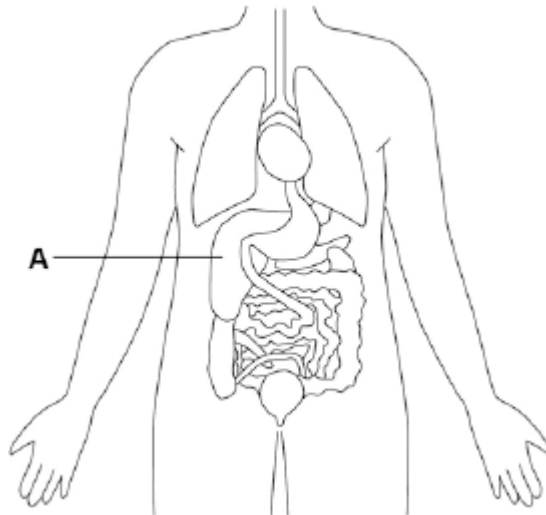


HOMEOSTASIS (PART 1)

Q1.

Humans control their internal environment in many ways.

Look at the diagram below.



- (a) Name organ **A**.

(1)

- (b) Organ **A** stores glucose.

People with Type 1 diabetes cannot effectively control the levels of glucose in their blood.

Name the **hormone** people with **Type 1 diabetes** have to inject to decrease their blood glucose level.

(1)

- (c) Which organ produces urine?

Tick **one** box.

Brain

Lungs

Kidney

Thyroid

(1)

- (d) Marathon runners often drink sports drinks during a race.

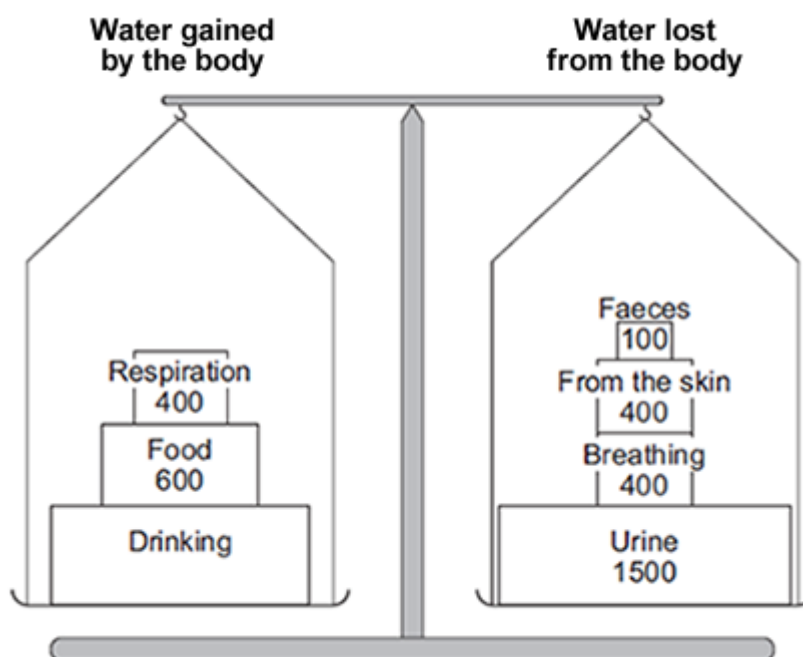
Explain why.

(2)
(Total 5 marks)

Q2.

The diagram below shows the water balance for a person on a cold day.

The numbers show the volume of water, in cm^3 , the person's body gained and lost.



(a) (i) How much water was lost from the body on the cold day?

Draw a ring around the correct answer.

1800 cm^3 **2400 cm^3** **3300 cm^3**

(1)

(ii) The volume of water gained by the body should balance the volume of water lost from the body.

How much water should the person have drunk to keep the balance?

Volume of water = _____ cm^3

(2)

- (b) (i) Name the process by which water is lost from the skin.

_____ (1)

- (ii) Why does the body need to lose water from the skin?

_____ (1)

- (c) The next day was a hot day. The person gained the same volume of water and did the same activities.

- (i) What effect did the increase in temperature have on the volume of water the person lost?

Tick (✓) **one** box.

Less water was lost through the skin.

More water was lost through the skin.

More water was lost in faeces.

(1)

- (ii) What effect would the increase in temperature have on the volume of urine the person lost?

Draw a ring around the correct answer.

decrease

increase

no change

(1)

(Total 7 marks)

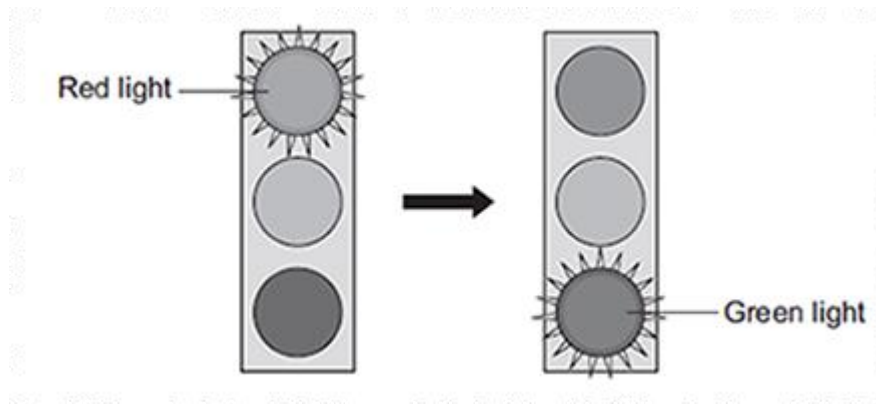
Q3.

Car drivers need quick reactions to avoid accidents.

A student uses a computer program to measure reaction time.

The computer screen shows a traffic light on red. The traffic light then changes to green.

The diagram below shows the change the person sees on the computer screen.



When the traffic light changes to green the person has to click the computer mouse as quickly as possible.

The computer program works out the time taken to react to the light changing colour.

(a) Special cells detect the change in colour.

(i) What word is used to describe special cells that detect a change in the environment?

Draw a ring around the correct answer.

receptor cells

reflex cells

stimulus cells

(1)

(ii) Where in the body are the special cells that detect the change in colour of the traffic lights?

(1)

(b) The student used the computer program on one computer to measure the reaction times of people of different ages.

(i) Give **one** variable the student should control so that a fair comparison can be made between the people of different ages.

(1)

(ii) The student did each measurement three times to calculate a mean value.

The table shows the results.

Age in years	Mean reaction time in milliseconds
15	242
30	
45	221

60	258
75	364
90	526

The reaction times for the 30-year-old person were **192, 174** and **180** milliseconds.

Calculate the mean reaction time of the 30-year-old person.

Mean reaction time = _____ milliseconds

(1)

- (iii) Which **one** of the following is an advantage of repeating each test three times and **not** doing the test just once?

Tick (✓) **one** box.

Any anomalies can be identified.

The results will be more precise.

There will be no errors.

(1)

- (iv) Some people think that old people should **not** be allowed to drive a car.

Why is it more dangerous for old people to drive cars?

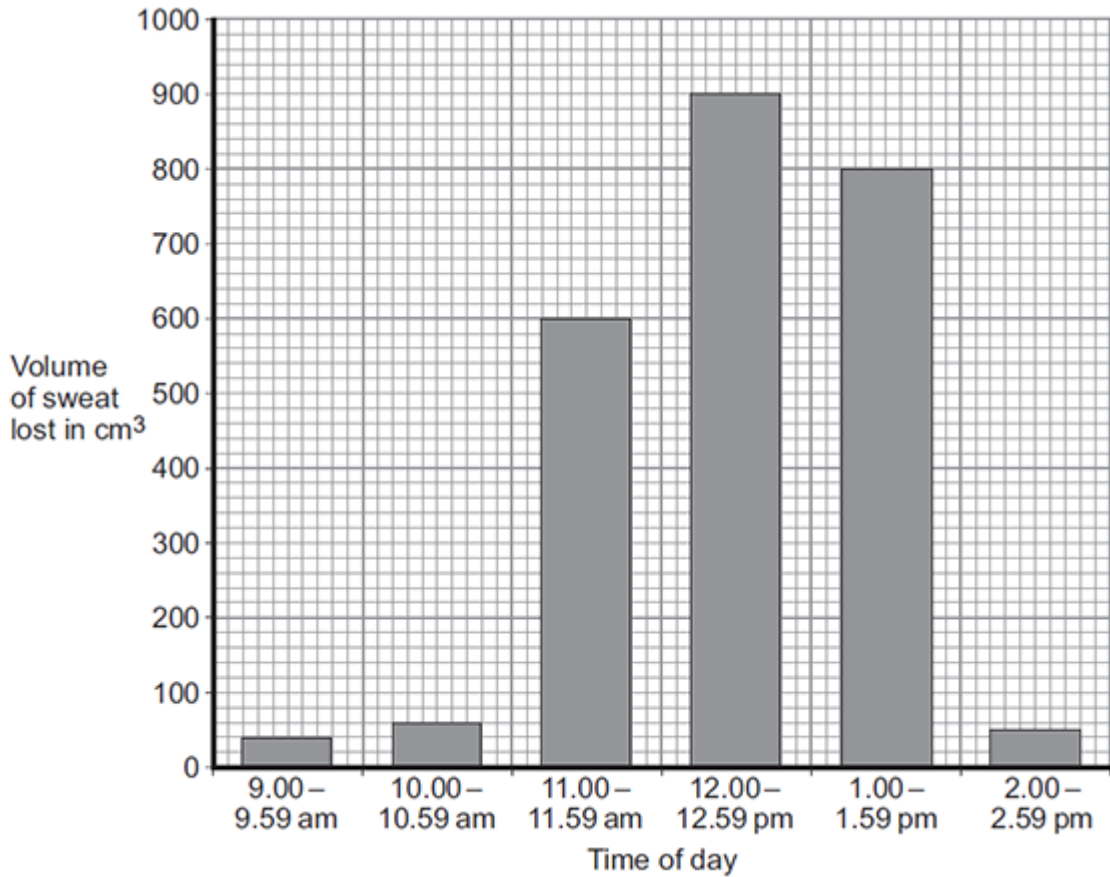
Use information from the table above to support your answer.

(2)

(Total 7 marks)

Q4.

A scientist measured the volume of sweat lost between 9.00 am and 2.59 pm in one day by one person. The graph below shows the results.



(a) (i) Suggest what happened at 11.00 am.

Tick (✓) **one** box.

The person moved into a cold room.

The person removed their coat.

The person started running a race.

(1)

(ii) Calculate the total volume of sweat lost between 11.00 am and 1.59 pm.

Total volume of sweat lost = _____ cm³

(1)

(iii) Suggest **one** way the person could replace the water that was lost as sweat.

(1)

(b) (i) Sweating helps keep our internal body temperature within a narrow range.

Which organ monitors body temperature?

Tick (✓) **one** box.

brain

kidney

pancreas

(1)

- (ii) The organ that monitors internal body temperature receives information about temperature from the skin.

