Homeostasis

These practice questions can be used by students and teachers and is suitable for GCSE AQA Biology topic Questions 8641

Level: GCSE AQA Biology 8641

Subject: Biology

Exam board: GCSE AQA

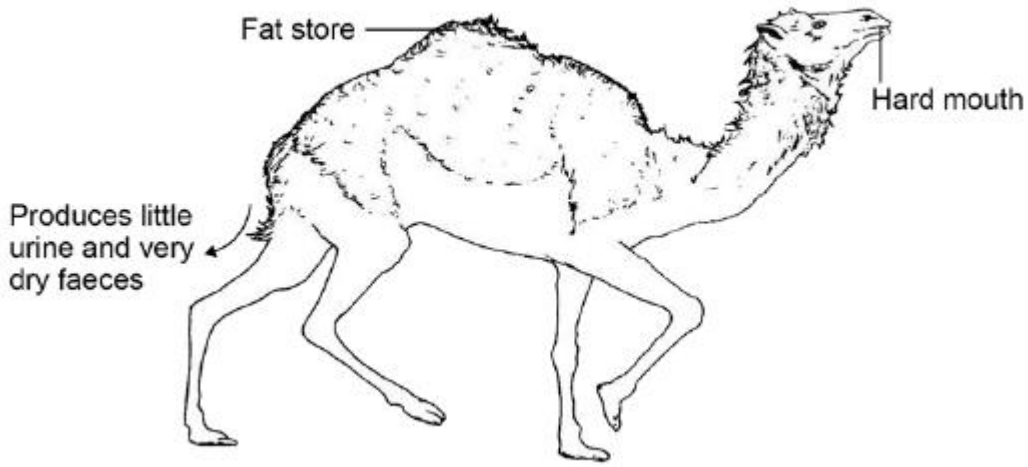
Topic: Homeostasis

Q1.

Figure 1 shows a type of camel called a dromedary (*Camelus dromedarius*).

The dromedary lives in hot, dry deserts.

Figure 1



(a) One adaptation of the dromedary is 'temperature tolerance'.

This means that the animal's body temperature can rise by up to 6 °C before it starts to sweat.

Explain how temperature tolerance can help the dromedary to survive in the desert.

_____

_____

_____

_____

_____

_____

_____

_____

(2)

(b) Three more adaptations of the dromedary are given in **Figure 1**.

Give a reason why each adaptation helps the animal survive in the desert.

Fat store

_____

_____

_____

Produces little urine and very dry faeces

_____

_____

_____

Hard mouth

_____

_____

_____

(3)

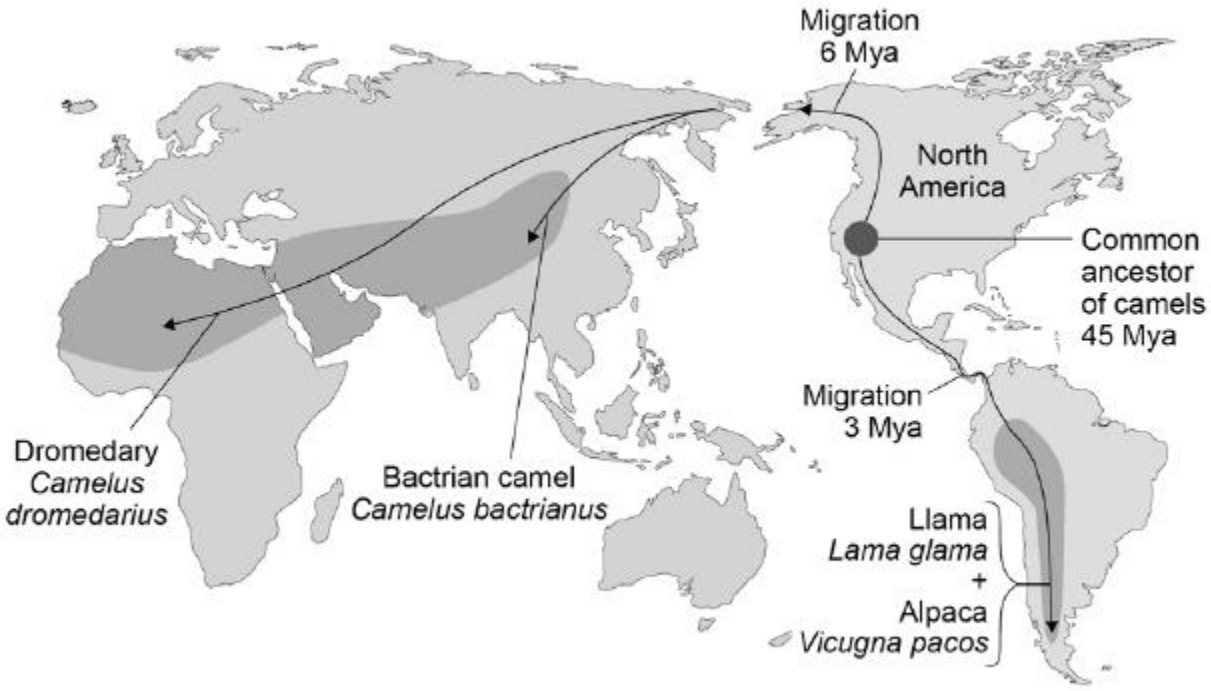
There are several species of the camel family alive today.

Scientists think these species evolved from a common ancestor that lived in North America about 45 million years ago (Mya).

Figure 2 shows:

- where four modern species of the camel family live today
- how the ancestors of these camels migrated from North America.

Figure 2



(c) Which **two** of the four modern species of camel do scientists believe to be most closely related to each other?

Give the reason for your answer.

_____ and _____

Reason

_____

_____

_____

(1)

(d) Describe the type of evidence used for developing the theory of camel migration shown in **Figure 2**.

_____

_____

_____

_____

_____

(2)

(e) Explain how several different species of camel could have evolved from a common ancestor over 45 million years.

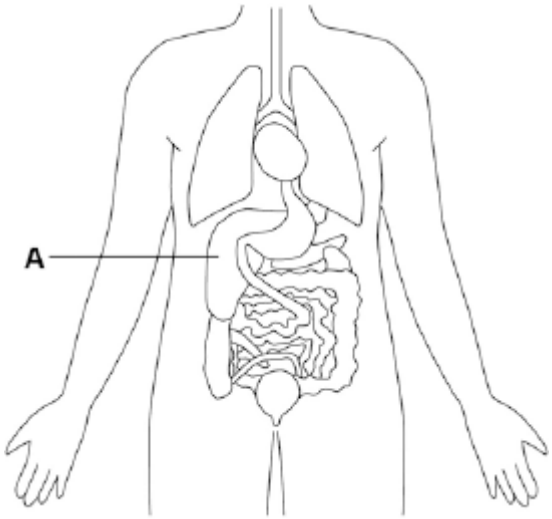
(6)

(Total 14 marks)

Q2.

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.

_____

_____

_____

_____

_____

_____

_____

_____

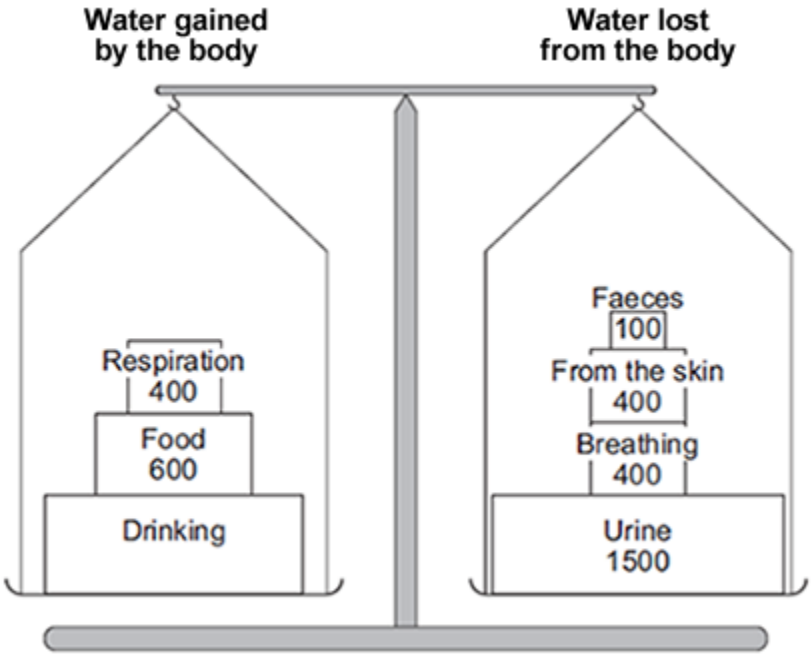
(2)

(Total 5 marks)

Q3.

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)

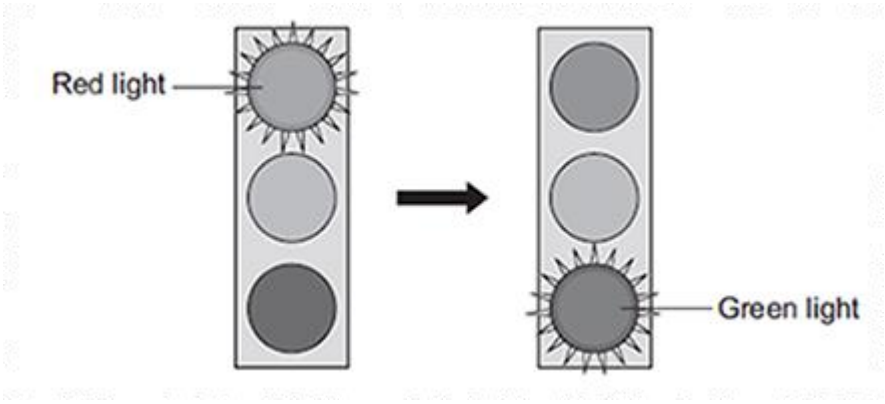
Q4.

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.

_____

_____

_____

_____

_____

_____

_____

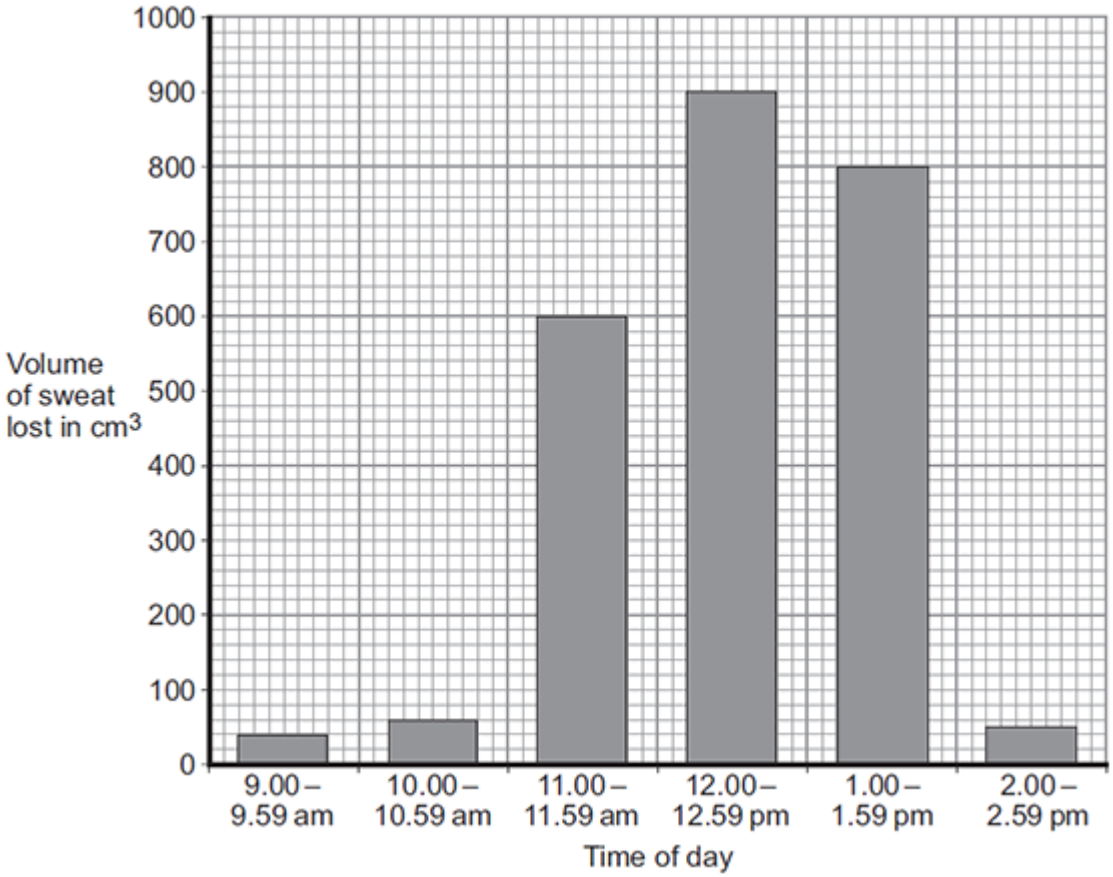
_____

(2)

(Total 7 marks)

Q5.

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 = _____ cm^3

(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)

Q6.

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?

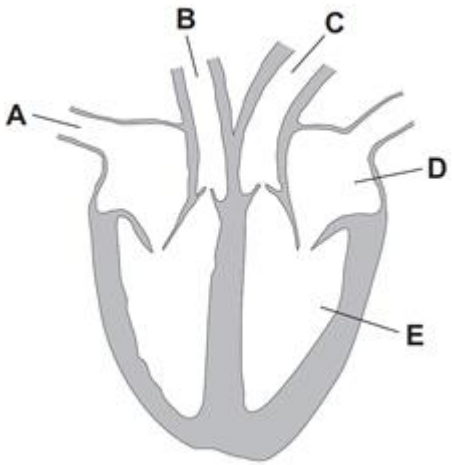
_____

_____

(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**.

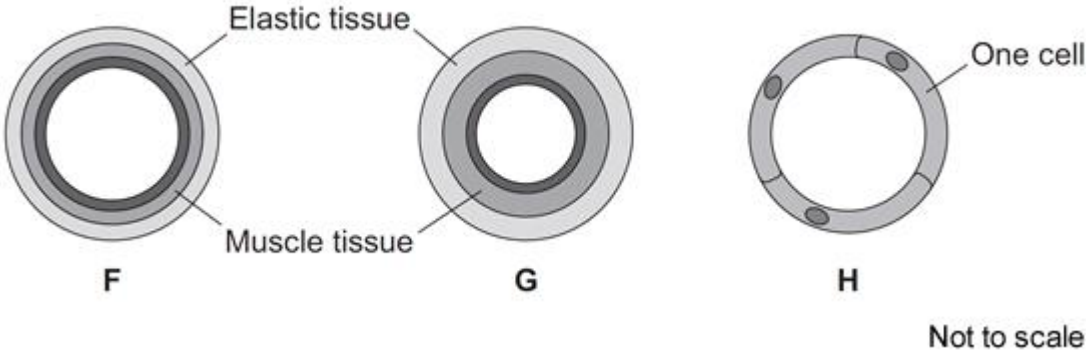
D _____

E _____

(2)

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

Figure 2



(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.

In which type of blood vessel would the stent be placed?

Tick (✓) **one** box.

an artery ☐

a capillary ☐

a vein ☐

(1)

(iii) Explain how a stent helps to prevent a heart attack.

_____

_____

_____

_____

_____

_____

_____

_____

(2)

(Total 9 marks)

Q7.

Humans keep their internal conditions almost constant.

Body temperature is kept within a narrow range.

When the core body temperature is too low, this is detected by the thermoregulatory centre in the brain.

Describe how the body responds when a decrease in core body temperature is detected.

(Total 6 marks)

Q8.

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)

Q9.

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.

Body temperature is monitored and controlled by the thermoregulatory centre in the brain.

Describe what happens in the body to keep the body temperature constant.

Extra space

(Total 6 marks)

Q10.

It is important that the amount of water in the body is controlled.

(a) The table below shows the main ways that a person takes in and loses water in one day.

Water taken in		Water lost	
Method	**Volume in cm^3**	**Method**	**Volume in cm^3**
Drink	1450	Urine	1500
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 = _____ cm^3

(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)

(c) Some people have kidney failure.

The two main types of treatment for kidney failure are dialysis and a kidney transplant operation.

Suggest reasons why most doctors think that a kidney transplant is better than dialysis treatment.

_____

(4)
(Total 17 marks)

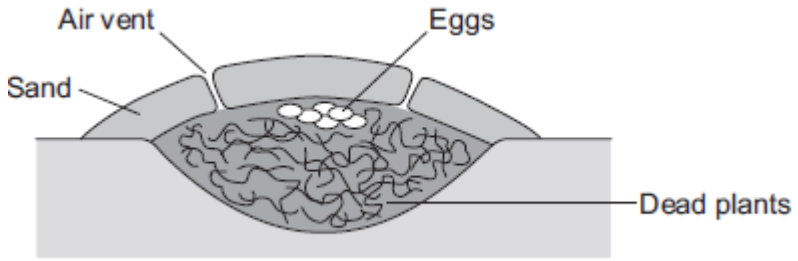
Q11.

