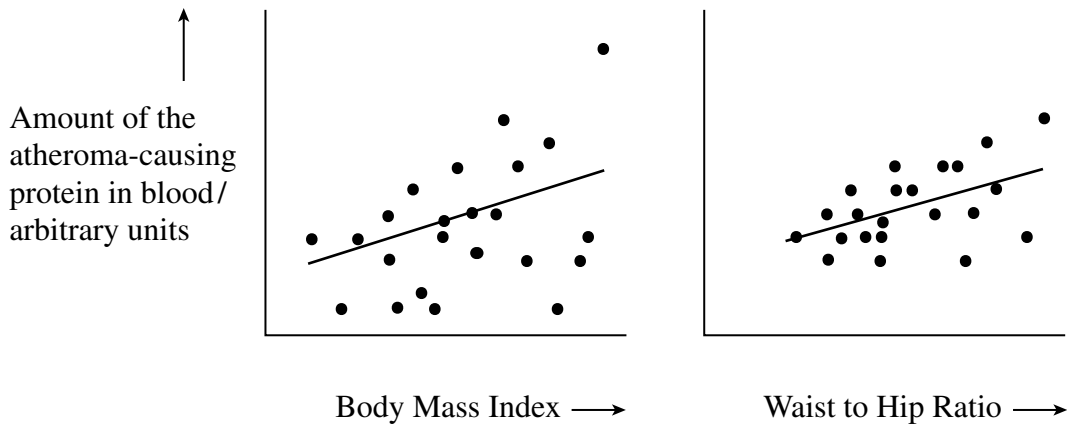
9 (b) (i) What do these data suggest about being obese and the risk of atheroma formation? Give the evidence for your answer.

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(2 marks)

9 (b) (ii) Using these data, would BMI or WHR be more reliable for identifying people who are likely to develop atheromas? Explain your answer.

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(2 marks)

9 (b) (iii) A person's BMI is calculated using the following equation.

$$BMI = \frac{mass}{height^2}$$

Suggest **one** reason why BMI may not be an accurate indicator of obesity.

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(1 mark)

8

Turn over for the next question

Turn over ▶

10 Read the following passage.

Measles, mumps and rubella are three diseases caused by viruses. These diseases are rarely fatal but can leave lasting damage. For example, mumps causes the blockage of lymph vessels and this can lead to swelling that damages affected tissues.

The MMR vaccine is given to young children and causes them to develop immunity to measles, mumps and rubella. The vaccine contains non-harmful forms of viruses. In 1998, a doctor in the UK published the results of a study on a small number of children who developed gut disorders shortly after receiving the MMR vaccine. The doctor suggested that there was a link between the vaccine and development of gut disorders. In the same year, scientists from Finland published the results of a 14-year study of 3 million children who had been given the MMR vaccine. They found 31 children had developed gut disorders after vaccination. All 31 children had recovered.

5

10

The UK study suggesting links between the MMR vaccine and gut disorders was reported in the press. The public reaction to these reports has caused health officials to think that there may soon be very large numbers of cases of measles in some parts of the country. One group of scientists concluded that a correlation would be found between the MMR vaccine and almost any illness.

15

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

10 (a) Explain why measles, mumps and rubella cannot be treated with antibiotics.

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(2 marks)

10 (b) Mumps causes blockage of lymph vessels (lines 2 – 4). Explain how this can lead to the swelling of tissues.

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(2 marks)

10 (c) The MMR vaccine causes a child to develop immunity against measles and mumps and rubella (lines 5 – 6).

Describe how.

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(7 marks)

(Extra space) ....

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Question 10 continues on the next page

Turn over ▶

10 (d) The public reaction to press reports of the UK study may lead to very large numbers of cases of measles in some parts of the country (lines 15 – 17).

Suggest why.

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(3 marks)

(Extra space) ....

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10 (e) Health authorities have decided that the MMR vaccine is safe and have decided to continue offering the vaccine to all children. Does the information in the passage support these decisions? Explain your answer.

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(4 marks)

(Extra space) ....

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10 (f) One group of scientists concluded that a correlation would be found between the MMR vaccine and almost any illness (lines 17 – 19). Explain why.

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(2 marks)

20

END OF QUESTIONS

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If you need extra space use this page for your answers.

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