AQA B3.3 Homeostasis LEVEL 2

89 minutes

88 marks

Q1. Information is passed to target organs in the body by hormones.

(a) (i) How do hormones travel around the body?

.....

(1)

(ii) What name is given to the organs that secrete hormones?

.....

(1)

(b) Explain the cause of diabetes and how it is controlled.

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(3)

(Total 5 marks)

Q2. The kidneys remove waste materials from the liquid part of the blood.

(a) What name is given to the solution of waste stored in the bladder? .....

(1)

(b) The table shows the concentration of certain substances

- in the liquid part of the blood
- in the liquid that has just been filtered from the blood in the kidneys
- in the solution in the bladder.

SUBSTANCE	CONCENTRATION (%)		
	IN LIQUID PART OF BLOOD	IN LIQUID THAT HAS BEEN FILTERED IN THE KIDNEYS	IN LIQUID IN THE BLADDER
Protein	7.0	0	0
Salt	0.35	0.35	0.5
Glucose	0.1	0.1	0
Urea	0.03	0.03	2.0

(i) Which **one** of these substances does **not** pass into the liquid that is filtered in the kidneys?

.....

(1)

(ii) Suggest **one** reason why this substance does **not** pass out of the blood.

.....

(1)

(c) What happens to the glucose in the liquid that is filtered in the kidneys?

.....

(1)

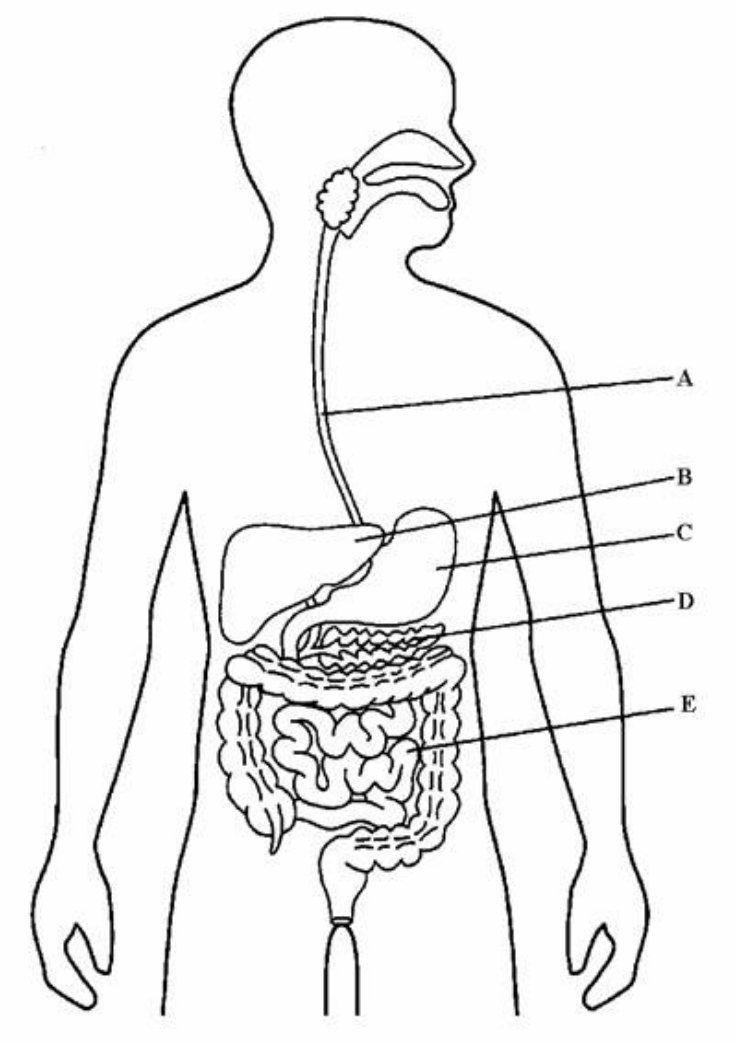
(d) Explain why the concentration of urea in the liquid in the bladder is much greater than the concentration of urea in the liquid that is filtered in the kidneys.

