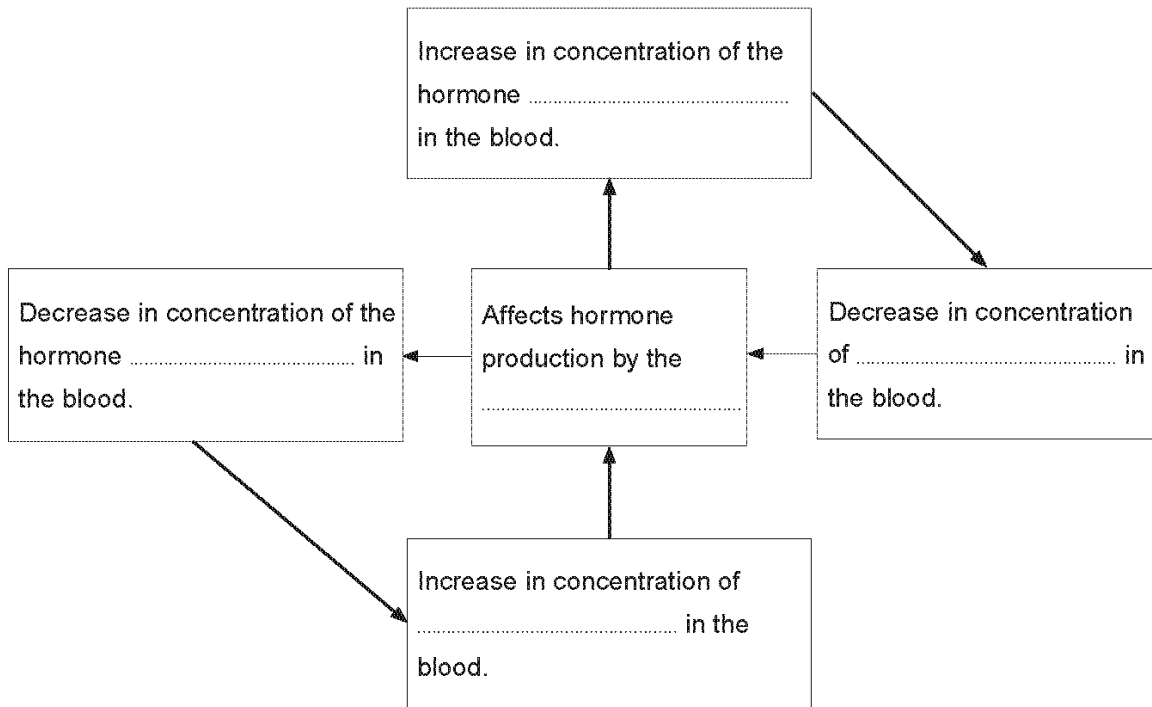


WJEC (Eduqas) Biology GCSE
Topic 4.3 Homeostasis in
Humans
Questions by Topic

1.

The principles of negative feedback can be summarised by the flow chart shown below.

- (a) Fill in the blank spaces to show how the source of energy in the blood is maintained at a constant concentration. [5]



2.

- (a) When athletes prepare to run a marathon, they eat a lot of carbohydrate on the day before the race. During the marathon, the concentration of insulin in their blood decreases, while the concentration of glucagon increases. [2]

- (i) Describe what happens to the concentration of glucose in the blood when the concentration of insulin decreases and state the benefit to the athlete. [2]

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- (ii) Explain how the concentration of glycogen in the liver and muscles changes when the concentration of glucagon increases. [2]

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- (b) What name is given to the mechanism which maintains the optimum concentration of glucose in the blood? [1]

.....

3.

Insulin has an important role in the control of blood glucose.

(a) What type of substance is insulin? [1]

Underline the correct answer:

fat

hormone

nutrient

(b) Use your knowledge to complete the following sentences about the control of blood glucose. [3]

As blood glucose level rises, insulin is released from the

.....

The insulin travels in the blood to the liver.

The liver then converts the excess into an insoluble form

called

(c) Some people have a medical condition in which they cannot control their blood glucose. State the name of the condition and describe one method of treating it. [2]

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| 6 |

4. The level of blood glucose must be kept within a very narrow range. It must not be allowed to rise too high or fall too low.

After a meal the blood glucose level begins to rise. Describe the processes which occur in the human body to bring the level of glucose in the blood back down to its normal level. [QWC 6]

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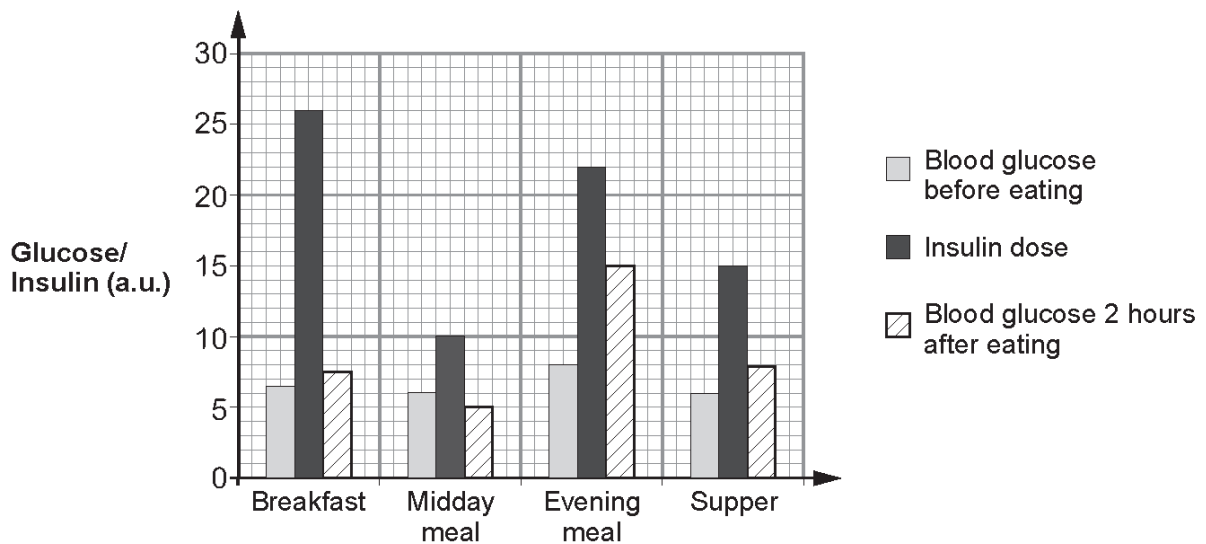
Anna has been a diabetic for 6 months. She injects herself with insulin before meals in order to control the level of glucose in her blood. Like all diabetics who have not been injecting insulin for very long she finds it difficult to get the dose correct. Before every meal Anna carries out the following procedure.

1. Measures the concentration of glucose in her blood.
2. Estimates whether the meal she is about to eat has a high, medium or low level of glucose (sugar) in it.
3. Inject insulin, the dose of which depends on the level of glucose in the meal.

Two hours after the meal she measures the concentration of glucose in her blood again.

Anna records all this information on an App, called **Glucose Buddy**, on her iPhone.

The chart below shows Anna's complete record for one day on **Glucose Buddy**.



- (a) (i) Which meal of the day did Anna estimate contained the lowest level of glucose? Give a reason for your answer. [2]

Meal

Reason

- (ii) Anna tries to keep her blood glucose level below 8 a.u. Using only the chart and the information opposite suggest reasons why her blood glucose level was still 15 a.u. two hours after she ate her evening meal. [2]

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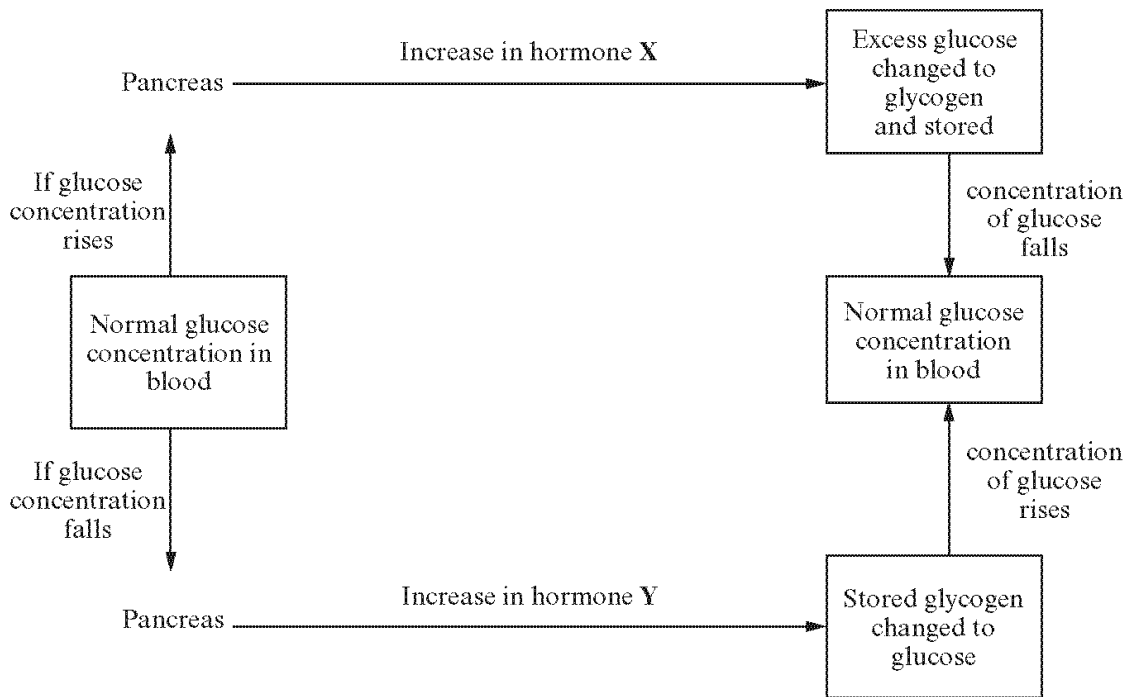
- (b) How does insulin lower the level of glucose in the blood? [2]

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6.