Which structures in the skin send impulses with this information?

Tick (✓) **one** box.

capillaries

glands

receptors

(1)

- (c) How does sweating help to control body temperature?

(1)

(Total 6 marks)

Q5.

The heart is part of the circulatory system.

- (a) (i) Name **one** substance transported by the blood in the circulatory system.

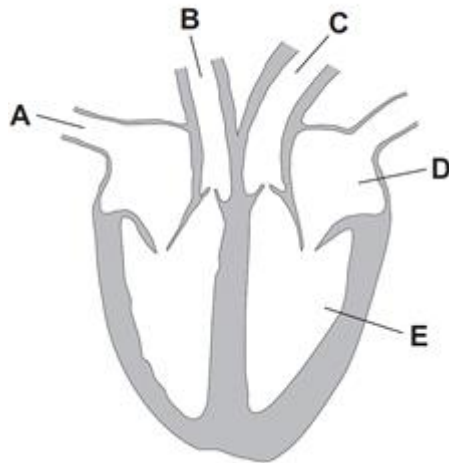
(1)

- (ii) What is the main type of tissue in the heart wall?

(1)

- (b) **Figure 1** shows the human heart.

Figure 1



(i) Which blood vessel, **A**, **B** or **C**, takes blood to the lungs?

(1)

(ii) Name parts **D** and **E** shown in **Figure 1**.

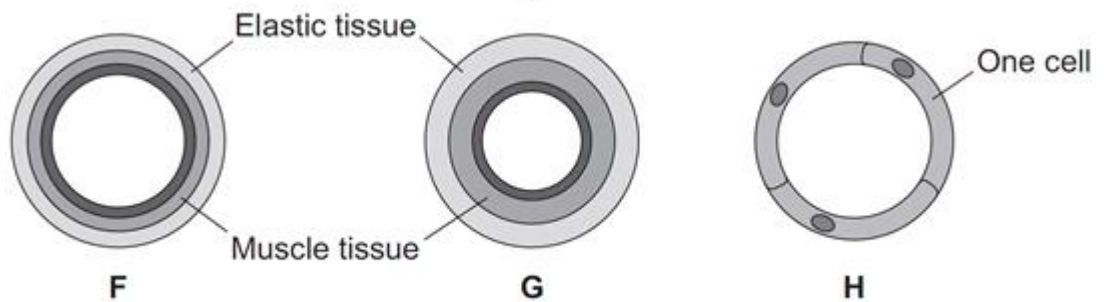
D _____

E _____

(2)

(c) **Figure 2** shows three types of blood vessel, **F**, **G** and **H**.

Figure 2



Not to scale

(i) What type of blood vessel is **F**?

Tick (✓) **one** box.

an artery

a capillary

a vein

(1)

(ii) A man needs to have a stent fitted to prevent a heart attack.

Q7.

This question is about the nervous system.

(a) Describe the function of receptors in the skin.

(2)

(b) A response is caused when information in the nervous system reaches an effector.

(i) There are two different types of effector.

Complete the table to show:

- the two different types of effector
- the response each type of effector makes.

Type of effector	Response the effector makes
1
2

(4)

(ii) Some effectors help to control body temperature.

Give **one** reason why it is important to control body temperature.

(1)

(Total 7 marks)

Q8.

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

The human body is kept at a constant internal temperature of about 37 °C.

Food	800	Sweat	600
Metabolic water	350	Breath	
		Faeces	100
Total	2600	Total	2600

(i) Calculate the volume of water lost from the body through breathing.

Use information from the table above.

Volume of water lost through breathing = _____ cm³

(2)

(ii) Metabolic water is water produced by aerobic respiration.

Complete the equation for aerobic respiration.

_____ + oxygen → _____ + water (+ energy)

(2)

(iii) If the water intake stays the same, what will happen to the volumes of sweat and urine lost from the body on a much hotter day?

Draw a ring around the correct answer to complete each sentence.

The volume of sweat will

decrease.
increase.
stay the same.

The volume of urine will

decrease.
increase.
stay the same.

(2)

(b) The kidneys help to control the water content of the body and the concentrations of substances dissolved in the body fluids. The kidneys do this by filtering the blood and then reabsorbing back into the blood the substances needed by the body.

The table above shows typical concentrations of some of the substances dissolved in a person's blood plasma, in the kidney filtrate, and in the urine.

Substance	Blood plasma in g per dm ³	Kidney filtrate in g per dm ³	Urine in g per dm ³
Protein	70	0	0

Glucose	1	1	0
Urea	0.3	0.3	20
Sodium ions	3	3	6

- (i) The table below shows that sodium ions are twice as concentrated in the urine as in the blood plasma.

Calculate how many times more concentrated **urea** is in the urine compared to the blood plasma.

Use information from the table.

Answer = _____ times more concentrated

(2)

- (ii) What is the main cause of this increase in concentration of urea between the blood plasma and the urine?

Tick (✓) **one** box.

Increased urea production by the kidney

Reabsorption of water by the kidney

Increased deamination of amino acids by the liver

(1)

- (iii) The table shows that both protein and glucose are found in the blood plasma but **not** in the urine.

Use your knowledge of kidney functioning to explain why.

Protein _____

Glucose _____

(4)

(3)

- (b) (i) Megapode birds open and close the air vents of the nest at different times of the day.

Suggest reasons why it is necessary to open and close the air vents.

(3)

- (ii) The sex of a megapode bird that hatches from an egg depends on the temperature at which the egg was kept.

Use this information to suggest why it is important for megapode birds to control the temperature of their nests.

(1)

(Total 7 marks)

Q11.

Human body temperature must be kept within narrow limits.

The image shows a cyclist in a race.



(a) Use the correct answer from the box to complete each sentence.

blood	brain	kidney	sweat	urine
--------------	--------------	---------------	--------------	--------------

The cyclist's body temperature is monitored by a centre in the _____ .

This centre is sensitive to the temperature of the cyclist's _____ .

If the cyclist's body temperature increases, his body increases the production of _____ .

(3)

(b) (i) Cyclists drink sports drinks after a race.

The table below shows the ratio of glucose to ions in three sports drinks, **A**, **B** and **C**.

	Sports drink		
	A	B	C
Ratio of glucose (g per dm³) to ions (mg per dm³)	15:14	12:1	2:7

The closer this ratio of glucose to ions is to 1:1 in a sports drink, the faster the body replaces water.

Which sports drink, **A**, **B** or **C**, would replace water fastest in an athlete?

(1)

(ii) Why should sports drinks contain ions?

(1)

(iii) Why should a person with diabetes **not** drink too much sports drink?

(1)

(Total 6 marks)

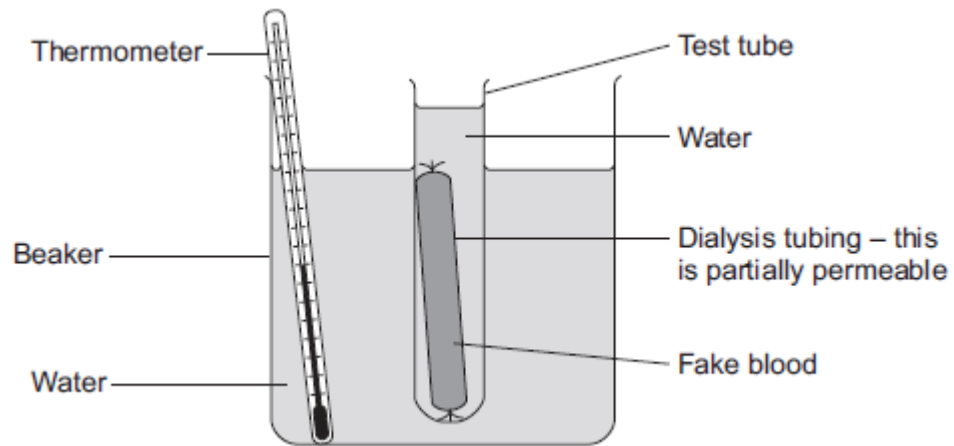
Q12.

A person's kidneys stop working. The person may be treated using a dialysis machine.

Some students made a model of a dialysis machine.

Figure 1 shows the students' model.

Figure 1



The fake blood contained:

- water
- sodium ions
- urea
- glucose
- protein.

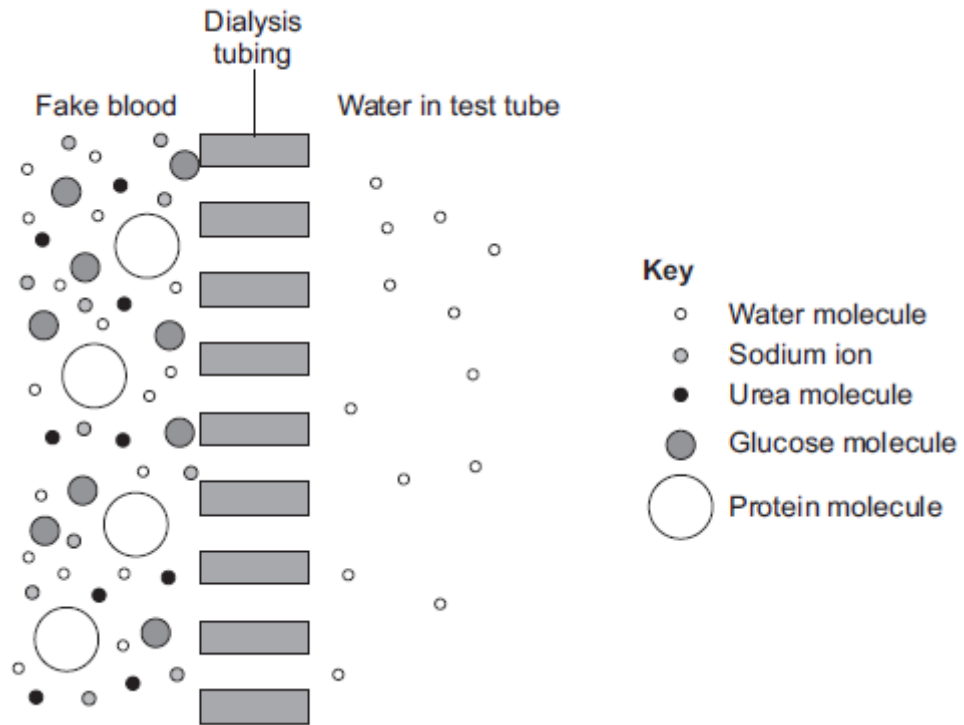
(a) (i) Suggest why the students kept the water in the beaker at 37 °C.

(1)

(ii) The dialysis tubing separates the fake blood from the water in the test tube.

Figure 2 shows the fake blood, the dialysis tubing and the water in the test tube.

Figure 2



After 1 hour, the students tested the water in the test tube to see which substances had filtered through from the fake blood.

Name **one** substance that the students would find in the water in the test tube after 1 hour.