.....

(1)

(Total 5 marks)

Q3. The diagram shows part of the human digestive system.



(i) Name part **B**.

.....

(1)

(ii) Describe the role of **B** and **D** in reducing blood sugar levels.

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(2)

(Total 3 marks)

Q4. (a) Why is the removal of water from the body an example of homeostasis?

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.....

(1)

(b) Why is homeostasis important in the body?

.....

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(1)

(c) This system also excretes a substance called urea.

What is excretion, and why is it necessary in the body?

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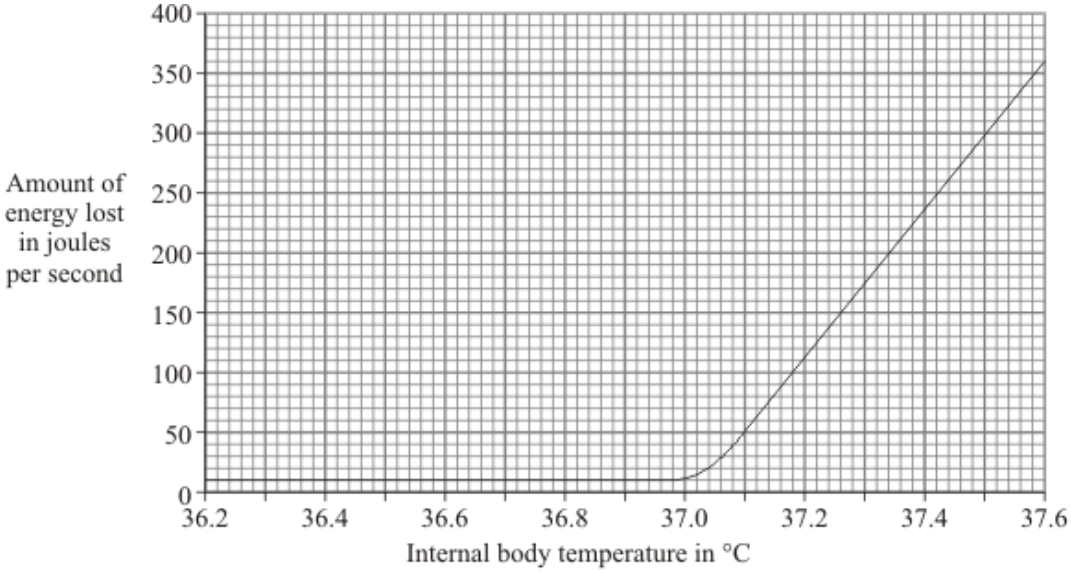
(2)
(Total 4 marks)

Q5. The internal body temperature determines how much a person sweats. The graph shows the effect of different internal body temperatures on a person's rate of energy loss by sweating.



(a) How much more energy was lost from the body each second by sweating when the body temperature was 37.6 °C than when it was 36.6 °C? Show clearly how you work out your final answer.

.....

.....

Amount of energy = ... joules per second

(2)

(b) Explain why a person would feel more thirsty when the body temperature was 37.6 °C than when it was 36.6 °C.

.....

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(2)

(c) Explain how sweating helps to control body temperature.