It is important to keep the concentration of glucose in the blood constant. The flow diagram shows how this happens.



(a) What term would you use to describe the control mechanism shown in the diagram? [1]

(b) Name the hormones, X and Y, shown in the diagram. [2]

(i) X

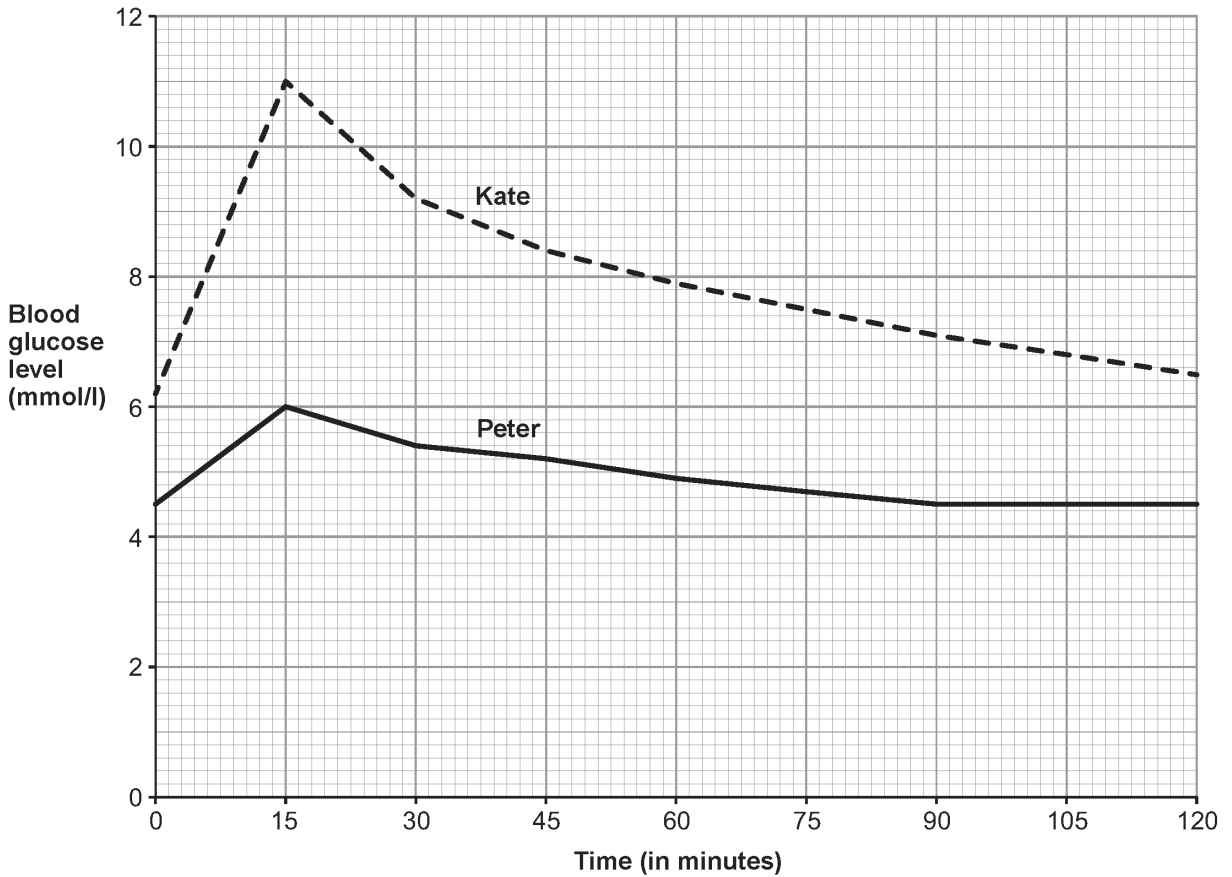
(ii) Y

(c) Name the organ of the body which stores glycogen. [1]

.....

7.

The graph below shows the blood glucose levels of Kate and Peter, after eating the same mass of sugary cereal at breakfast time. The normal blood glucose range before meals is 4.0 – 5.9 mmol/l.



(a) Explain why Peter's blood glucose level rises then falls. [3]

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.....

(b) State **two** pieces of evidence, shown in the graph, which indicate that Kate has diabetes. [2]

I.

II.

8.

This question is about the control of blood glucose levels.

After eating a meal, the blood glucose level rises. Complete the description of how the blood glucose level is returned to normal.

Use **all** of the following words in your answer. [3]

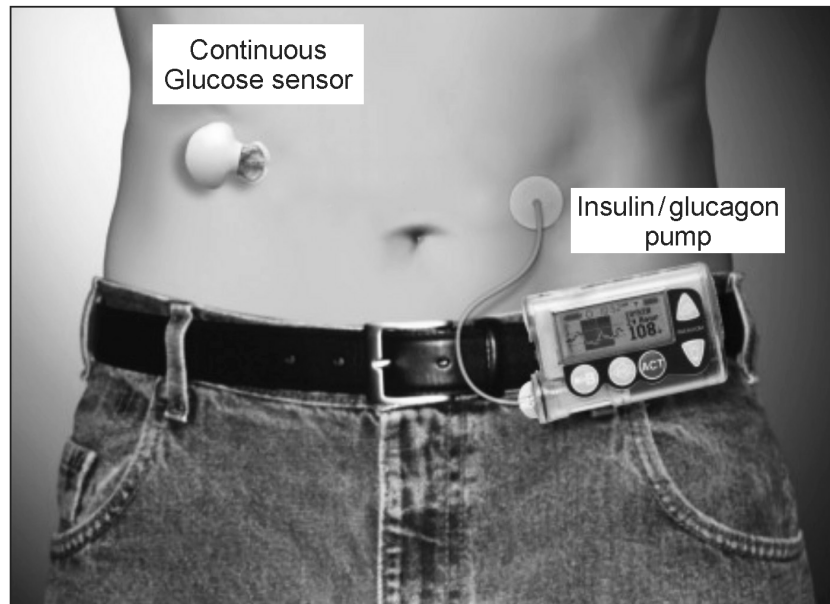
insulin glycogen liver

When blood glucose levels rise, the pancreas

.....

9.

In 2014, scientists developed a new treatment for diabetes involving a smartphone app. Every five minutes, a wireless signal is sent from a glucose sensor under the user's skin to the app. The app then calculates the dose of insulin or glucagon needed to balance the blood glucose level. It then sends a signal to a hormone supply carried by the user to pump the required dose via a tube into the blood. This maintains the body's normal negative feedback mechanism.



(a) Which gland in the body is replaced by this treatment? [1]

.....

(b) Describe the function of glucagon when it reaches the liver and muscles. [1]

.....

.....

(c) State **two** ways in which the app could react if the blood glucose concentration became higher than normal. [2]

1.

2.

(d) A 55 year old man was newly diagnosed as having some symptoms of diabetes. A doctor recommended that the man should change his diet before trying any further treatment.

Suggest:

(i) the change of diet that would have been recommended; [1]

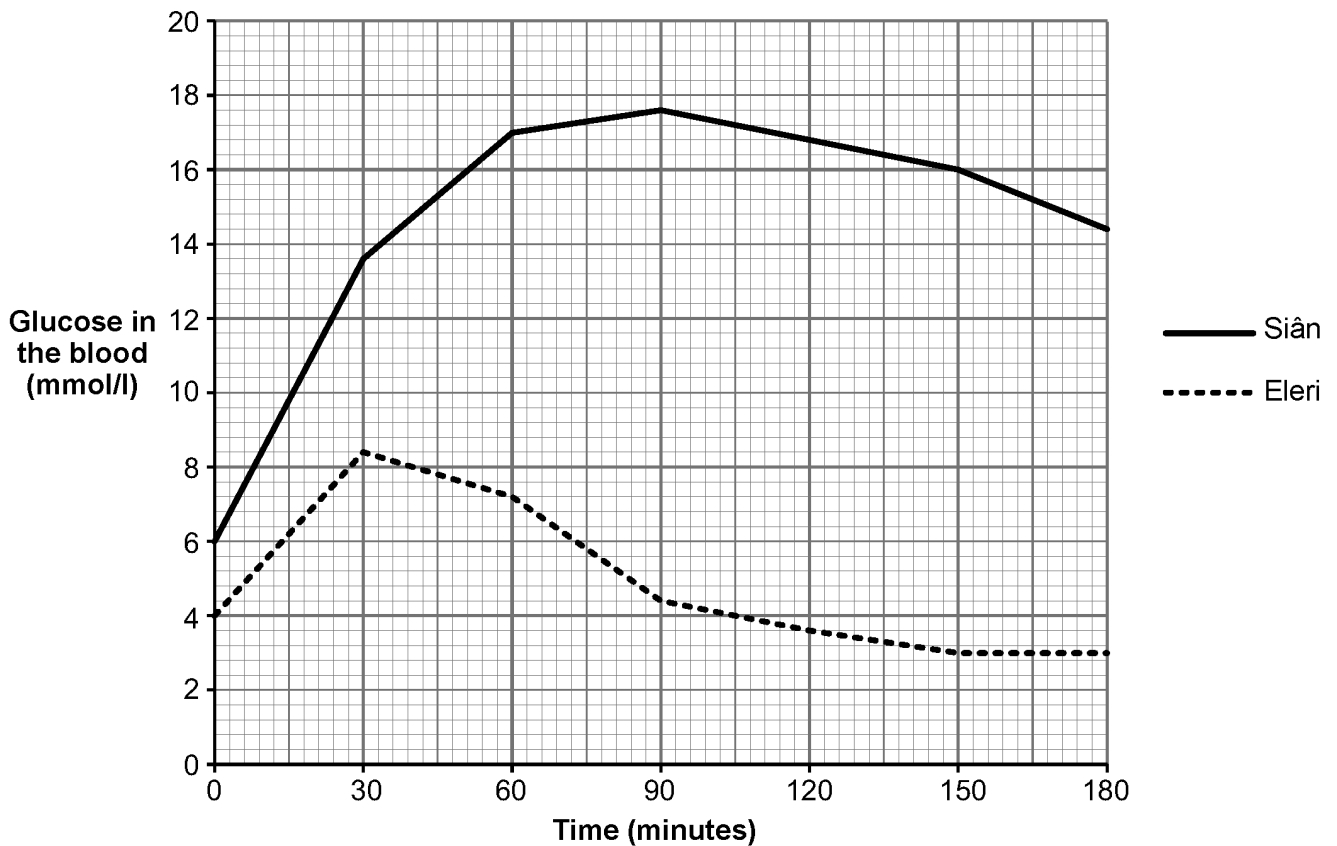
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(ii) the reason why the man was probably suffering from Type 2 diabetes rather than Type 1 diabetes. [2]

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10. Eleri and Siân ate identical meals. After the meal the concentration of glucose in their blood was measured at regular intervals over the next 180 minutes. The graph below shows the results obtained.



