AQA GCSE Biology | 8461

SPECIFICATION POINT 4.5.3.2

Control of blood glucose concentration

Past-paper questions

Tier	**Higher**
Question groups	**22**
Available paper years	**2007–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

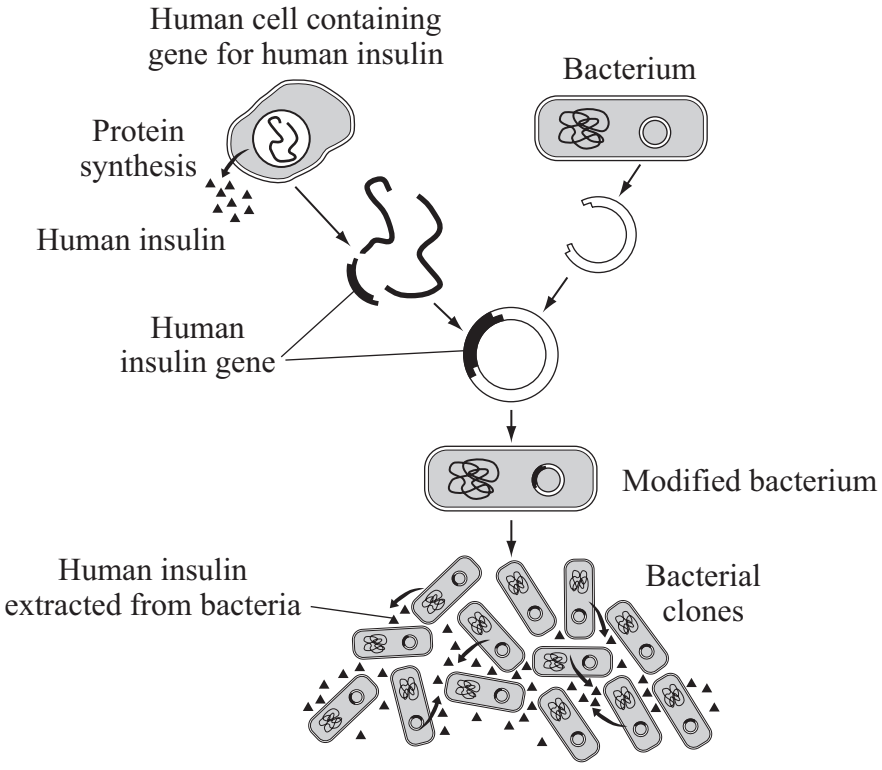
4.5.3.2 Control of blood glucose concentration

Question 01

June 2007 | BLY1B | Original Q5 | Legacy

QUESTION FIVE

The diagram shows some of the stages involved in the production of the human protein insulin, by a bacterium.



5A The human insulin gene was cut out of a human . . .

1 chromosome.

2 gamete.

3 nucleus.

4 embryo.

5B The removal of the insulin gene from the human cell is carried out by . . .

1 an enzyme.

2 a hormone.

3 a human gene.

4 a bacterium.

4.5.3.2 Control of blood glucose concentration

5C The advantage of using bacteria rather than mammals to manufacture the insulin is that . . .

1 it needs less research.

2 the bacteria can provide more insulin than a mammal.

3 the bacteria will produce insulin that is less toxic.

4 there are likely to be fewer ethical objections.

5D This method of producing a product using bacteria is an example of . . .

1 sexual reproduction.

2 evolution.

3 genetic engineering.

4 natural selection.

Turn over for the next question

4.5.3.2 Control of blood glucose concentration

Question 02

November 2007 | BLY1A | Original Q2 | Legacy

QUESTION TWO

This question is about substances in the diet.

Match substances **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

A LDLs

B polyunsaturated fats

C salt

D sugar

	Information
1	found in large amounts in the blood of diabetics
2	may cause heart disease
3	may lead to high blood pressure
4	may help to lower cholesterol levels

4.5.3.2 Control of blood glucose concentration

Question 03

June 2008 | BLY2H | Original Q5 | Legacy

5 The hormone insulin is a protein. Insulin is produced in the pancreas and controls blood glucose concentration.

5 (a) Which organ in the body monitors blood glucose concentration?

.....

(1 mark)

5 (b) We now know that a lack of the hormone insulin causes diabetes. In the early twentieth century there was no known cure for diabetes.

Frederick Banting and Charles Best carried out a number of experiments on dogs.

In the first experiment they removed part of the pancreas from a healthy dog (dog **A**). They ground up the pancreas tissue and injected an extract into dog **B**, whose pancreas had been removed to make it diabetic. Dog **B**'s diabetes was **not** cured.

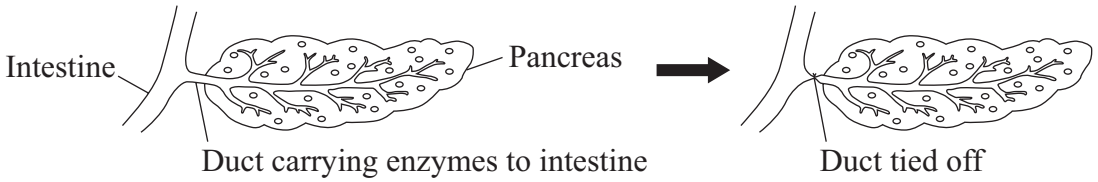
Banting thought that an enzyme produced in the pancreas of dog **A** had digested the hormone before it was injected.

Name the enzyme that might have been responsible for digesting the hormone.

.....

(1 mark)

5 (c) In the second experiment with another healthy dog, Banting and Best tied off the duct which normally carries digestive enzymes out of the pancreas. This did **not** kill the dog.



5 (c) (i) The dog survived even though enzymes from the pancreas could not digest food in the intestine.

Explain why the dog survived.

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.....

(1 mark)

4.5.3.2 Control of blood glucose concentration

Question 03 · continued

for mark

5 (c) (ii) As a result of these experiments, a method was developed to extract insulin from the pancreas.

Insulin is used to treat humans with diabetes.

The amount of insulin injected needs to be carefully controlled.

Explain why.

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(1 mark)

5 (d) Evaluate the use of dogs in experiments of this type.

Remember to include a conclusion to your evaluation.

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(3 marks)

7

4.5.3.2 Control of blood glucose concentration

Question 04

November 2008 | BLY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about substances in the diet.

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A mono-unsaturated fats

B LDLs

C salt

D sugar

1	is directly linked to high blood pressure
2	is found in large amounts in the blood of diabetics
3	may help to reduce cholesterol levels in the blood
4	may lead to high levels of cholesterol in the blood

4.5.3.2 Control of blood glucose concentration

Question 05

January 2009 | BLY2H | Original Q2 | Legacy

2 Diabetes is a disease in which a person's blood glucose concentration rises to higher levels than normal.
Diabetes is caused by insufficient insulin being produced.

2 (a) (i) Which organ monitors blood glucose concentration?

.....

(1 mark)

2 (a) (ii) Insulin reduces the concentration of glucose in the blood.

Describe how insulin does this.

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.....

(1 mark)

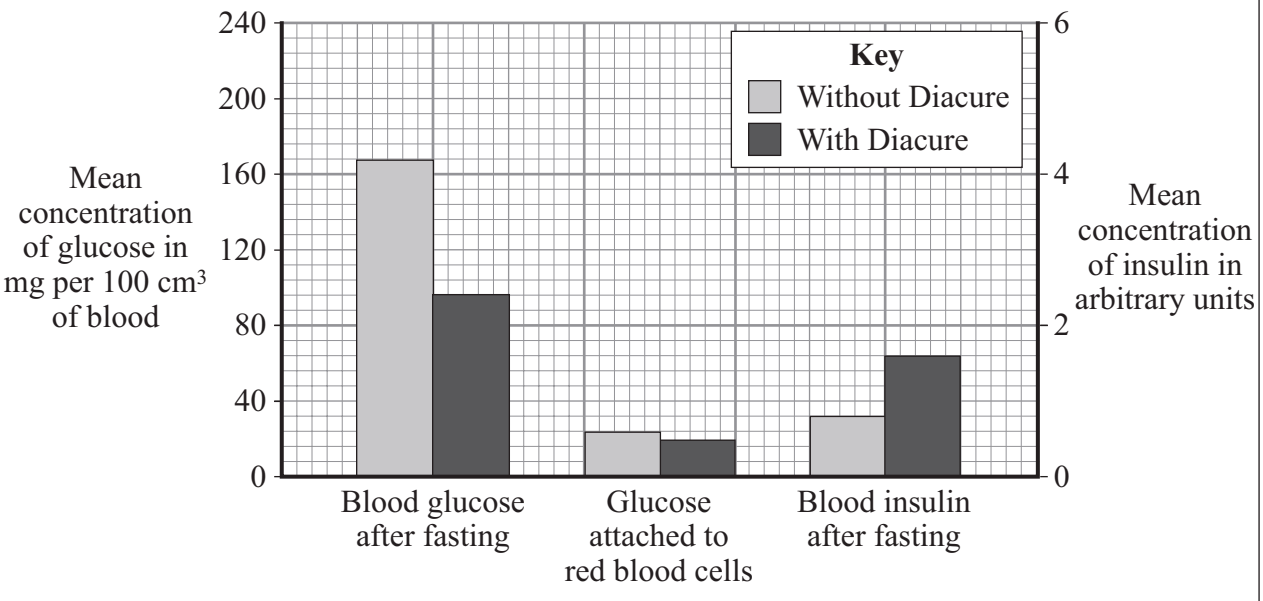
2 (b) A person with diabetes can be monitored in three ways:

- measuring the blood glucose concentration after fasting (going without food for 12 hours)
- measuring the amount of glucose attached to red blood cells: this is a measure of the average blood glucose concentration over the previous three months
- measuring the concentration of insulin in the blood after fasting

The manufacturer of a new treatment for diabetes, called Diacure, publishes the following two claims.