Most birds sit on their eggs to keep them warm until they hatch.

Megapode birds:

- dig a large hole in sand
- fill the hole with dead plants
- lay their eggs on top of the dead plants
- cover the surface with a thick layer of sand.

The image below shows a megapode bird's nest.



(a) The dead plants in the nest decay. The decaying process helps to keep the eggs warm for many weeks.

Suggest how.

_____
_____

_____
_____

_____
_____

_____
_____

_____
_____

_____

_____

(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)

Q12.

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 dm^3)	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)

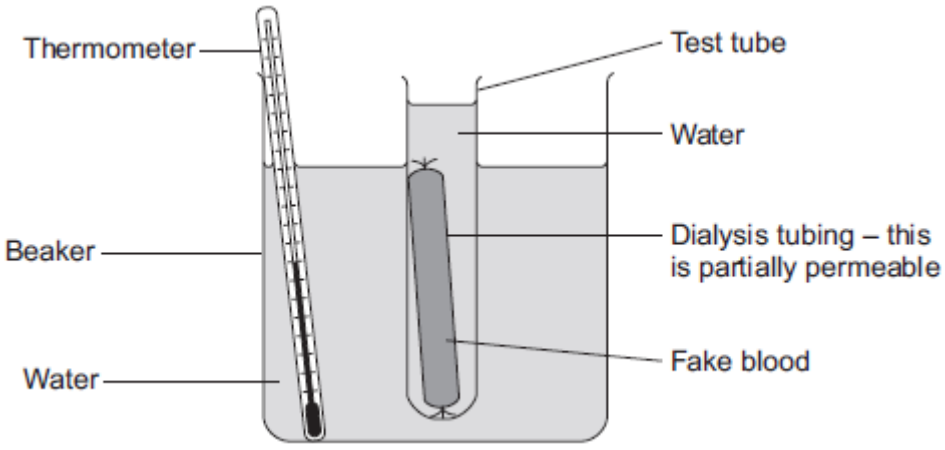
Q13.

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.

_____

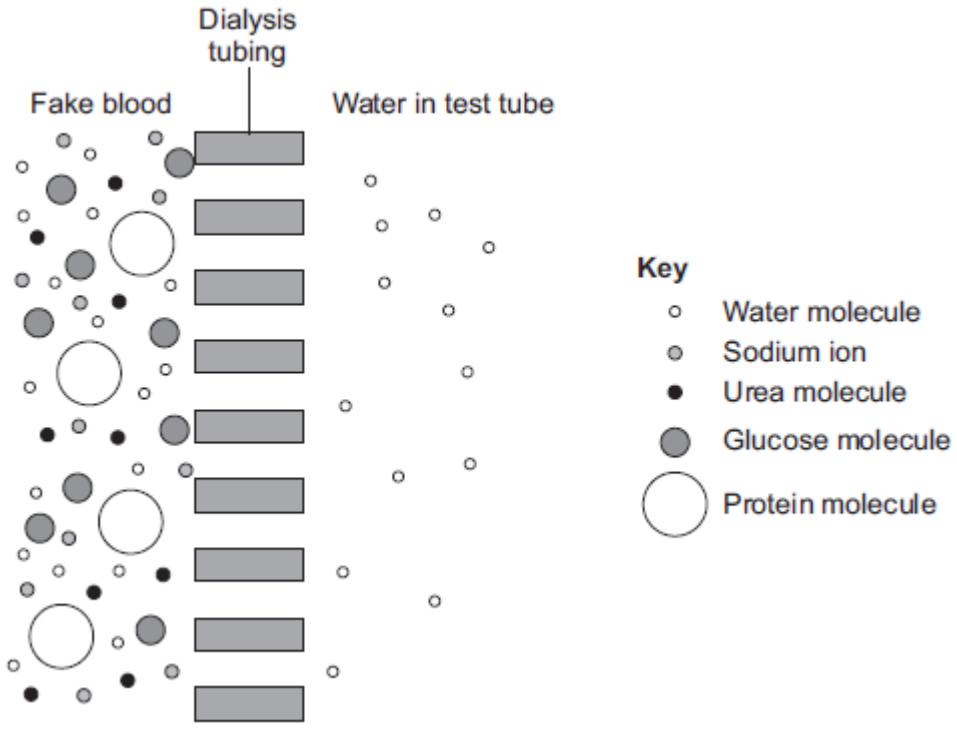
_____

(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)

Q14.

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.

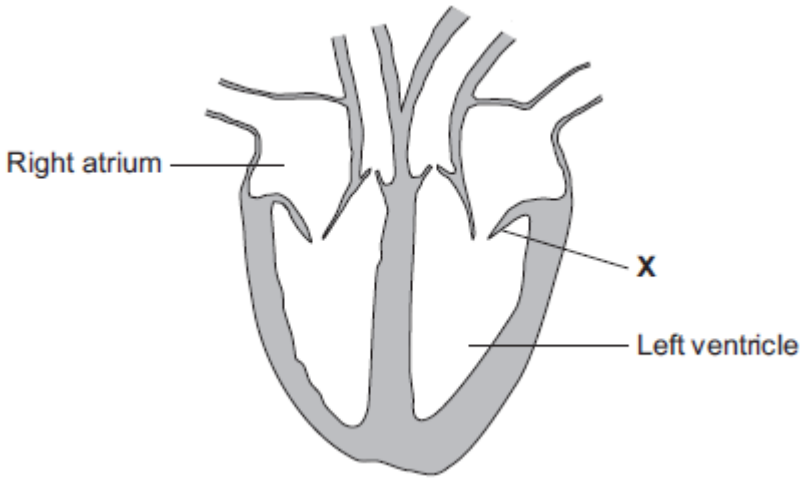
Complete the following sentence.

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

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

(2)

(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.

_____
_____

_____
_____

_____
_____

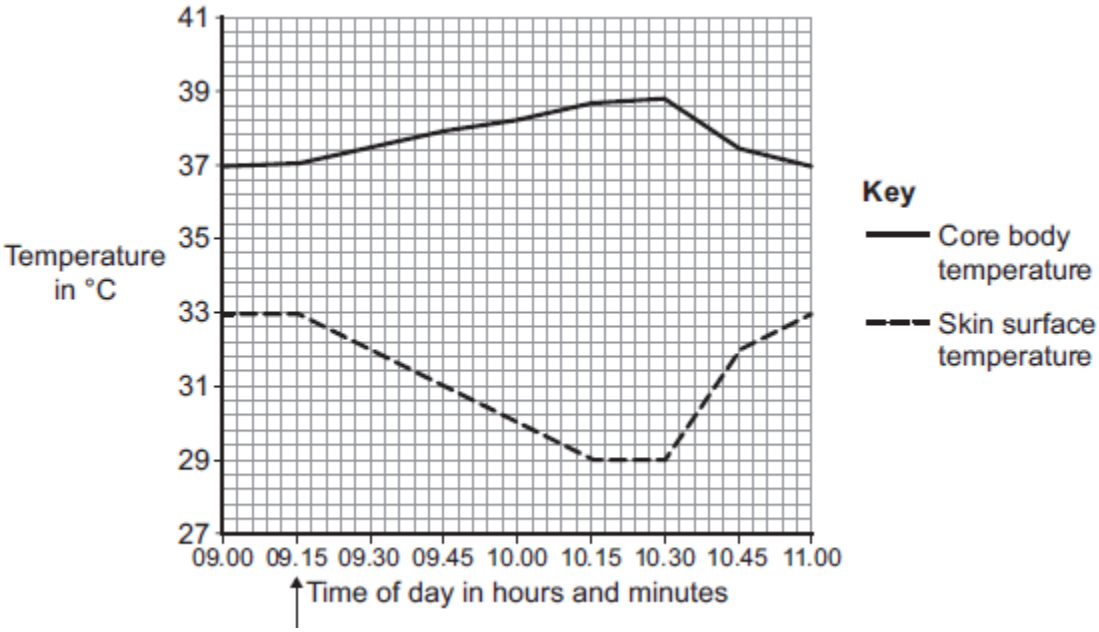
_____
_____

(2)

(Total 6 marks)

Q15.

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.

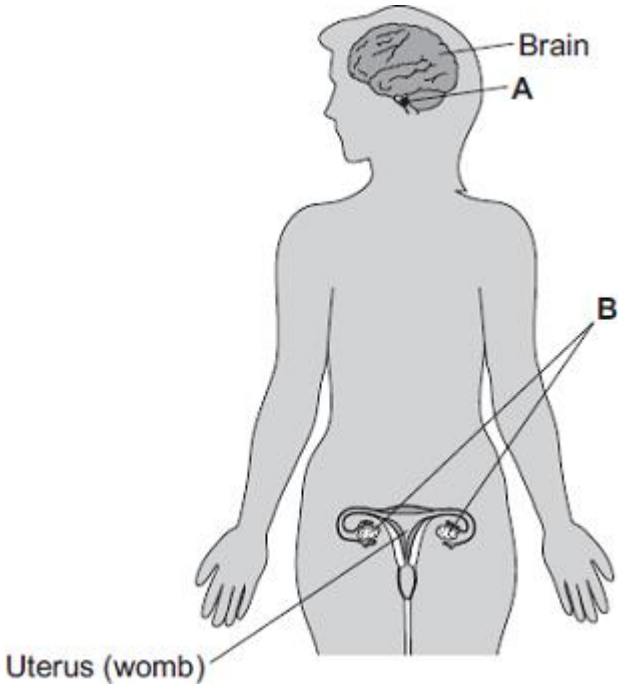
Describe how the body responds when the blood glucose concentration begins to decrease.

(3)

(Total 12 marks)

Q16.

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)

Q17.

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.

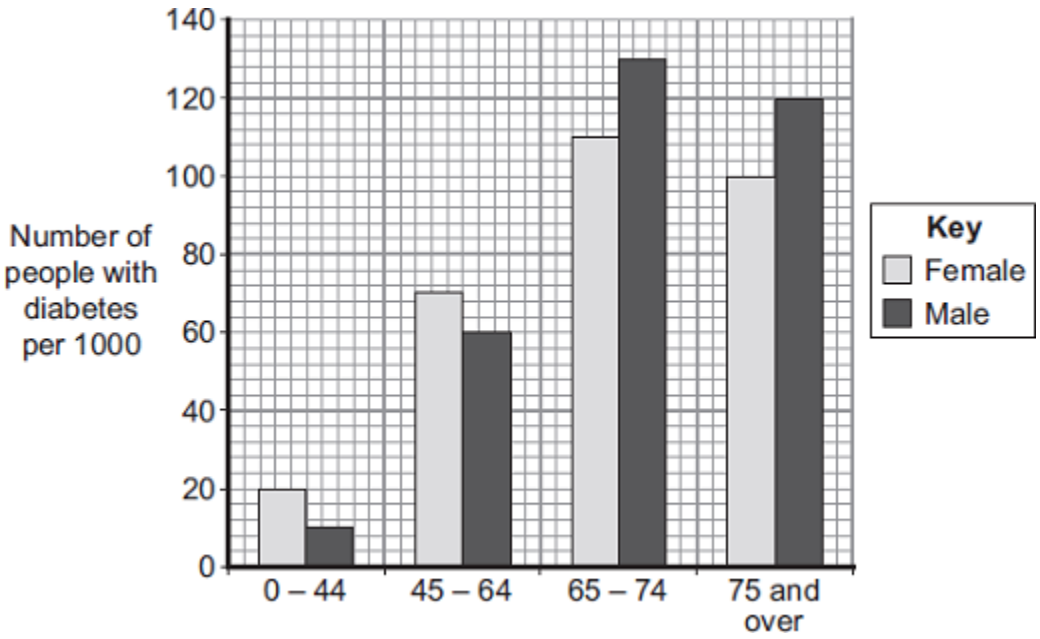
carbohydrate **fat** **protein**

(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)

Q18.

(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.

_____

_____

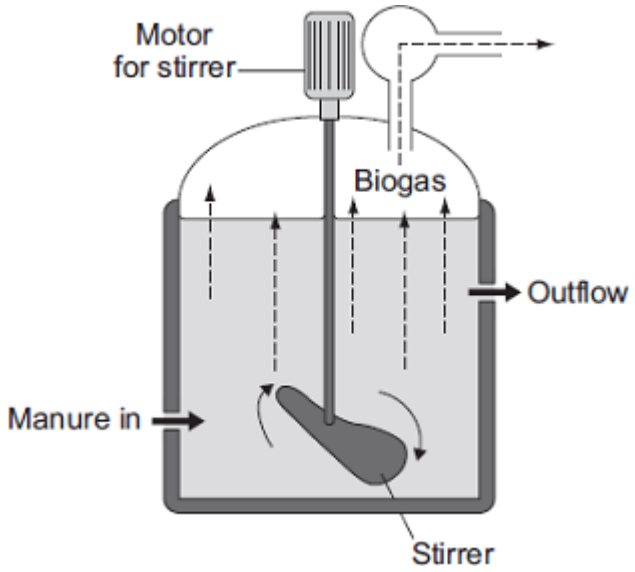
_____

(3)

(Total 4 marks)

Q19.

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.

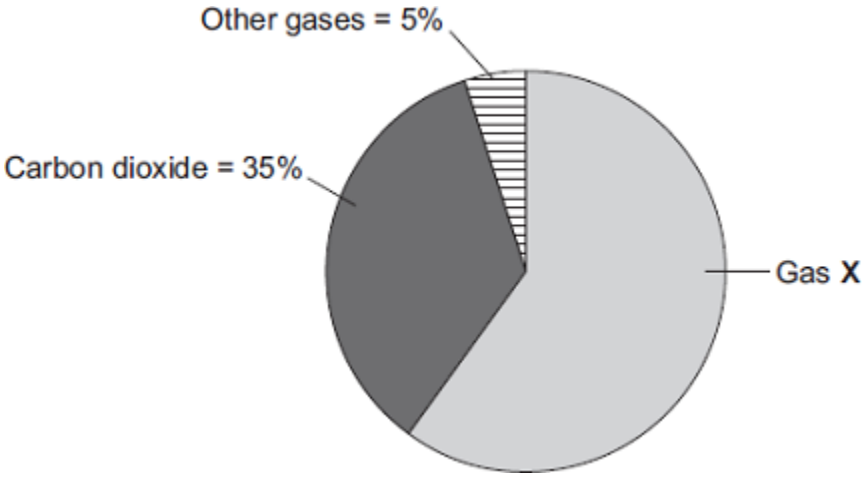
A higher concentration contains too little oxygen. ☐

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.

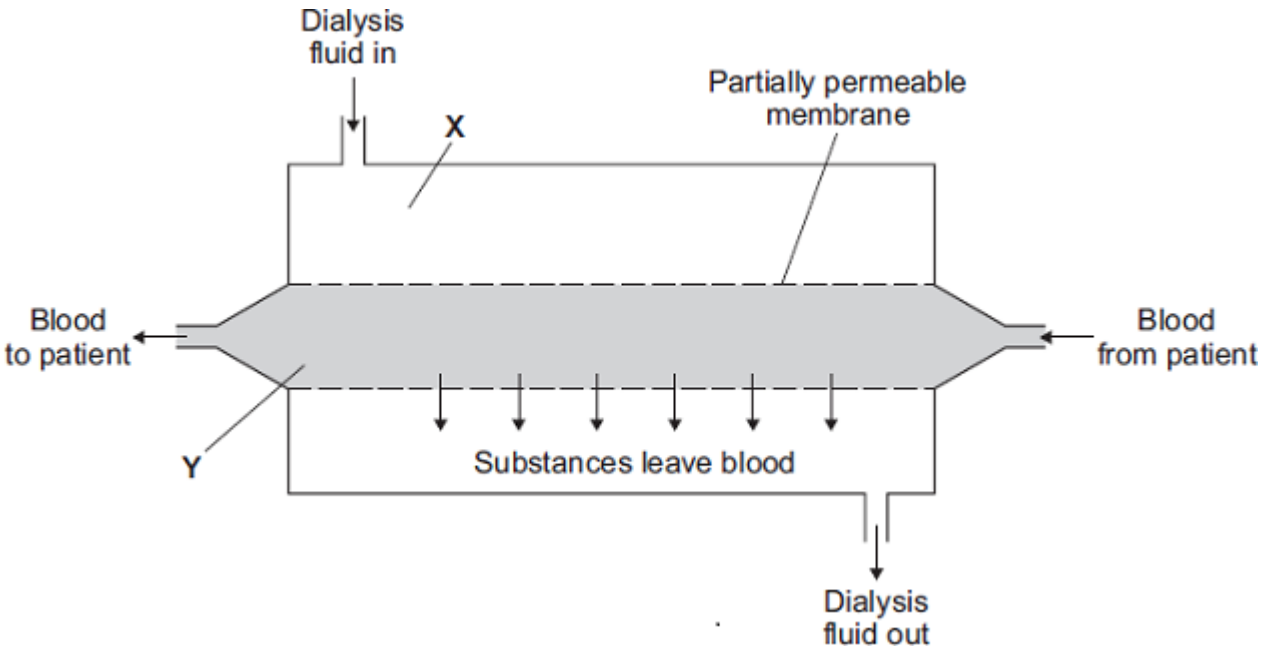
(1)

(Total 6 marks)

Q20.

