

Controlling Blood Glucose level

Q:1 Type 1 diabetes develops when the body does not produce enough insulin.

(a) Which organ produces insulin?

(1 mark)

(b) One treatment for diabetes is to inject insulin.

The table gives the properties of four different types of insulin, A, B, C and D.

Type of insulin	Time taken for the insulin to begin to work in minutes	Time taken for insulin to reach maximum concentration in the blood in minutes	Time when insulin is no longer effective in hours
A	15–20	30–90	3–4
B	30–60	80–120	4–6
C	120–240	360–600	14–16
D	240–360	600–960	18–20

(b) (i) Some people with diabetes need to inject insulin just before a meal to stop a big increase in blood sugar concentration.

Which type of insulin, A, B, C or D, should these people with diabetes inject just before a meal?

Give the reason for your answer.

(2 marks)

(b) (ii) A person with diabetes is told to inject type B insulin immediately after breakfast at 09.00.

The person with diabetes is told to then inject a second type of insulin at lunchtime at 12.00.

The second type of insulin should keep the blood sugar level under control for the rest of the 24 hours.

Which type of insulin, A, C or D, should this person with diabetes inject at lunchtime?

Give the reason for your answer.

(2 marks)

(b) (iii) Apart from injecting insulin, give one other way in which Type 1 diabetes can be controlled.

(1 mark)

Q:2 The pancreas and the liver are both involved in the control of the concentration of glucose in the blood.

The liver has two veins:

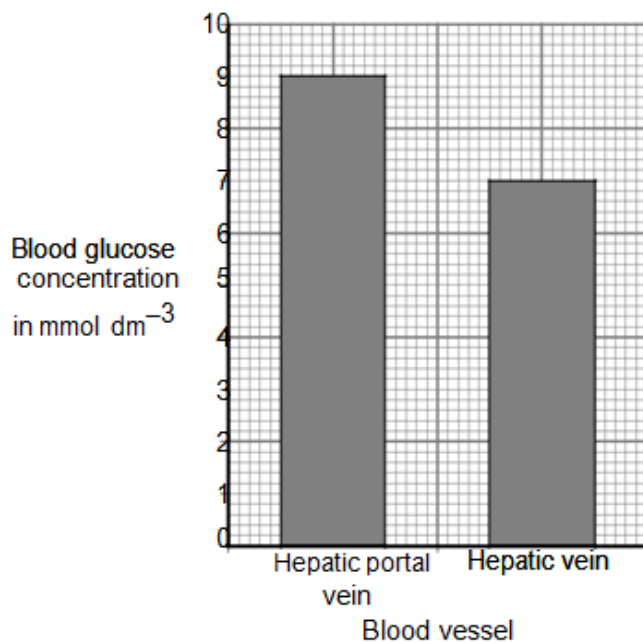
the hepatic portal vein taking blood from the small intestine to the liver

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



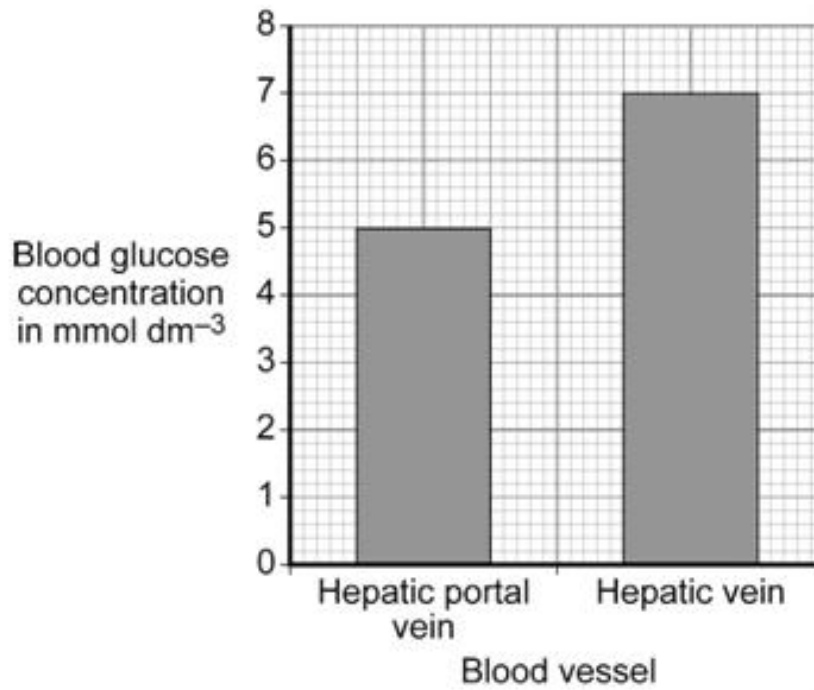
(a) The concentration of glucose in the blood of the two vessels is different.