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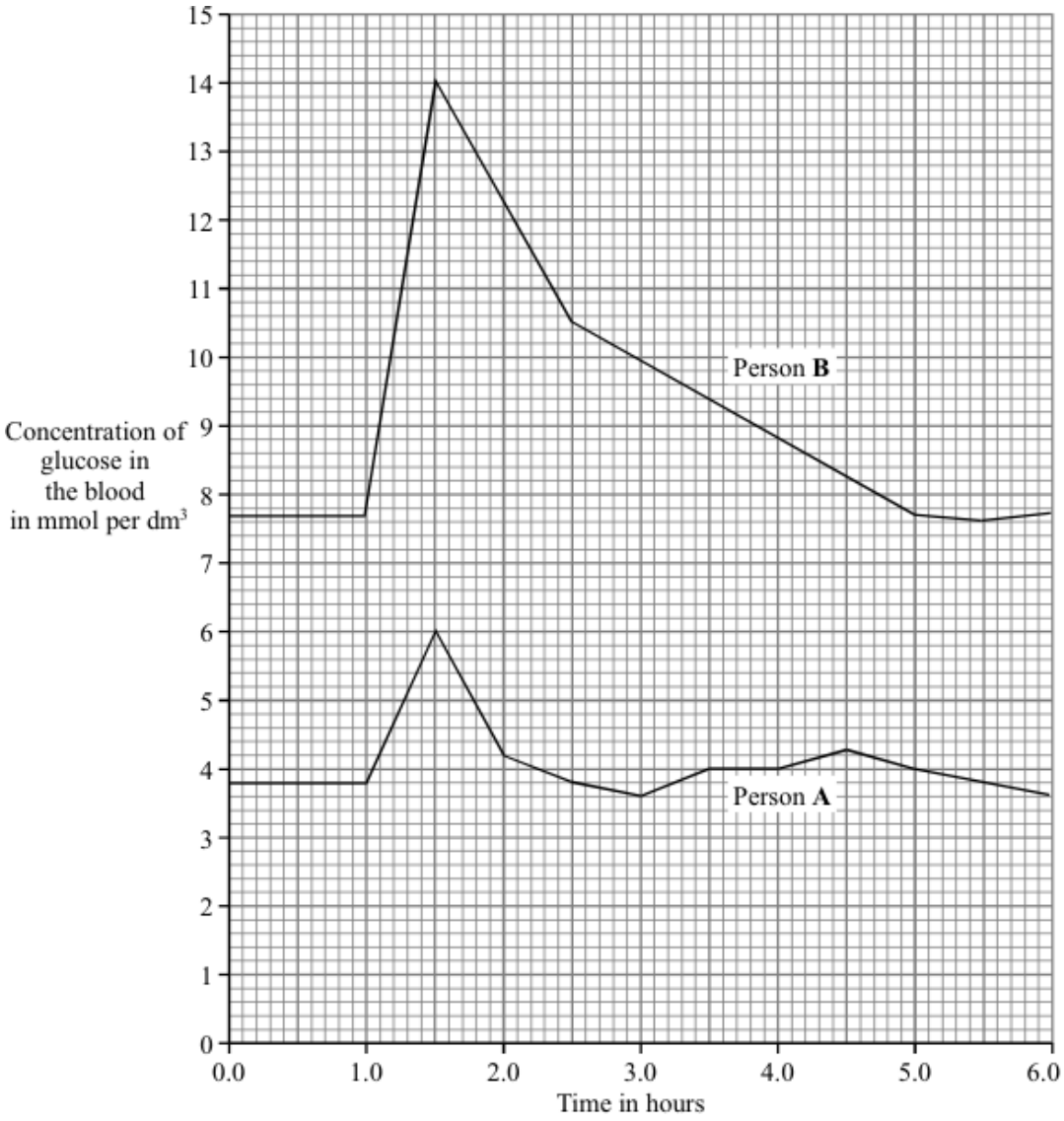
(3)

(Total 7 marks)

Q6. The graph shows the concentration of glucose in the blood of two people. Person **A** is a non-diabetic. Person **B** has diabetes. Each person ate 75 grams of glucose at 1.0 hours.



(a) (i) What was the maximum concentration of glucose in the blood of Person **A**?

..... mmol per dm^3

(1)

(ii) After eating the glucose, how long did it take for the concentration of glucose in the blood of Person **B** to return to normal?

..... hours

(1)

(b) A diabetic person does not produce enough insulin.

(i) Which organ produces insulin?

.....

(1)

(ii) Write the letter **X** on the graph to show one time when the blood of Person **A** would contain large amounts of insulin.