- (a) The meal both Eleri and Siân ate contained no added glucose or other sugars. Suggest which type of food in the meal could have caused the increase in blood sugar. [1]

.....

- (b) It is important that the concentration of glucose in the blood remains between 3.5 and 7.5 mmol/l. Explain how the level of glucose in Eleri's blood is reduced after 30 minutes. [2]

.....

- (c) What evidence, shown in the graph, suggests that Siân is suffering from diabetes? [1]

.....

11. Read the following article about diabetes.

1 In type 1 diabetes, the cells of the pancreas that make insulin are destroyed by cells of the immune system.
You are more likely to develop it, if diabetes runs in your family.
The immune system may be triggered to act on the pancreas by a virus, pollutants, or stress causing type 1 diabetes.

6 In type 2 diabetes, not enough insulin is produced or cells in the liver fail to respond to the insulin that is produced. It is more likely to occur if it runs in your family, but there are also several risk factors.

These include:

- certain lifestyle choices
- certain ethnic origins
- age

16 Despite a rapid rise in the incidence of diabetes, there has been a 28% fall in the number of deaths from diabetes-related conditions in Wales between 2009 and 2013. This shows there has been some success in how diabetes has been managed but early diagnosis is vital.

A spokesperson for a charity promoting diabetes awareness in Wales said:

"Type 2 diabetes can be prevented, but there is no way of preventing type 1. Looking after your own health can reduce the risk of developing type 2 diabetes."

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

- (a) (i) Give the reason why people at high risk of developing diabetes should be tested regularly. [1]

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- (ii) Does the evidence given in the article support the claim made in line 18, that "*type 2 diabetes can be prevented*" in every individual? Give reasons for your answer. [1]

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- (b) Explain **one** way in which *“looking after your own health can reduce the risk of developing type 2 diabetes”* (lines 18 & 19). [2]

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- (c) Explain what would happen in the body if the *“cells in the liver fail to respond to the insulin that is produced”*. [3]

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12.

The list below describes processes involved in the control of blood glucose but they are in the wrong order.

1. the hormone enters the bloodstream
2. the pancreas detects the rise
3. blood glucose level rises
4. the glycogen is stored
5. the pancreas releases insulin
6. the liver turns excess glucose into glycogen

(a) Write down the numbers of the processes above in the right order to complete the sequence correctly. Two have been done for you. [3]

3 6

(b) State the name of the substance in urine which shows a person may have diabetes. [1]

.....

(c) The table below shows the percentage of people in Wales with diabetes between 2006 and 2010.

| Year | Percentage of people in Wales with diabetes (%) |
|------|---|
| 2006 | 4.1 |
| 2007 | 4.2 |
| 2008 | 4.4 |
| 2009 | 4.6 |
| 2010 | 4.9 |

(i) Calculate the increase in diabetes between 2006 and 2010. [1]

.....%

(ii) Most of the increase in diabetes is due to a rise in Type 2 diabetes. One doctor working with diabetics in South Wales has called for a tax on chocolate.

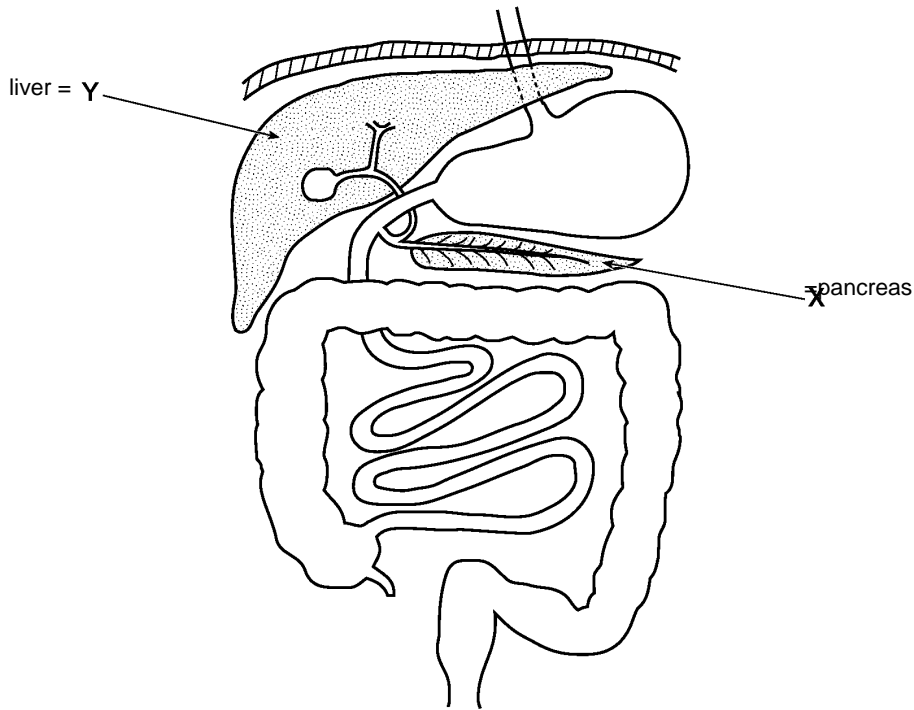
How could a person's lifestyle possibly lead to Type 2 diabetes? [3]

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13.

This question is about the control of blood sugar.

(a) The diagram shows part of the human body with two labelled organs, X and Y.



(iii) How does insulin travel from organ X to organ Y? [1]

.....

(b) In Wales, in 2010, the cost of treating diabetes was £500 million.

1. The percentage of the population with type 2 diabetes is increasing.
2. The percentage of the population who are obese is increasing.
3. The population is increasing.

Using the three statements above, which of the following (A, B or C) shows that the cost of treating diabetes will increase in the future? [1]

- A. 1
- B. 1 and 2
- C. 1, 2 and 3

Answer

(c) Complete the following sentence. [1]

Diabetes may be diagnosed by testing a sample of urine for presence of

.....

(d) Suggest **two** healthy lifestyle choices which might help prevent the development of type 2 diabetes. [2]

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14.

The concentration of glucose in the blood is normally between 60 mg and 160 mg per 100 cm³ of blood. Insulin reduces the concentration and prevents it from rising above the normal level.

(a) State the name of the organ which produces insulin. [1]

.....

(b) Doctors investigated the concentration of blood glucose in Kate and John. They suspected that Kate had diabetes but they knew that John did not.

Their blood glucose was measured after taking a glucose drink.

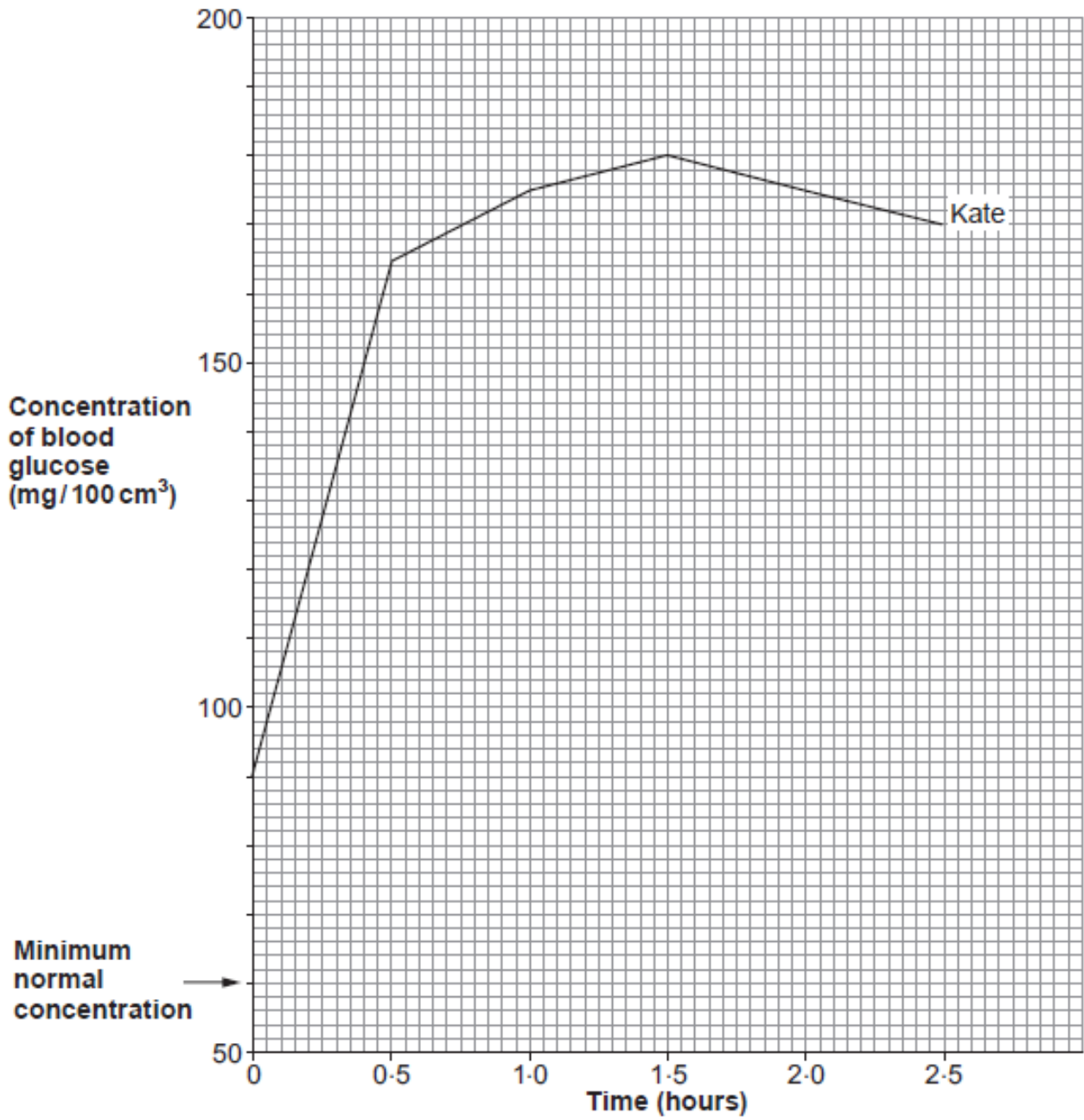
The results for John are shown in the table below. Kate's results are shown on the graph.