1. 98.6% of all people who used Diacure reported an improvement in their condition.

2. An independent study of 30 diabetic patients showed a significant reduction in blood glucose concentrations and a significant increase in insulin production, as shown by the graph.



4.5.3.2 Control of blood glucose concentration

Question 05 · continued

for mark

2 (b) (i) Which of the manufacturer's claims is **not** based on scientific evidence?

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(1 mark)

2 (b) (ii) Why might the data in this study be unreliable?

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(1 mark)

2 (b) (iii) The manufacturer did **not** draw attention to the data for the amount of glucose attached to red blood cells.

Suggest an explanation for this.

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(2 marks)

2 (b) (iv) The study of diabetic patients was carried out by an independent company.

Why is it important that the study should be independent?

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(1 mark)

7

4.5.3.2 Control of blood glucose concentration

Question 06

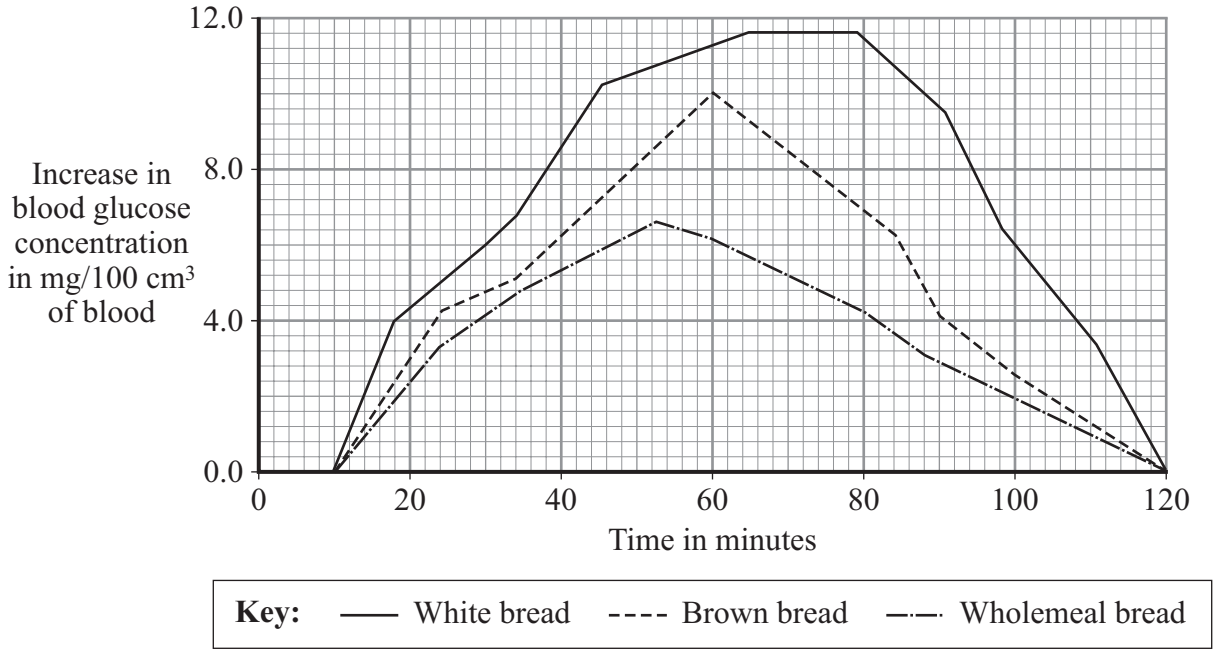
June 2009 | BLY2H | Original Q5 | Legacy

5 Insulin controls blood glucose concentration.

5 (a) The rate at which blood glucose concentration changes is affected by the food eaten.

In an experiment a person who does not have diabetes ate two slices of white bread. The change in her blood glucose concentration was recorded over the next 120 minutes.
The experiment was repeated; first with two slices of brown bread and then with two slices of wholemeal bread.

The graph shows the results of the three experiments.



5 (a) (i) Which type of bread would be most suitable for a person with diabetes?

Type of bread.....

Give **two** reasons for your answer.

1 .....

.....

2 .....

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(2 marks)

4.5.3.2 Control of blood glucose concentration

Question 06 · continued

for mark

5 (a) (ii) Explain, as fully as you can, the reasons for the changes in blood glucose concentration when the person ate the brown bread.

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(4 marks)

5 (b) *Pancreatic-cell transplantation* is a new treatment for diabetes. Insulin-making cells are taken from up to three dead donors. The cells are kept alive before being injected into the diabetic in a small operation. The cells soon begin to make insulin.

In one recent study 58% of recipients of pancreatic-cell transplants no longer needed insulin injections.

Give the advantages and disadvantages of the new treatment for diabetes compared with using insulin injections.

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(3 marks)

9

4.5.3.2 Control of blood glucose concentration

Question 07

January 2010 | BLY2H | Original Q3 | Legacy

3 (a) (i) Which organ in the body monitors the concentration of glucose (sugar) in the blood?

.....

(1 mark)

3 (a) (ii) In a healthy person, insulin prevents high levels of glucose in the blood.

How does it do this?

.....

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(1 mark)

3 (b) There are two forms of diabetes.

In type 1 diabetes, the body produces little or no insulin.
In type 2 diabetes, the body cells do not respond to insulin.

There are two ways in which diabetes can be treated.

Draw lines to join the type of diabetes to the way or ways in which it can be treated.

Type of diabetes	Treatment
Type 1	Careful attention to diet only
	Careful attention to diet **and** injection of insulin
Type 2	Injection of insulin only

(2 marks)

4.5.3.2 Control of blood glucose concentration

Question 07 · continued

for mark

3 (c) To make insulin, cells in the pancreas need amino acids.
A *small section of DNA* in the pancreas cells is involved in making insulin from the amino acids.

3 (c) (i) Insulin is a hormone.

What type of substance is insulin?

Draw a ring around **one** answer.

carbohydrate **lipid** **protein**

(1 mark)

3 (c) (ii) What term is used to describe the *small section of DNA* which controls the production of insulin?

.....

(1 mark)

3 (c) (iii) Amino acids cannot be stored in the body.

Describe, as fully as you can, what happens to the excess amino acids.

You may wish to use the following words in your explanation:

liver **kidneys** **bladder**

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(3 marks)

9

4.5.3.2 Control of blood glucose concentration

Question 08

November 2010 | BLY1AP | Original Q9 | Legacy

QUESTION NINE

The amount of energy we need depends on age, gender and activity.

9A The table shows the mean energy needed per day by different people.

Person	Mean energy needed per day in kJ	
	Male	Female
6-year old	7 500	7 500
16-year old	13 000	10 000
30-year old office worker	11 000	9 500
30-year old labourer	16 000	13 500
Pregnant woman		10 500

From the data in the table, which of the following has the biggest effect on the amount of energy needed by the body?

1 your gender

2 pregnancy

3 how active you are

4 how fit you are

9B Of the following, who needs least food?

People who . . .

1 exercise little and live in cold climates.

2 exercise a lot and live in warm climates.

3 exercise little and live in warm climates.

4 exercise a lot and live in cold climates.

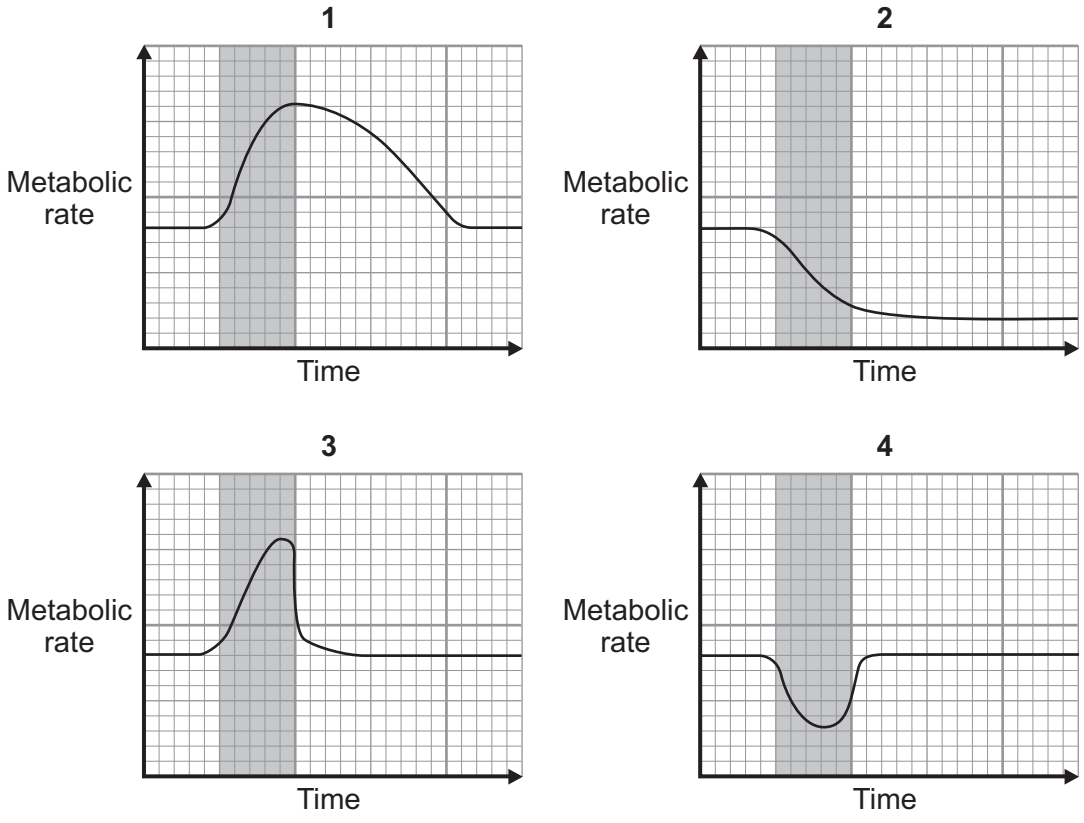
Question 08 · continued

9C Some people take more energy into their body than they use.