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 dm^3.

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 dm^3.

(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	51 000
	medical care in each further year	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 ?

_____

_____

_____

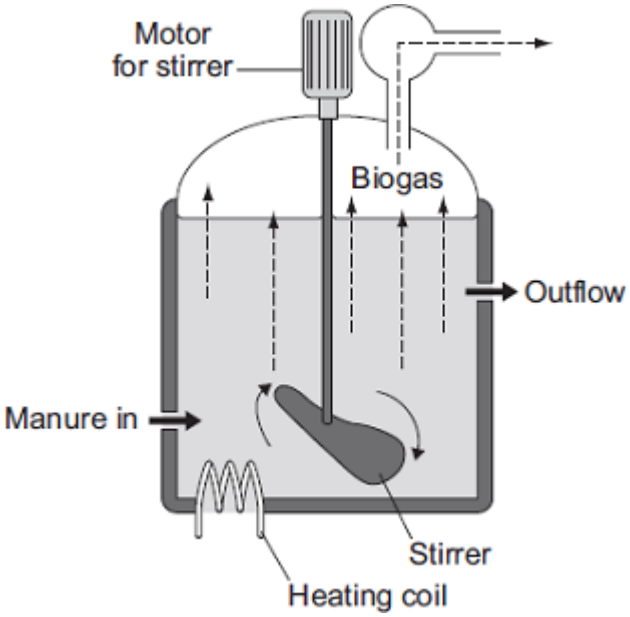
_____

(1)

(Total 6 marks)

Q21.

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.

_____

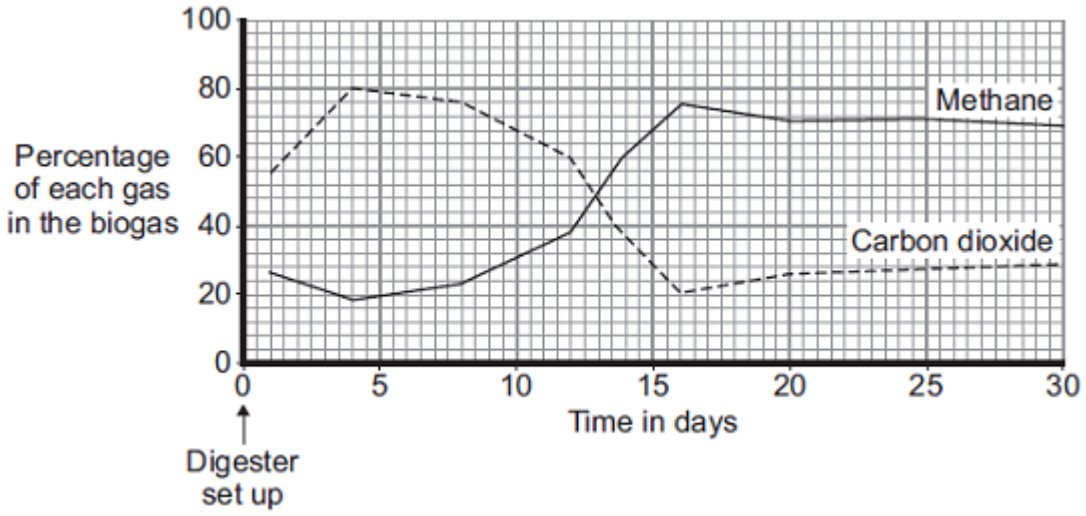
_____

_____

_____

(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)

Q22.

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.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

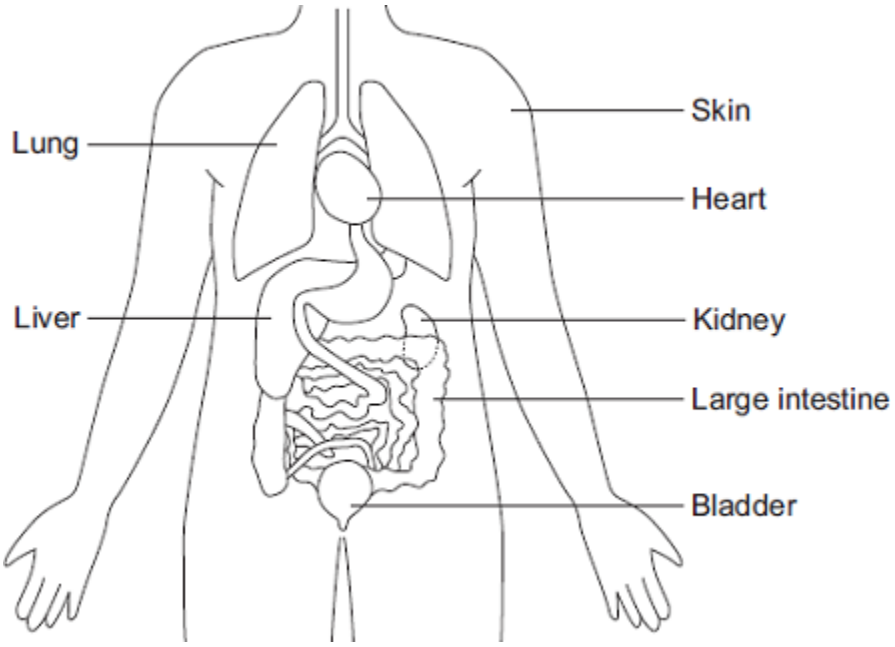
_____

(3)

(Total 8 marks)

Q23.

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 _____

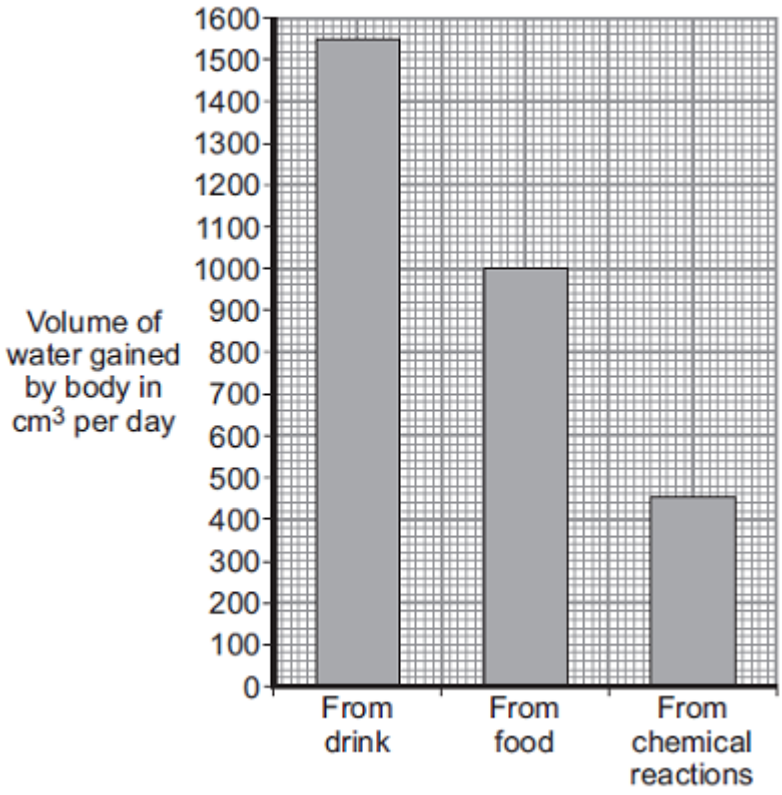
(1)

(v) helps to control body temperature? _____

(1)

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

Bar chart 1



Source of water gained by body

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

_____

_____

_____

_____

_____

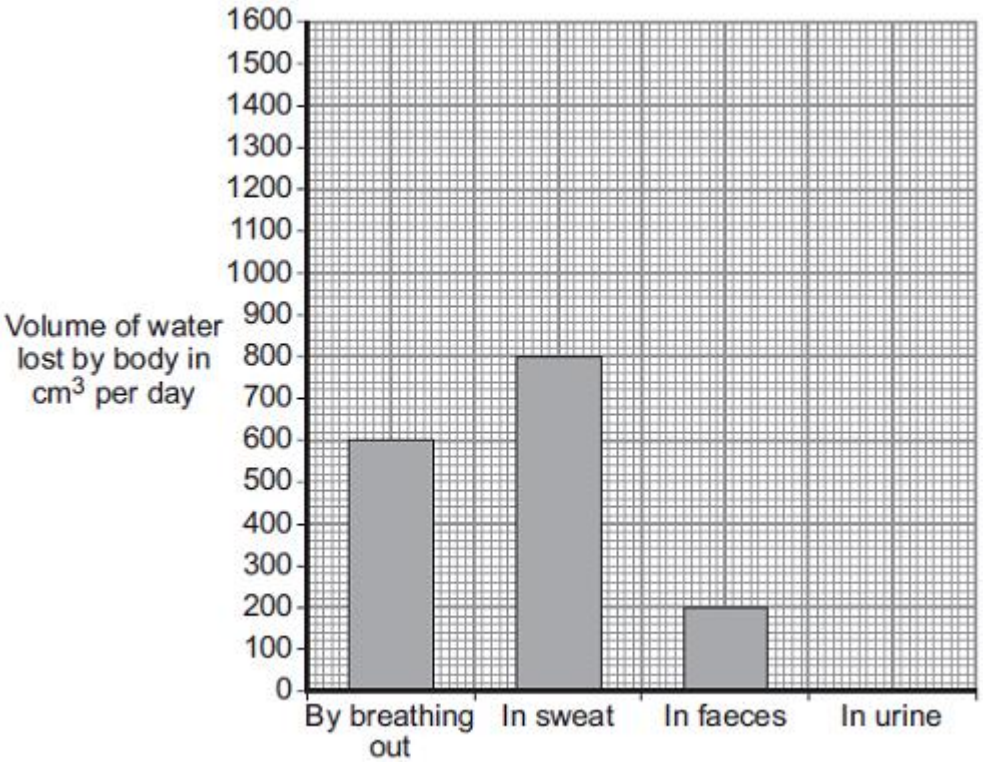
_____

Total volume of water gained = _____ cm^3

(2)

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

Bar chart 2



Water lost by body

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

_____

_____

_____

_____

Volume = _____ cm^3

(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 = _____ cm^3

(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)

Q24.

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.

_____

_____

_____

_____

(2)

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

_____

_____

(1)

(Total 6 marks)

Q25.

Humans maintain an almost constant body temperature.

(a) Describe the role of blood vessels in the control of body temperature.

(4)

(b) An athlete can run a marathon in 2 hours 15 minutes on a dry day in outside temperatures up to 35 °C.

If the air is dry, his body will **not** overheat.

In humid conditions the same athlete can run the marathon in the same time. However, in humid conditions, if the outside temperature goes over 18 °C then his body **will** overheat.

Suggest an explanation for the athlete overheating in humid conditions.

_____

_____

_____

(3)

(Total 7 marks)

Q26.

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

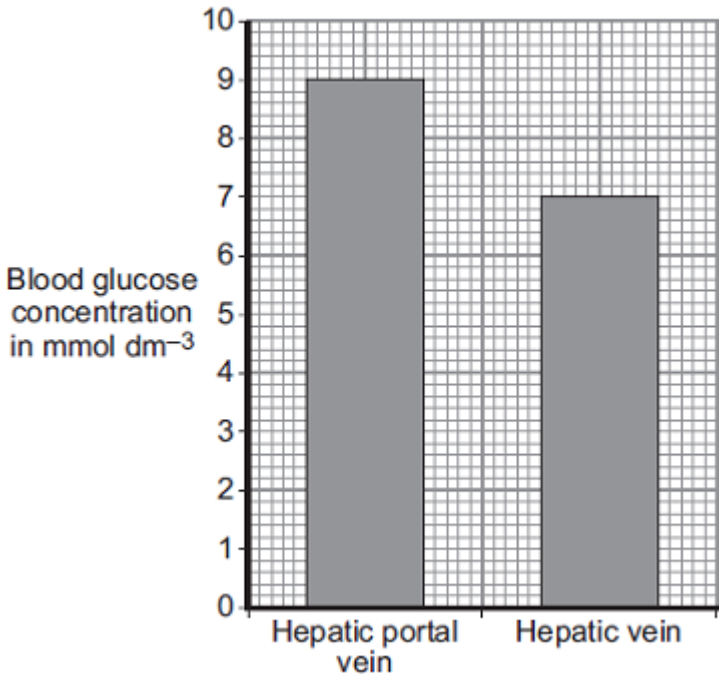
The liver has two veins:

- the hepatic portal vein taking blood from the small intestine to the liver
- the hepatic vein taking blood from the liver back towards the heart.

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

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

Graph 1



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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

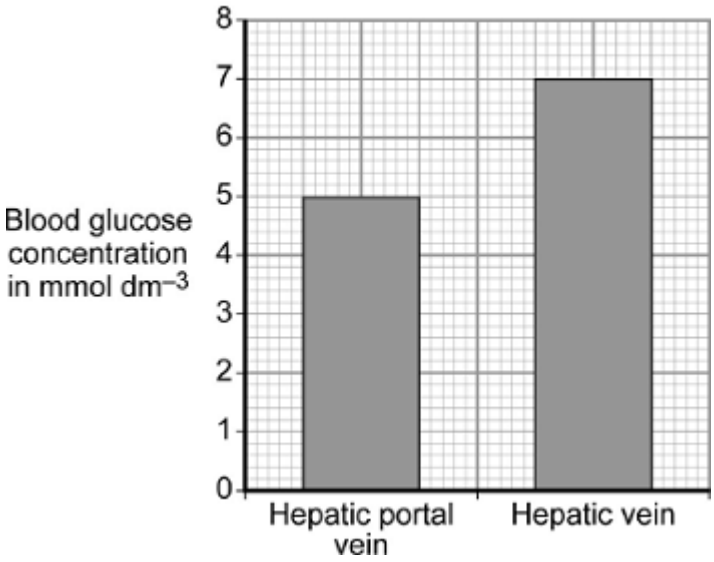
_____

_____

(3)

(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)

Q27.

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.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

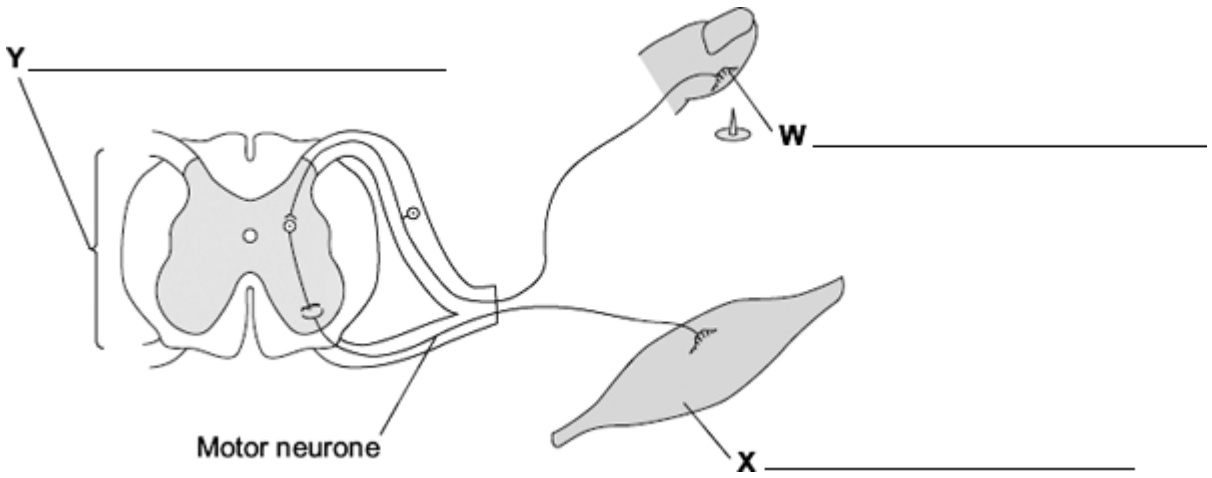
_____

(3)

(Total 6 marks)

Q28.

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)

Q29.

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)

Q30.

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.