| Time (hours) | John's blood glucose level (mg / 100 cm ³) |
|--------------|--|
| 0 | 80 |
| 0.5 | 115 |
| 1.0 | 134 |
| 1.5 | 110 |
| 2.0 | 95 |
| 2.5 | 84 |

(i) Complete the graph of results by: [4]

- I. drawing an arrow on the axis for glucose concentration to show the **maximum normal concentration** of blood glucose (the minimum has been done for you);
- II. plotting the blood glucose results for John;
- III. joining your plots with a ruler and labelling your line.

Graph of results



Use the graph to answer the questions.

- (ii) At what time does insulin start to affect the concentration of glucose in John's blood? Give a reason for your answer. [2]

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(iii) How do the results for Kate at 0.5 hours show that she has diabetes? [1]

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(iv) Describe how the results for Kate are different from those of John, between 0.5 and 2 hours. [3]

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(v) The doctors concluded that Kate had diabetes. How could they increase the confidence they had in their results? [1]

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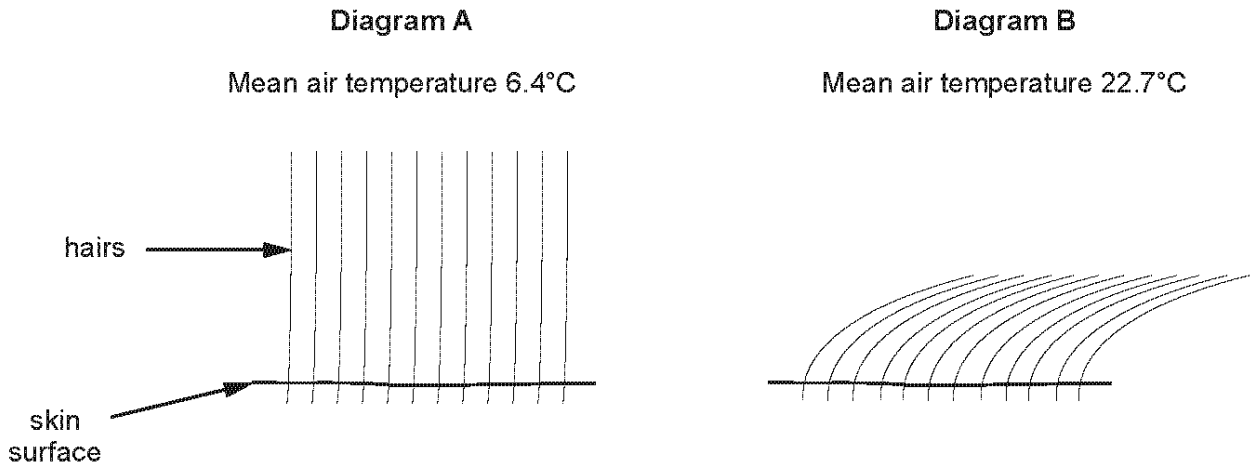
(c) (i) State **one** way in which Kate's diabetes could be treated. [1]

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(ii) Arthur is 70 years old. He produces insulin but his liver cells do not respond to it. State the precise name of this medical condition. [1]

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15. The diagram below shows the hairs on the surface of the skin of a cat at different air temperatures.



(a) Name the structures in the skin that raise each hair to the position shown in **Diagram A**. [1]

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(b) Explain why the skin in **Diagram A** loses less heat to the air than the skin in **Diagram B**. [3]

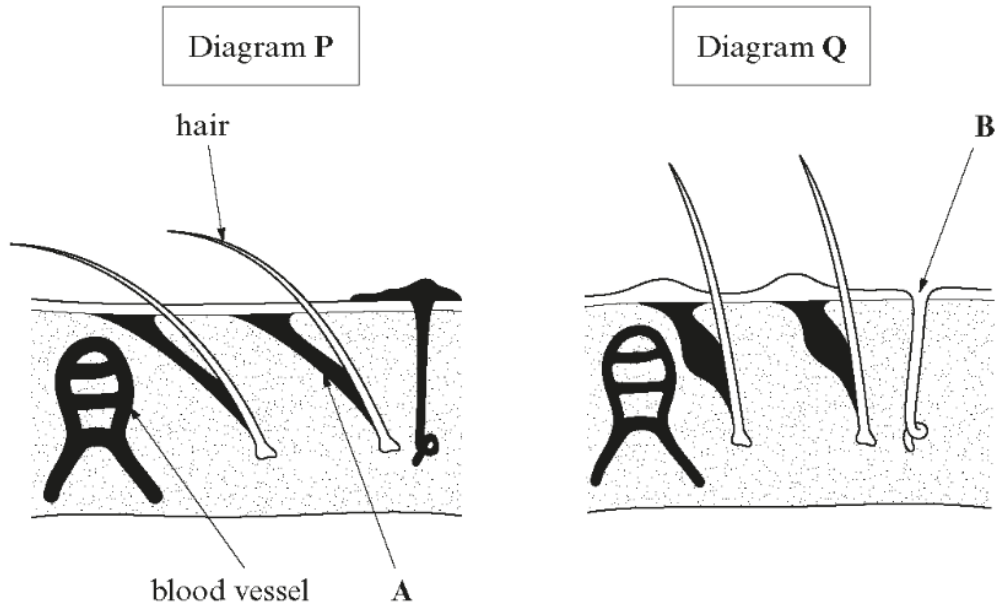
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(c) State two *other* ways in which the skin reduces heat loss from the body. [2]

I

II

16. The diagrams below show the skin under two different environmental conditions.



(a) Name the parts **A** and **B** labelled on the diagrams. [2]

A

B

(b) Diagram **P** shows how the skin responds to cool the body down. Identify **two** of these responses and explain how each cools the body.

(i) Response [1]

Explanation of cooling effect. [1]

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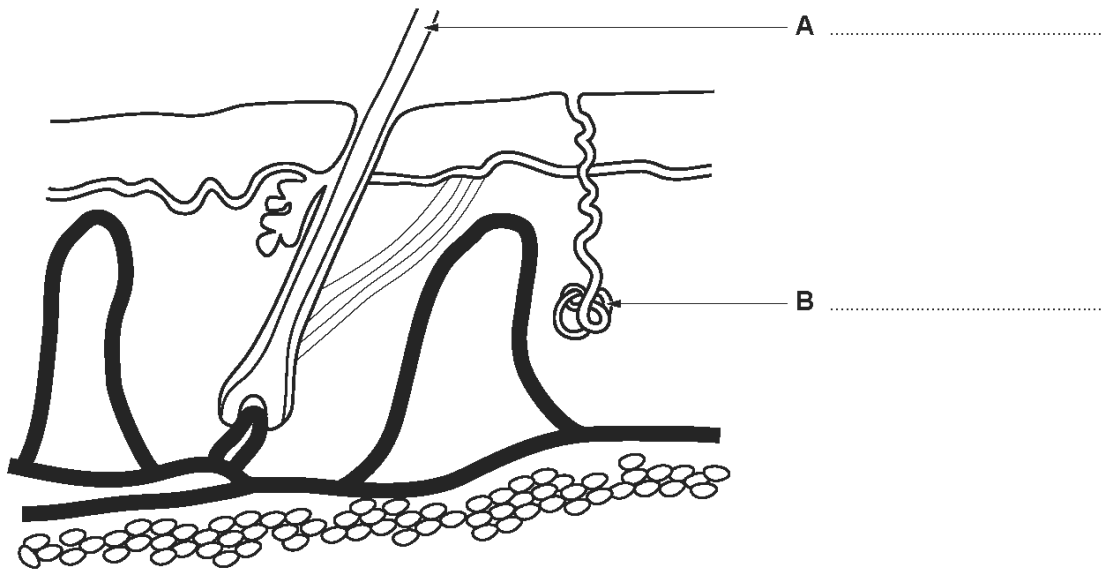
(ii) Response [1]

Explanation of cooling effect. [1]

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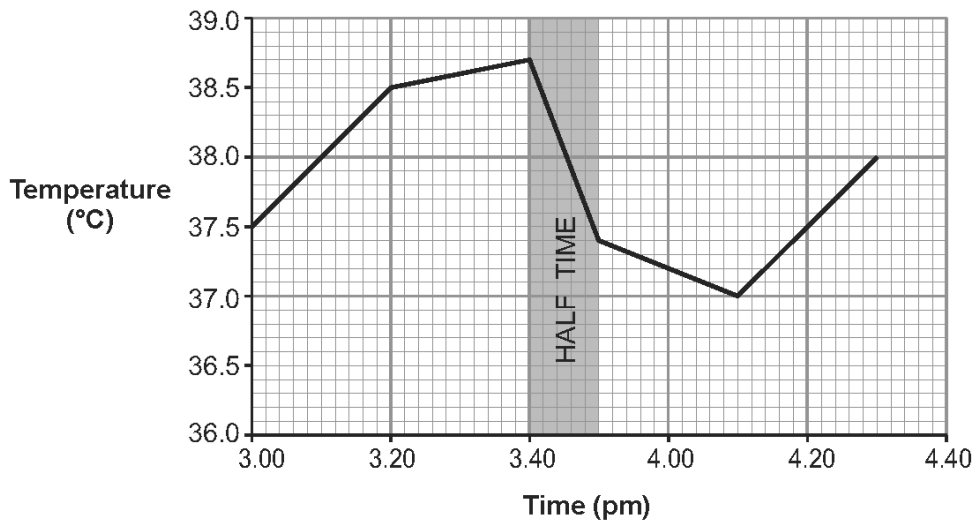
17.