Which row in the table shows diseases linked with this?

	Arthritis	Cancer	Diabetes	Rubella	Deficiency diseases
1	✓	✓		✓	
2			✓		✓
3	✓		✓		
4		✓		✓	✓

9D Which graph shows a person's metabolic rate, before, during and after a 20-minute period of exercise?



END OF TEST

4.5.3.2 Control of blood glucose concentration

Question 09

January 2011 | BLY2H | Original Q3 | Legacy

3 In diabetics blood glucose concentrations are sometimes abnormal.

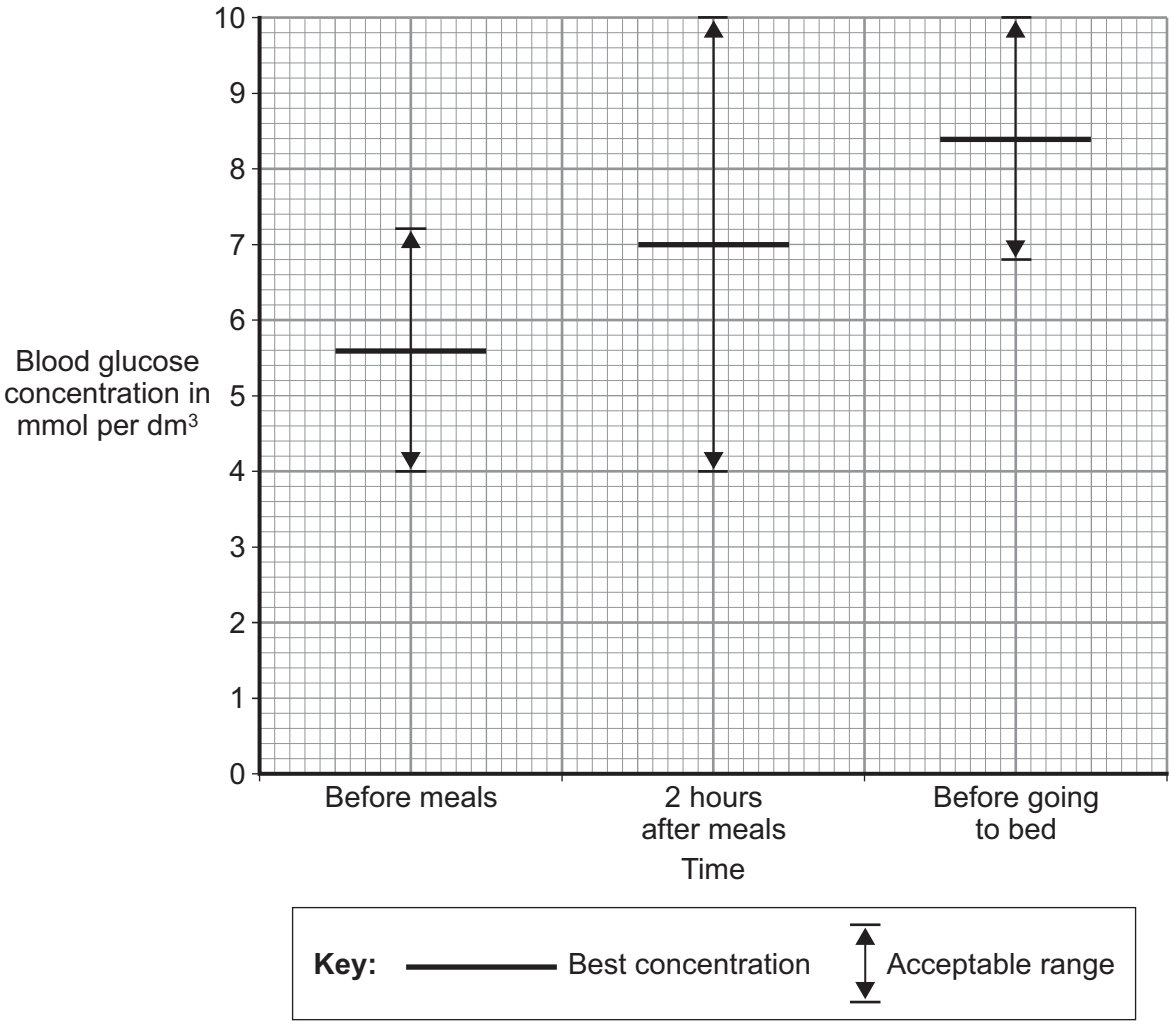
3 (a) Name the organ that monitors the concentration of glucose in the blood.

.....

(1 mark)

3 (b) Diabetics can measure their blood glucose concentration.

The graph shows the best blood glucose concentration and the acceptable range of blood glucose concentration at different times.



What is the acceptable range for the blood glucose concentration before meals?

From ..... to ..... mmol per dm^3

(1 mark)

4.5.3.2 Control of blood glucose concentration

Question 09 · continued

3 (c) The amount of insulin a diabetic injects can be changed so that blood glucose concentration is kept near to the best level.

Two hours after eating breakfast a diabetic measures his blood glucose concentration. His blood glucose concentration is 13 mmol per dm^3.

He reads these instructions:

- for every 2 mmol per dm^3 of blood glucose *above* the best concentration, inject 1 unit *more* of insulin
- for every 2 mmol per dm^3 of blood glucose *below* the best concentration, inject 1 unit *less* of insulin.

How should he change his normal insulin injection to bring his blood glucose level to the best concentration?

Show clearly how you work out your answer.

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Answer = ...

(3 marks)

5

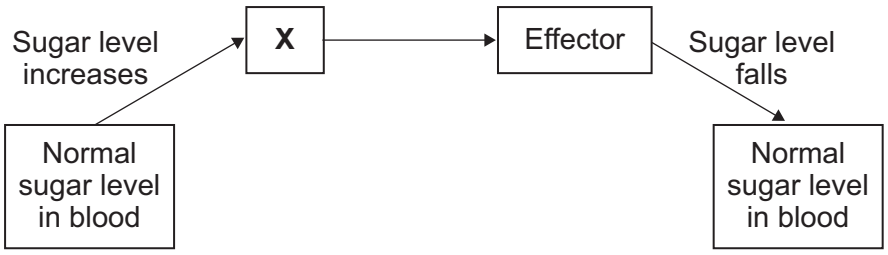
4.5.3.2 Control of blood glucose concentration

Question 10

June 2011 | BLY1AP | Original Q3 | Legacy

QUESTION THREE

The diagram shows what happens to sugar levels in the blood after a meal.



3A Structure **X** is sensitive to increases in blood sugar levels.

Structure **X** is a . . .

1 synapse.

2 relay neurone.

3 motor neurone.

4 receptor.

3B Structure **X** sends information to the effector in the blood stream.

This information is sent as . . .

1 a hormone.

2 an enzyme.

3 a synapse.

4 a nerve impulse.

4.5.3.2 Control of blood glucose concentration

Question 10 · continued June 2011 | BLY1AP | Original Q3 | Legacy

3C All effectors are . . .

1 glands.

2 neurones.

3 target organs.

4 muscles.

3D Sometimes, the organs controlling blood sugar concentration do not work properly and the sugar levels in the blood stay high.

This condition is called . . .

1 arthritis.

2 diabetes.

3 heart disease.

4 rubella.

4.5.3.2 Control of blood glucose concentration

Question 11

November 2011 | BLY1AP | Original Q6 | Legacy

QUESTION SIX

Diabetes is linked to body mass index (BMI).

BMI is calculated using the formula:

$$\text{BMI} = \frac{\text{mass (in kg)}}{\text{height}^2 \text{ (in m}^2\text{)}}$$

A 15 year old girl is 1.61 metres tall, with a mass of 58 kg.

6A Use the formula to calculate her BMI.

Her BMI is . . .