_____

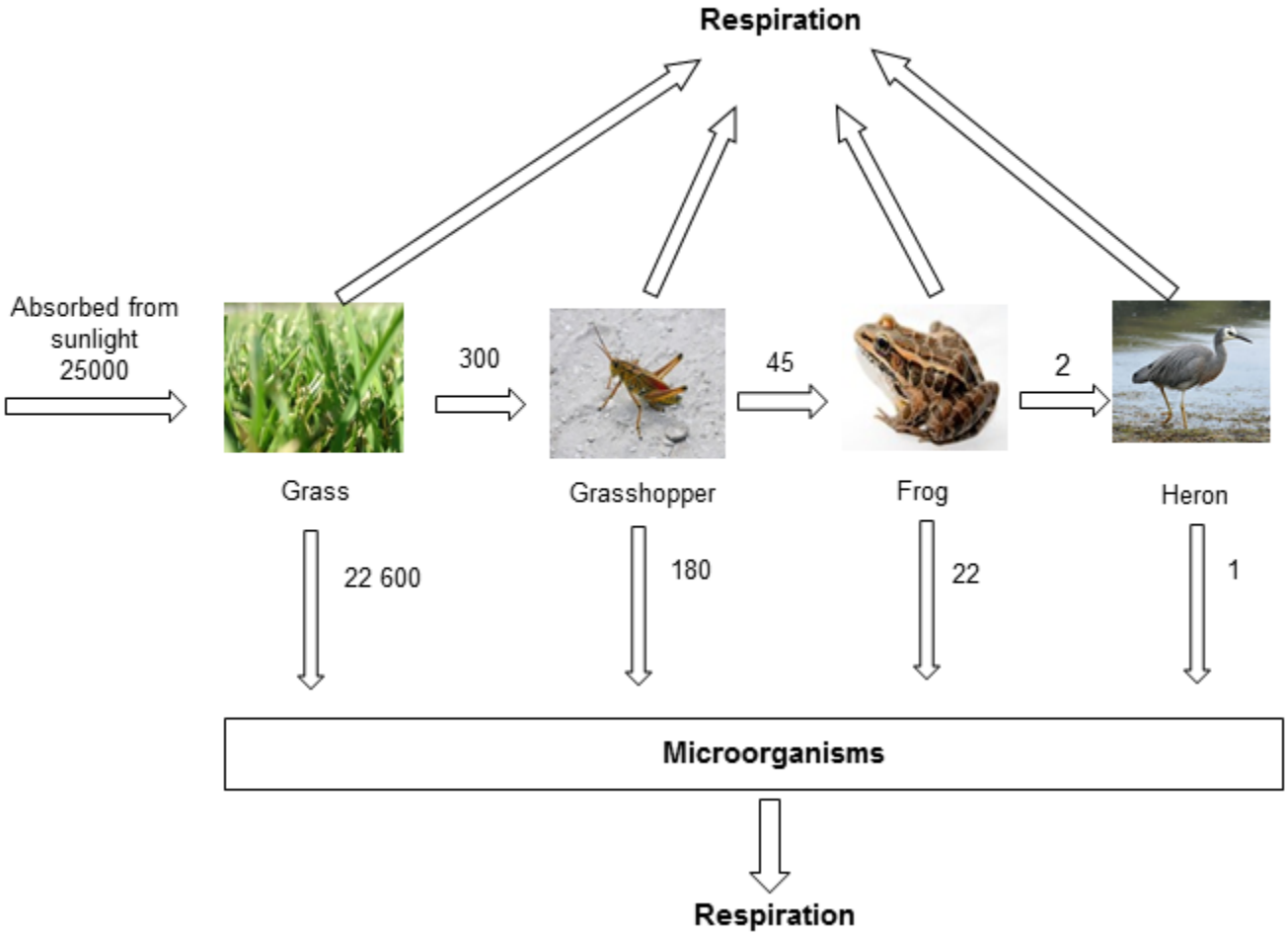
_____

(2)
(Total 5 marks)

Q31.

The diagram shows the annual energy flow through 1 m^2 of a habitat.

The unit, in each case, is kJ per m^2 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)

Grass by By Catarina Carvalho from Lisboa, Portugal (Flickr) [CC-BY-2.0], via Wikimedia Commons. 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.

Q32.

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)

Q33.

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)

Q34.

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

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

Modern elephant

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

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

_____

_____

_____

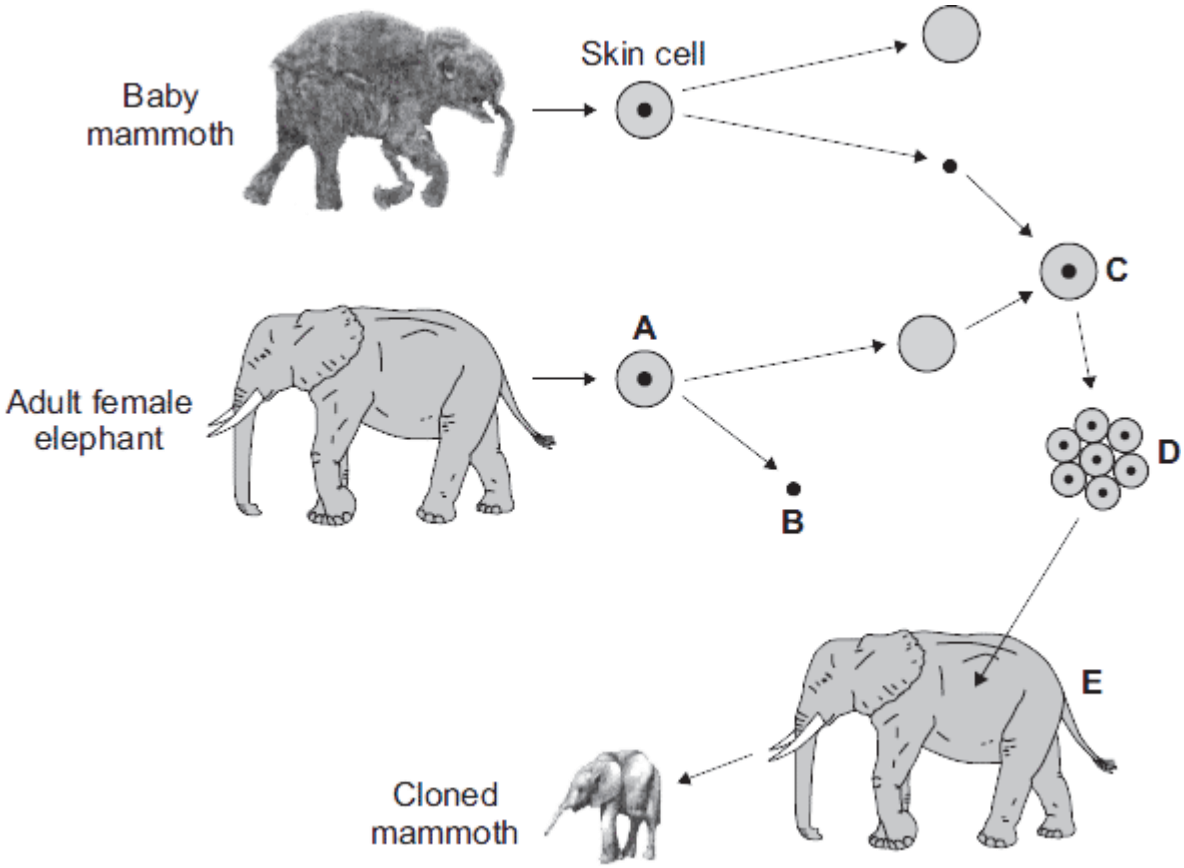
_____

(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?

treated with enzymes.

Cell **C** is

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)

Q35.

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

(a) Water enters the body in drinks.

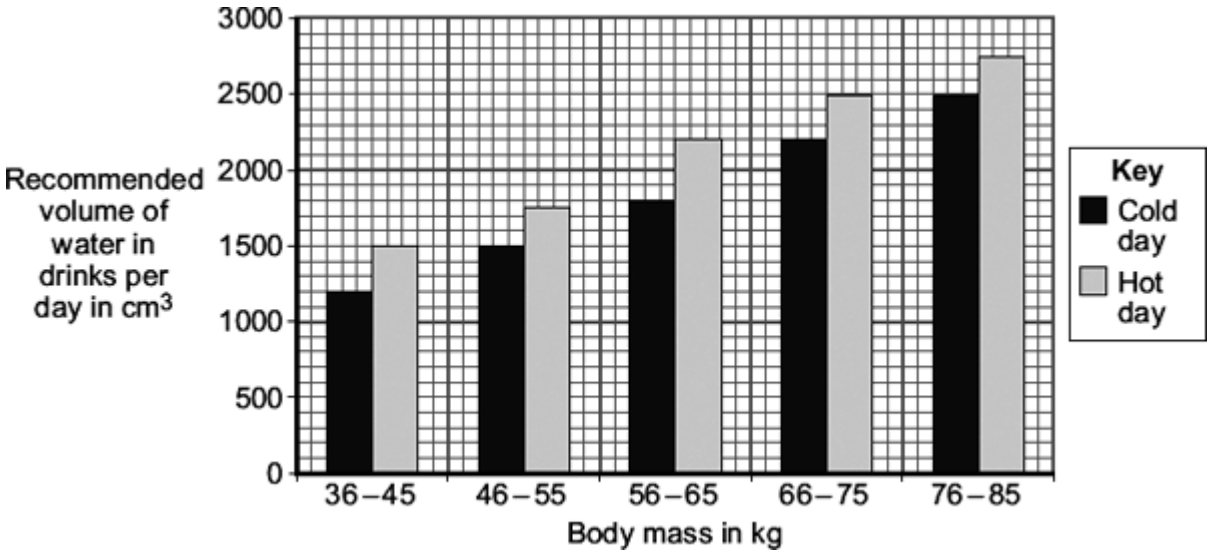
Give **one** other way the body can get water.

_____

_____

(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?

_____ cm^3

(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 = _____ cm^3

(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)

Mark schemes

Q1.

(a) less sweating so less water loss

1

(as) no / little water available in desert

1

(b) (fat store) can be metabolised / respired to water

1

(little urine…) conserve water

1

(hard mouth) not damaged by spines on plants / on food
or
not damaged by hard / dry food

1

(c) dromedary / *C.dromedarius*
and bactrian / *C. bactrianus*

no mark for the names, but must be identified

because
same genus

ignore 'both are Camelus'

1

(d) any **two** from:

- the fossil record
- oldest fossils in N. America
  or
- newer fossils in S. America / in Asia / in Africa

*allow numbers for ages (45 Mya **and** 3 Mya / 6 Mya)*

- chemical / DNA analysis of living species

allow radioactive dating of fossils

2

(e) isolation of separate camel populations by sea
or
by mountains

1

habitat variation / described between populations

allow examples – biotic (e.g. food / predators) or abiotic

1

genetic variation / mutation in each population

1

45 million years is sufficient time to accumulate enough mutations

1

natural selection

or
better adapted survive to reproduce

1

pass on favourable allele(s)
allow gene(s)

1

[14]

Q2.

(a) liver

1

(b) insulin
*do **not** accept glucagon*

1

(c) kidney

1

(d) to replace water / ions / salt

1

(that is) lost in sweat

1

[5]

Q3.

(a) (i) 2400 cm^3

1

(ii) 1400 (cm^3)
*allow **2** marks for ecf of correct answer to [answer given in (a)(i) – 1000]*
*allow **1** mark for 2400 – (600 + 400) or equivalent with no or incorrect answer*
*allow **1** mark for ecf of answer given in (a)(i) – 1000 or equivalent with no or incorrect answer*

2

(b) (i) sweat(ing)
allow evaporation
allow perspiration

1

(ii) any **one** from:
- for cooling
- to maintain body temperature

1

(c) (i) More water was lost through the skin.

1

(ii) decrease

1

[7]

Q4.

(a) (i) receptor cells

1

(ii) eye(s)

accept retina

1

(b) (i) any **one** from:

- gender / sex
- quality of eyesight

eg wearing glasses

- eg of factor that might affect reaction times

eg alcohol consumption / distractions / tiredness / health / time of day / amount of practice (at this test)

do not allow time / age

1

(ii) 182

allow 182.0

1

(iii) Any anomalies can be identified.

1

(iv) reaction time (too) long **or** reactions (too) slow

1

allow reaction time (too) slow

*allow examples of data quoted **or** derived from the table, eg (mean) reaction time for 90 year olds is 162 ms longer than for 75 year olds*

(so) more likely to have / cause an accident

1

[7]

Q5.

(a) (i) The person started running a race.

1

(ii) 2300

1

(iii) drinking (water / sports drink)
or
through eating

1

(b) (i) brain

1

(ii) receptors

1

(c) cools us down

allow evaporates

1

[6]

Q6.

(a) (i) any **one** from:

- glucose
- oxygen
- carbon dioxide
- urea
- water

allow hormones

allow named example of a product of digestion

1

(ii) (cardiac) muscle

allow muscular

1

(b) (i) **B**

1

(ii) **D** atrium / atria

ignore references to left or right

1

E ventricle(s)

ignore references to left or right

1

(c) (i) a vein

1

(ii) an artery

1

(iii) keeps artery open / wider

allow ecf from part cii

1

(so) blood / oxygen can pass through (to the heart muscle)

1

[9]

Q7.

blood vessels supplying skin

1

constrict

allow vasoconstriction
*do **not** allow capillaries /veins constricting*
*do **not** allow moving blood vessel*

1

less blood flow (to / through capillaries / to skin)

allow blood flows further away from skin surface

1

so less energy is lost (to the surroundings)

allow less heat is lost

1

'shivering' by muscle (contraction)

allow muscles contract (and relax) rapidly

1

releasing energy **or** respiring (more)

allow 'heat produced'
*do **not** allow energy produced / made*
*do **not** allow energy **for** respiration*
allow sweating stops / reduces

ignore hair erection

1

[6]

Q8.

(a) detect changes in surroundings **or** detect stimuli

allow any named stimulus for skin

1

convert information to impulse

allow send impulse to sensory neurones / brain

1

(b) (i)

muscle	contract(ion)
gland	release / secrete / produce chemical / hormone / enzyme

***1** mark for each effector*
***1** mark for each response*
response must match type of effector (if given)
ignore examples
ignore relax(ation) / movement for contraction
*do **not** allow expansion for muscles*

4

(ii) any **one** from:

- (maintain temperature at which) enzymes work best
- so chemical reactions are fast(est)
- prevent damage to cells / enzymes

allow prevent enzymes being denatured (by temperature being too high)

1

[7]

Q9.

Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1 – 2 marks)
There is a description of thermoregulation **or** at least one correct mechanism (skin, sweat glands or muscles) but roles may be confused.

Level 2 (3 – 4 marks)
There is a description of thermoregulation **or** some correct mechanisms (sweating, shivering, blood flow in the skin).

Level 3 (5 – 6 marks)
There is a clear description of thermoregulation by TC or skin **and** some correct control mechanisms.

examples of biology points made in the response:

full marks may be awarded for detailed description of what happens if the core temperature is <u>either</u> too high <u>or</u> too low

- temperature receptors in TC
- the TC detects (core) body / blood temperature
- temperature receptors in the skin send impulses to the TC, giving information about skin temperature
- if the core body temperature is too high: blood vessels / arterioles supplying the skin capillaries dilate / vasodilation

  ***do not** accept refs to veins instead of arterioles or answers that imply blood vessels have moved up / down through the skin.*
- so that more blood flows (through the skin) and more heat is lost
- sweat glands release more sweat to cool the body
- by evaporation
- if the core body temperature is too low: blood vessels supplying the skin capillaries constrict
- to reduce the flow of blood (through the skin) and less heat is lost

  allow idea of blood diverted to vital organs in extreme cold
- muscles may shiver to release (heat) energy
- from respiration, some of which is lost as heat

[6]

Q10.

(a) (i) 400

*correct answer = **2** marks with or without working*
2600 – (1500 + 600 + 100)
or
2600 – 2200
*for **1** mark*

2

(ii) LHS: glucose

accept $C_6H_{12}O_6$ / C6H12O6 / sugar

1

RHS: carbon dioxide

accept CO_2 / CO2
*do **not** accept CO^2 / CO*

1

(iii) (sweat) increase

1

(urine) decrease

1

(b) (i) 66.7 / 66.67 / $66\frac{2}{3}$ / $66.\dot{6}$ / 67

accept answers in range
*correct answer = **2** marks with **or** without working*
or
$\frac{20}{0.3}$ *for **1** mark*

or 66 / 66.6 / 66.66 / 66.6$\dot{7}$ / 67.0 for 1 mark
*(penalise excessive number of sig. figs. –**1** mark) (eg no more than 2 decimal places)*

2

(ii) reabsorption of water by the kidney

1

(iii) (protein) (too) big

1

cannot pass through filter / stays in blood / cannot enter kidney tubule

1

(glucose) small / can pass through filter

1

all taken back into blood / all reabsorbed

allow the glucose is reabsobed

1

(c) any **four** from:

- transplant is permanent / dialysis is repetitive treatment / dialysis only short term
- kidney works all the time / dialysis intermittent
- concentrations in blood kept (±) constant / substances build up in blood between dialysis sessions
- poisoning / damage to body by build-up of substances (with dialysis)
- danger of infection / damage to blood vessels by needles (with dialysis)
- risk of blood clots with dialysis or anticlotting drugs (can lead to blood loss)
- long term expense of dialysis / excessive use of health service resources
- social point – inconvenience of dialysis described – can eat or drink without constraint with transplant

4

[17]

Q11.