The diagram shows a section through the skin.



(a) Label parts **A** and **B** on the diagram. [2]

(b) The graph shows the body temperature of a player during the course of a rugby match.



(i) State two responses made by the skin to cause the change in body temperature observed between 3.40pm and 4.10pm. [2]

I.

II.

(ii) Explain how the narrowing of blood vessels in the skin helps maintain body temperature in cold conditions. [2]

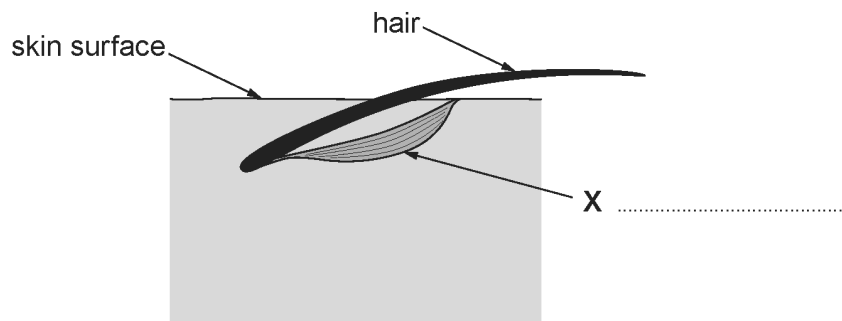
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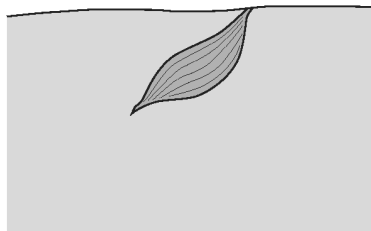
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18. (a) The diagram below shows a section of skin with the position of a hair on a hot day.



- (i) Label structure **X** on the diagram. [1]
- (ii) Complete the diagram below by drawing in the position of the hair on a **cold** day. [1]



- (iii) State how structure **X** causes the change in the position of the hair on a cold day. [1]

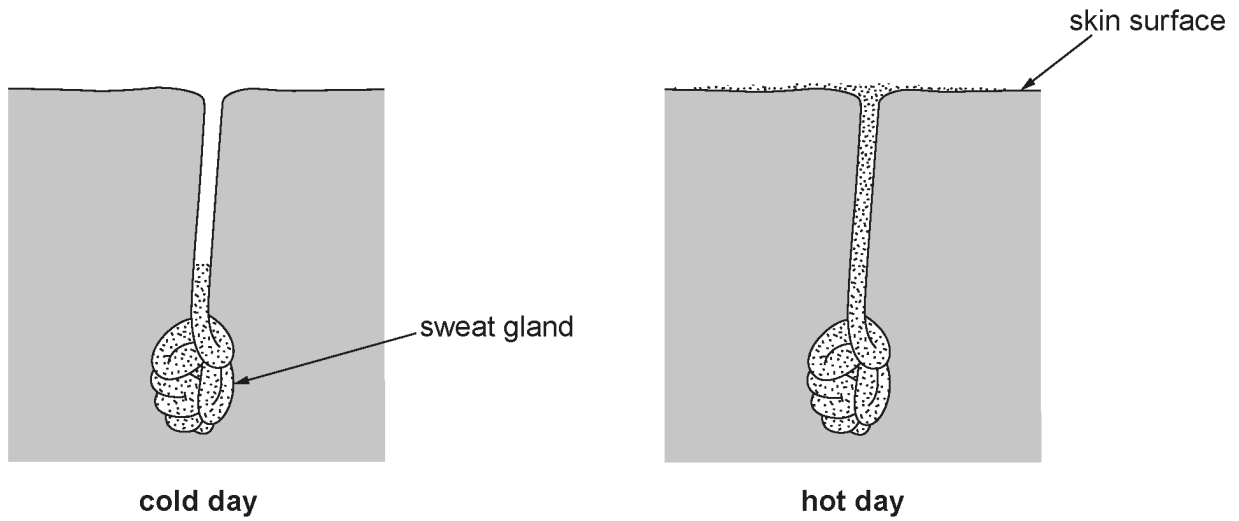
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- (iv) Describe how hair reduces heat loss from the surface of the skin. [2]

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(b) The diagram shows a section through the skin on a cold day and on a hot day.



Use the diagram to describe and explain how the processes taking place in the sweat gland **and on the skin surface** help to cool the body on a **hot** day. [3]

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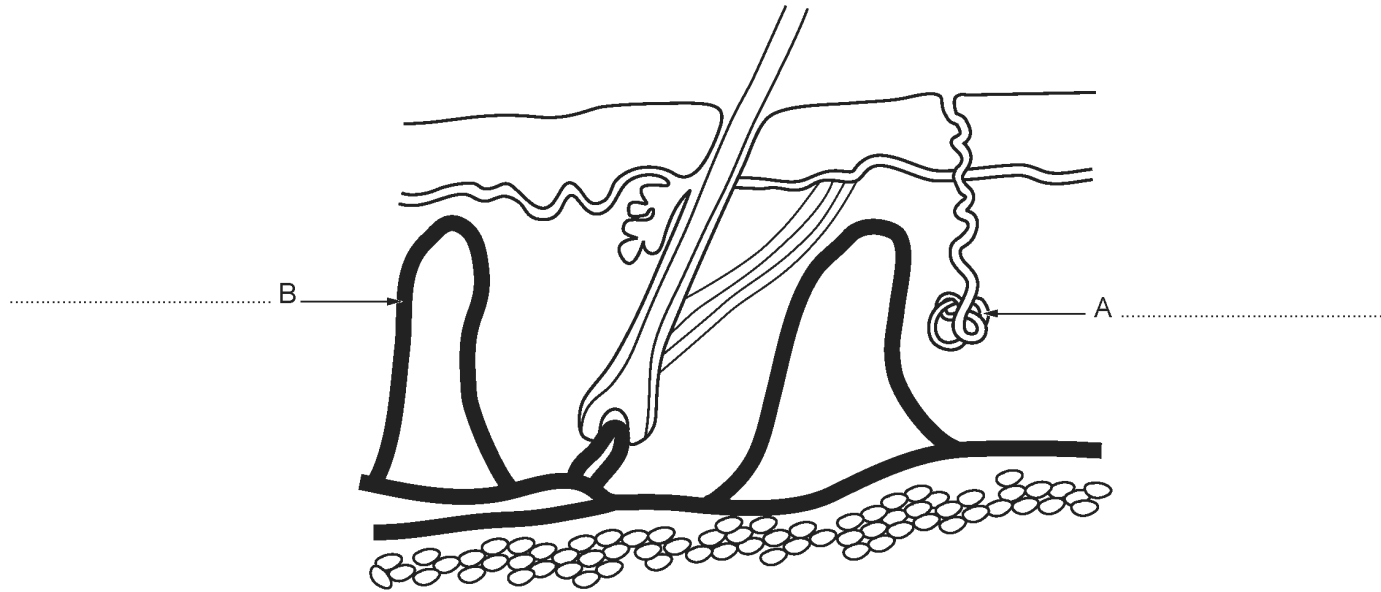
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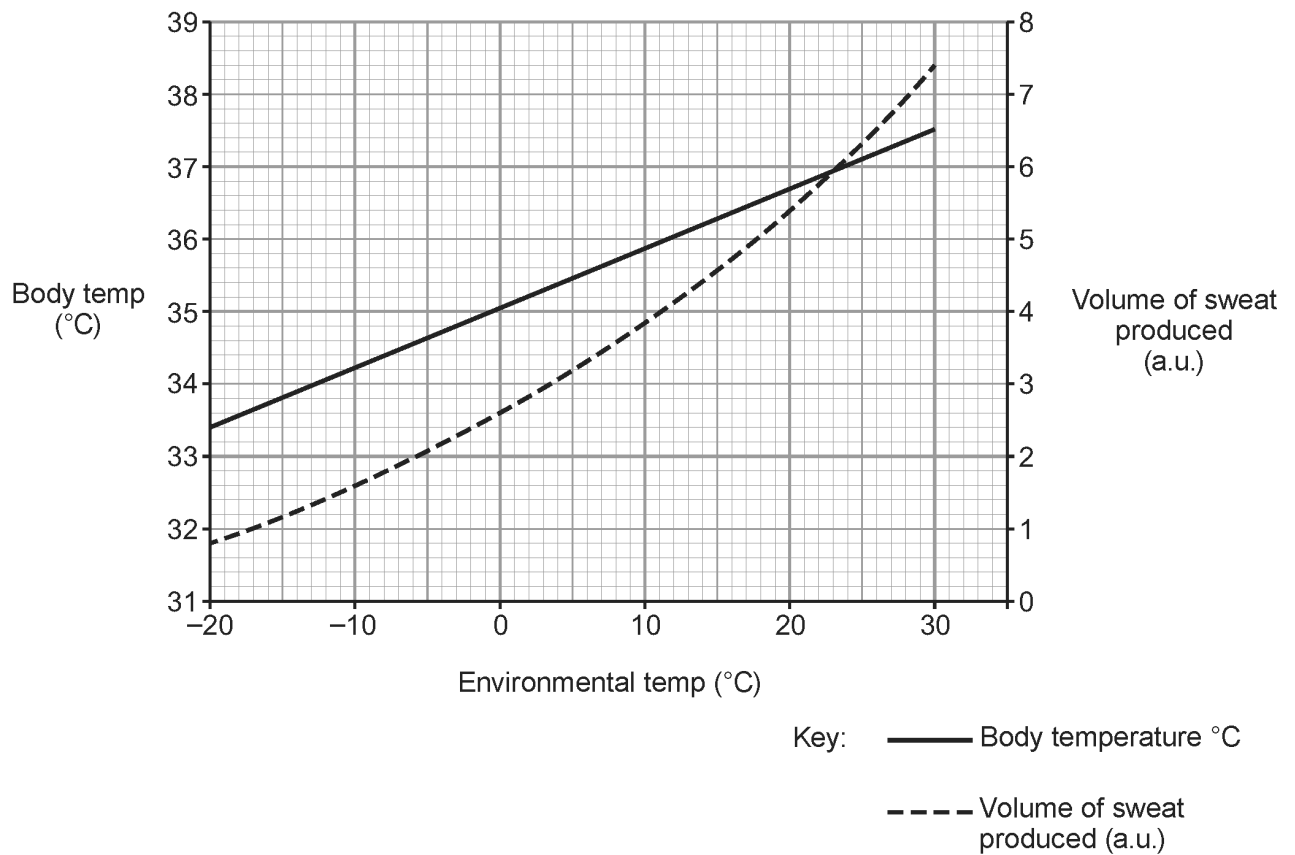
The diagram shows a vertical section through the skin.