Explain why.

(3 marks)

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

Graph 2



(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?

(1 mark)

(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.

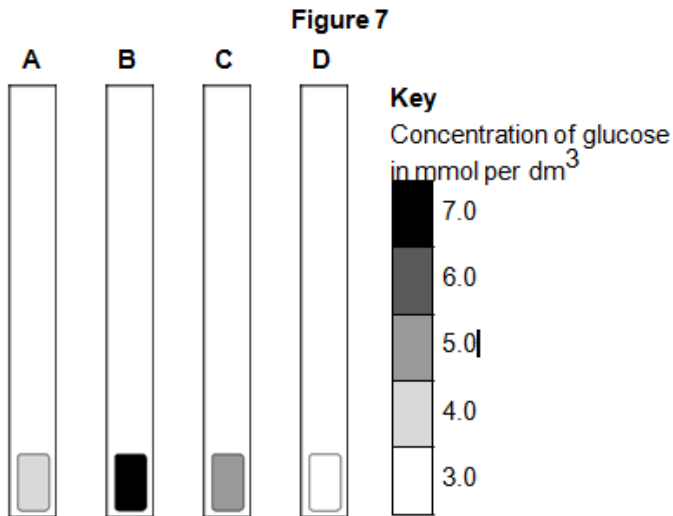
Explain why.

(3 marks)

Q:3 Blood glucose concentration in humans must be kept between 4.4 and 6.1 mmol per dm³.

Four students, A, B, C and D, tested their blood glucose concentration with glucose testing strips.

Figure 7 shows the results of their tests and the key from the test strip bottle.



(a) (i) Which student, A, B, C or D, has diabetes and has eaten a large piece of cake?

[1 mark]

(a) (ii) Which student, A, B, C or D, is in most need of eating carbohydrates?

[1 mark]

(a) (iii) Which student, A, B, C or D, has a healthy blood glucose concentration?

[1 mark]

(b) (i) Name the hormone that people with diabetes inject to prevent their blood glucose concentration from becoming too high.

[1 mark]

(b) (ii) Blood glucose concentration is monitored in the body.

Which organ monitors blood glucose concentration?

Draw a ring around the correct answer.

brain liver pancreas

[1 mark]

Q:4 The pancreas is involved in digestion and controlling the internal conditions of the body.

(a) Name two digestive enzymes produced by the pancreas.

1. _____

2. _____

(2 marks)

(b) Diabetes may be caused by a lack of insulin.

Part of the treatment for someone with diabetes is to pay careful attention to the diet.

(i) Give one symptom of diabetes.

(1 mark)

(ii) Give one way in which a diabetic may be advised to change their diet.

(1 mark)

(iii) How does this change in diet help the diabetic?

(1 mark)

(iv) State one other way in which the symptoms of diabetes may be treated.

(1 mark)

(c) Many of the cells in the pancreas contain large numbers of ribosomes. What is the function of ribosomes in a cell?

(1 mark)

Q:5 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.

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

(1 mark)

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

Describe how insulin does this.