(a) microorganisms

allow microbes / bacteria / fungi / decomposers

1

(microorganisms) respire

*do **not** allow dead plants respire*

1

(respiration / decay / microorganisms) releases (thermal) energy / 'heat'

ignore produce 'heat'

*do **not** allow produce energy*

*do **not** allow dead plants release 'heat'*

1

(b) (i) any **three** from:

- (opening) allows oxygen in
- microorganisms / eggs need oxygen

  allow air for oxygen
- oxygen needed for respiration
- (opening) allows release of carbon dioxide (from microorganisms / respiration / eggs)

  allow gaseous exchange (1 mark) of / for microorganisms / eggs (1 mark) if none of first four points given
- (opening) allows energy / 'heat' to escape
- (closing) retains energy / 'heat' if too cool / at night

  *if no mark awarded for either of these points allow 1 mark for vents open in the day to prevent overheating **and** close at night to prevent it getting too cold*
- (closing) retains moisture

  allow (opening) releases moisture

3

(ii) any **one** from:

- maintains sex balance

  e.g. equal / best / correct numbers of male and female
- (survival of species depends on there being) males and females in population

  allow so the offspring are not all the same sex

1

[7]

Q12.

(a) brain

in correct order only

1

blood

1

sweat

1

(b) (i) A

1

(ii) to replace ions lost (in sweat)

accept salts

allow named examples, eg. prevent cramps

1

(iii) any **one** from:

- there is too much glucose / sugar in the sports drink
- they shouldn't have too much glucose / blood sugar
- it would cause their blood glucose / sugar to rise (too high)

1

[6]

Q13.

(a) (i) (37C is the same as human) body temperature

1

(ii) any **one** from:

- urea
- glucose
- sodium

ignore water

1

(iii) (as they are) small enough to pass through (the membrane)

allow because there is a high concentration in the fake blood and a low concentration in the water (so will diffuse across)

1

(iv) glucose

1

(b) any **two** from:

- don't have to go to hospital **or** done at home rather than hospital
- less effect on lifestyle / can be mobile
- always filtering urea out

  continuous is insufficient
- don't need a medical professional (to do it for you)

  allow takes a shorter time

  allow does not have to be connected to blood vessels

  ignore 'less painful'

2

[6]

Q14.

(a) (i) defence against **or** destroy pathogens / bacteria / viruses / microorganisms

*do **not** allow 'destroy disease'*
accept engulf pathogen / bacteria / viruses / microorganism

accept phagocytosis

accept produce antibodies / antitoxins

allow immune response

1

(ii) they are small fragments of cells

1

(b) liver

in this order only

1

kidney(s)

1

(c) any **two** from:

- that it doesn't cause an immune response **or** isn't rejected / damaged by white blood cells
- whether it is a long lasting material / doesn't decompose / corrode / inert
- if it is strong (to withstand pressure)
- it will open at the right pressure
- that it doesn't cause clotting
- that it doesn't leak **or** it prevents backflow
- non toxic

  ignore correct size

2

[6]

Q15.

(a) (i) 1 hour 15 mins / 1.25 hours / 75 mins

allow 1:15

ignore 1.15 hours

1

(ii) increase in (core / body) temperature

ignore numbers

1

(due to an) increase in respiration **or** more muscle contraction

1

releasing energy (as a waste product)

allow produces 'heat'

*do **not** allow making energy*

1

skin temperature decreases

1

(because there is) sweating

1

(which) evaporates and cools the skin

ignore references to vasodilation or vasoconstriction

1

(iii) (there is) dilation of vessels (supplying skin capillaries)

allow vasodilation

allow blood vessels widen

ignore expand

*do **not** accept dilating capillaries or moving vessels*

1

(so) more blood flows (near skin) (surface) **or** blood is closer (to the skin)

ignore ref to heat

1

(c) pancreas detects (low) blood glucose

1

produces glucagon

*do **not** allow glucagon made in the liver*

1

(so) glycogen is converted to glucose

allow adrenaline released which increases conversion of glycogen to glucose

or

reduced insulin production so less glucose into cells / less glucose converted to glycogen

for 1 mark

1

[12]

Q16.

(a) (i) **A** – pituitary

allow hypothalamus

1

B – ovary / ovaries

1

(ii) in blood (stream)

accept in plasma

ignore dissolved

1

(b) (i) FSH and Luteinising Hormone (LH)

1

(ii) fertilised
OR
reference to sperm

1

form embryos / ball of cells or cell division

1

(embryo) inserted into mother's womb / uterus

allow (fertilised egg) is inserted into mother's womb / uterus

1

(iii) any **one** from:

- multiple births lead to low birth weight
- multiple births cause possible harm to mother / fetus / embryo / baby / miscarriages

allow premature

ignore reference to cost / ethics / population

1

(c) (i) any **one** from:

- almost identical

allow S (slightly) more successful

- both approximately 20%

1

(ii) larger numbers (in clinic R) (in 2007)

allow only 98 (in S) (compared to 1004 (in R))

1

results likely to be more repeatable (in 2008)

allow more reliable

*do **not** accept more reproducible / accurate / precise*

1

[11]

Q17.

(a) pancreas

apply list principle

1

(b) (i) protein

apply list principle

1

(ii) any **one** from:

- (controlling / changing) diet
  accept sugar(y foods) / named eg
  ignore references to starch / fat / protein / fibre
- exercise
  accept example, eg go for a run
- pancreas transplant
  accept named drug eg metformin

1

(c) (i) increase

ignore reference to women

1

then fall

1

relevant data quote (for male)

*eg max at ages 65–74 **or** starts at 10 (per thousand) **or** max at 130 (per thousand) **or** ends at 120 (per thousand)*

accept a difference between any pairs of numbers in data set

*accept quotes from scale eg '130' or '130 per thousand' but **not** '130 thousand'; to within accuracy of +/- 2 (per thousand)*

1

(ii) (between 0 and 64) more females (than males) **or** less males (than females)

ignore numbers

allow eg females more diabetic than males

1

(over 65) more males (than females) or less females (than males)

allow eg males more diabetic than females

1

[8]

Q18.

(a) Pancreas

allow phonetic spelling

1

(b) any **three** from:

max 2 *if any one process goes on in wrong organ*

- (amino acids) broken down
- (amino acids) form urea
- (amino acids broken down / converted **or** urea formed) in liver
- (urea / broken down amino acids) removed / filtered by kidney

  *do **not** allow amino acids filtered / removed by kidney*
- (urine / urea / broken down amino acids) stored / held in bladder

  *do **not** allow amino acids stored / held in bladder*

3

[4]

Q19.

(a) a higher concentration would be difficult to stir

1

(b) (i) methane

1

(ii) 60

100 - (5 + 35) but incorrect answer allow 1 mark

2

(c) (i) aerobic respiration

1

(ii) oxygen

1

[6]

Q20.

(a) (i) water

1

(ii) small

1

(iii) 3.15

1

(b) (i) 21 000

1

(ii) 2 years

1

(iii) prevent rejection

1

[6]

Q21.

(a) (i) without <u>oxygen</u>

ignore reference to 'air'

1

(ii) otherwise difficult to stir / to pump / to transfer

allow prevent 'clogging' owtte

1

(iii) need to stir / pump / heat

1

(b) (i) rises then falls

1

then levels / slight rise

1

quantitative descriptor
- e.g. to 80% / max. on day 4 / min. on day 16

accept other valid quantitative descriptor

allow accuracy ± ½ small square

1

(ii) 16 (15.5 to 16.4)

1

(c) any **two** from:

- oxygen present
- (CO_2 produced) by <u>aerobic</u> respiration

  or not much anaerobic respiration
- **not** much methane / CH_4 produced

2

[9]

Q22.

(a) (i) **A**

1

(ii) (protein) molecule is large

ignore letters

1

cannot pass through filter

(protein is) too big to get through the filter = 2 marks

1

(b) **B** is taken back into the blood **or**
B is reabsorbed

1

reabsorbed completely

or reabsorbed after filtration

1

(c) RBC is too big to pass through filter

1

Haemoglobin is inside red blood cells
or haemoglobin released when RBC bursts

1

Haemoglobin is small enough to pass through filter

or haemoglobin diameter

1

[8]

Q23.

(a) (i) kidney

1

(ii) bladder

1

(iii) liver

1

(iv) lung(s)

1

(v) skin

1

(b) (i) 3000

allow 2970 to 3030

*correct answer gains **2** marks with or without working*

*if answer incorrect allow **1** mark for evidence of 1550 + 450 + 1000 (allow tolerance of + or – ½ square on each)*

2

(ii) 1600

allow 1570 to 1630

1

(iii) 1400

allow (b)(i) – (b)(ii)

1

(iv) correct plot from (b)(iii)

tolerance ½ square ignore width

1

(v) cells swell / overhydrated / damaged

accept poisoned (by urea)

1

[11]

Q24.

(a) pancreas

allow phonetic spelling

1

(b) (i) A

1

shortest / quicker time (to work)

1

(ii) D

1

acts for longest time

mark dependent on D

allow D will last until 09.00 / breakfast / 24 hours

1

(iii) diet / exercise

if 'diet' is qualified, then will need correct qualification, e.g. 'less carbohydrate / sugar'

accept pancreas transplant / stem cell treatment

1

[6]

Q25.

(a) if body temperature too high blood vessels supplying skin (capillaries) dilate / widen

*do **not** accept capillaries / veins dilate/constrict*

1

if body temperature is too low blood vessels supplying skin (capillaries) constrict / narrow

*do **not** accept idea of blood vessels moving (through skin)*

1

ignore expand

accept arteries / arterioles for 'blood vessels'

if no reference to skin allow blood vessels dilate and blood vessels constrict for one mark

so more / less blood flows through skin (capillaries) or nearer the surface of the skin

must correctly relate to dilation or constriction

1

so more / less heat is lost (from the skin by radiation)

must correctly relate to dilation or constriction

1

(b) sweat released

1

cannot evaporate because of high humidity / all the water vapour in the air

1

so less heat lost / less cooling

or

it is evaporation of sweat that cools the body

1

[7]

Q26.

(a) (concentration high) in the hepatic portal vein is blood with glucose absorbed from the intestine

1

concentration is lower in the hepatic vein because insulin

1

(has caused) glucose to be converted into glycogen

1

or

allows glucose into liver cells

(b) (i) (after 6 hours) most of the glucose has been absorbed from the intestine **or** from food into the blood

1

(ii) because glucagon (made in the pancreas) causes

if biological terms incorrectly spelt they must be phonetically accurate

*do **not** accept glucagon made / produced by the liver*

1

glycogen to be converted into glucose

1

glucose released into blood

allow the liver maintains the correct / constant level of glucose in the blood

1

[7]

Q27.

(a) (i) any **one** from:

- chemical messenger / message
  allow substance / material which is a messenger
- chemical / substance produced by a gland
  allow material produced by a gland
- chemical / substance transported to / acting on a target organ
- chemical / substance that controls body functions

1

(ii) gland / named endocrine gland
brain alone is insufficient
allow phonetic spelling

1

(iii) in blood / plasma **or** circulatory system **or** bloodstream
accept blood vessels / named
*do **not** accept blood cells / named*

1

(b) *each hormone must be linked to correct action*
apply list principle
ignore the gland producing hormone

FSH stimulates oestrogen (production) / egg maturation / egg ripening
ignore production / development of egg

1

oestrogen inhibits FSH
allow oestrogen stimulates LH / build up of uterine lining

1

LH stimulates egg / ovum release / ovulation
accept LH inhibits oestrogen
accept LH controls / stimulates growth of corpus luteum
ignore production of egg

1

[6]

Q28.

(a) Y - spinal cord / central nervous system / CNS
*do **not** accept spine*
ignore nerve / nervous system / coordinator
ignore grey / white matter

1

W - receptor / nerve ending

ignore sensory / neurone / stimulus

1

X - effector / muscle

allow gland

1

(b) any **two** from: eg

accept reverse argument for each marking point

- reflex action quicker
- effect of reflex action over shorter period
- hormone involves blood system and reflex involves neurones / nerve cells

ignore nervous system / nerves

- reflex involves impulses and hormone involves chemicals
- reflex action affects only one part of the body

ignore involves brain

ignore outside / inside stimuli

2

[5]

Q29.

(a) (i) the lower the temperature the shorter the time

a trend is required

accept reverse

or

the lower the temperature the more chance of frostbite

accept the lower the temperature the faster you get frostbite

*accept positive correlation but **not** directly proportional*

ignore wind speed

1

(ii) any value from 5 to below 10

*do **not** accept 10*

*allow less than 10 **or** < 10*

1

(b) Muscles 'shiver'

*if more than two boxes ticked deduct **1** mark for each additional tick*

1

Blood vessels supplying the skin capillaries constrict

1

[4]

Q30.

(a) B

1

less / no insulin (produced) **or** insulin produced in pancreas

allow pancreas can't monitor (blood) sugar (level)

ignore pancreas can't control (blood) sugar (level)

allow increased glucagon production

*allow A as liver stores less glucose / sugar for **2** marks only*

1

(b) (i) (it / protein / insulin) digested / broken down

if ref to specific enzyme must be correct (protease / pepsin)

ignore denatured

*do **not** accept digested in mouth / other incorrect organs*

1

(ii) any **two** from:

ignore injections

- (attention to) diet

  *accept examples, eg eat less sugar(y food) **or** eat small regular meals*

  allow eat less carbohydrate / control diet

  ignore cholesterol or balanced / healthy diet

- exercise

  ignore keep fit / healthy

- (pancreas) transplant / stem cells / genetic engineering

2

[5]

Q31.

(a) 0.18

award both marks for correct answer irrespective of working

if no answer or incorrect answer

*allow **1** mark for 45 × 100 / 25000*

2

(b) heat / thermal

allow heat from respiration

1

(c) energy / mass / biomass lost / not passed on **or** energy / mass / biomass is used **or** not enough energy / mass / biomass left

ignore reference to losses via eg respiration / excretion / movement / heat

1

a sensible / appropriate use of figures including heron

*eg <u>only</u> **2** from frog / to heron*
ignore units

1

(d) any **three** from:

accept marking points if candidate uses other terms for microorganisms

- (microorganisms) decay / decompose / digest / breakdown / rot
  ignore eat
- (breakdown) releases minerals / nutrients / ions / salts / named
  ignore food
- (microorganisms) respiration
  ignore other organisms respiring
- (microorganisms / respiration) release of carbon dioxide

3

[8]

Q32.

(a) (i) (too) big

1

cannot fit / pass through filter / through (pores) in membrane / cannot be filtered
*too big to be filtered = **2** marks*

1

(ii) water

1

(iii) partially permeable

1

(b) any **two** from:

- hazards of operation / named eg
- may be rejected **or** need to use immunosuppressant drugs / long term drug use **or** transplant may need to be replaced
- susceptible to other infections
- shortage of donors
- high <u>initial</u> cost

2

[6]

Q33.

(a) proteins are not filtered

1

glucose is filtered and (re)absorbed
allow glucose (completely) reabsorbed
1

ions are filtered and some (re)absorbed
allow some ions are reabsorbed
1

urea is filtered [and some / none (re)absorbed]
allow some / no urea is reabsorbed
1

(b) more / a lot of sweating occurred
accept converse arguments for cold day
1

more / a lot of water loss (by sweating)
1

more / a lot of water reabsorption / more water absorption by the kidney
1

lower volume of urine
allow less urine / less water in urine
1

[8]

Q34.

(a) too cold / very cold **or** oxygen / microbes cannot reach it
allow not enough energy / heat / warmth
ignore frozen
1

for microorganisms / microbes / bacteria / fungi / enzyme / reaction (to work)
ignore other consumers
1

(b) no longer exist
or no more left
or died out / all died
ignore died unqualified
1

(c) (i) egg cell
1

(ii) nucleus
1

(iii) given an electric shock
1

(iv) womb
1

(d) has mammoth genes / chromosomes

accept genetic information / DNA / alleles / nucleus
accept converse

1

[8]

Q35.

(a) any **one** from:

- (in) food / named

  allow eating

- (from) respiration

  *do **not** allow breathing*

1

(b) (i) the greater / heavier the body mass the more water (should be drunk)

ignore references to hot / cold day
accept positive (relationship)
ignore figures unqualified

1

(ii) 2200

1

(iii) 400

*award **2** marks for correct answer, irrespective of working*
*allow ecf from b(ii) for **2** marks*
*if no answer or incorrect answer: 2200 - 1800 **or** b(ii) - 1800 gains **1** mark*

2

(c) need to replace water lost / prevent dehydration / keep hydrated

idea of balancing input and output

1

from / by (more) sweat

ignore other losses

1

(d) kidney

1

[8]

Q1.

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?