(1)

(c) A high concentration of glucose in the blood can harm body cells as a result of osmosis. Explain why.

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(4)
(Total 8 marks)

Q7. 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)

(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)

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

.....

.....

(1)

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

.....

.....

(1)

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

.....

(1)

(c) Many of the cells in the pancreas contain large numbers of ribosomes.

What is the function of ribosomes in a cell?

.....

.....

(1)

(Total 7 marks)

Q8. 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)

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

Describe how insulin does this.

.....

.....

(1)

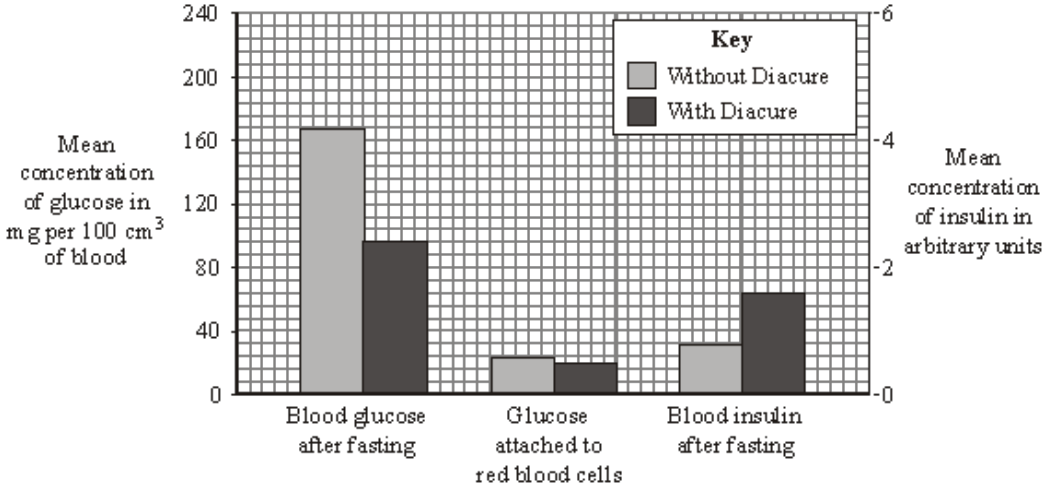
(b) A person with diabetes can be monitored in three ways:

- 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.



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

.....

.....

(1)

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

.....

.....

.....

(1)

(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)

(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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.....

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(1)

(Total 7 marks)

Q9. The food we eat affects how quickly the blood glucose concentration changes.

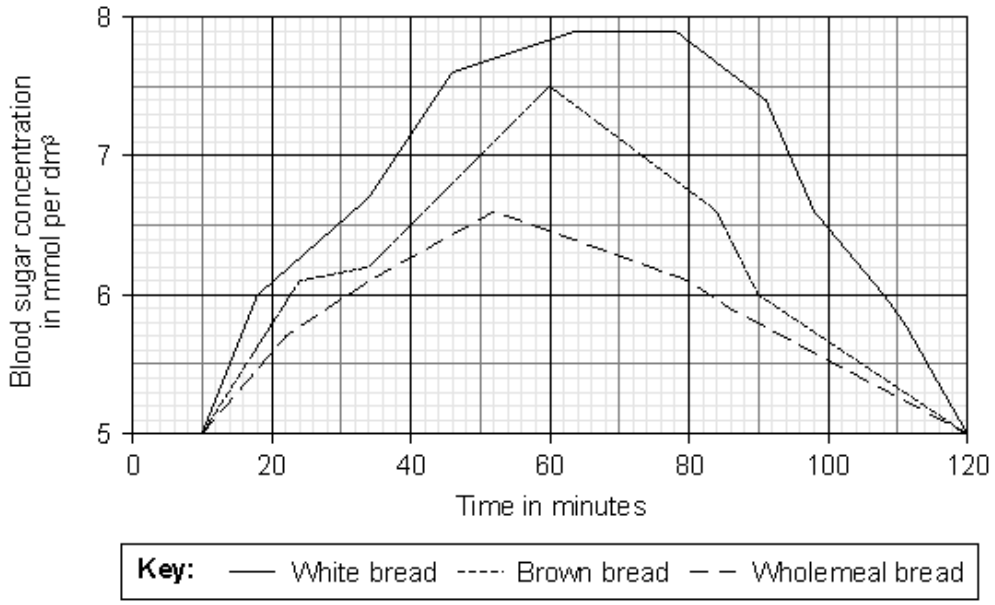
In an experiment a person ate two slices of white bread.