(a) On the diagram label structures A and B.

[2]

(b) At a polar research station scientists investigated the effect of changing environmental temperatures on both the body temperature and the volume of sweat produced by a polar explorer. The results are shown in the graph below.



Use the graph to answer the following questions.

- (i) State how the change in environmental temperature relates to both changes in body temperature and the volume of sweat produced. [2]

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- (ii) By how much does the body temperature change when the environmental temperature decreases from 30°C to 20°C? [1]

Body temperature change = °C

- (c) Explain how sweating helps to change body temperature in hot conditions. [3]

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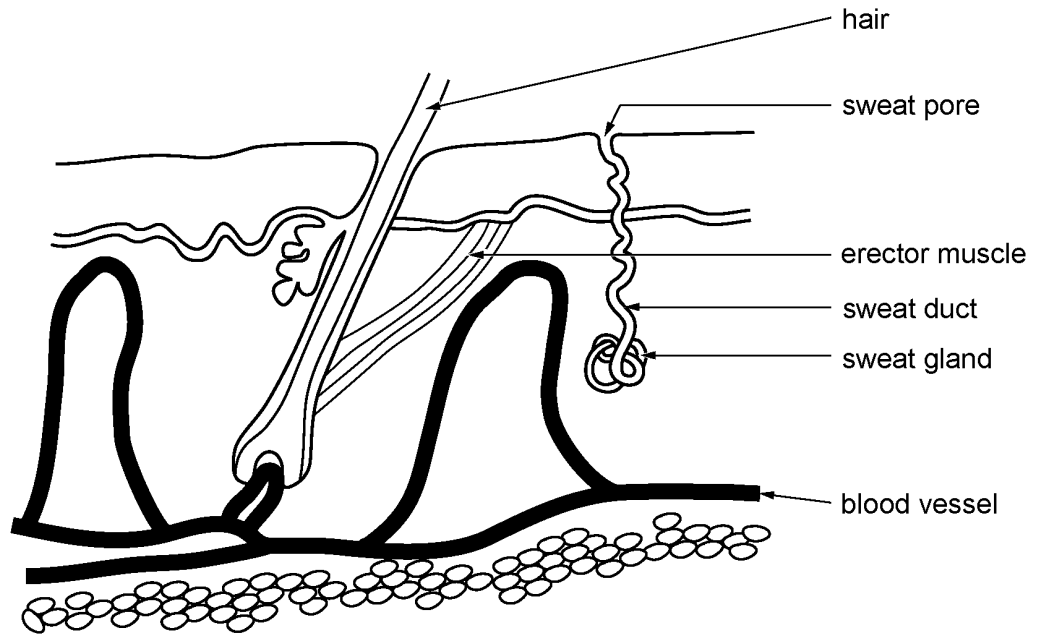
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20.

Explain how human skin helps to control body temperature in hot conditions. Use the features labelled on the diagram below to help with your answer. [6 QWC]



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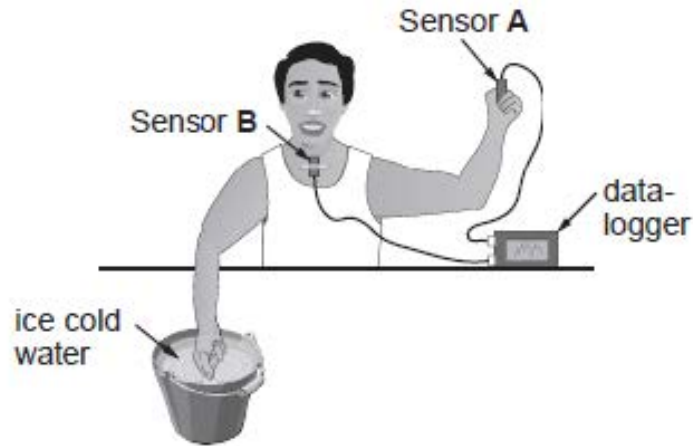
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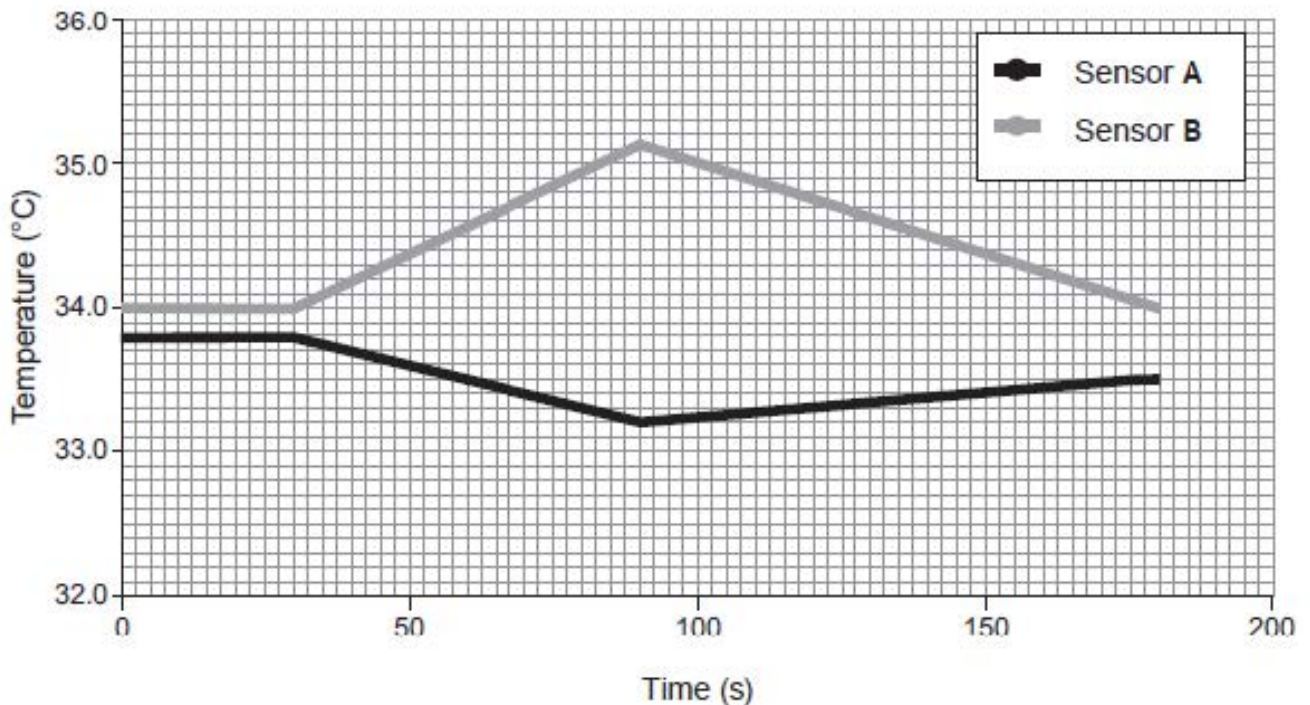
21. Dylan set up an experiment to study negative feedback mechanisms associated with rapid cooling of the hand.

A temperature sensor was held between the fingertips of a volunteer and another sensor was taped to the skin on the upper chest. The sensors were connected to a data logger that was set to record for three minutes.



The volunteer placed their right hand into ice cold water 30 seconds after the recording started. The hand was then removed from the ice cold water after a further 30 seconds.

The results from the data logger are shown below:



(a) State what is meant by a negative feedback mechanism.

[2]

.....

.....

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(b) (i) Describe the results for sensor A after the hand was placed in the ice cold water.

[1]

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(ii) Explain the change in temperature recorded by sensor A between 30 seconds and 90 seconds.

[4]

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22.

- (a) Complete the sentence. [1]

The kidneys remove waste products in a process called

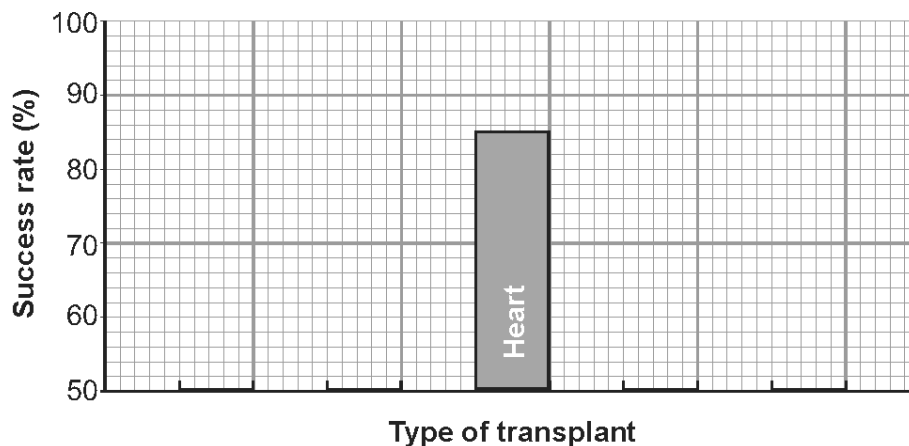
- (b) When a human organ fails to function doctors can carry out a transplant operation using an organ from a donor. The transplant is said to be successful if the transplanted organ functions normally for at least one year.