(1)

(iii) Give a reason for your answer to part (a)(ii).

(1)

(iv) In hospitals, dialysis machines use dialysis fluid, not pure water.

Dialysis fluid contains the same concentration of useful substances as the blood.

Which substance is at the same concentration in dialysis fluid as in blood?

Tick (✓) **one** box.

Glucose

Insulin

Oxygen

(1)

- (b) When the kidneys stop working, the person can be treated by a continuous process called CPD.

In CPD:

- dialysis fluid is put into the abdomen
- the fluid is changed four times a day at home
- changing the fluid takes about 45 minutes.

Suggest **two** advantages of having CPD instead of treatment on a dialysis machine.

1. _____

2. _____

(2)

(Total 6 marks)

Q13.

Blood is part of the circulatory system.

- (a) (i) Give **one** function of white blood cells.

(1)

- (ii) Which of the following is a feature of platelets?

Tick (✓) **one** box.

They have a nucleus.

They contain haemoglobin.

They are small fragments of cells.

(1)

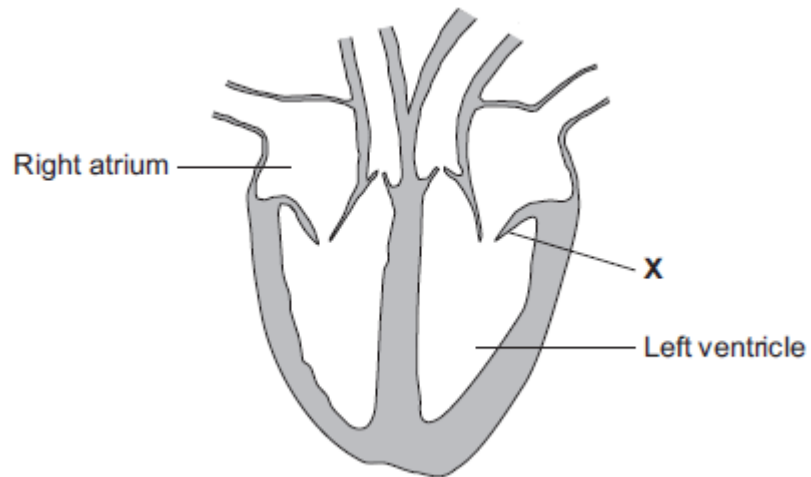
- (b) Urea is transported by the blood plasma from where it is made to where the urea is excreted.

Complete the following sentence.

Blood plasma carries urea from where it is made in the _____

to the _____ where the urea is removed from the blood.

(c) The illustration shows a section through the human heart.



Structure **X** is a valve. If valve **X** stops working, it may need to be replaced.

A scientist is designing a new heart valve. The scientist knows that the valve must be the correct size to fit in the heart.

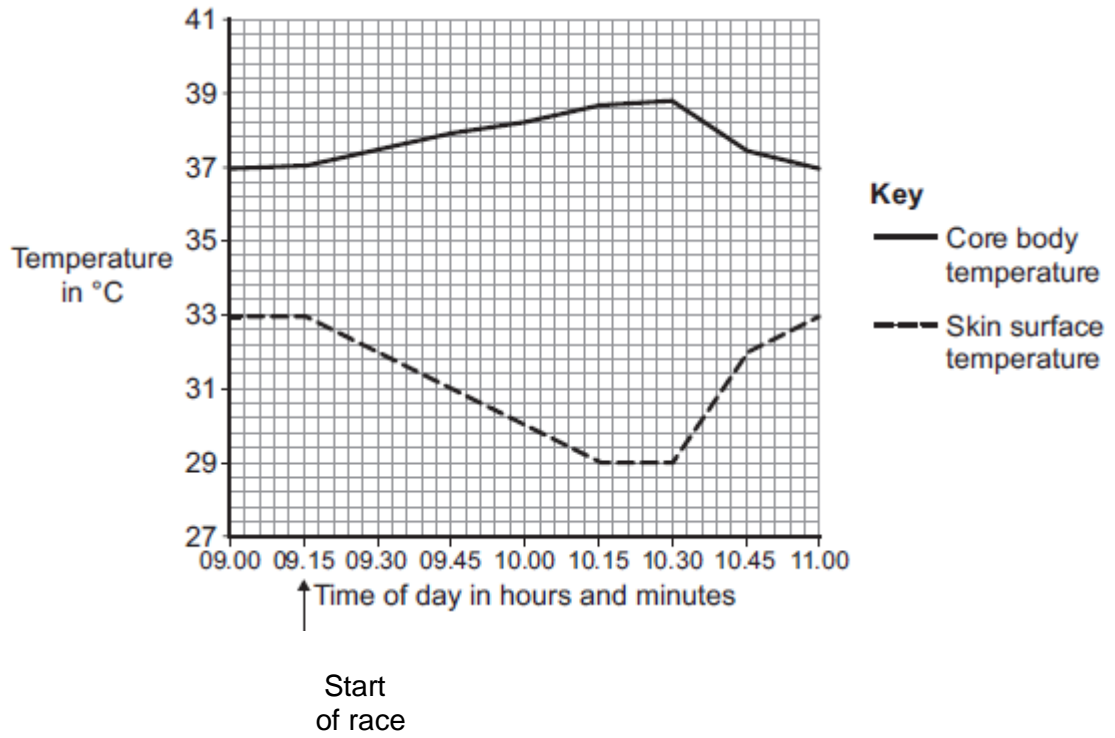
Suggest **two** other factors the scientist needs to consider so that the newly designed valve works effectively in the heart.

(2)

(Total 6 marks)

Q14.

The graph shows the core body temperature and the skin surface temperature of a cyclist before, during and after a race.



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

How long did the race last?

(1)

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

(6)

- (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)

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

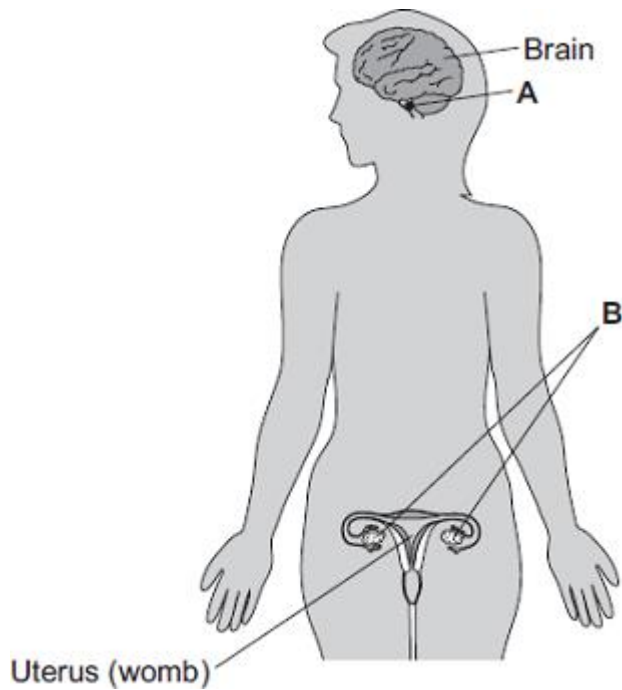
Describe how the body responds when the blood glucose concentration begins to decrease.

(3)

(Total 12 marks)

Q15.

The diagram shows the position of two glands, **A** and **B**, in a woman.



(a) (i) Name glands **A** and **B**.

A _____

B _____

(2)

(ii) Gland **A** produces the hormone Follicle Stimulating Hormone (FSH).
FSH controls changes in gland **B**.

How does FSH move from gland **A** to gland **B**?

(1)

(b) (i) A woman is not able to become pregnant. The woman does not produce mature eggs. The woman decides to have In Vitro Fertilisation (IVF) treatment.

Which **two** hormones will help the woman produce and release mature eggs?

Tick (✓) **one** box.

FSH and Luteinising Hormone (LH)

FSH and oestrogen

Luteinising Hormone (LH) and oestrogen

(1)

(ii) Giving these hormones to the woman helps her to produce several mature eggs.

Doctors collect the mature eggs from the woman in an operation.

Describe how the mature eggs are used in IVF treatment so that the woman may become pregnant.

(3)

(iii) IVF clinics have been set a target to reduce multiple births.

At least 76% of IVF treatments should result in single babies and a maximum of 24% of treatments should result in multiple births.

Suggest **one** reason why the clinics have been set this target to reduce multiple births.

(1)

(c) Two clinics, **R** and **S**, used IVF treatment on women in 2007. Doctors at each clinic used the results of the treatments to predict the success rate of treatments in 2008.

The table shows the information.

	Total number of IVF treatments in 2007	Number of IVF treatments resulting in pregnancy in 2007	Predicted percentage success rate in 2008
Clinic R	1004	200	18–23
Clinic S	98	20	3–56

(i) Compare the success rates of the two clinics in 2007.

(1)

(ii) The range of the predicted success rate in 2008 for clinic **R** is much smaller than the range of the predicted success rate for clinic **S**.

Suggest why.

(2)
(Total 11 marks)

Q16.

Diabetes is a disease in which the concentration of glucose in a person's blood may rise to fatally high levels.

Insulin controls the concentration of glucose in the blood.

- (a) Where is insulin produced?

Draw a ring around **one** answer.

gall bladder

liver

pancreas

(1)

- (b) People with diabetes may control their blood glucose by injecting insulin.

- (i) If insulin is taken by mouth, it is digested in the stomach.

What type of substance is insulin?

Draw a ring around **one** answer.

carbohydrate

fat

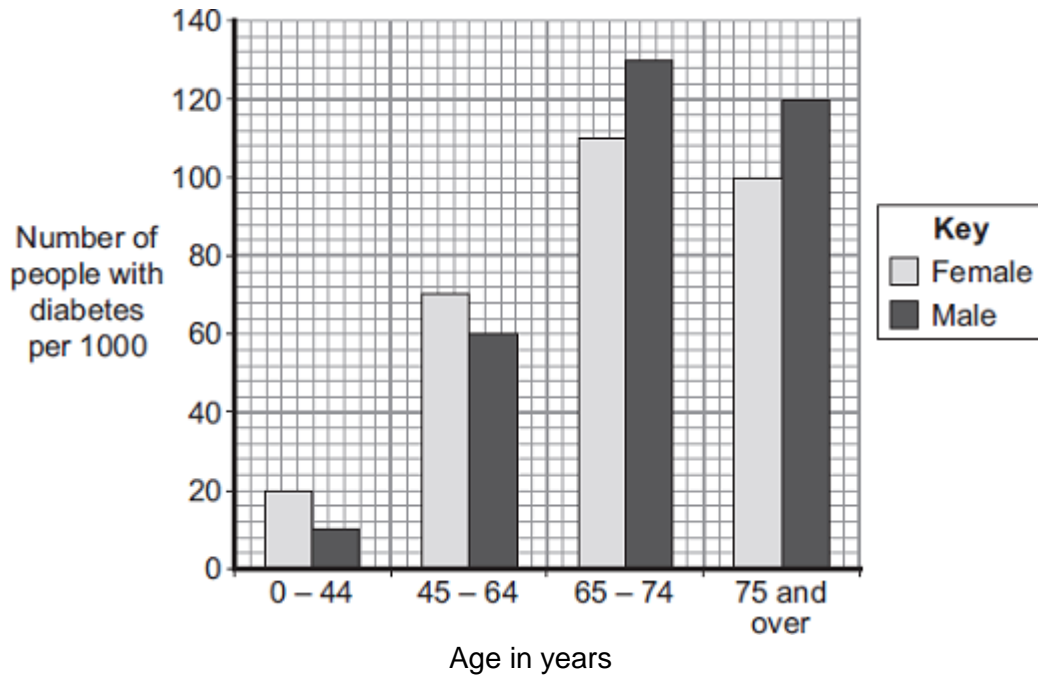
protein

(1)

- (ii) Apart from using insulin, give **one** other way people with diabetes may reduce their blood glucose.