Her blood glucose concentration was recorded over the next 120 minutes.

The experiment was repeated:

- first with two slices of brown bread
- then with two slices of wholemeal bread.

The graph shows the results of the three experiments.



(a) Describe the effect of eating two slices of white bread on the person's blood sugar concentration.

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(2)

(b) Wholemeal bread would be most suitable for a person with diabetes.

Explain why.

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(3)
(Total 5 marks)

Q10. (a) (i) Which organ in the body monitors the concentration of glucose (sugar) in the blood?

.....

(1)

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

How does it do this?

.....

.....

(1)

(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)

(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.

(i) Insulin is a hormone.

What type of substance is insulin?

Draw a ring around **one** answer.

carbohydrate **lipid** **protein**

(1)

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

.....

(1)

(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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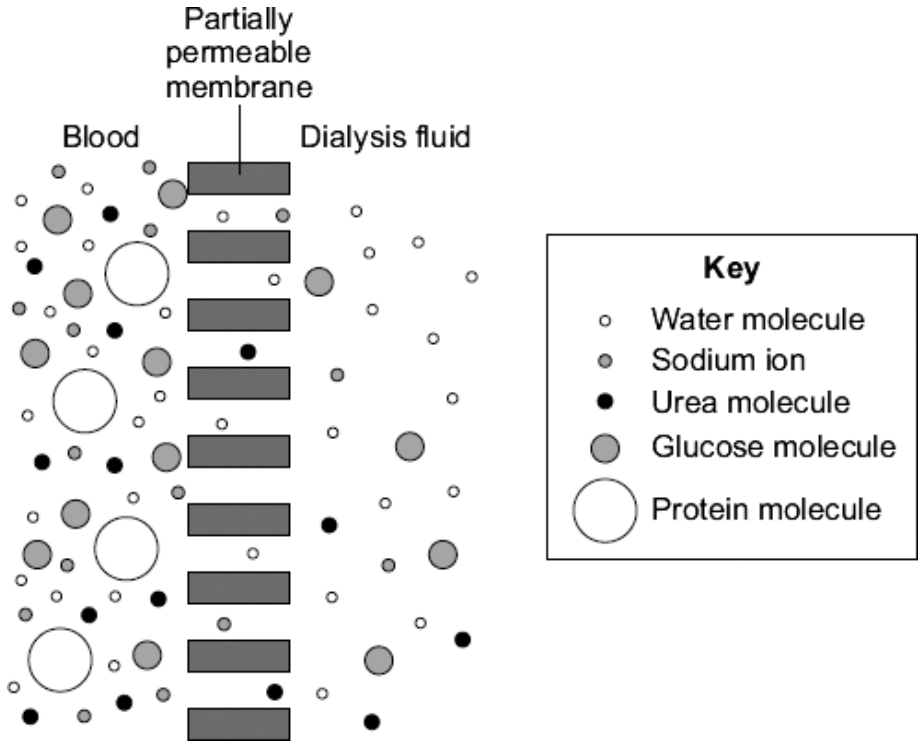
(3)
(Total 9 marks)

Q11. Dialysis can be used to treat a person with kidney disease.

The diagram shows blood and dialysis fluid separated by a partially permeable membrane.



Blood plasma and dialysis fluid contain several substances dissolved in water.