(1 mark)

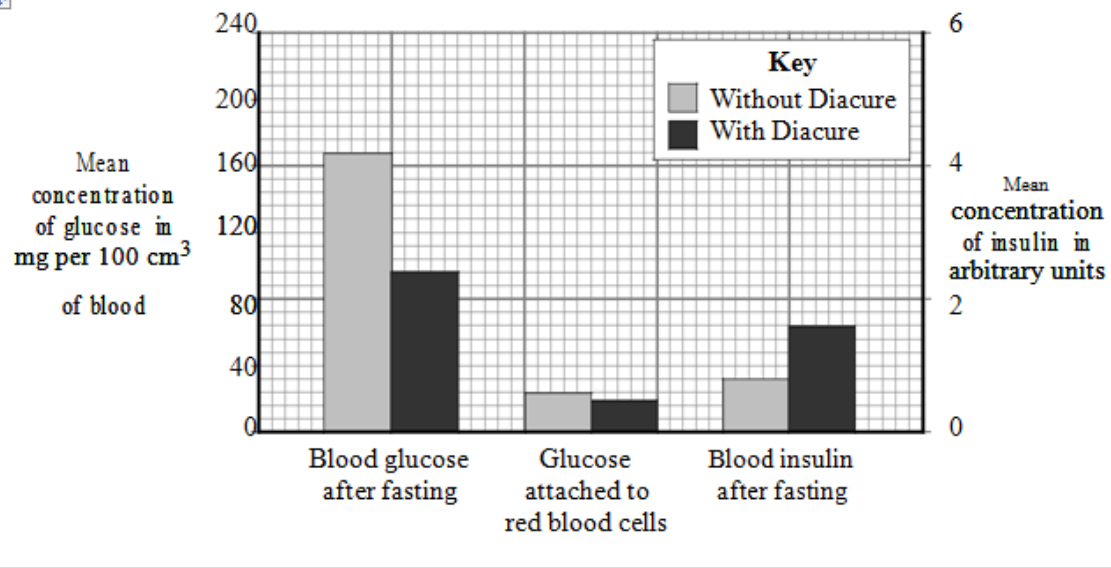
(b) A person with diabetes can be monitored in three ways:

- 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.



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

(1 mark)

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

(1 mark)

(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.

(2 marks)

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

Why is it important that the study should be independent?

(1 mark)

Q:6 Diabetes is a disease in which blood glucose (sugar) concentration may rise more than normal.

(a) Which organ in the body monitors this rise in blood sugar? Draw a ring around your answer.

liver pancreas stomach

(1 mark)

(b) One way of treating diabetes is by careful attention to diet.

Chart 1 shows the recommended diet for a person with diabetes.

Chart 2 shows a diet for a person without diabetes.

Chart 1 Person with diabetes

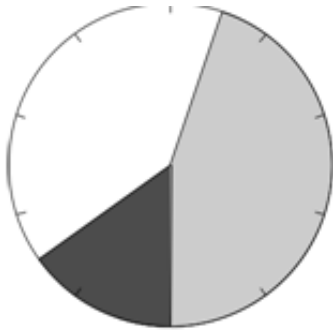
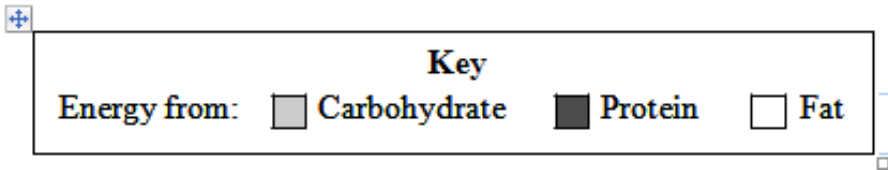
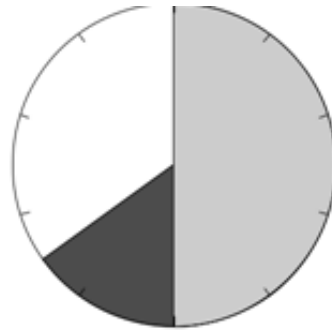


Chart 2 Person without diabetes



How is the recommended diet of a person with diabetes different from the diet of a person without diabetes?

Use information from the charts.

Tick (☑) two boxes.

The diabetic should get more energy from fat.

The diabetic should get more energy from protein.

The diabetic should get less energy from carbohydrate.

The diabetic should get less energy from protein.

(2 marks)

(c) Other than diet, give one way in which diabetes may be treated.

(1 mark)

TOTAL MARKS=30