1 0.04

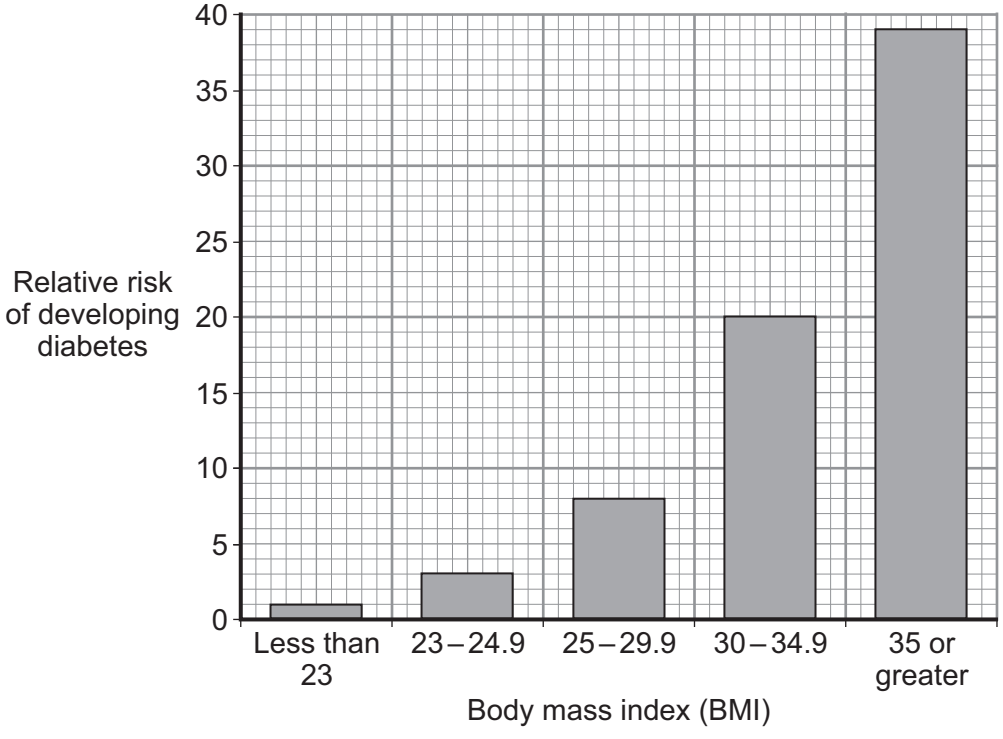
2 18.0

3 22.4

4 36.0

The bar chart shows the link between BMI and the relative risk of developing diabetes.

A relative risk of 1 is the normal risk of developing diabetes.



4.5.3.2 Control of blood glucose concentration

Question 11 · continued

6B One conclusion that can be made from this bar chart is that . . .

1 heavy people usually develop diabetes.

2 an increase in BMI from 24 to 25 increases the risk of developing diabetes by three times.

3 a person with a BMI of 36 will develop diabetes.

4 a person with a BMI of 20 might develop diabetes.

6C An athlete has a BMI of 32. However, her risk of developing diabetes is likely to be less than 20 times the normal risk.

The most likely reason for this is that she . . .

1 is very short.

2 is fit and healthy.

3 has a lot of muscle compared to fat.

4 has a high metabolic rate.

6D A doctor saw a person with a BMI of 35. The doctor advised the person to take statins. Statins affect the levels of LDL and HDL in the blood.

For a healthy heart there should be . . .

1 high levels of LDL and HDL.

2 a high level of LDL and a low level of HDL.

3 a high level of HDL and a low level of LDL.

4 low levels of LDL and HDL.

4.5.3.2 Control of blood glucose concentration

Question 12

June 2013 | BL3HP | Original Q7 | Legacy

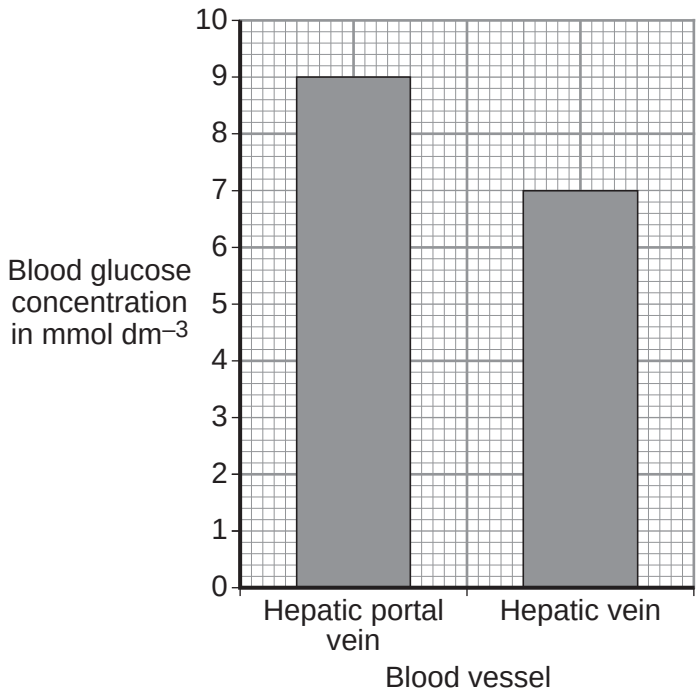
7 The pancreas and the liver are both involved in the control of the concentration of glucose in the blood.

The liver has two veins:
- the hepatic portal vein taking blood from the small intestine to the liver
- the hepatic vein taking blood from the liver back towards the heart.

Scientists measured the concentration of glucose in samples of blood taken from the hepatic portal vein and the hepatic vein. The samples were taken 1 hour and 6 hours after a meal.

Graph 1 shows the concentration of glucose in the two blood vessels 1 hour after the meal.

Graph 1



7 (a) The concentration of glucose in the blood of the two vessels is different.
Explain why.

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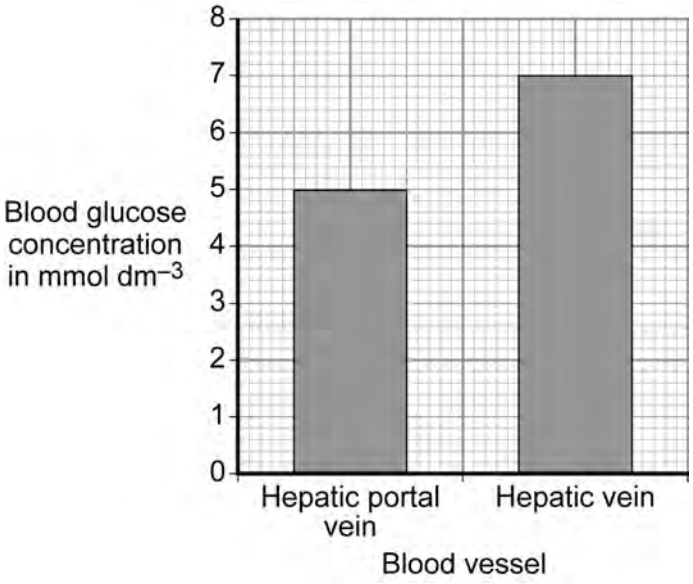
(3 marks)

4.5.3.2 Control of blood glucose concentration

Question 12 · continued

7 (b) **Graph 2** shows the concentration of glucose in the two blood vessels 6 hours after the meal.

Graph 2



7 (b) (i) The concentration of glucose in the blood in the hepatic portal vein 1 hour after the meal is different from the concentration after 6 hours.

Why?

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(1 mark)

7 (b) (ii) The person does **not** eat any more food during the next 6 hours after the meal.

However, 6 hours after the meal, the concentration of glucose in the blood in the hepatic vein is higher than the concentration of glucose in the blood in the hepatic portal vein.

Explain why.

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(3 marks)

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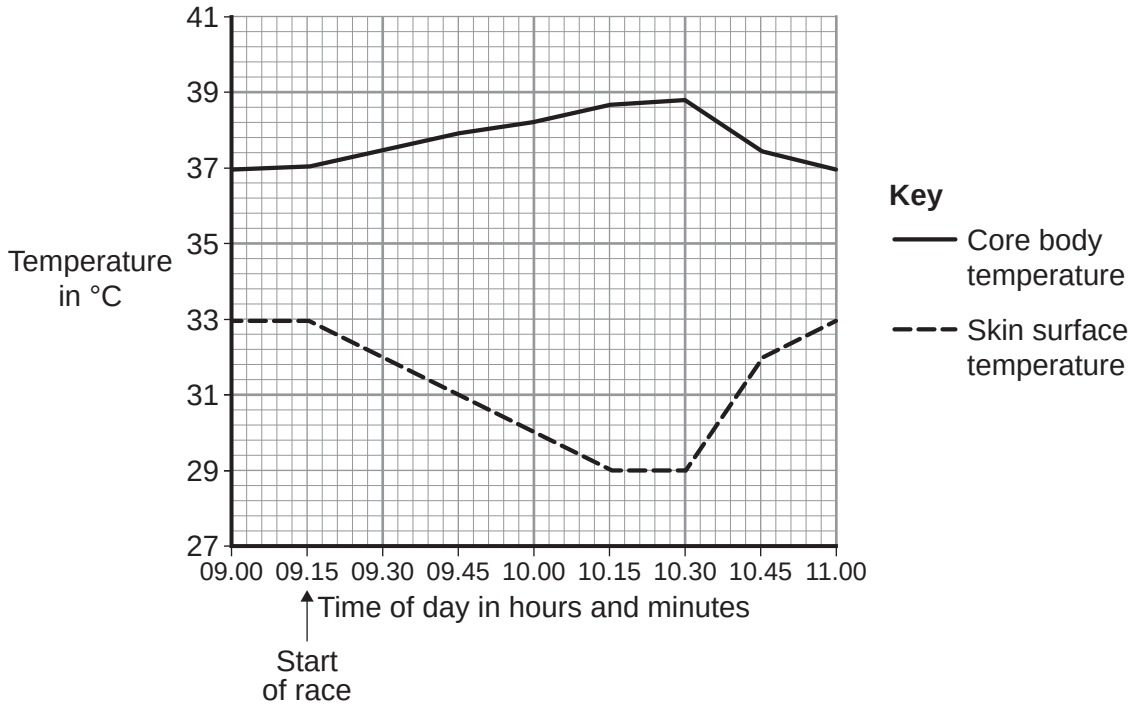
4.5.3.2 Control of blood glucose concentration

Question 13

June 2014 | BL3HP | Original Q6 | Legacy

6 **Figure 6** shows the core body temperature and the skin surface temperature of a cyclist before, during and after a race.