The table shows the concentrations of some of these substances in dialysis fluid and in the blood plasma of a person with kidney disease immediately before dialysis.

Substance	Concentration of substance in grams per dm^3	
	Blood plasma of person with kidney disease	Dialysis fluid
Sodium ions	3.26	3.15
Urea	0.45	0.00
Glucose	0.90	0.99
Protein	60.00	0.00

(a) Protein molecules are **not** able to move from the blood to the dialysis fluid.
Use information from the diagram to explain why.

.....

.....

(1)

(b) Urea molecules move from the blood into the dialysis fluid.

(i) Give the name of this type of movement. .....

(1)

(ii) Why do the urea molecules move in this direction?

Use information from the table to help you to answer this question.

.....

.....

(1)

(c) The concentration of sodium ions in the blood plasma will change during dialysis.

Suggest a value for the concentration of sodium ions in the plasma at the end of dialysis.

Use information from the table.

Concentration of sodium ions = ... grams per dm^3

(1)

(d) For most patients a kidney transplant is better than continued treatment by dialysis.

(i) Give **two** advantages of having a kidney transplant rather than treatment by dialysis.

1 .....

.....

2 .....

.....

(2)

(ii) Give **two** possible disadvantages of having a kidney transplant.

1 .....

.....

2 .....

.....

(2)

(Total 8 marks)

Q12. In diabetics blood glucose concentrations are sometimes abnormal.

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

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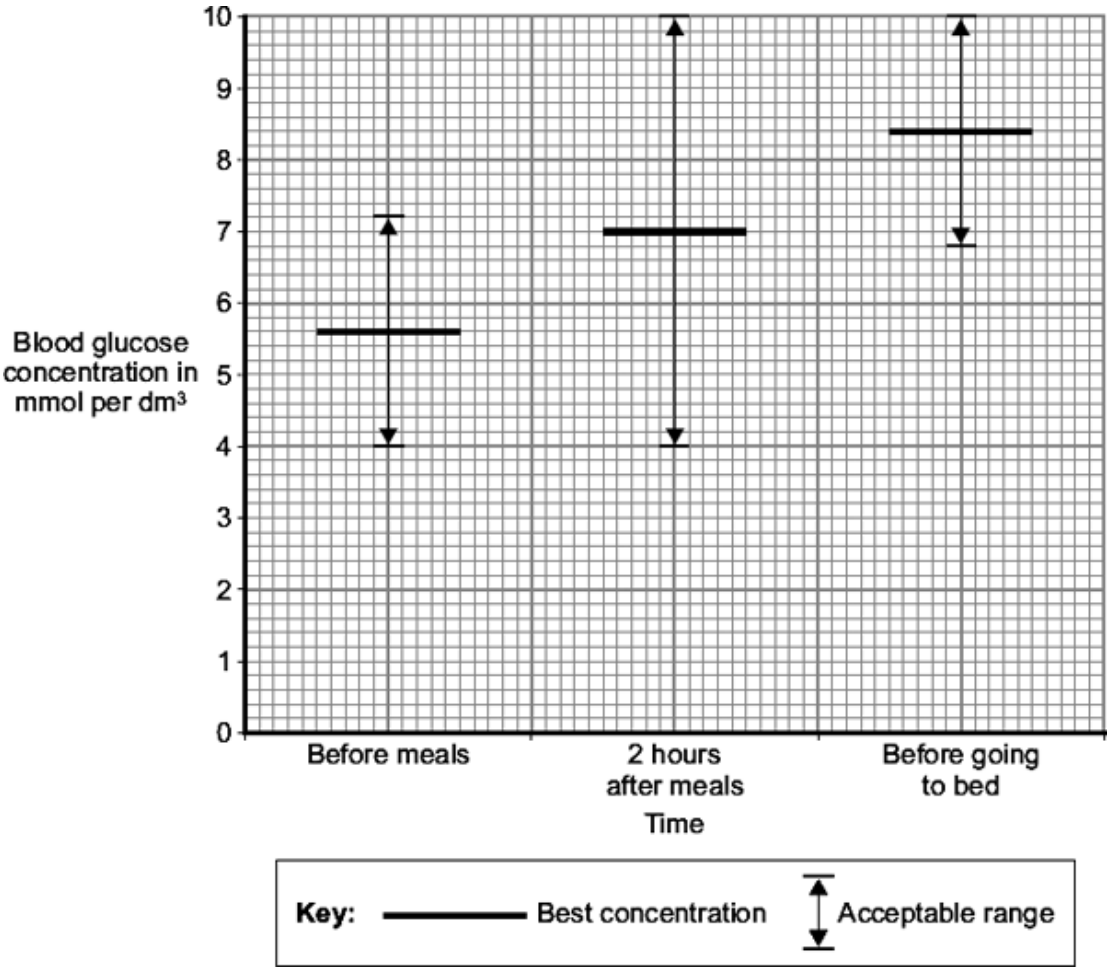
(1)