(1)

- (c) The bar chart shows the number of people with diabetes in different age groups in the UK.



- (i) Describe how the number of males with diabetes changes between the ages of 0 – 44 years and 75 years and over.

(3)

- (ii) Compare the number of males and females with diabetes:
between the ages of 0 and 64 years

over the age of 65 years.

(2)

(Total 8 marks)

Q17.

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

(1)

- (b) In a healthy person, insulin prevents high levels of glucose in the blood. To make insulin, cells in the pancreas need amino acids.

Amino acids cannot be stored in the body.

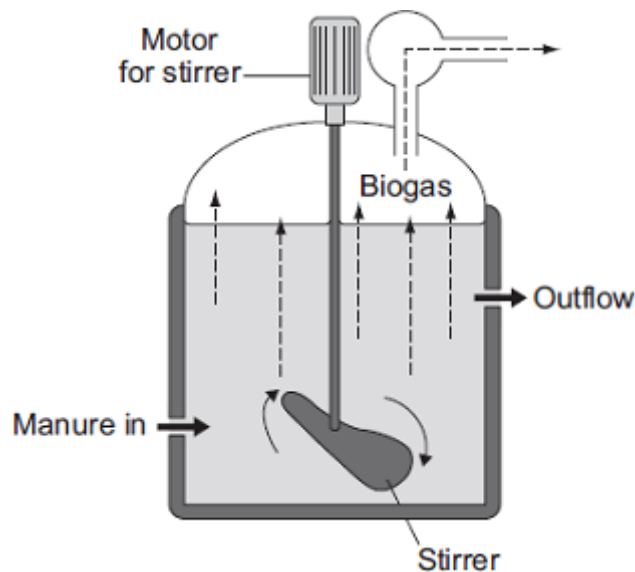
Describe, as fully as you can, what happens to amino acids that cannot be stored in the body.

(3)

(Total 4 marks)

Q18.

The diagram shows one type of biogas generator.



- (a) With this type of biogas generator, the concentration of solids that are fed into the reactor must be kept very low.

Suggest **one** reason for this.

Tick (✓) **one** box.

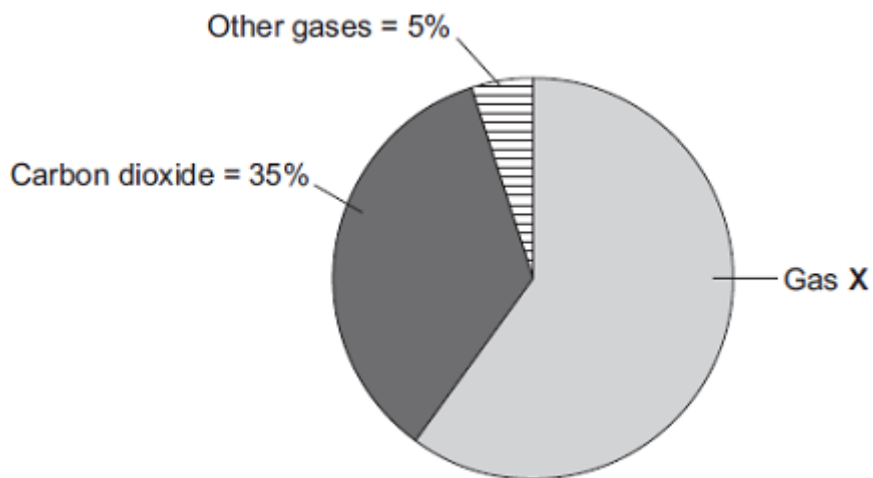
A higher concentration contains too little oxygen.

A higher concentration would be difficult to stir.

A higher concentration contains too much carbon dioxide.

(1)

(b) The pie chart shows the percentages of the different gases found in the biogas.



Gas **X** is the main fuel gas found in the biogas.

(i) What is the name of gas **X**?

Draw a ring around **one** answer.

methane

nitrogen

oxygen

(1)

(ii) What is the percentage of gas **X** in the biogas?

Show clearly how you work out your answer.

Percentage of gas **X** = _____

(2)

(c) If the biogas generator is not airtight, the biogas contains a much higher percentage of carbon dioxide.

Draw a ring around **one** answer in each part of this question.

(i) The air that leaks in will increase the rate of

- aerobic respiration.
- anaerobic respiration.
- fermentation.

(1)

(ii) The process in part (c)(i) occurs because the air contains

- ammonia.
- nitrogen.
- oxygen.

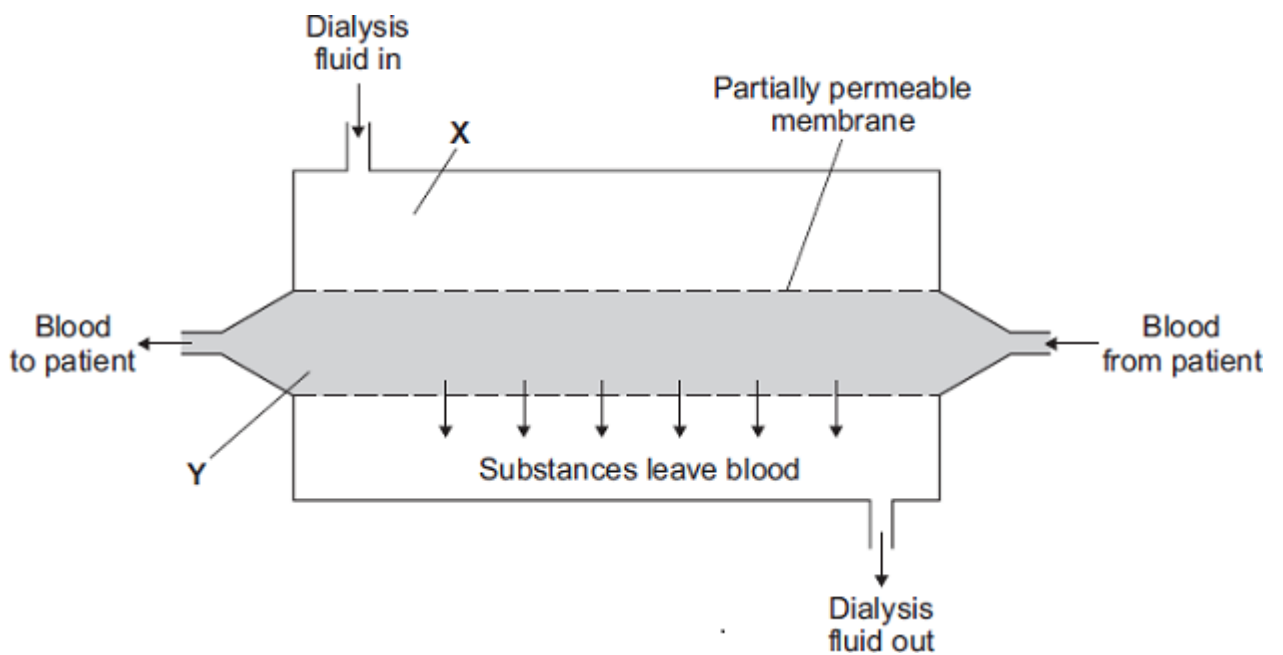
(1)

(Total 6 marks)

Q19.

People with kidney disease may be treated by dialysis.

The diagram shows a dialysis machine.



(a) Draw a ring around the correct answer to complete each sentence.

A person loses mass during dialysis. One patient lost 2.2 kilograms during a dialysis session.

(i) This person lost mass mainly because

- salt
- urea
- water

was removed from the blood.

(1)

(ii) This substance was able to pass through the partially permeable membranes

because its molecules are

large.
round.
small.

(1)

(iii) The concentration of sodium ions at **X** is 3.15 grams per dm³.

At the end of a dialysis session, the most likely concentration of sodium ions

at **Y** would be

0.00
3.15
6.30

grams per dm³.

(1)

(b) The table shows the cost, in the UK, of treating one patient who has kidney disease.

Treatment	Cost per year in pounds
Dialysis	30 000
Kidney transplant: operation + first year's medical care medical care in each further year	51 000 5 000

(i) During the first year, dialysis treatment is cheaper than a kidney transplant.

How much cheaper is the dialysis treatment? _____
pounds

(1)

(ii) After some time, the cost of treating a patient by a transplant operation would be cheaper than continual treatment by dialysis.

How many years would it take?

Draw a ring around **one** answer.

2 years

3 years

4 years

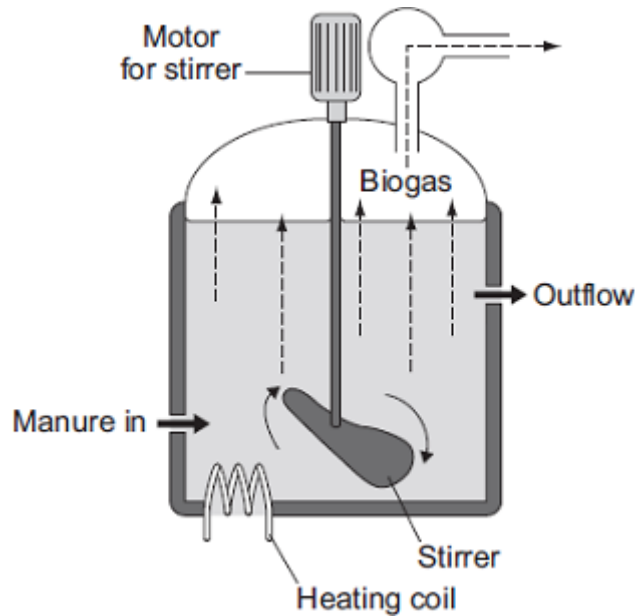
(1)

(iii) A transplant patient needs to take drugs for the rest of his life to suppress the immune system.

Why is it necessary to suppress the immune system ?

Q20.

The diagram shows one type of *anaerobic* digester. The digester is used to produce biogas.



(a) (i) What does *anaerobic* mean?