Figure 6



6 (a) (i) When the cyclist finished the race, his core body temperature started to decrease.

How long did the race last?

[1 mark]

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6 (a) (ii) Describe and explain the different patterns shown in the core body temperature and skin surface temperature between 09.15 and 10.15.

[6 marks]

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4.5.3.2 Control of blood glucose concentration

Question 13 · continued

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6 (a) (iii) After 10.30, the core body temperature decreased.

Explain how changes in the blood vessels supplying the skin caused the skin surface temperature to increase.

[2 marks]

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6 (b) During the race, the cyclist's blood glucose concentration began to decrease.

Describe how the body responds when the blood glucose concentration begins to decrease.

[3 marks]

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12

4.5.3.2 Control of blood glucose concentration

Question 14

June 2015 | BL3HP | Original Q5 | Legacy

5 Many runners drink sports drinks to improve their performance in races.

A group of students investigated the effects of three brands of sports drink, **A**, **B** and **C**, on the performance of three runners on a running machine. One of the runners is shown in **Figure 4**.

Figure 4



Table 2 gives information for each drink.

Table 2

	Brand of sports drink		
Nutrient per dm^3	**A**	**B**	**C**
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

4.5.3.2 Control of blood glucose concentration

Question 14 · continued

5 (a) (i) In the investigation, performance was measured as the time taken to reach the point of exhaustion.

Exhaustion is when the runners could not run anymore.

All three runners:
- ran on a running machine until the point of exhaustion
- each drank 500 cm^3 of a different brand of sports drink
- rested for 4 hours to recover
- ran on the running machine again and recorded how much time they ran until the point of exhaustion.

The speed at which the runners ran was the same and all other variables were controlled.

The students predicted that the runner drinking brand **B** would run for the shortest time on the second run before reaching the point of exhaustion.

Use information from **Table 2** to suggest an explanation for the students' prediction.

[2 marks]

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5 (a) (ii) If the balance between ions and water in a runner's body is not correct, the runner's body cells will be affected.

Describe **one** possible effect on the cells if the balance between ions and water is **not** correct.

[1 mark]

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5 (b) When running, a runner's body temperature increases.

Describe how the brain monitors body temperature.

[3 marks]

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4.5.3.2 Control of blood glucose concentration

Question 14 · continued

5 (c) (i) **Table 2** is repeated here to help you answer this question.

Table 2

	Brand of sports drink		
Nutrient per dm^3	**A**	**B**	**C**
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

People with diabetes need to be careful about drinking too much sports drink.

Use information from **Table 2** to explain why drinking too much sports drink could make people with diabetes ill.

[3 marks]

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5 (c) (ii) Other than paying attention to diet, how do people with diabetes control their diabetes?

[1 mark]

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10

4.5.3.2 Control of blood glucose concentration

Question 15

June 2015 | BL3HP | Original Q7 | Legacy

7 It is important to remove waste products from our bodies.

Healthy kidneys help to keep our internal environment constant.

7 (a) Describe how a healthy kidney produces urine.

[5 marks]

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7 (b) A child has kidney failure and is treated with dialysis.

Before the dialysis starts, the doctor measures the concentration of urea and glucose in the child's blood.

Table 3 shows the results.

Table 3

	Concentration in the blood before dialysis starts in mmol per dm^3
Urea	28
Glucose	6

The child has a normal blood glucose concentration.

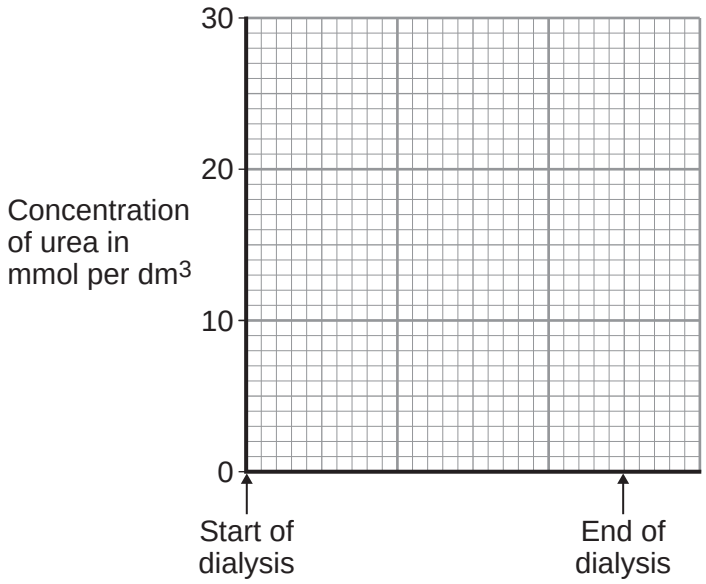
4.5.3.2 Control of blood glucose concentration

Question 15 · continued

7 (b) (i) Sketch a graph on **Figure 7** to suggest what will happen to the concentration of urea in the blood during dialysis.

[1 mark]

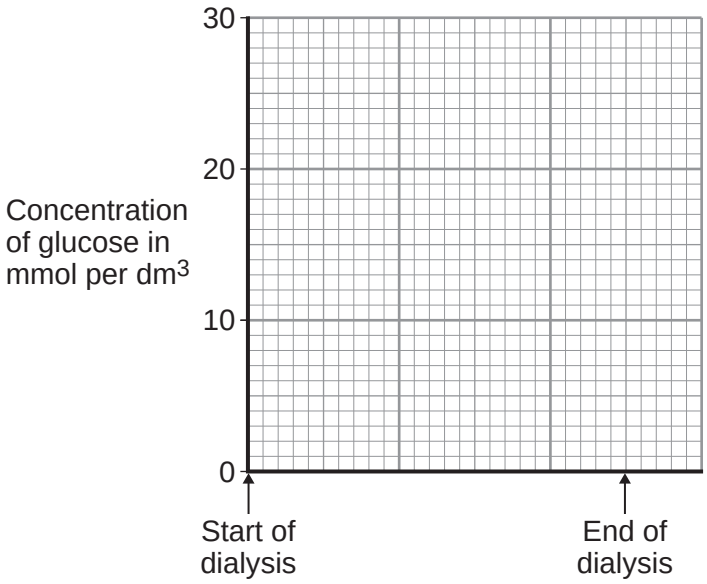
Figure 7



7 (b) (ii) Sketch a graph on **Figure 8** to suggest what will happen to the concentration of glucose in the blood during dialysis.

[1 mark]

Figure 8



Question 7 continues on the next page

4.5.3.2 Control of blood glucose concentration

Question 15 · continued

7 (c) (i) Another way of treating kidney failure is with a kidney transplant.

A transplanted kidney can be rejected.

Explain why the new kidney may be rejected.

[3 marks]

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7 (c) (ii) Describe **one** way in which doctors try to prevent kidney rejection.

[1 mark]

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11

4.5.3.2 Control of blood glucose concentration

Question 16

June 2016 | BL3HP | Original Q8 | Legacy

8 People with type 1 diabetes inject insulin to control their blood glucose level.

A pancreas transplant is another treatment for type 1 diabetes.

One risk of a pancreas transplant is organ rejection.