(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)

(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)

(Total 5 marks)

Q13. It is important that the concentration of glucose (sugar) in the blood is controlled.

(a) (i) Which hormone controls the concentration of glucose in the blood?

.....

(1)

(ii) Which organ produces this hormone?

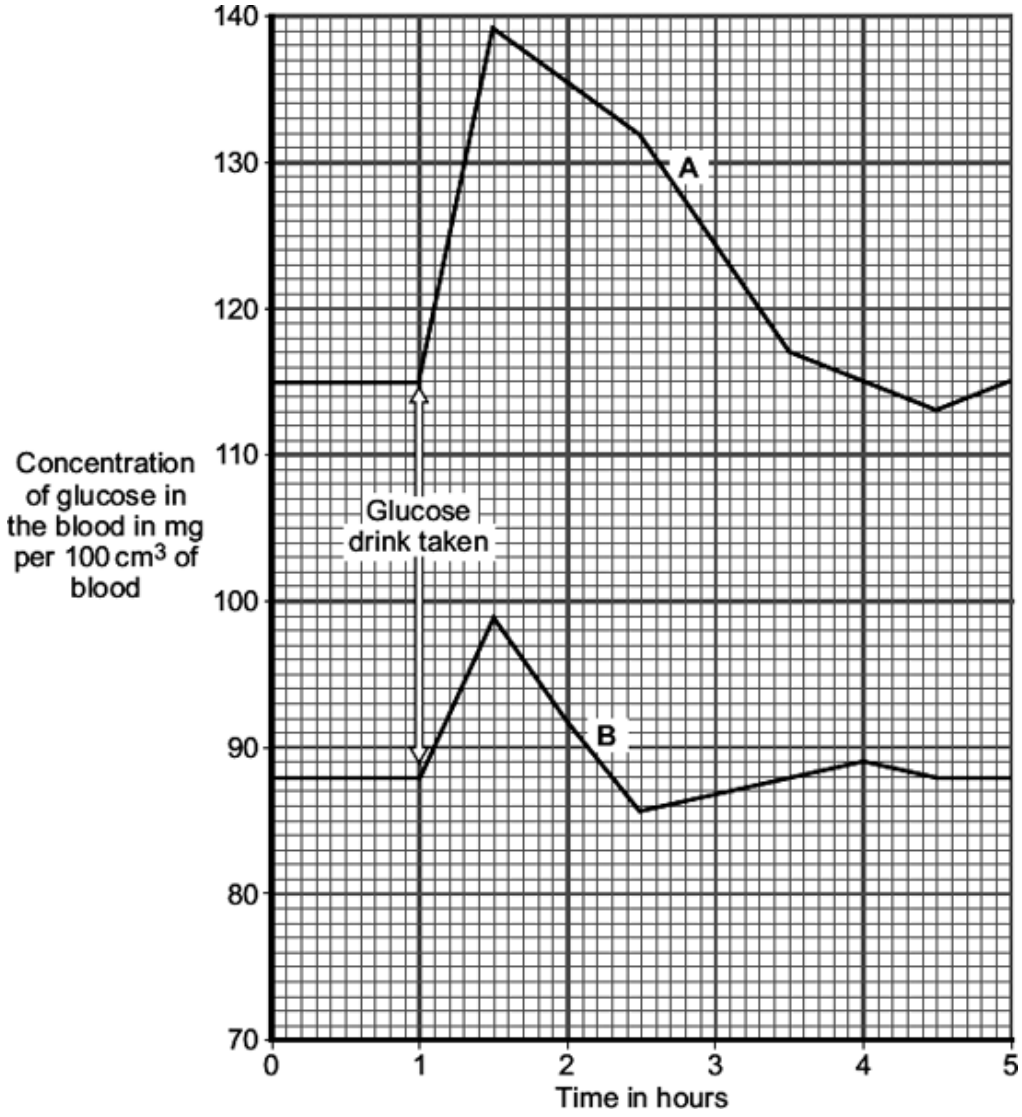
.....