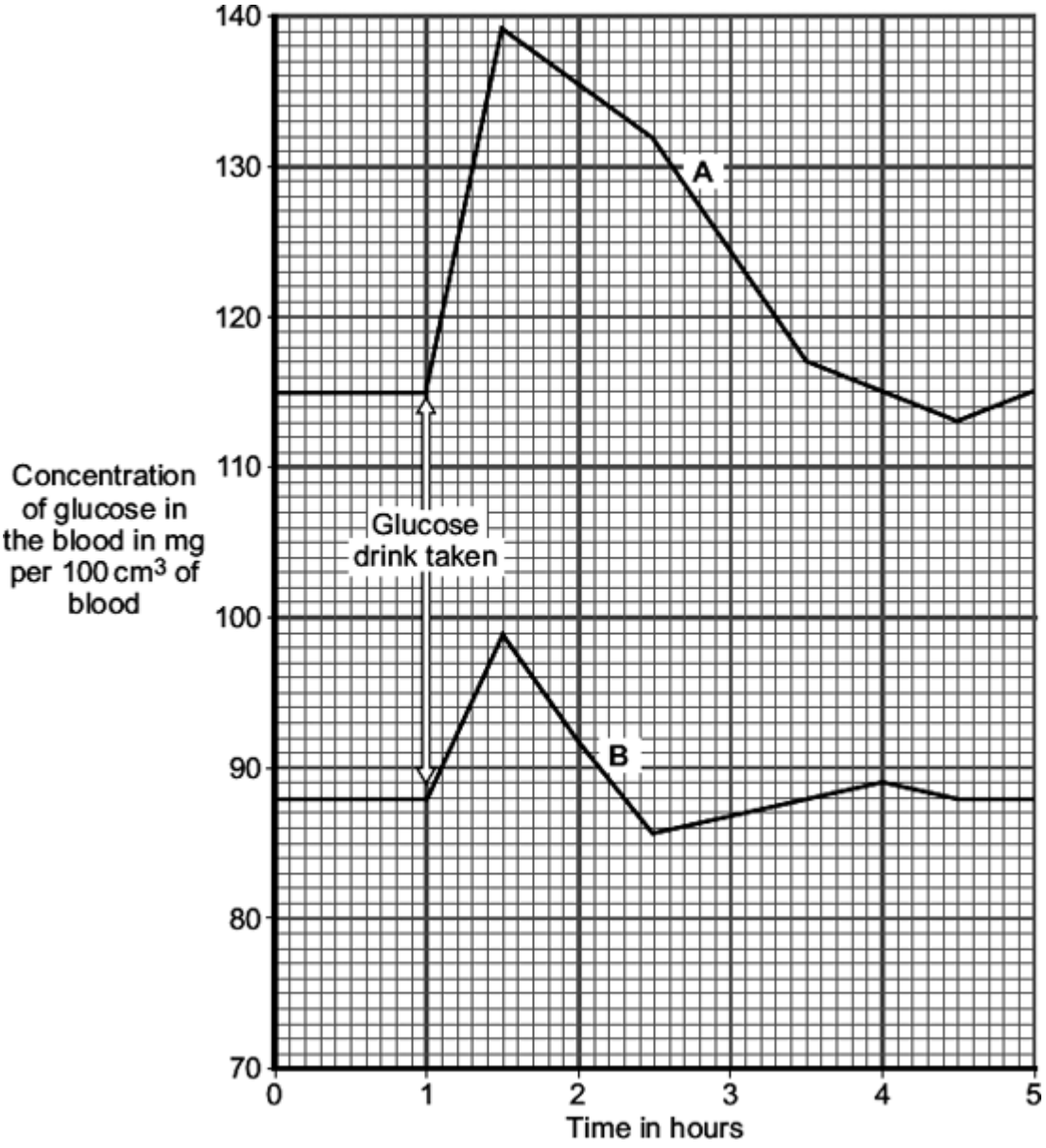
_____

(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)

Q2.

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)

Q3.

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)

Q4.

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.

_____

_____

_____

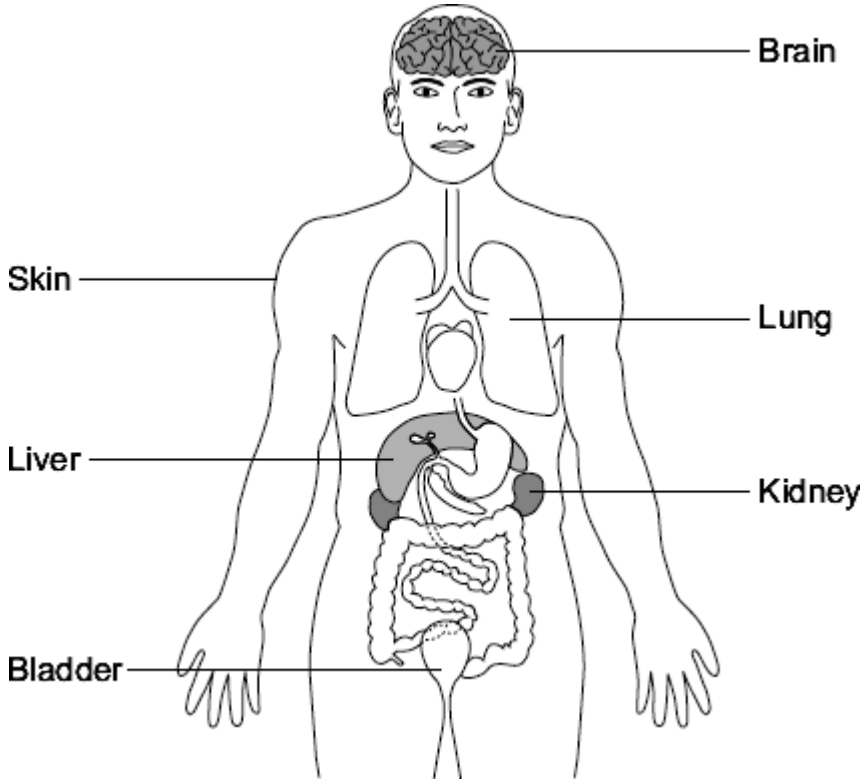
_____

(2)

(Total 7 marks)

Q5.

(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.

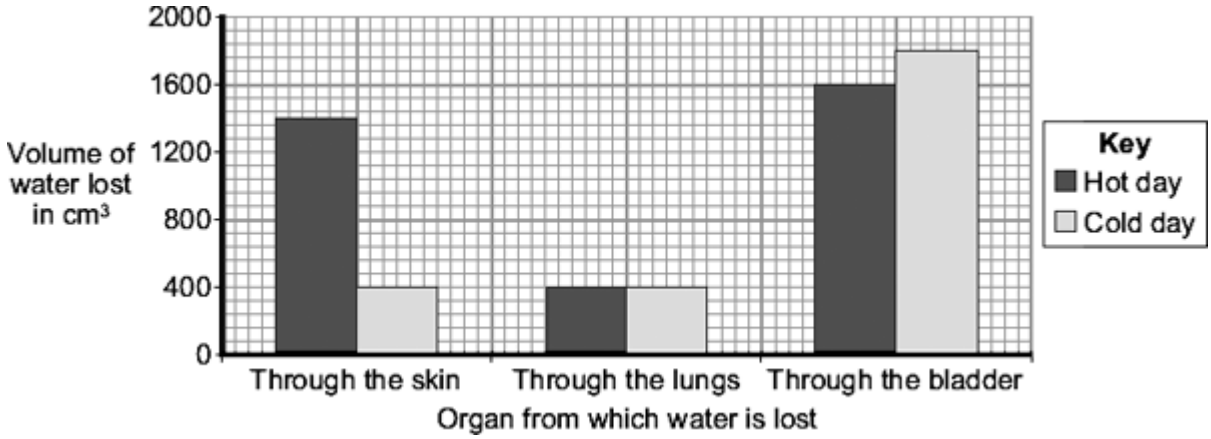
(1)

(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)

Q6.

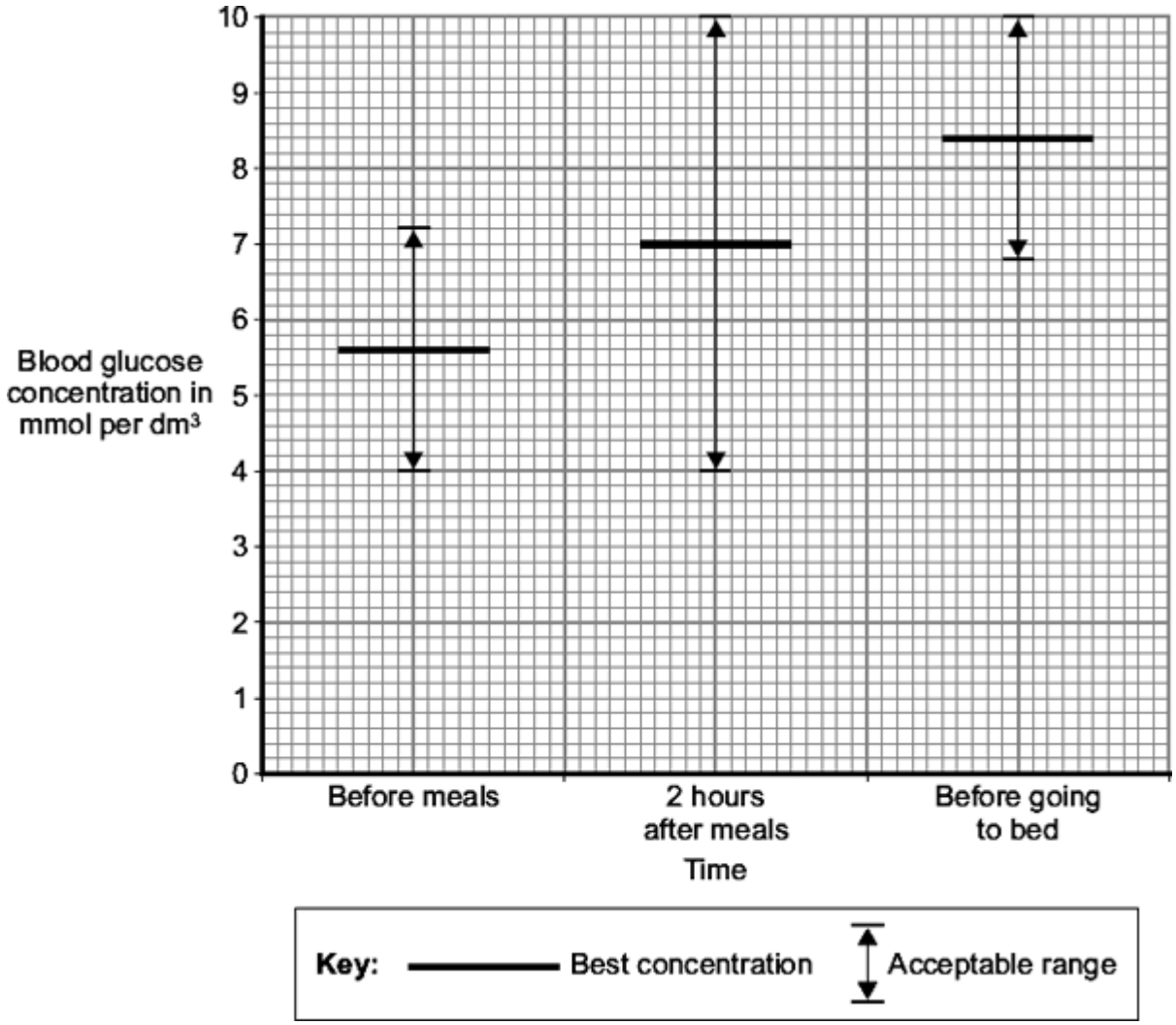
In diabetics blood glucose concentrations are sometimes abnormal.

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

(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.

Answer = _____

(3)

(Total 5 marks)

Q7.

The temperature in a sauna is much hotter than core body temperature.

A woman sits in a sauna.
The high temperature of the sauna causes the woman's core body temperature to rise.

(a) When the woman's core body temperature rises, the woman's rate of sweating increases.

Explain why.

(2)

(b) The woman comes out of the sauna.
The woman's skin looks redder than when she went into the sauna.

Describe what happened to the blood circulation in her skin to cause this change in colour.

_____

_____

_____

_____

(2)

(c) After coming out of the sauna the woman gets into a bath of icy water.
This makes the woman shiver.

(i) What process brings about shivering?

_____

_____

(1)

(ii) Shivering increases body temperature.

Explain how.

_____

_____

_____

_____

(2)

(Total 7 marks)

Q8.

(a) Urine contains mineral ions, and other substances, dissolved in water.

What effect will each of the activities in **Table 1** have on the concentration of mineral ions in the urine?

Use words from the box to complete **Table 1**.

increase	**decrease**	**stay the same**

Table 1

Activity	Concentration of mineral ions in urine
Drinking a large bottle of water	

Eating salty foods such as potato crisps	

(2)

(b) A person with kidney disease may be treated by having a kidney transplant.

Table 2 shows the effect of a person's age on the success of a kidney transplant.

Table 2

	Age of patient	
	50-59 years	**Over 60 years**
Percentage of kidneys rejected	38	23
Percentage of kidneys which continued to work for at least 5 years	82	87
Percentage of patients who survived for at least 10 years	82	76

Some doctors think that people over 60 years of age should not be given transplants.

From the data in the table, do you agree with these doctors?

Draw a ring around your answer. **Yes / No**

Give **two** reasons for your answer.

1. _____

_____

2. _____

_____

(2)

(Total 4 marks)

Q9.

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	1.0
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) Explain why protein is **not** found in the urine of a healthy person.

_____

_____

(1)

(b) 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 can be found in the urine of a person with haemolytic anaemia.

Explain why.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

Q10.

Our bodies control the concentration of glucose in the blood.

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

(a) The concentration of glucose in the blood is controlled by a

hormone called

carbohydrase.
insulin.
protease.

(1)

(b) This hormone is produced by the

intestine.
stomach.
pancreas.

(1)

(c) If the body does not produce enough of this hormone,

the person develops

diabetes.
cystic fibrosis.
Huntington's disease.

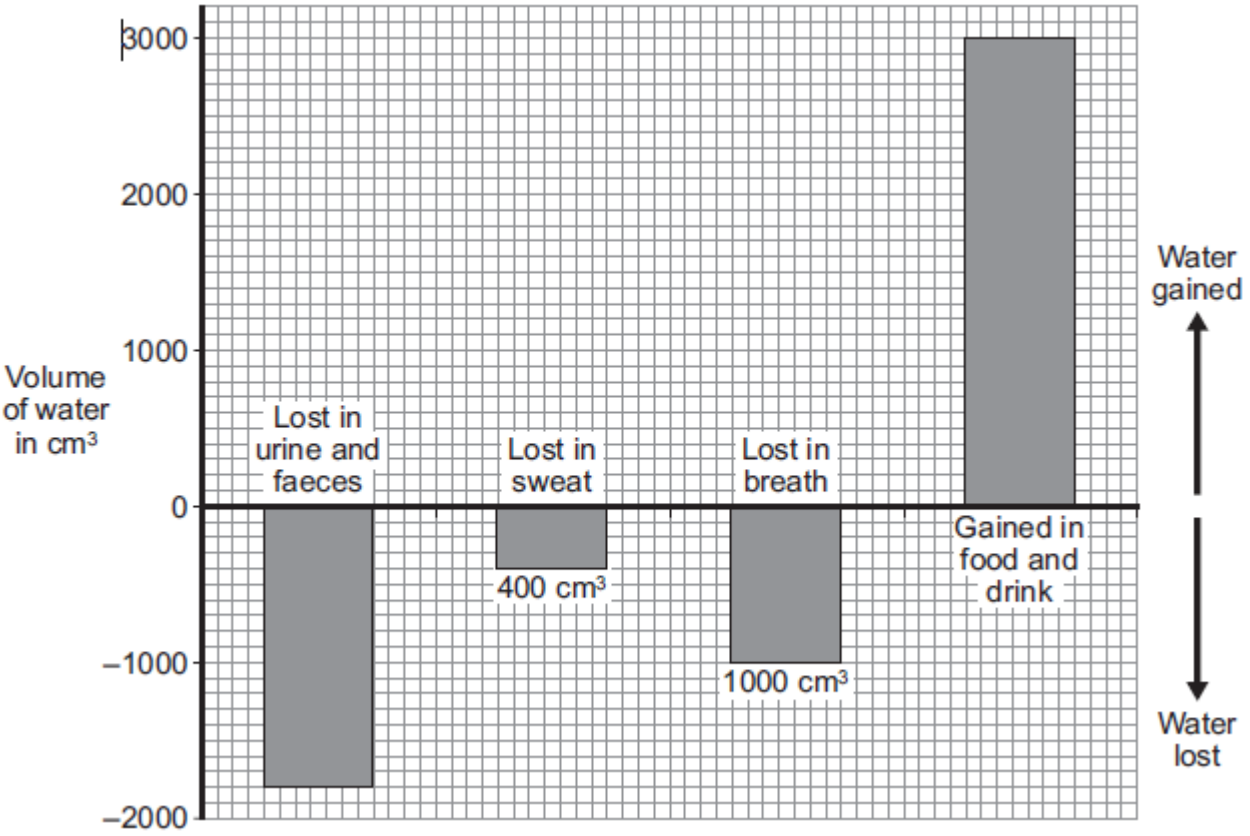
(1)

(Total 3 marks)

Q11.

The bar chart shows different ways in which water is lost from and gained by the body on one day.

The volumes of water lost in the sweat and in the breath are labelled on the bars.