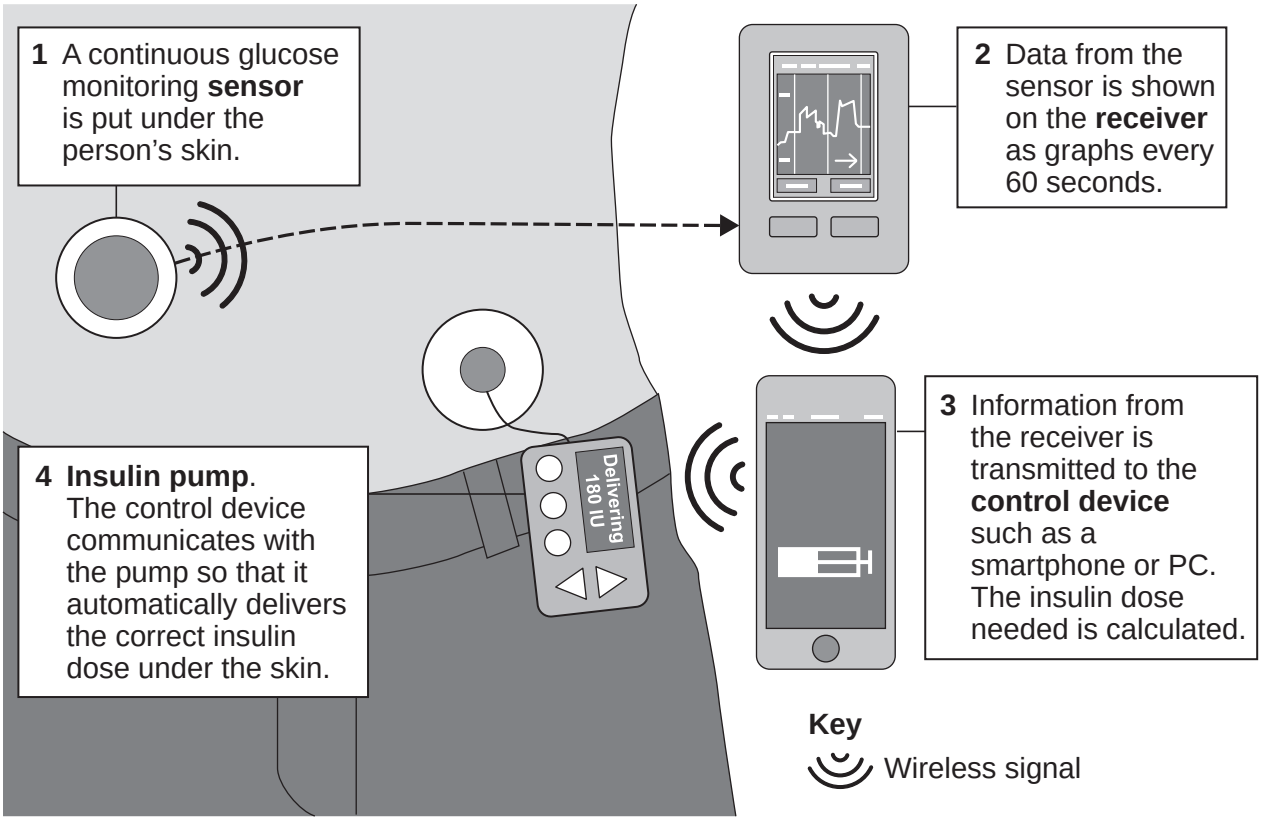
8 (a) Explain why a transplanted organ may be rejected.

[3 marks]

8 (b) Scientists have developed an artificial pancreas to treat type 1 diabetes.

Figure 7 shows how an artificial pancreas works.

Figure 7



4.5.3.2 Control of blood glucose concentration

Question 16 · continued

June 2016 | BL3HP | Original Q8 | Legacy

8 (b) (i) A woman with type 1 diabetes has an artificial pancreas. The woman eats a meal high in sugar. The meal causes her blood glucose level to rise.

Use information from **Figure 7** to describe what happens to bring the blood glucose level of the woman back to normal.

[4 marks]

8 (b) (ii) The traditional way of monitoring and treating type 1 diabetes is to take a small sample of blood and put it on a test strip to find out how much insulin to inject.

Suggest **one** possible advantage, other than not having to do blood tests, of the method used in **Figure 7**.

[1 mark]

8

4.5.3.2 Control of blood glucose concentration

Question 17

June 2017 | BL2HP | Original Q5 | Legacy

5 Scientists investigated the effect of drinking glucose solution during long-distance athletic events.

The scientists selected seven racing cyclists.

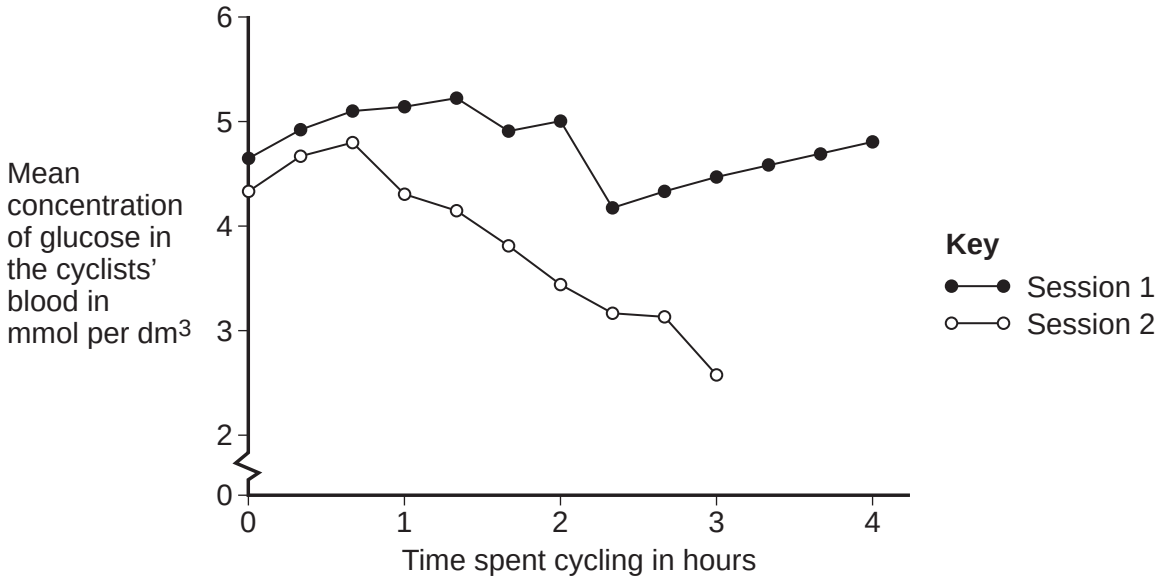
In two separate sessions, the cyclists pedalled stationary bicycles at a constant speed until they could not continue.

- **Session 1**: the cyclists drank 60 grams of glucose per hour in an energy drink.
- **Session 2**: a week later, the same cyclists drank a placebo drink that tasted the same but did **not** contain glucose.

The scientists measured the concentration of glucose in the cyclists' blood at intervals during each of the two sessions.

Figure 6 shows the results.

Figure 6



5 (a) In each session, the cyclists did not know whether they were drinking the glucose drink or the placebo.

Why was this important?

[2 marks]

4.5.3.2 Control of blood glucose concentration

Question 17 · continued

5 (b) (i) The scientists concluded that drinking glucose during a race would improve athletic performance.

Evaluate the validity of the method used in this investigation and the evidence for the scientists' conclusion.

[4 marks]

Question 5 continues on the next page

4.5.3.2 Control of blood glucose concentration

Question 17 · continued

5 (b) (ii) During both sessions, the cyclists' heart rates and breathing rates were much higher than at rest.

Describe how increased heart rate, increased breathing rate and increased blood glucose concentration would improve athletic performance.

[4 marks]

10

4.5.3.2 Control of blood glucose concentration

Question 18

June 2017 | BL3HP | Original Q9 | Legacy

9 (a) In a healthy person, blood sugar levels are kept within a narrow range.

Describe what happens in a healthy person when the pancreas detects a rise in blood sugar level.

[2 marks]

9 (b) Glycogen storage disorder is an inherited condition affecting a small number of people.

In some people with the disorder, glycogen does not form properly.

After exercise, a person with this type of glycogen storage disorder can feel very tired and can become unconscious.

Explain why the person has these symptoms after exercise.

[4 marks]

6

4.5.3.2 Control of blood glucose concentration

Question 19

June 2019 | 8461/1H | Original Q6

0 6 People with diabetes have difficulty controlling their blood glucose concentration.

0 6 . 1 Which part of the blood transports glucose?

[1 mark]

Tick (✓) **one** box.

- Lymphocytes ☐
- Plasma ☐
- Platelets ☐
- Red blood cells ☐

Glucose is often found in the urine of people with diabetes.

0 6 . 2 Name a chemical used to test for glucose.

[1 mark]

_____

0 6 . 3 Describe a test that could be used to show that a person's urine contains glucose.

[2 marks]

Test _____

_____

Positive result _____

_____

4.5.3.2 Control of blood glucose concentration

Question 19 · continued

0 6 . 4 The body cells of a person with untreated diabetes lose more water than the body cells of a person who does **not** have diabetes.

Explain how diabetes can cause the body cells to lose more water.

[3 marks]

0 6 . 5 Glucose is absorbed into the blood in the small intestine by both diffusion and active transport.

Describe how the small intestine is adapted for efficient absorption.

[5 marks]

12

4.5.3.2 Control of blood glucose concentration

Question 20

June 2019 | 8461/2H | Original Q8

0 8 It is important to keep the blood glucose concentration within narrow limits.

0 8 . 1 A person eats a meal containing a lot of carbohydrate. This causes an increase in the person's blood glucose concentration.

Explain how the hormones insulin **and** glucagon control the person's blood glucose concentration after the meal.

[5 marks]

0 8 . 2 The body cells of a person with Type 2 diabetes do **not** respond to **insulin**.

A person with Type 2 diabetes often has a higher blood **insulin** concentration than a non-diabetic person.

Explain why.

[3 marks]

4.5.3.2 Control of blood glucose concentration

Question 20 · continued

Metformin is a drug used for treating people who have Type 2 diabetes.

Scientists investigated the effects of metformin and two other drugs, **A** and **B**.

The scientists wanted to see how the drugs affected the blood glucose concentrations of 220 people with Type 2 diabetes.

This is the method used.

1. Put the 220 people into five groups.
2. Treat each group with a different drug or combination of drugs for several weeks.
3. Give each person a meal high in carbohydrate.
4. Measure the blood glucose concentration of each person 30 minutes after the meal and again 3 hours after the meal.