The table below compares the success rates of some transplant operations.

| type of transplant | success rate (%) | year when doctors first started transplants | number of years doctors have been doing transplants (up to 2014) |
|---------------------------|------------------|---|--|
| kidney (family donor) | 98 | 1960 | 54 |
| kidney (non-family donor) | 87 | 1960 | 54 |
| lung | 77 | 1986 | |
| heart | 85 | 1975 | |
| liver | 84 | 1983 | 31 |

- (i) Complete the table by writing your answers on the dotted lines. [1]

- (ii) Complete the bar chart below by adding the bars for kidneys, liver and lung. Place the bars in order from the **most** to the **least** successful and label them. *The bar for heart has been completed for you.* [3]

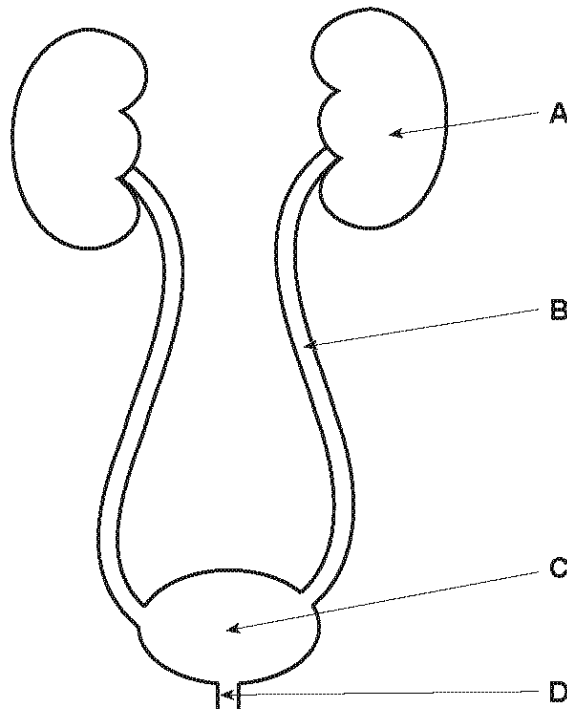


- (iii) Use only information in the table and the bar chart to suggest a reason why the success rates for the various transplant operations are different. [1]

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23.

The diagram below shows the excretory system of the human body.



(a) From the diagram above, complete the table below.

[3]

| Letter on diagram | Name of structure | Function |
|-------------------|-------------------|-------------------------------|
| | ureter | |
| | | carries urine out of the body |
| C | | |

(b) (i) Name two waste substances excreted in urine.

[1]

.....

(ii) State how the concentration of the urine changes when there is too little water in the blood.

[1]

.....

24. (a) (i) The following information relates to the kidney.
Draw lines to join the scientific terms with the correct descriptions. [2]

| scientific term | description |
|-----------------|--|
| ureter | fluid leaving the kidney |
| urethra | tube carrying waste solution out of the body |
| urine | tube carrying waste solution to the bladder |

- (ii) Name the process by which waste substances are removed from the blood by the kidneys.
Underline your answer. [1]

25.

(a) What is meant by the term excretion?

[1]

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.....

(b) The table below shows mean fluid intake and urine produced in astronauts studied before and during space flights.

| sampling period | mean water intake (cm ³) | mean urine produced (cm ³) | percentage of mean water intake that passes into the urine (%) |
|-------------------|--------------------------------------|--|--|
| day before flight | 3800 | 2700 | 71.0 |
| during flight | 2500 | 1700 | |

(i) Calculate the percentage of mean water intake that passes into the urine during a flight. Write your answer in the table above. Use the space below for your working out. [1]

(ii) During space flights, the kidneys remove unusually high levels of salts from the blood.

I. What happens to salts removed from the blood by the kidneys? [1]

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II. Use data in the table and the information above to describe and explain how the concentration of urine changes during a space flight. [2]

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- (ii) The doctor thought that this patient's urine would contain protein but no glucose. What is the evidence in the table to support this? [2]

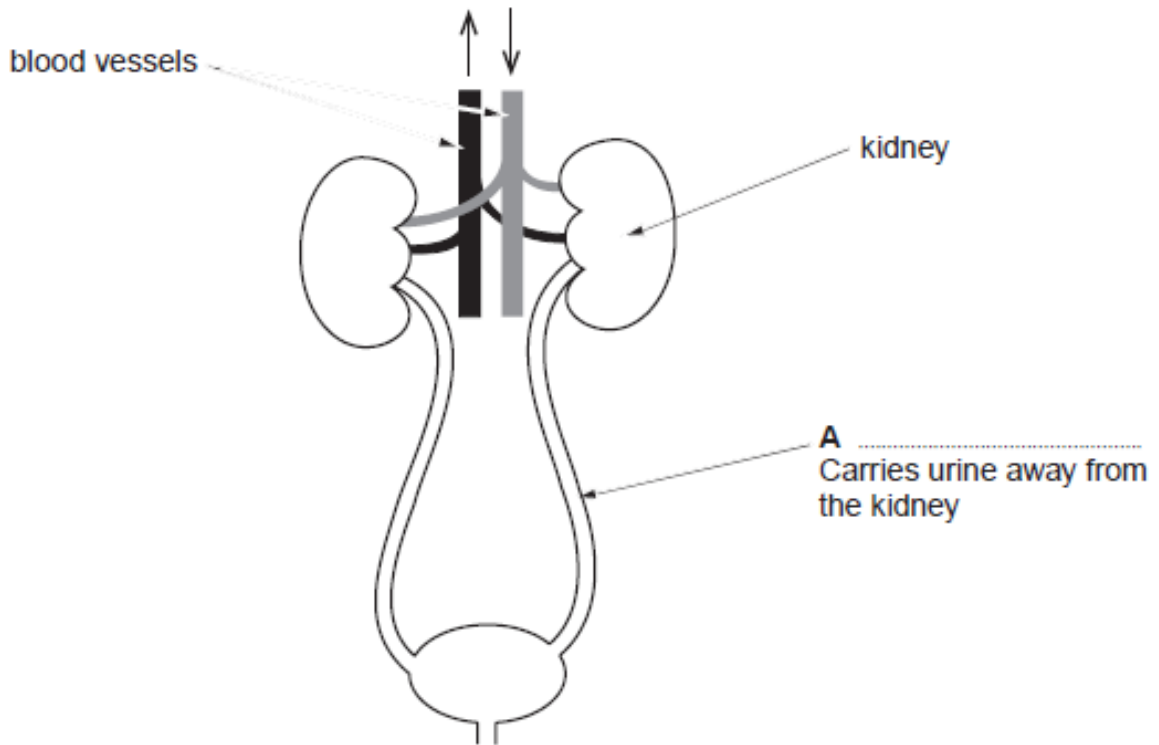
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- (iii) The urine was tested to find out if the doctor was correct

26. The diagram shows the human excretory system.



- (a) **Complete** label **A** on the diagram. [1]
- (b) A doctor investigated the concentrations of some substances present in the blood entering and leaving a patient's kidneys.

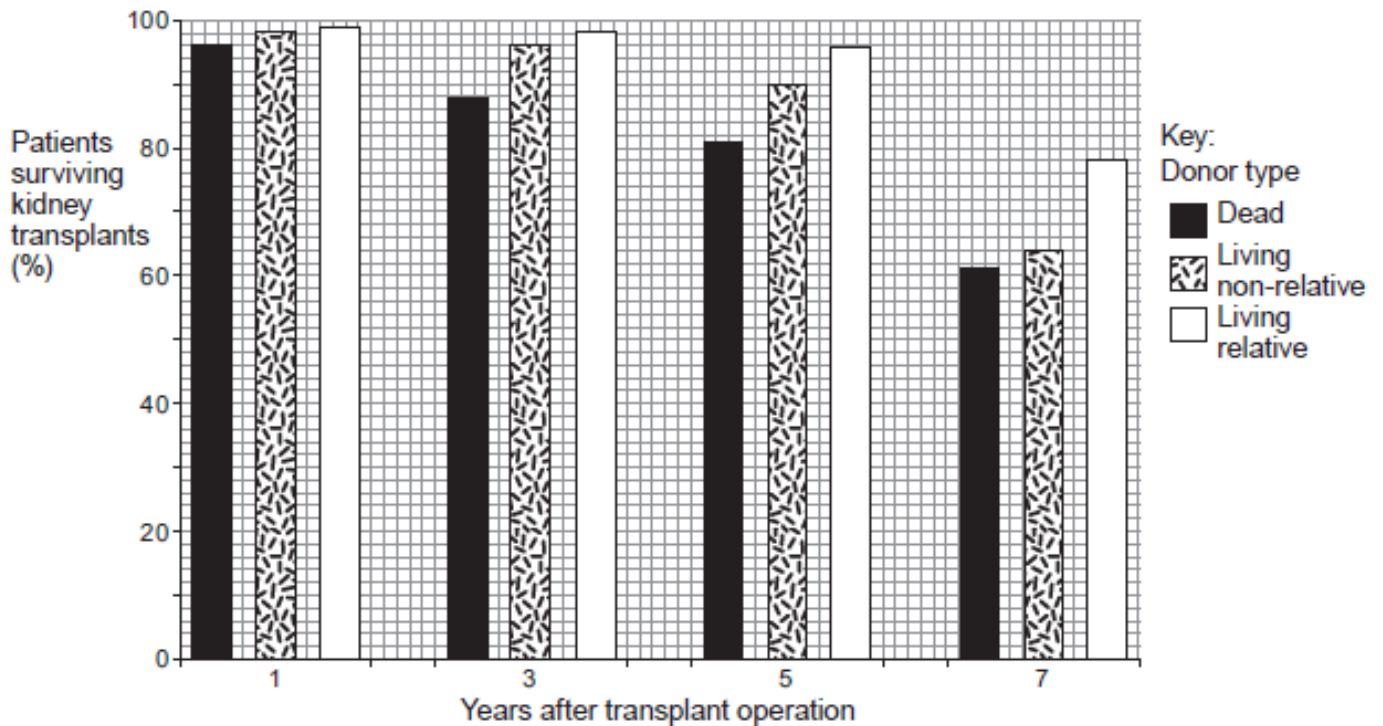
| Substance | Concentration in blood (a.u.) | |
|---------------|-------------------------------|----------------------|
| | blood entering kidney | blood leaving kidney |
| glucose | 168 | 168 |
| salt (sodium) | 35 | 33 |
| protein | 180 | 150 |
| urea | 314 | 11 |

- (i) From the table, state the waste substance which would be present in the patient's urine at the highest concentration. [1]

- (ii) The doctor thought that this patient's urine would contain protein but no glucose. What is the evidence in the table to support this? [2]

- (c) In the case of serious kidney disease a transplant operation can be carried out if a suitable kidney is available from a donor.