(a) How much water was lost in the urine and faeces? _____ cm³

(1)

(b) Water is lost from the body in urine, faeces, sweat and breath.

What was the total volume of water lost from the body on this day?

Show clearly how you work out your answer.

_____

_____

Answer = _____ cm³

(2)

(c) The volume of water lost should balance the volume of water gained.

What should the person do to balance the water gained with the water lost?

_____

_____

_____

_____

(2)

(Total 5 marks)

Q12.

A walker falls through thin ice into very cold water.

The walker's core body temperature falls. He may die of hypothermia (when core body temperature falls too low).

(a) (i) Which part of the brain monitors the fall in core body temperature?

_____

(1)

(ii) How does this part of the brain detect the fall in core body temperature?

_____

_____

_____

_____

(2)

(b) While in the water the walker begins to shiver.

Shivering helps to stop the core body temperature falling too quickly.

Explain how.

_____

_____

_____

_____

(2)

(c) The walker had been drinking alcohol.

Alcohol causes changes to the blood vessels supplying the skin capillaries, making the skin look red.

(i) Describe the change to the blood vessels.

_____

_____

(1)

(ii) The walker is much more likely to die of hypothermia than someone who has not been drinking alcohol.

Explain why.

_____

_____

_____

_____

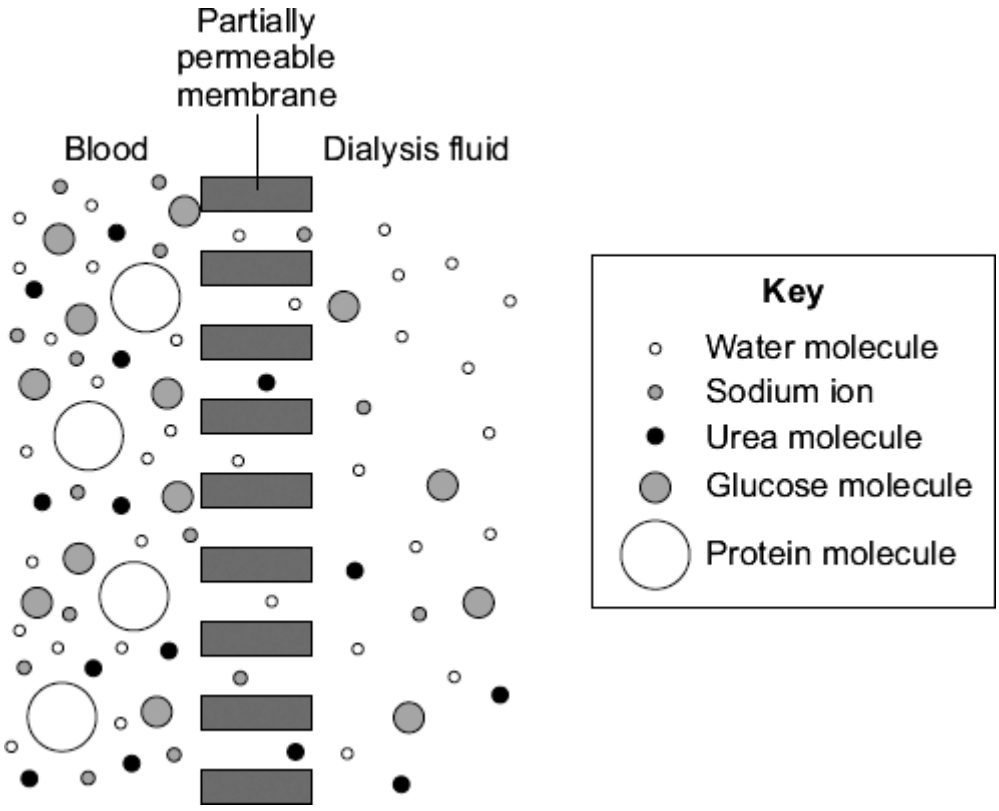
(2)

(Total 8 marks)

Q13.

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)

Q14.

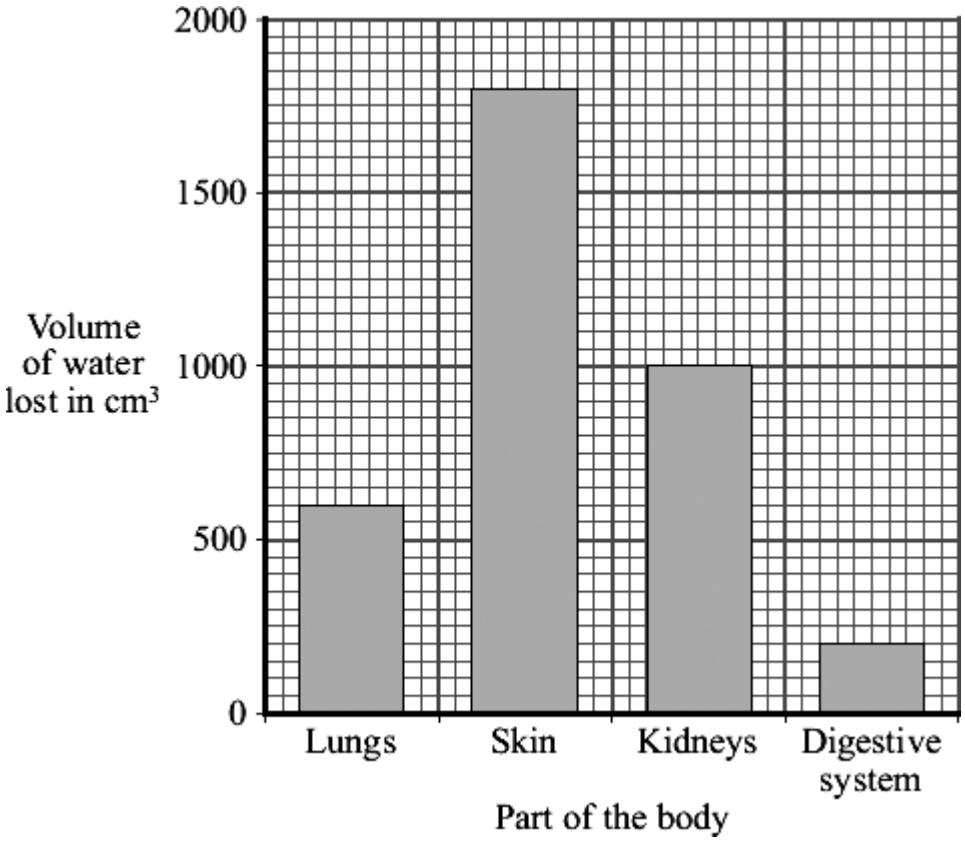
Water is lost from several parts of the body.

(a) Draw **one** line from each body part to the substance in which water is lost.

Body Part	Substance
	Urine
Kidneys	
	Faeces
Lungs	
	Sweat
Skin	
	Breath

(3)

(b) The bar chart shows the volume of water a person lost from different parts of the body during a warm day.



(i) What volume of water was lost through the skin on the warm day?

Tick (✓) **one** box.

600 cm³ ☐

1600 cm³ ☐

1800 cm³ ☐

(1)

(ii) What effect would colder weather have on the amount of water lost through the skin?

Draw a ring around your answer.

decreases **increases** **stays the same**

(1)

(iii) Give a reason for your answer.

_____

(1)

(c) What effect does cold weather generally have on the amount of urine produced?

Draw a ring around your answer.

decreases **increases** **stays the same**

(1)

(Total 7 marks)

Q15.

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

(a) Which organ in the body monitors this rise in blood sugar?

Draw a ring around your answer.

liver **pancreas** **stomach**

(1)

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

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

Chart 2 shows a diet for a person without diabetes.

Chart 1 Person with diabetes

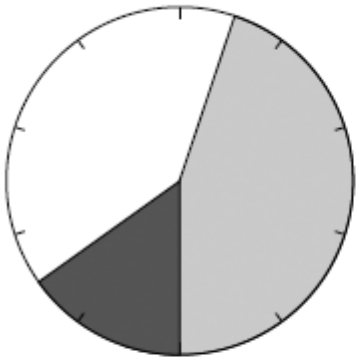
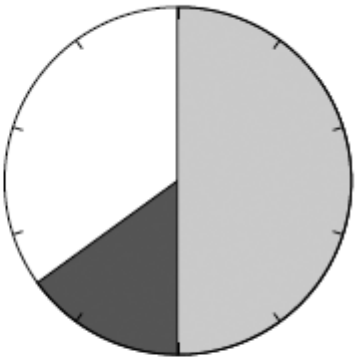
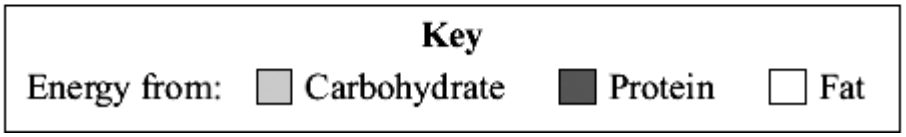


Chart 2 Person without diabetes





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

Use information from the charts.

Tick (✓) **two** box.

The diabetic should get more energy from fat. ☐

The diabetic should get more energy from protein. ☐

The diabetic should get less energy from carbohydrate. ☐

The diabetic should get less energy from protein. ☐

(2)

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

_____

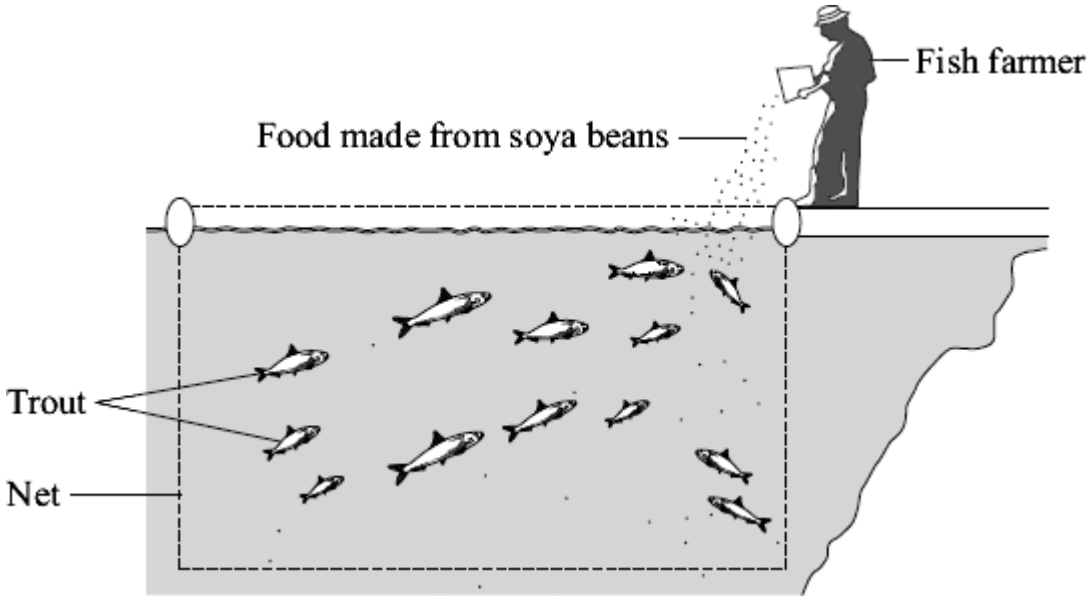
_____

(1)

(Total 4 marks)

Q16.

A fish farmer keeps trout in a large net in a lake.



The fish farmer feeds the trout on food made from soya beans.

When the trout are large enough the farmer sells them for food for people.

(a) Draw a pyramid of biomass for the three organisms in this food chain.

Label the pyramid.

(2)

(b) It would be more energy efficient if people ate the soya beans rather than eating the trout.

Which **two** of the following are reasons for this?

Tick (✓) **two** boxes.

Some people do not like eating animals such as trout. ☐

The trout release energy when they respire. ☐

Soya bean plants release energy when they respire. ☐

Some energy will be lost in waste from the trout. ☐

Soya bean plants absorb energy during photosynthesis. ☐

(2)

(c) Suggest **one** advantage to the fish farmer of keeping the trout in a large net instead of letting them swim freely in the lake.

_____

_____

(1)

(d) Some trout die before they are large enough to be sold.
The dead trout contain carbon.

Use your knowledge of the carbon cycle to describe how this carbon is returned to the atmosphere after the trout die.

_____

_____

_____

_____

_____

(2)

(Total 7 marks)

Q17.

(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**

_____

_____

_____

_____

_____

_____

_____

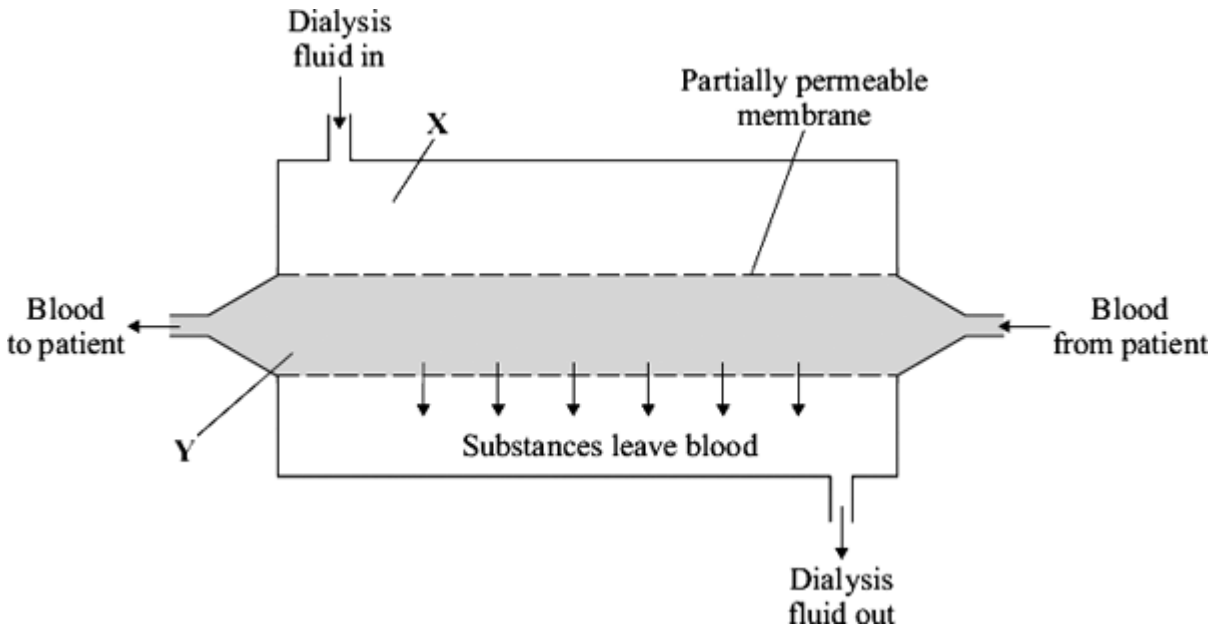
_____

(3)

(Total 9 marks)

Q18.

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 the substance

salt
urea
water

was removed from the blood.

(1)

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

because its molecules are

large.
round.
small.

(1)

(iii) The concentration of sodium ions at **X** is 3.15 grams per dm^3.

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

at **Y** would be

0.00
3.15
6.85

grams per dm^3.

(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 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 this necessary?

_____

_____

(1)

(Total 6 marks)

Q19.

A person had diseased kidneys.

The table shows the concentrations of dissolved substances in this person's urine.

Substance	Concentration in grams per dm^3
Protein	6
Glucose	0

Amino acids	0
Urea	21
Mineral ions	19

(a) One of the substances found in this person's urine would **not** be found in the urine of a healthy person.

(i) Name this substance. _____

(1)

(ii) Explain why this substance would **not** be found in the urine of a healthy person.

_____

_____

_____

_____

_____

(2)

(b) A person with diseased kidneys may be treated by dialysis.

Explain how dialysis trexatment restores the concentrations of dissolved substances in the blood to normal levels.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 7 marks)

Q20.

Drinking after exercise to replace the water lost in sweat is called rehydration. Scientists at a Spanish university investigated rehydration after exercise.

- 24 students took part in the investigation.
- All the students ran on a treadmill in a temperature of 40 °C until they were exhausted.
- 12 of the students were each given half a litre of beer to drink.
- The other 12 students were each given half a litre of tap water to drink.
- Both groups of students were then allowed to drink as much tap water as they wanted.
- The scientists measured how quickly each student rehydrated.
- The students who had been given beer rehydrated 'slightly better' than the ones given only water.

A newspaper reported the investigation.

The headline was

The newspaper headline was **not** justified.

Explain why.

_____

_____

_____

_____

_____

_____

_____

_____

(Total 3 marks)

Q21.