(1)

(ii) The concentration of solids that are fed into this digester must be kept very low.

Suggest **one** reason why.

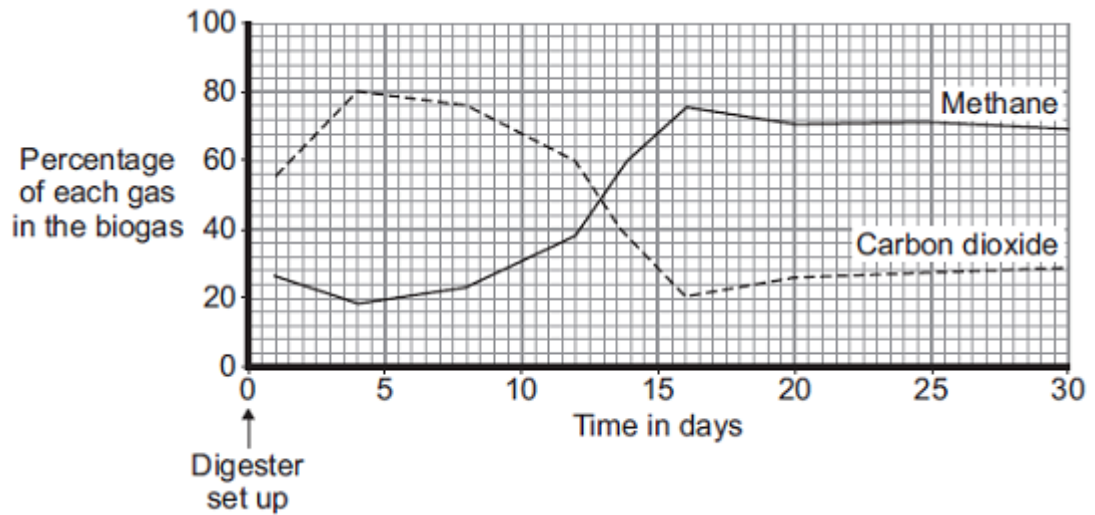
(1)

(iii) This digester is more expensive to run than some other simpler designs of biogas generator.

Suggest **one** reason why.

(1)

(b) The graph shows how the composition of the biogas produced by the digester changed over the first 30 days after the digester was set up.



Use information from the graph to answer the following questions.

- (i) Describe how the percentage of carbon dioxide changed over the 30 days.

(3)

- (ii) On which day was the best quality biogas produced? _____

(1)

- (c) Four days after the digester was first set up, the biogas contained a high percentage of carbon dioxide.

Suggest an explanation for this.

(2)

(Total 9 marks)

Q21.

Urine consists of water, ions and other substances such as urea.
 Urine is formed in the kidney by filtering the blood.
 The diameter of the pores in the filter is about 6 nanometres.

The table shows the diameters of the molecules of some of the substances in the blood.

Substance	Diameter of molecule in nanometres
A	10 to 20
B	1
C	0.6
D	0.5
E	0.2

Use information from the table and your own knowledge to answer the questions.

- (a) (i) Which substance, **A**, **B**, **C**, **D** or **E**, is protein?

(1)

- (ii) Protein is **not** found in the urine of a healthy person.

Explain why.

(2)

- (b) Substance **B** is **not** found in the urine of a healthy person. Suggest an explanation for this.

(2)

- (c) Haemolytic anaemia is a disease in which some of the red blood cells burst open.

Small amounts of haemoglobin may be found in the urine of a person suffering from haemolytic anaemia.

The diameter of a haemoglobin molecule is 5.5 nanometres.

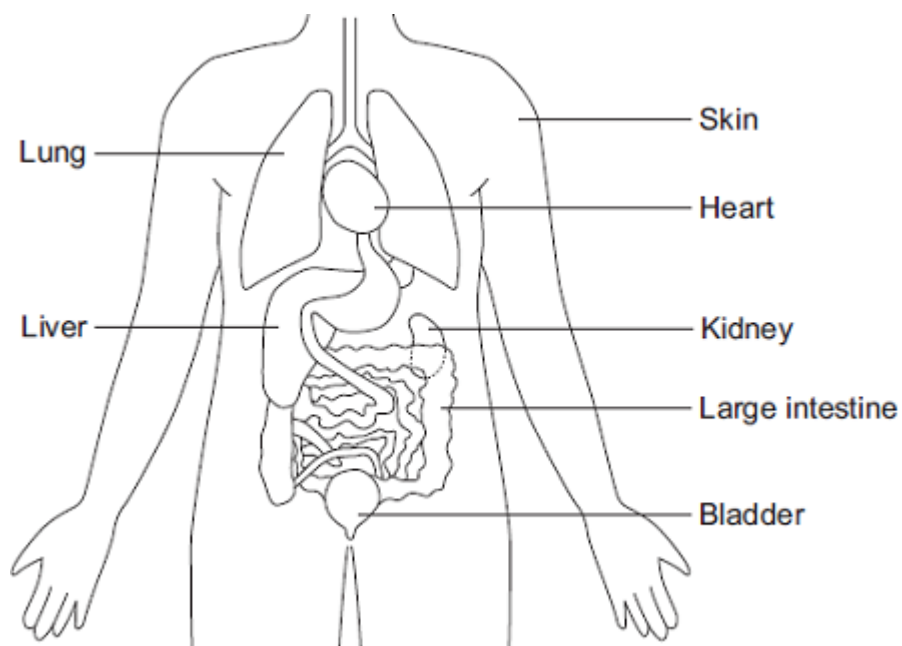
Haemoglobin is **not** found in the urine of a healthy person, but haemoglobin can be found in the urine of a person with haemolytic anaemia.

Explain why.

(3)
(Total 8 marks)

Q22.

The diagram shows some of the organs of the human body.



(a) Which organ labelled on the diagram:

(i) produces urine _____

(1)

(ii) stores urine _____

(1)

(iii) produces urea _____

(1)

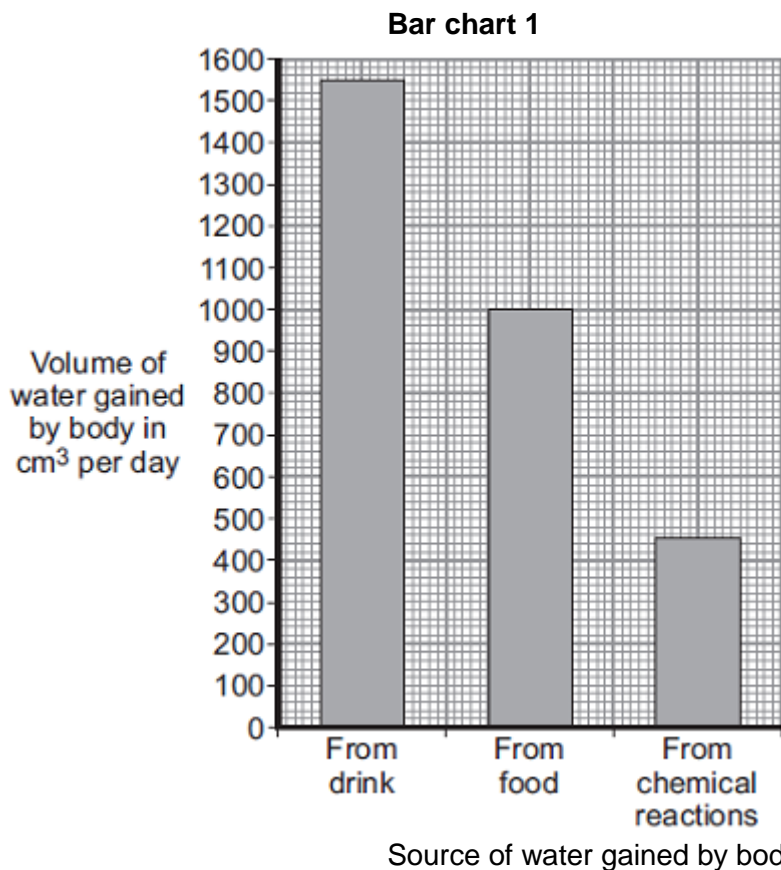
(iv) gets rid of carbon dioxide _____

(1)

(v) helps to control body temperature? _____

(1)

(b) **Bar chart 1** shows the volume of water the human body gains each day.



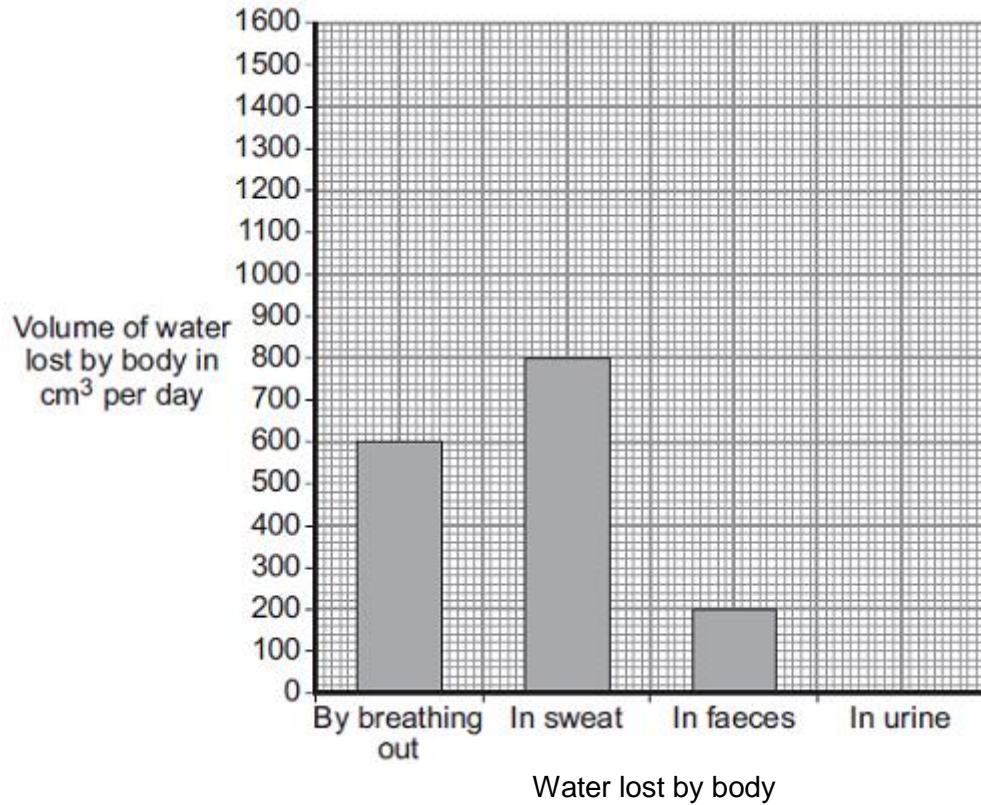
(i) Calculate the total volume of water the body gains each day.

Total volume of water gained = _____ cm³

(2)

Bar chart 2 shows the volume of water lost each day by breathing out, in sweat and in faeces.