The bar chart shows the results of kidney transplant operations with donors of different types. All the recipients and donors were aged 30 – 50 years.



From the bar chart state **three** conclusions that can be drawn to compare the survival of patients after kidney transplant operations with different types of donors. [3]

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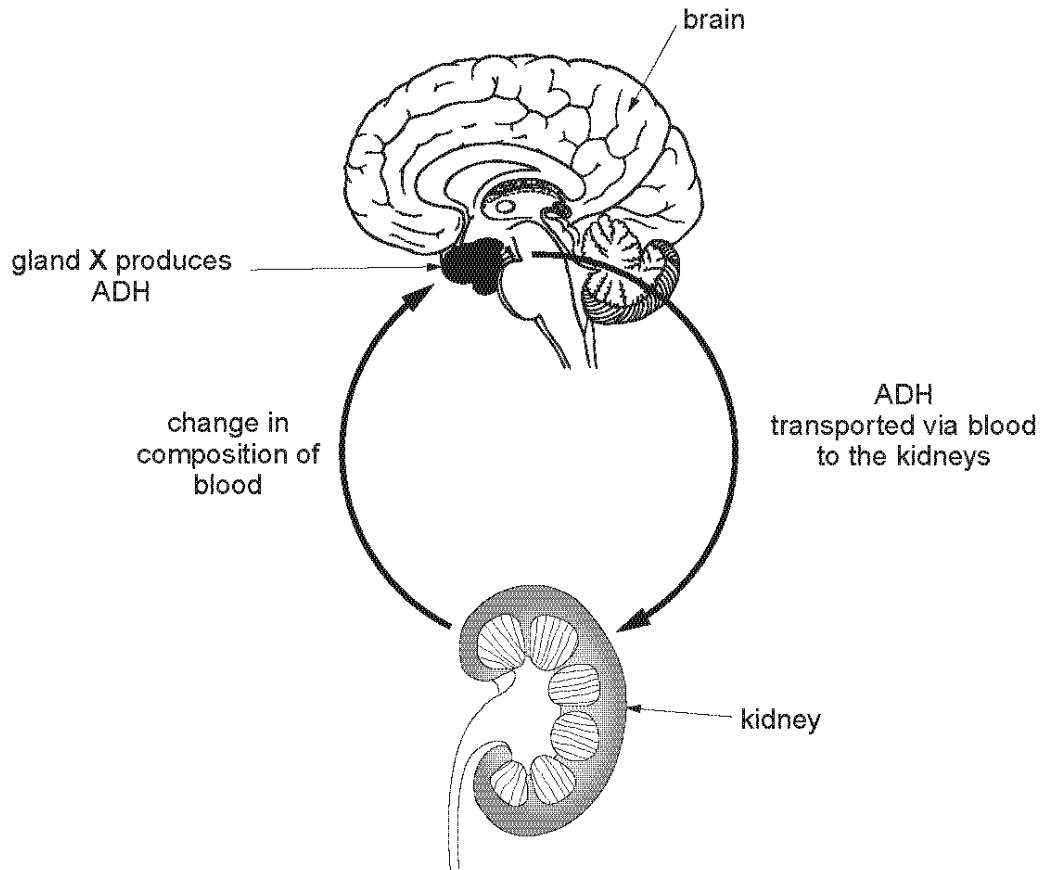
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27. The diagram below shows some of the processes which control the composition of blood and urine.



- (a) Identify the stimulus which causes gland X to release ADH. [1]

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- (b) Describe the effect of an increase in ADH production on the kidney and on the composition of urine. [3]

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28.

The presence of protein in the urine is a symptom of a kidney disease called nephrotic syndrome. The drug endaravone is used as a treatment for this disease. Rats with nephrotic syndrome were used to investigate the effects of endaravone. A control group of healthy rats was also used in the investigation.

The results are shown in the table:

| group of rats | protein in urine (mg/day/rat) |
|---------------------------------|-------------------------------|
| control | 0 |
| with nephrotic syndrome | 350 |
| after treatment with endaravone | 0.5 |

(a)

- (ii) Give a reason for the absence of protein in the urine of rats which do not show nephrotic syndrome (control group). [1]

.....

.....

(b) State three factors which must be kept the same in this investigation. [3]

- (i)
- (ii)
- (iii)

29. Explain how anti-diuretic hormone (ADH) helps the kidneys regulate the water content of the blood. [6 QWC]

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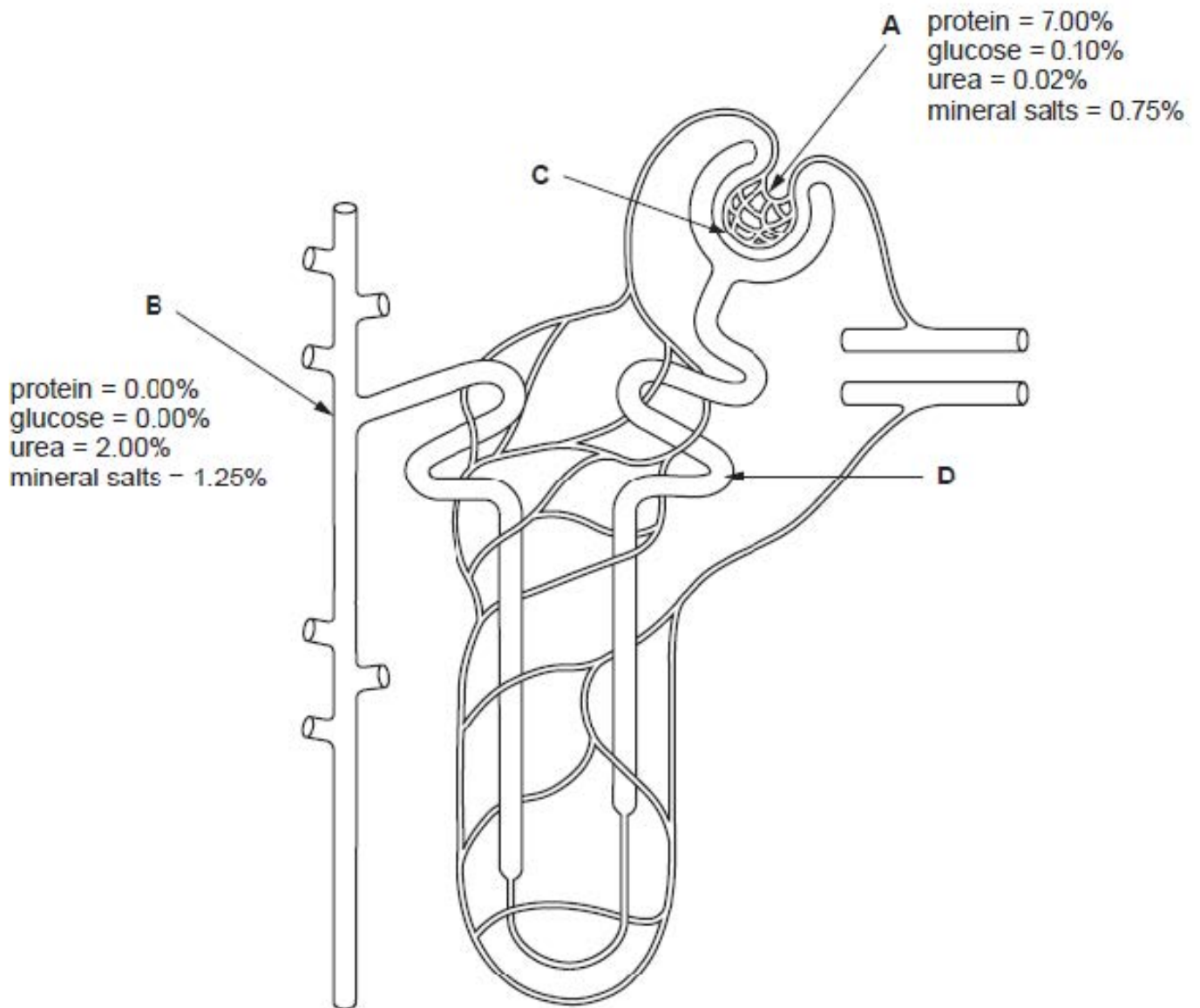
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30.

The diagram below represents a human nephron. The concentration of various substances is shown at two different points, **A** and **B**.



(a) Use the diagram and your own knowledge to answer the following questions.

(i) Name and describe the process occurring at point **C**. [2]

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(ii) Explain why the concentration of glucose is different at points **A** and **B**. [1]

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(iii) State the name of structure **D**. [1]

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(b) State a reason for the increase in the concentration of urea and mineral salts between points **A** and **B**. [1]

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