0 8 . 3 Suggest **three** variables that the scientists should have controlled in the investigation.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

4.5.3.2 Control of blood glucose concentration

Question 20 · continued

The scientists recorded their results as a mean value for each group.

The scientists calculated the 'standard deviation' for each group's result.

Standard deviation is a measure of the spread of the individual results above or below (±) the mean value.

The scientists gave each group's result as:

mean ± standard deviation

The larger the standard deviation, the greater is the spread of results around the mean.

0 8 . 4 Which of the results is the most precise?

[1 mark]

Tick (✓) **one** box.

Mean = 171.6 ± 16.3 ☐

Mean = 177.2 ± 15.4 ☐

Mean = 182.5 ± 18.2 ☐

Mean = 205.2 ± 19.4 ☐

Question 8 continues on the next page

4.5.3.2 Control of blood glucose concentration

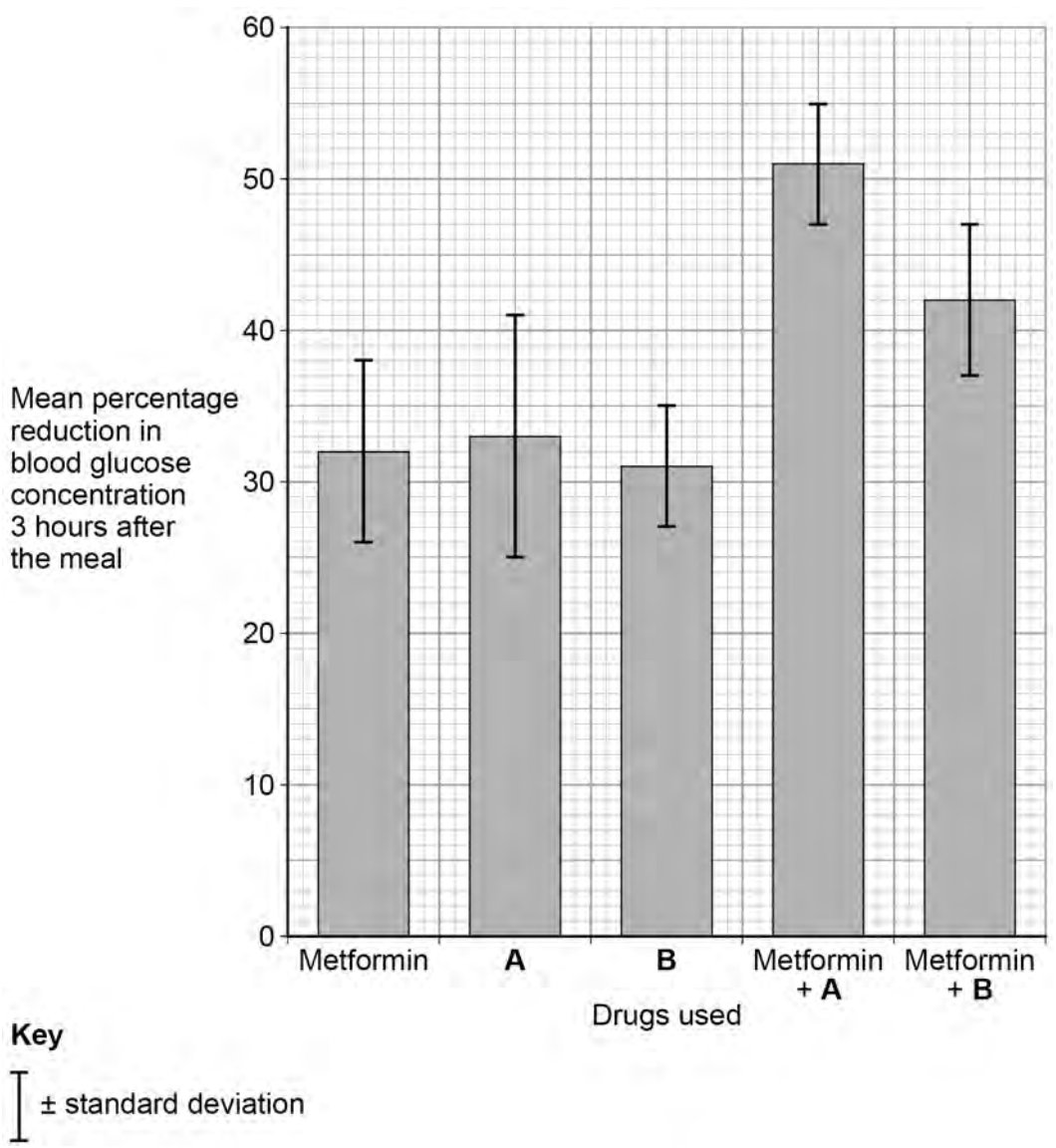
Question 20 · continued

Table 3 and **Figure 9** show the scientists' results.

Table 3

Drugs used	Metformin	A	B	Metformin + A	Metformin + B
Number of people	60	40	25	65	30
Mean blood glucose concentration 30 minutes after the meal in mg/100 cm^3 ± standard deviation	177.2 ± 15.4	182.5 ± 18.2	171.6 ± 16.3	205.2 ± 19.4	206.5 ± 19.6

Figure 9



4.5.3.2 Control of blood glucose concentration

Question 20 · continued

0 8 . 5 In **Table 3** and **Figure 9** some standard deviations of results overlap.

- An overlap of standard deviations shows the difference between the means is **not** significant.
- **No** overlap of standard deviations shows a significant difference between the means.

A student looked at the scientists' method and the results in **Table 3** and **Figure 9**.

The student stated:

'Metformin works better when used with other drugs.'

Evaluate the student's statement.

[6 marks]

18

4.5.3.2 Control of blood glucose concentration

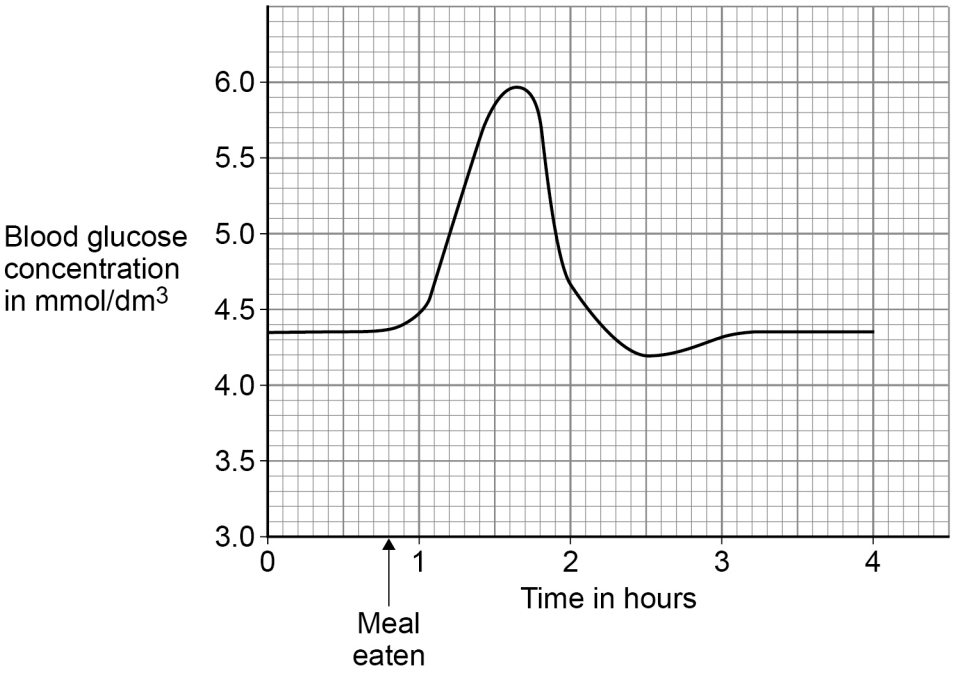
Question 21

June 2022 | 8461/2H | Original Q3

0 3 It is important to control the concentration of glucose in the blood.

Figure 2 shows how the concentration of glucose in the blood of a person changed over 4 hours.

Figure 2



0 3 . 1 Give **one** time when the concentration of **insulin** in the person's blood would be high.

Use **Figure 2**.

[1 mark]

Time = _____ hours

4.5.3.2 Control of blood glucose concentration

Question 21 · continued

0 3 . 2 Explain the effect a high concentration of insulin has on blood glucose concentration.