Bar chart 2



- (ii) Calculate the total volume of water lost each day by breathing out, in sweat and in faeces.

Volume = _____ cm³

(1)

- (iii) The volume of water the body loses must balance the volume of water the body gains.

Use your answers to part (b)(i) and part (b)(ii) to calculate the volume of water lost in urine.

Volume of water lost in urine = _____ cm³

(1)

- (iv) Plot your answer to part (b)(iii) on **Bar chart 2**.

(1)

- (v) After taking some types of recreational drugs, the kidneys produce very little urine.

What happens to the body cells if the kidneys produce very little urine?

(1)
(Total 11 marks)

Q23.

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

- (a) Which organ produces insulin?

_____ (1)

- (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

- (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)

- (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.

Q25.

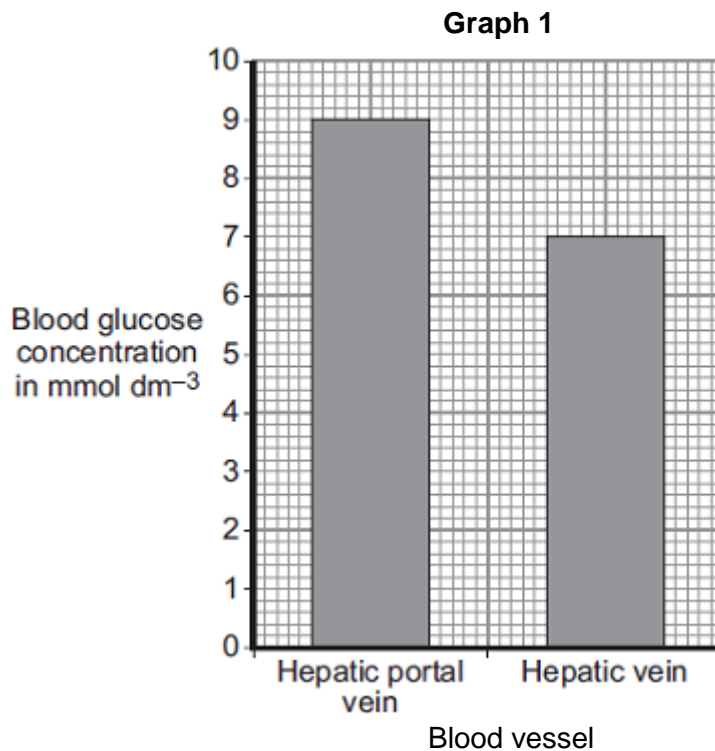
The pancreas and the liver are both involved in the control of the concentration of glucose in the blood.

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.

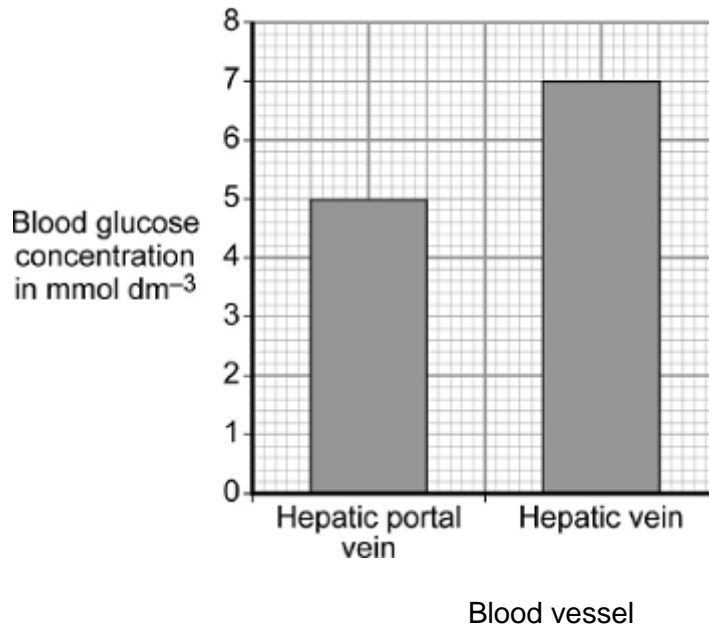
Graph 1 shows the concentration of glucose in the two blood vessels 1 hour after the meal.



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

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

Graph 2



- (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)

- (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)

(Total 7 marks)

Q26.

The human body produces many hormones.

- (a) (i) What is a *hormone*?

(1)

- (ii) Name an organ that produces a hormone.

(1)

- (iii) How are hormones transported to their target organs?

(1)

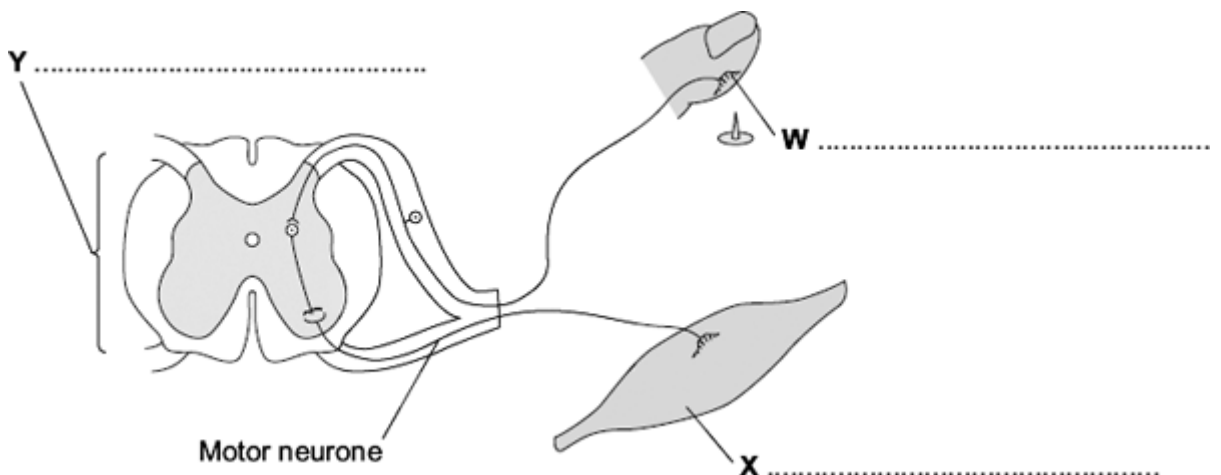
- (b) Describe how the hormones FSH, oestrogen and LH are involved in the control of the menstrual cycle.

(3)

(Total 6 marks)

Q27.

The diagram shows the structures involved in a reflex action.



(a) On the diagram, name the structures labelled **W**, **X** and **Y**.

(3)

(b) The control of blood sugar level is an example of an action controlled by hormones.

Give **two** ways in which a reflex action is different from an action controlled by hormones.

1. _____

2. _____

(2)





(Total 5 marks)

Q28.

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	
	No frostbite
	30 minutes
	10 minutes
	5 minutes

Time taken to get frostbite:

- (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)

Q29.

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. _____

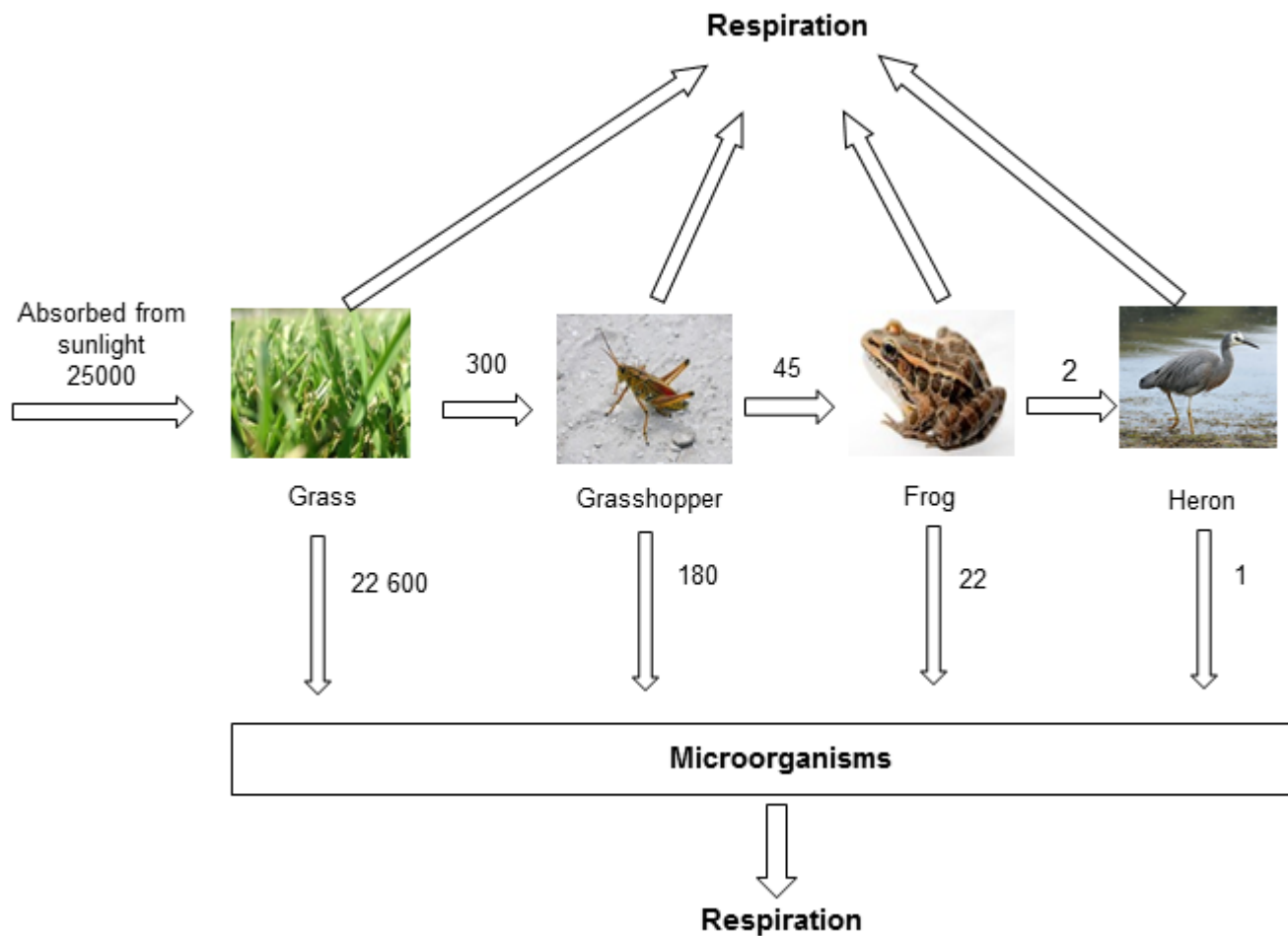
(2)

(Total 5 marks)

Q30.

The diagram shows the annual energy flow through 1 m² of a habitat.