(1)

(b) The concentration of glucose in the blood of two people, **A** and **B**, was measured every half an hour.

One hour after the start, both people drank a solution containing 50 g of glucose.

The graph shows the result.



(i) By how much did the blood glucose concentration in person **B** rise after drinking the glucose drink?

..... mg per 100 cm^3 of blood

(1)

(ii) A doctor suggests that person **A** has diabetes.

Give **two** pieces of evidence from the graph to support this suggestion.

1 .....

.....

2 .....

.....

(2)

(iii) Give **one** reason for the fall in blood glucose concentration in person **B**, shown in the graph.

.....

(1)

(Total 6 marks)

Q14. Diabetes is a disease in which a person's blood glucose concentration may rise.

Doctors give people drugs to treat diabetes.

The table shows some of the side effects on the body of four drugs, **A, B, C** and **insulin,** used to treat diabetes.

Drug	Side effects on the body
A	Weight loss Liver, kidney and heart damage Feeling of sickness
B	Weight gain Damage to some cells in pancreas
C	More water is kept in the body Weight gain Increased chance of bone breakage in women
Insulin	A little more water is kept in the body Weight gain Increased risk of lung damage

(a) Which drug, **A, B, C** or **insulin,** is most likely to result in an increase in blood sugar concentration in some people?

Explain your answer.

Drug .....

Explanation

.....

.....

(2)

(b) (i) Drugs **A, B and C** can be taken as tablets.

The chemicals in the tablets are absorbed into the blood from the digestive system.

Insulin is a protein.

Insulin **cannot** be taken as a tablet.

Why?

.....

(1)

(ii) Other than using drugs, give **two** methods of treating diabetes.

1 .....

2 .....

(2)
(Total 5 marks)

Q15. A group of students is going on an outdoor expedition.
The students need to keep warm in windy conditions.

The table shows the effect of wind speed on how quickly someone gets frostbite at different air temperatures.

Wind speed in metres per second	**Air temperature in °C**				
	10	**0**	**–10**	**–20**	**–30**
0					
5					
10					
15					
20					

Key

Time taken to get frostbite:
- No frostbite
- 30 minutes
- 10 minutes
- 5 minutes

(a) (i) Describe the effect of changing air temperature on the time taken to get frostbite.

.....

.....

(1)

(ii) What is the longest time it is safe to stay outside when the air temperature is –20 °C and the wind speed is 10 metres per second?

..... minutes

(1)

(b) When core body temperature begins to fall, changes may happen in the body.

Which **two** changes will happen when core body temperature begins to fall?

Tick (✓) **two** boxes.

More blood flows through skin capillaries ☐

Muscles 'shiver' ☐

Blood vessels supplying the skin capillaries constrict ☐

Sweat glands release more sweat ☐

(2)
(Total 4 marks)