[3 marks]

Effect _____

Explanation _____

_____

_____

_____

Question 3 continues on the next page

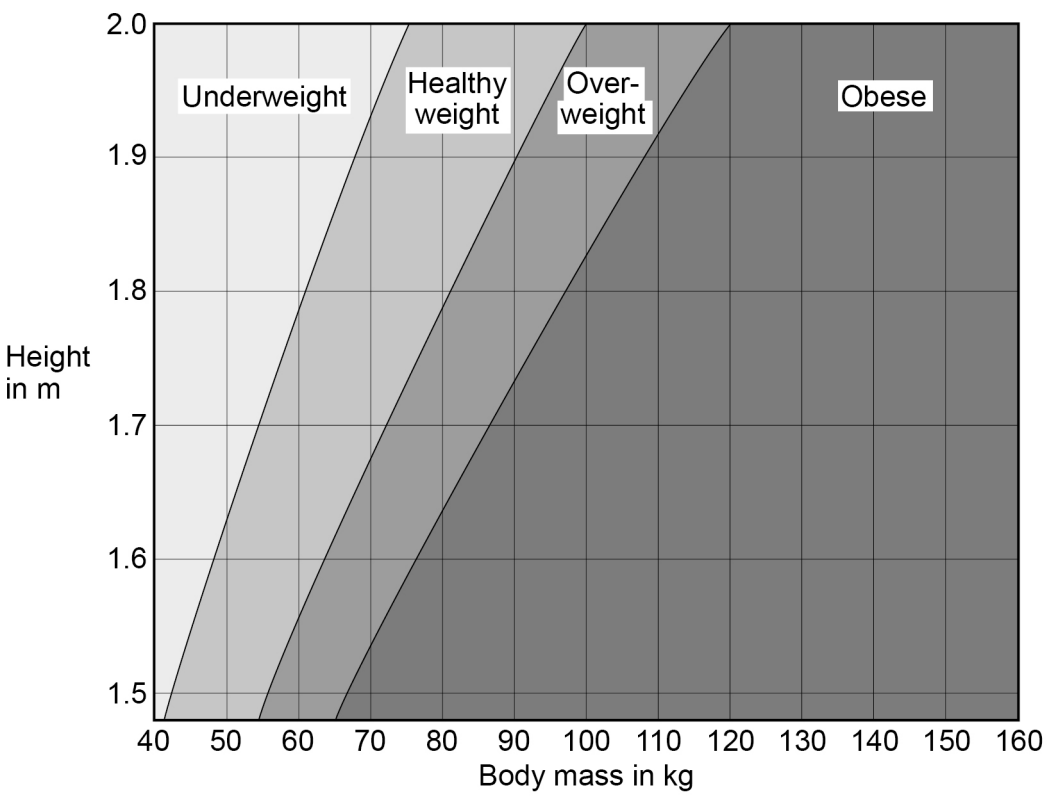
Question 21 · continued

People with diabetes have difficulty controlling the concentration of glucose in their blood.

Type 2 diabetes is linked to obesity.

Figure 3 shows how to find if an adult's body mass is healthy for their height.

Figure 3



4.5.3.2 Control of blood glucose concentration

Question 21 · continued

0 3 . 3 Person **A**:

- is 1.75 m in height
- has a body mass of 52 kg.

What is person **A**'s weight category?

[1 mark]

Tick (✓) **one** box.

Underweight ☐

Healthy weight ☐

Overweight ☐

Obese ☐

0 3 . 4 Person **B** is 1.9 m in height.

Give the range of body masses that would put person **B** in the healthy weight category.

[1 mark]

Range from _____ kg to _____ kg

Question 3 continues on the next page

Question 21 · continued

0 3 . 5 Person **C** is obese.

A doctor thinks that person **C** has Type 2 diabetes.

The doctor tests a sample of blood from person **C**.

Table 2 shows:

- the results of the blood test
- the mean results for people who do **not** have diabetes.

Table 2

	Concentration in blood	
	Person C	**Mean for people who do not have diabetes**
Cholesterol in mmol/dm^3	6.21	5.20
Glucose in mmol/dm^3	9.56	4.51
Insulin in arbitrary units	24.32	14.83

Type 2 diabetes occurs when body cells have a reduced response to insulin.

Give **two** ways the results of the blood test show that person **C** might have Type 2 diabetes.

[2 marks]

1 _____

_____

2 _____

_____

4.5.3.2 Control of blood glucose concentration

Question 21 · continued

0 3 . 6 Give **two** ways that a person can reduce the chance of developing Type 2 diabetes.

[2 marks]

1 _____

_____

2 _____

_____

10

Turn over for the next question

4.5.3.2 Control of blood glucose concentration

Question 22

June 2025 | 8461/2H | Original Q9

0 9 Type 2 diabetes is a condition that has become more common in recent years.

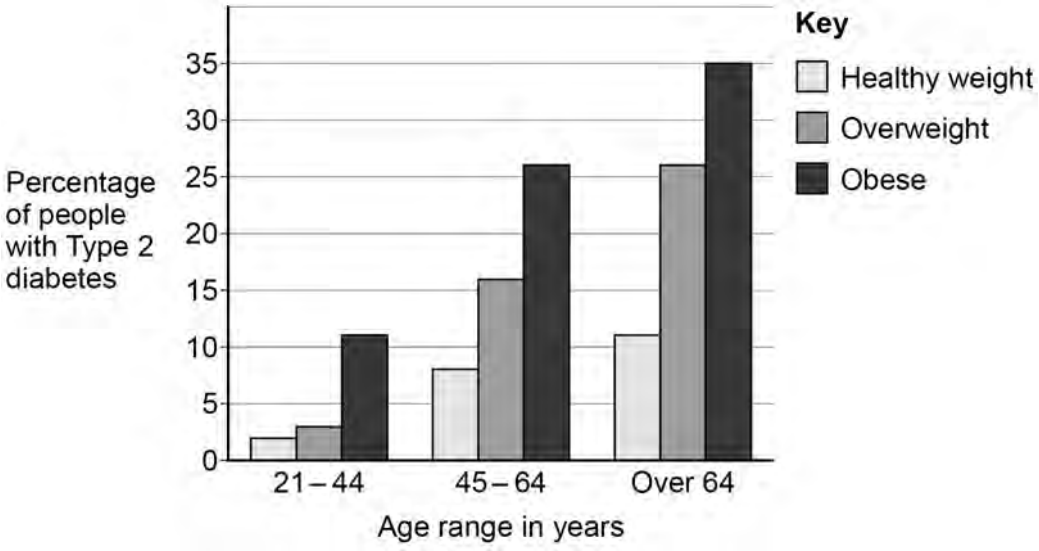
0 9 . 1 Scientists recorded the percentage of people of different ages who had Type 2 diabetes.

The people were in different weight categories:

- healthy weight
- overweight
- obese.

Figure 10 shows the results.

Figure 10



Give **two** conclusions from the results in **Figure 10**.

[2 marks]

1 _____

_____

2 _____

_____

Question 9 continues on the next page

Question 22 · continued

Two groups of scientists investigated the use of different drugs to treat Type 2 diabetes.

In both investigations, the scientists measured the percentage of haemoglobin with glucose attached (Hb-G).
This showed the long-term concentration of glucose in the blood.

Investigation 1:

The scientists injected drug **A** into 175 patients with Type 2 diabetes once each day for 12 weeks.

Table 4 shows the results.

Table 4

	Mean value	
	At start	**At 12 weeks**
Percentage (%) of haemoglobin with glucose attached (Hb-G)	9.2	7.6

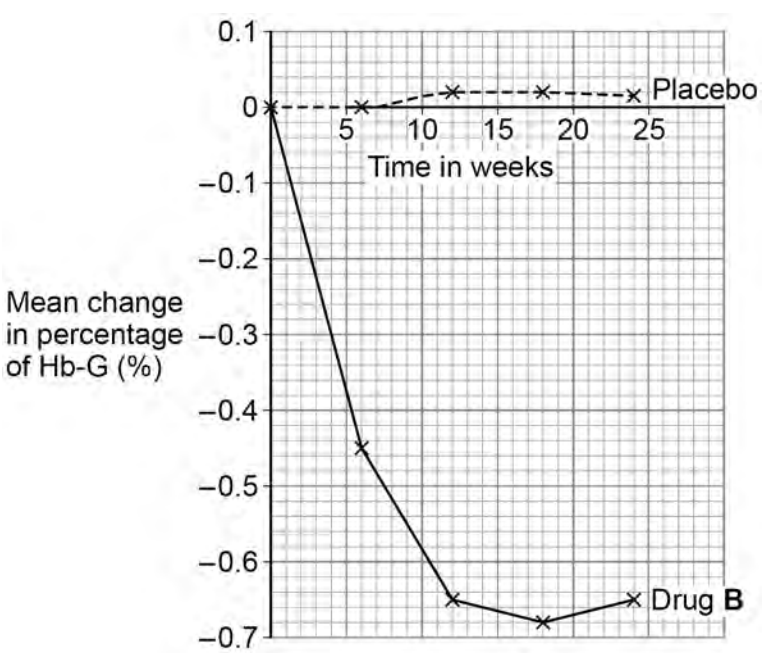
Investigation 2:

631 patients with Type 2 diabetes took one tablet containing drug **B** each day.
A control group of 630 patients took a placebo tablet each day.

The scientists measured the Hb-G in each patient's blood at the start of the investigation and at 6-week intervals up to 24 weeks.

Figure 11 shows the results.

Figure 11



4.5.3.2 Control of blood glucose concentration

Question 22 · continued

0 9 . 2 For the patients treated with drug **B** the mean percentage of Hb-G at the start was 8.3%.

What was the mean percentage of Hb-G after 12 weeks for the patients treated with drug **B**?

[1 mark]

Tick (✓) **one** box.

0.65% ☐ 0.75% ☐ 7.65% ☐ 8.95% ☐

0 9 . 3 In a person **without** diabetes, the Hb-G value is between 4.5% and 6%.

When treating patients with Type 2 diabetes, doctors think that an Hb-G value <7% is acceptable.

Evaluate:

- the methods used in the investigations
- the usefulness of drug **A** and drug **B** for controlling Type 2 diabetes.

[6 marks]

Extra space

9