The unit, in each case, is kJ per m² per year.



- (a) Calculate the percentage of the energy absorbed by the grass from sunlight that is transferred to the frog.

Show clearly how you work out your answer.

Answer _____ %

(2)

- (b) All of the energy the grass absorbs from the sun is eventually lost to the surroundings.

In what form is this energy lost?

(1)

- (c) Food chains are usually **not** more than five organisms long.

Explain why.

To gain full marks you must use data from the diagram.

(2)

- (d) In this habitat microorganisms help to recycle materials.

Explain how.

(3)

(Total 8 marks)

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Grasshopper by I, Daniel Schwen [GFDL, CC-BY-SA-3.0], via Wikimedia Commons. Frog by Brian Gratwicke (Pickerel Frog) [CC-BY-2.0], via Wikimedia Commons. Heron by Glen Fergus (Own work, Otago Peninsula, New Zealand) [CC-BY-SA-2.5], via Wikimedia Commons.

Q31.

Doctors use dialysis to treat patients with kidney failure.

The table shows the sizes of molecules of some of the substances found in blood plasma.

Substance	Size of molecule in arbitrary units
Water	18
Sodium ion	23
Urea	60
Glucose	180
Albumin (a blood protein)	68 000

- (a) Use information from the table to answer the questions.

- (i) Albumin is a blood protein. Albumin is **not** removed from the blood during dialysis.

Explain why.

(2)

- (ii) During a dialysis session, one patient's body mass decreased by 2 kilograms.

This decrease was mainly due to removal from the blood of one of the substances in the table.

Which substance was this? _____

(1)

- (iii) The substance you named in part (a)(ii) was able to pass through the dialysis membrane.

Draw a ring around the correct answer to complete the sentence.

The substance passed through because the

membrane was

impermeable.

partially permeable.

surrounded by capillaries.

(1)

- (b) For most patients, a kidney transplant is better than continued treatment using dialysis.

Kidney transplants have some disadvantages.

Give **two** disadvantages of kidney transplants.

1. _____

2. _____

(2)

(Total 6 marks)

Q32.

Use your knowledge of how the kidney works to answer the following questions.

- (a) Blood plasma contains mineral ions, glucose, urea and proteins.

Explain why urine contains mineral ions and urea, but **no** glucose or protein.

(4)

- (b) A man ate and drank the same amounts of the same substances and he did the same amount of exercise on two different days. On one of the two days the weather was hot and on the other day the weather was cold.

The man's urine contained a higher concentration of mineral ions and urea on the hot day than on the cold day.

Explain why.

(4)

(Total 8 marks)

Q33.

When animals die, they usually fall to the ground and decay.

In 1977 the body of a baby mammoth was discovered.

The baby mammoth died 40 000 years ago and its body froze in ice.

The picture shows the mammoth.



By Thomas Quine [CC BY-SA 2.0], via Wikimedia Commons

- (a) Explain why the body of the baby mammoth did **not** decay.

(2)

- (b) Mammoths are closely related to modern elephants. The pictures show these two animals.

What scientists think a mammoth looked like

Modern elephant



By WolfmanSF (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

By Caitlin from Hertfordshire, UK [CC-BY-2.0], via Wikimedia Commons

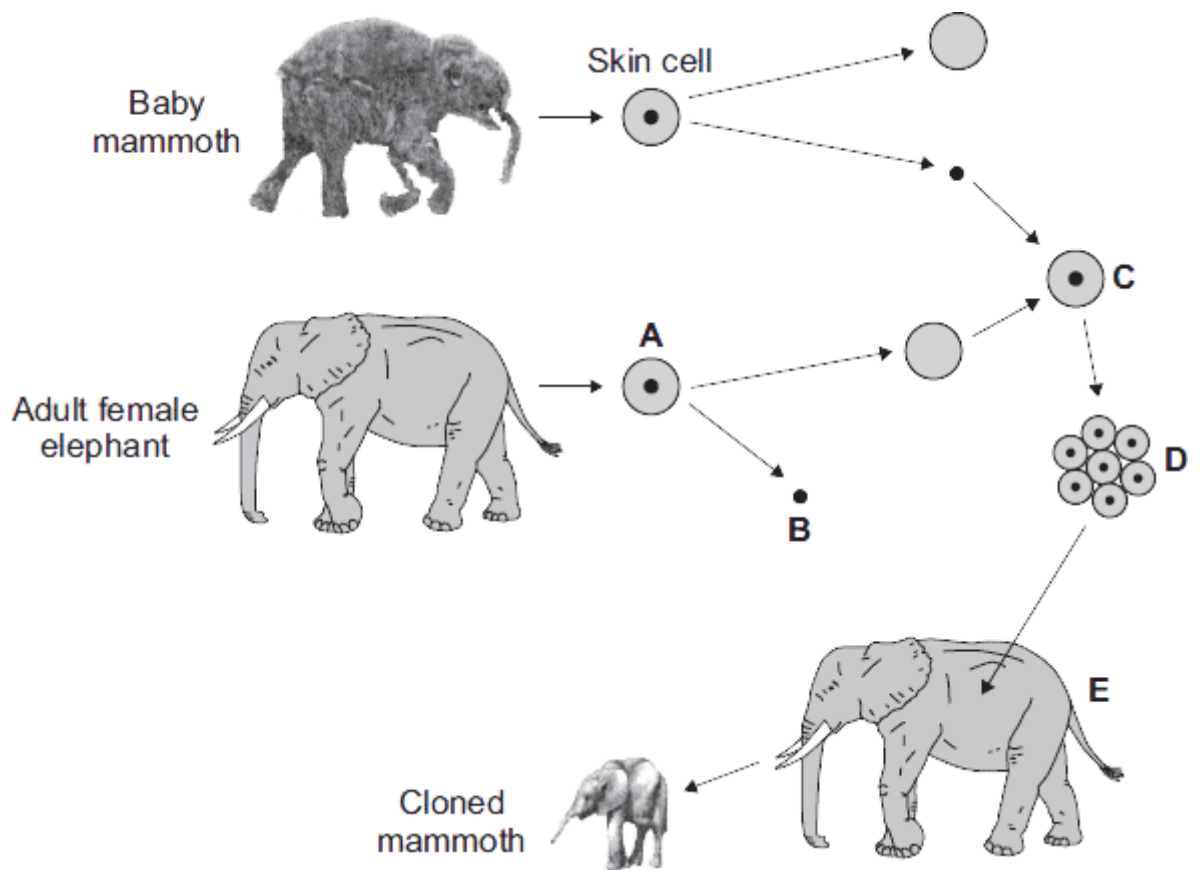
Mammoths are *extinct*. What does *extinct* mean?

(1)

- (c) Scientists believe they may be able to use adult cell cloning to recreate a living mammoth.

The scientists will use a skin cell from the baby mammoth.

The diagrams show how the skin cell will be used.



In each question, draw a ring around the correct answer.

(i) What type of cell is cell **A**?

skin cell egg cell sperm cell

(1)

(ii) Part **B** is removed from cell **A**.

What part of the cell is part **B**?

nucleus cytoplasm cell membrane

(1)

(iii) After cell **C** is formed, it divides into embryo cells.

What is done to cell **C** to make it divide?

Cell **C** is

treated with enzymes.
mixed with sperm cells.
given an electric shock.

(1)

- (iv) The embryo cells form a ball of cells. The ball of cells will be put into female elephant, **E**.

Which part of elephant **E** is the ball of cells put into?

womb stomach ovary

(1)

- (d) The scientists expect any offspring of the adult cell cloning to look like a mammoth and **not** like an elephant.

Why?

(1)

(Total 8 marks)

Q34.

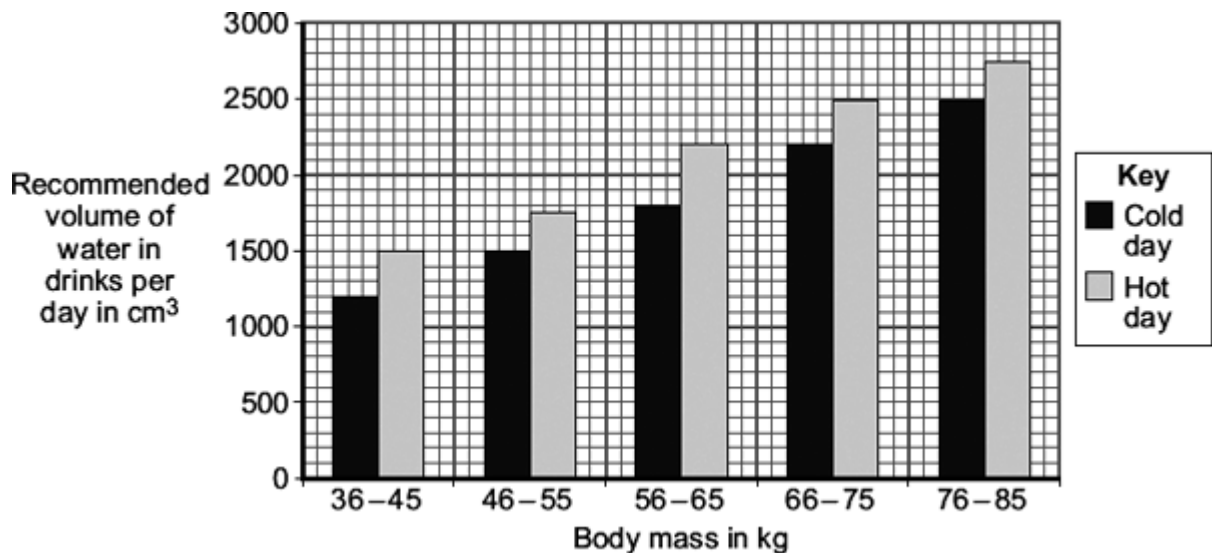
The volume of water the body needs depends on a number of factors.

- (a) Water enters the body in drinks.

Give **one** other way the body can get water.

(1)

- (b) The chart shows the recommended volume of water that women of different body masses should drink, on a cold day and on a hot day.



- (i) Describe the relationship between body mass and the recommended volume of water that a woman should drink.

(1)

- (ii) What is the recommended volume of water that a 70 kg woman should drink on a cold day?

_____ cm³

(1)

- (iii) While following a diet, the 70 kg woman loses 10 kg of body mass.

Calculate how much less water she is recommended to drink on a cold day.

Use information from the chart.

Show clearly how you work out your answer.

Answer = _____ cm³

(2)

- (c) It is recommended that women should drink more water on a hot day than on a cold day.

Why?

(2)

- (d) Excess water is lost from the body in urine.

Name the organ that produces urine.

(1)

(Total 8 marks)

Q35.

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)

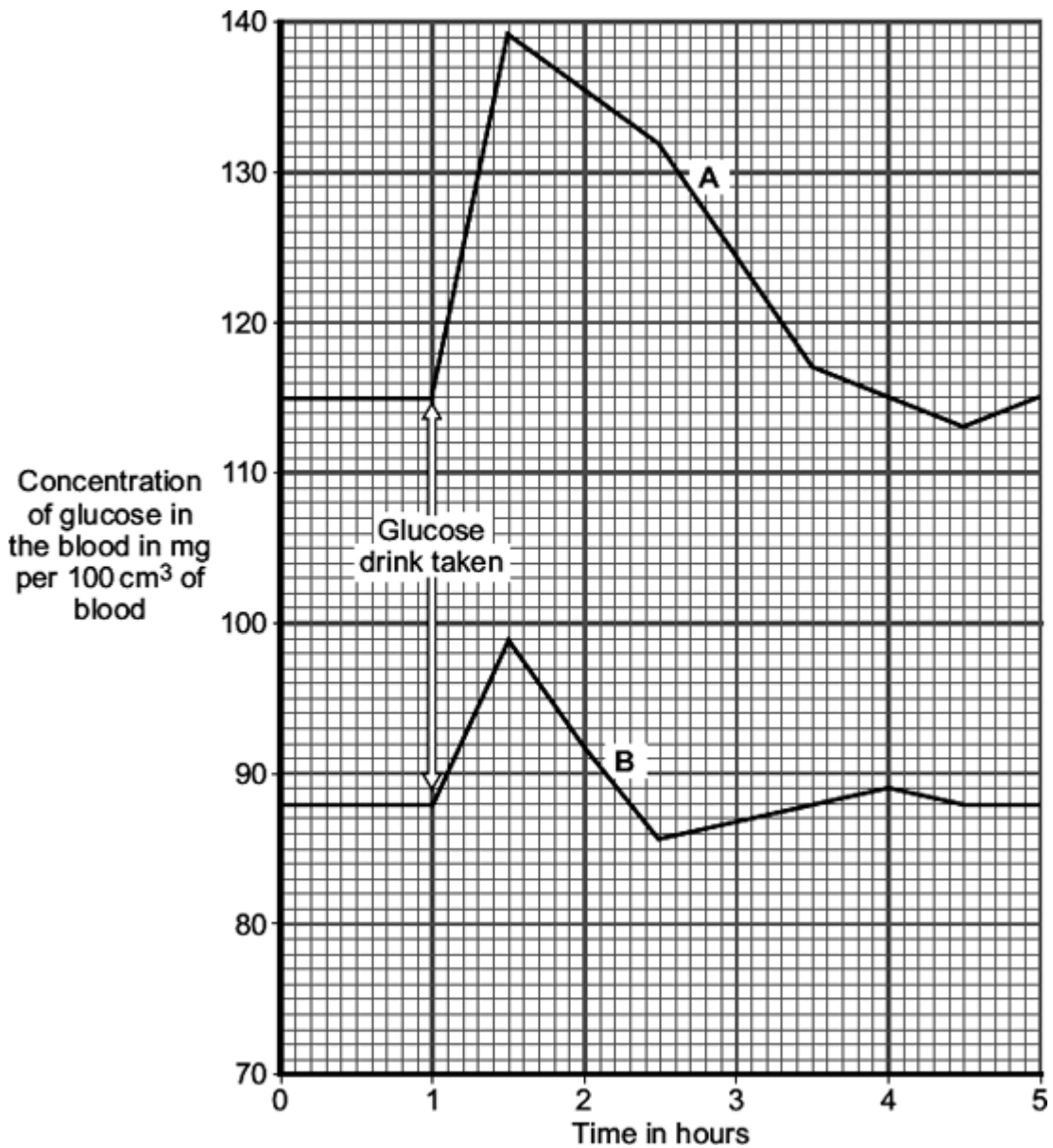
- (ii) Which organ produces this hormone?

(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 cm³ 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)

Q36.

One group of scientists is working in a hot desert and another group is working in a tropical rainforest.

The table shows information about the scientists and the conditions in the desert and the rainforest.

Information	Hot desert	Rainforest
Mean core body temperature of scientists in °C	37.3	38.9
Air temperature in °C	36.0	35.5
Mean percentage concentration of moisture in the air	9.0	92.0
Mean wind speed at ground level in metres per second	12.0	3.0

- (a) Both groups of scientists are doing similar jobs. The jobs cause the scientists to sweat a lot.

Use information from the table to explain the difference in the mean core body temperature of the two groups of scientists.

(2)

- (b) Changes to blood vessels in the skin help to decrease body temperature.

Explain how.

(2)
(Total 4 marks)

Q37.

The kidneys produce urine.

The table shows the composition of a sample of urine from one person.

Substance	Percentage
Ions	2.5
Urea	2.6
Water	

- (a) (i) Calculate the percentage of water in this sample of urine.

Show clearly how you work out your answer.

Percentage of water = _____ %

(2)

- (ii) The urine of a healthy person does **not** contain protein.

What is the reason for this?

Tick (✓) **one** box.

Protein molecules in the plasma cannot pass through the filter in the kidney.

Protein molecules in the plasma can pass through the filter in the kidney and are then reabsorbed.

There are no protein molecules in the plasma.

(1)

- (b) Dialysis can be used to treat a person with kidney disease.

Draw a ring around the correct answer to complete each sentence.

- (i) The dialysis machine contains membranes that are

fully permeable. impermeable.

partially permeable.

(1)

(ii) At the end of a dialysis session, the concentration of substances in the blood would be

- higher than
- lower than
- the same as

the concentration of substances in the dialysis fluid.

(1)

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

Kidney transplants have some disadvantages.

Give **one** disadvantage of a kidney transplant.

(1)

(Total 6 marks)

Q38.

Blood plasma is a solution of glucose, and many other substances, in water.

The urine of a healthy person contains water but does not contain glucose.

(a) Name **two** more substances found in the urine of a healthy person.

- 1. _____
- 2. _____

(2)

(b) (i) Describe what happens to the glucose in the blood of a healthy person when the blood enters the kidney.

(3)

(ii) A diabetic person's blood often contains a high concentration of glucose.

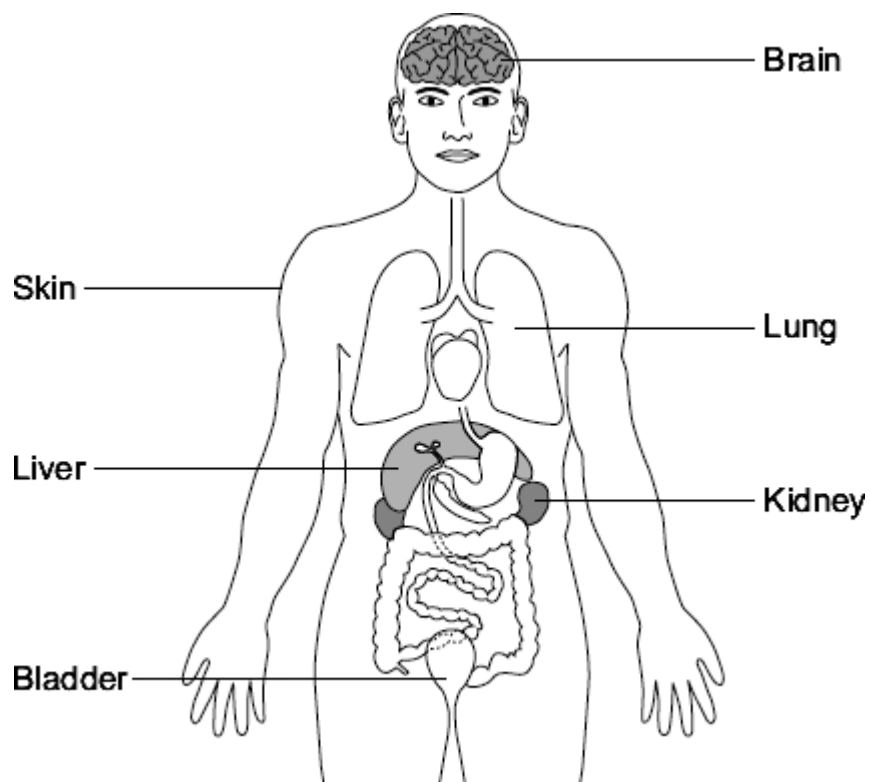
The urine of a diabetic person may contain glucose.

Suggest an explanation why.

(2)
(Total 7 marks)

Q39.

(a) The diagram shows organs which help to control conditions inside the body.



Draw a ring around the correct answer to complete each sentence.

(i) Carbon dioxide is removed from the body by the

kidney.
lung.
skin.

(1)

(ii) Urine is made in the

kidney.
lung.
skin.

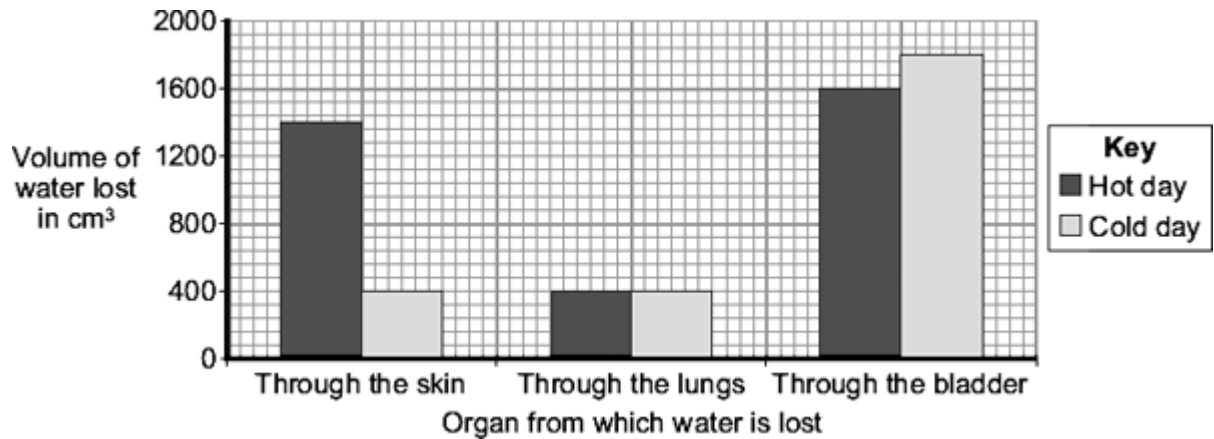
(1)

(iii) Urine is stored in the

- bladder.
- liver.
- skin.

(1)

(b) The bar chart shows the volume of water lost from different organs of the body. The information is shown for a hot day and for a cold day.



(i) Look at the bar chart.

How does the volume of water lost on the hot day compare with the volume of water lost on the cold day for each organ?

Complete the table using words from the box.

the same	less	more
-----------------	-------------	-------------

Organ	Volume of water lost on a hot day compared with volume of water lost on a cold day
Skin	
Lungs	
Bladder	

(3)

(ii) In total, more water is lost on the hot day than on the cold day.

How does the increase in the volume of water lost on the hot day help to control the body temperature?

(1)

(Total 7 marks)