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)

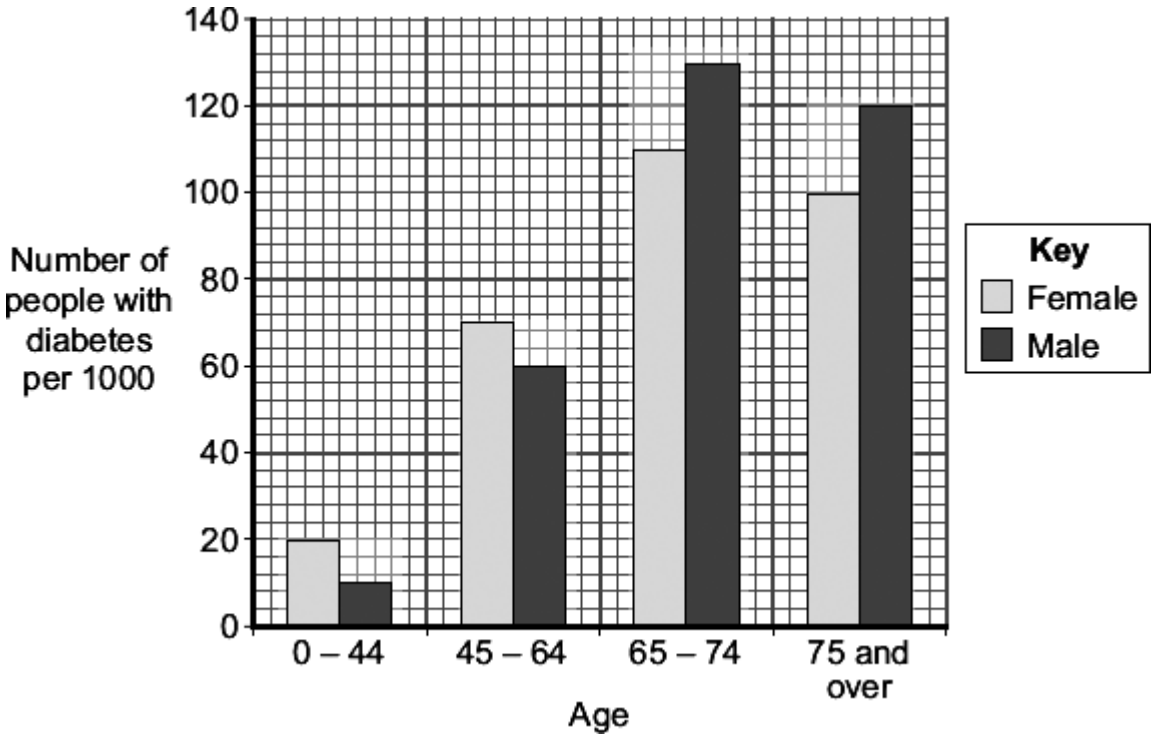
(b) Diabetics may control their blood glucose by injecting insulin.

Apart from using insulin, give **one** other way diabetics 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 and 75 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.

_____

_____

(2)

(Total 7 marks)

Q22.

Conditions inside the body must be kept constant.

(a) Urea must be removed from the body.

(i) Name the organ which makes urea.

_____

(1)

(ii) Which organ removes urea from the body?

_____

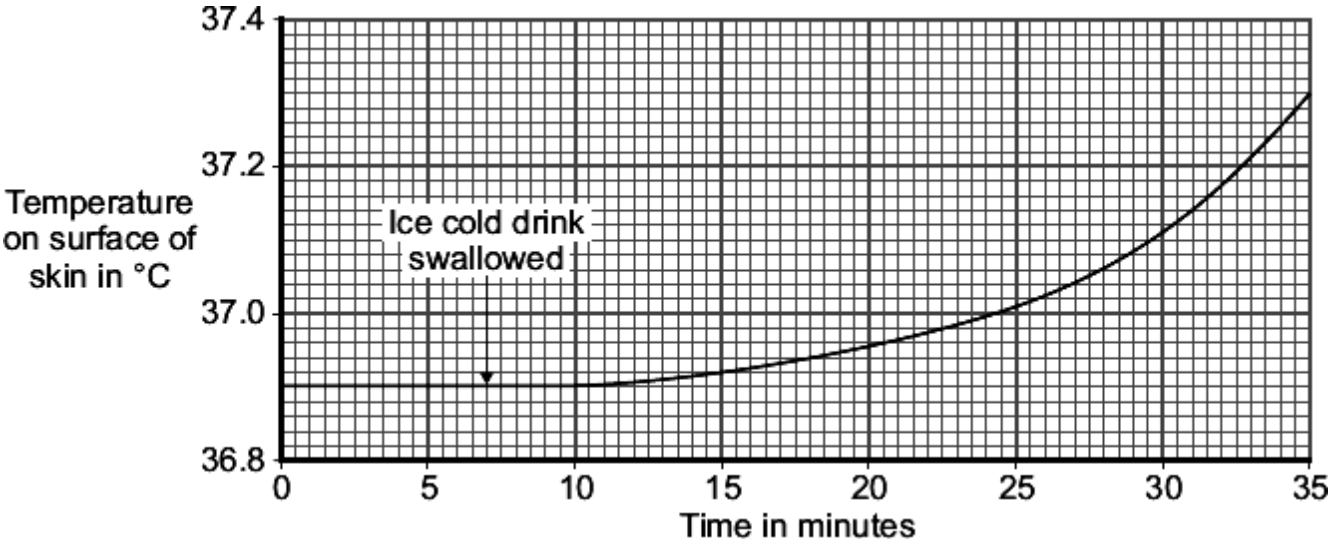
(1)

(iii) What is urea made from?

_____

(1)

A man sat in a room where the temperature was maintained at 40 °C. The temperature on the surface of his skin was monitored for 35 minutes. He swallowed an ice cold drink at the time indicated on the graph.



(b) The sweat glands contribute to the change in the temperature on the surface of the skin shown on the graph.

Explain how.

(2)

(c) The blood vessels near the surface of the skin also contribute to the changes in skin temperature shown on the graph.

(i) How do the blood vessels in the skin change when the core body temperature falls?

(1)

(ii) How does this change in the blood vessels explain the change in the skin temperature shown on the graph?

(1)

(Total 7 marks)

Q23.

The table shows the concentrations of some substances in the blood plasma, kidney filtrate and urine of one person.

Substance	Concentration in grams per dm^3		
	Plasma	Filtrate	Urine
Protein	78.0	0.0	0.0
Glucose	0.8	0.8	0.0
Urea	0.3	0.3	20.0
Sodium ions	2.8	2.8	3.5

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

(i) Protein is **not** found in the filtrate.

This is because protein molecules are

too large to pass through the filter.

used up in respiration.

reabsorbed into the blood.

(1)

(ii) Glucose is found in the filtrate but **not** in the urine.

This is because glucose is

too large to pass through the filter.

used up in respiration.

passed through the filter, then reabsorbed into the blood.

(1)

(iii) The concentration of urea is much higher in the urine than in the filtrate.

This is because

urea is made by the kidney.

water is reabsorbed from the filtrate into the blood.

glucose and salts are reabsorbed from the filtrate into the blood.

(1)

(iv) The fluid entering the bladder

water, protein, glucose, urea and sodium ions.

will contain

water, urea and sodium ions.
water, glucose, urea and sodium ions.

(1)

(b) An athlete ran a 10-kilometre race on a cold day. He then ran the same race on a hot day. He ate and drank the same on each day.

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

(i) On the **hot** day this athlete will produce

more urine.
less urine.
the same amount of urine.

(1)

(ii) On the **hot** day the athlete's urine will be

more concentrated.
less concentrated.
the same concentration.

(1)

(Total 6 marks)

Q24.

Diffusion and active transport take place in healthy kidneys.

(a) Explain what is meant by:

(i) diffusion _____

_____

_____

_____

(2)

(ii) active transport _____

_____

_____

_____

(2)

(b) Describe, as fully as you can, how urine is produced by the kidneys.

_____

(5)

(Total 9 marks)

Q25.

Waste products, such as carbon dioxide and urea, have to be removed from the body.

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

(a) Carbon dioxide is produced by

breathing
diffusion
respiration

.

(1)

(b) Most carbon dioxide leaves the body through the

kidneys
lungs
skin

.

(1)

(c) Urea is produced in the

kidneys
liver
lungs

.

(1)

(d) Urea is produced from the breakdown of

amino acids
glucose

.

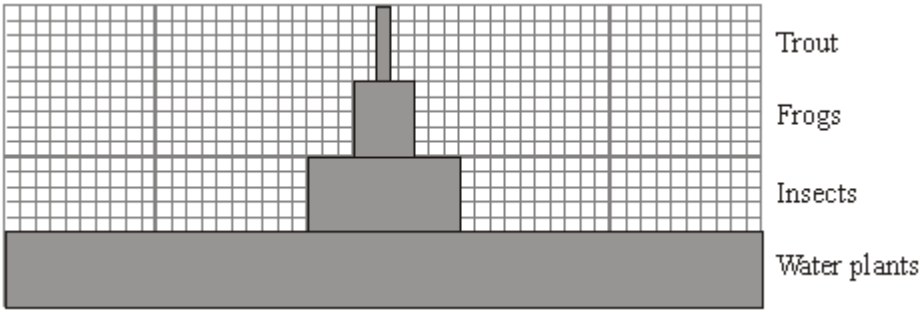
urine

(1)

(Total 4 marks)

Q26.

The diagram shows a pyramid of biomass drawn to scale.



(a) What is the source of energy for the water plants?

_____

(1)

(b) The ratio of the biomass of water plants to the biomass of insects is 5 : 1.

Calculate the ratio of the biomass of insects to the biomass of frogs.

Show clearly how you work out your answer.

_____

_____

ratio = _____ : 1

(2)

(c) Give **two** reasons why the biomass of the frog population is smaller than the biomass of the insect population.

1. _____

_____

2. _____

_____

(2)

(d) Some insects die.

Describe how the carbon in the dead insect bodies may be recycled.

_____

(4)

(Total 9 marks)

Q27.

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:

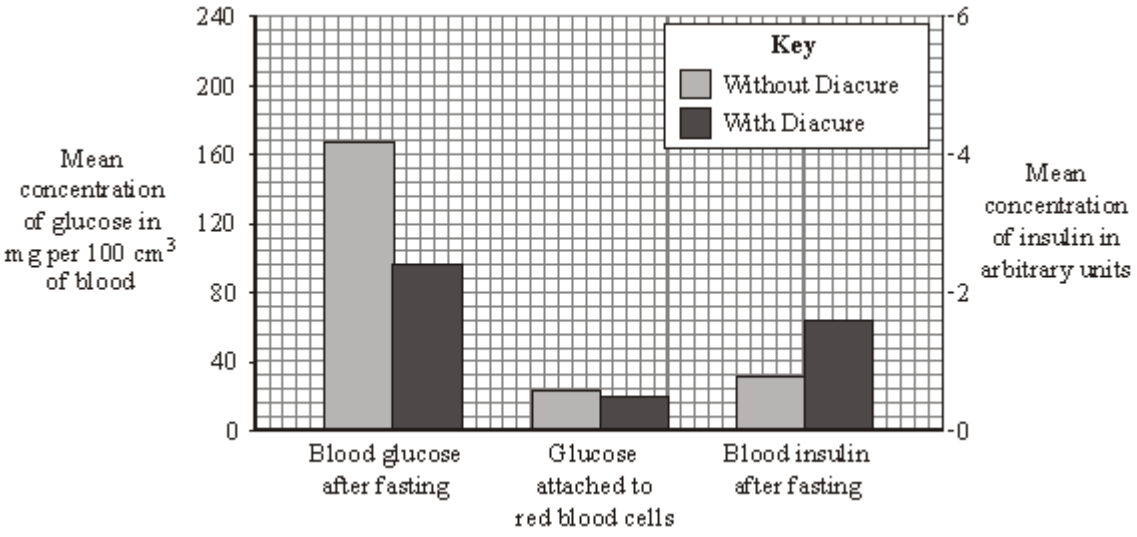
- measuring the blood glucose concentration after fasting (going without food for 12 hours)
- measuring the amount of glucose attached to red blood cells: this is a measure of the average blood glucose concentration over the previous three months
- measuring the concentration of insulin in the blood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

(1)

(Total 7 marks)

Q28.

During exercise an athlete's core body temperature may rise.

(a) What causes this rise in core body temperature?

(1)

(b) During a long race one athlete did not drink any liquid. Towards the end of the race the amount of sweat he produced began to fall.

(i) This athlete's core body temperature increased more than that of other similar athletes who had drunk enough liquid during the race.

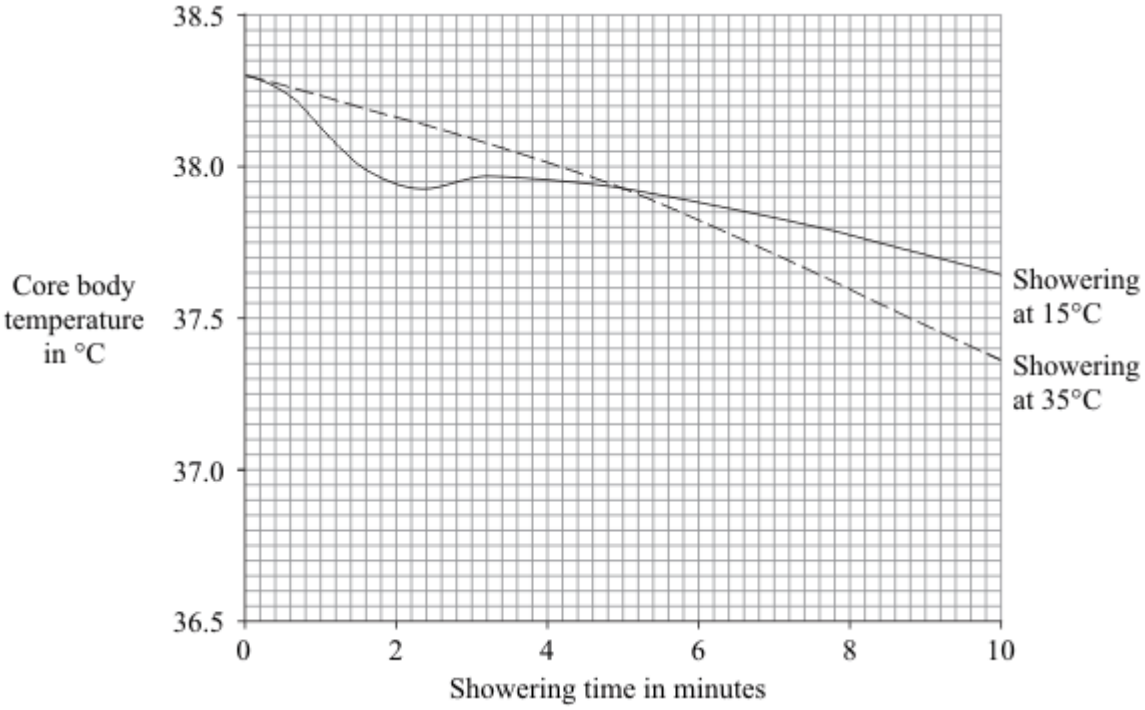
Explain why.

(2)

(ii) Describe **one** other way in which this athlete's body would respond in order to reduce core body temperature.

(2)

(c) The graph shows the effects of showering for ten minutes at 15 °C and at 35 °C on core body temperature after a long race.



Suggest an explanation for the differences in core body temperature:

(i) between 0 and 2 minutes

(1)

(ii) between 4 and 10 minutes.

(2)

(Total 8 marks)

Q29.

(a) The kidney controls the amount of water in the body.

The table shows the volume of water filtered from the blood and the volume of urine produced in one day.

	Volume in dm^3
Water filtered from blood	180
Urine	2

Calculate the volume of water reabsorbed into the blood.

Show clearly how you work out your answer.

Volume of water reabsorbed = _____ dm^3

(2)

(b) On a hot sunny afternoon, Man **A** sat in the shade, drinking beer. Man **B** went jogging in the desert.

Man **A**

Man **B**

As a result, the volume and concentration of the urine of the two men were different.

Complete the table by writing the word '**higher**' or '**lower**' in each box.

The first line has been completed for you.

	Man A	**Man B**
Volume of urine produced	higher	lower

Volume of water reabsorbed by the kidneys		
Concentration of urine		

(2)

(Total 4 marks)

Q30.

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	1.0
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) Explain why protein is **not** found in the urine of a healthy person.

_____

_____

_____

_____

(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 can be found in the urine of a person with haemolytic anaemia.

Explain why.

(3)

(Total 8 marks)

Q31.

Water can be lost from the body in several ways.
The table shows the volume of water lost by a man on a cold day.

Way in which water is lost	Volume of water lost in cm^3
In urine	2000
Through skin	600
Breathed out	300

In faeces	100
Total	**3000**

(a) Calculate the proportion of water that the man lost through his skin.

Show clearly how you work out your answer.

_____

_____

Proportion = _____

(2)

(b) More water is lost through the skin on a hot day than on a cold day.

(i) Explain why.

_____

_____

(1)

(ii) To maintain water balance in the body, the total volume of water taken in must equal the total volume of water lost.

Give **two** ways this is achieved on a hot day, when compared to a cold day.

Tick (✓) **two** boxes.

The volume of water in the urine decreases. ☐

The volume of water in the faeces increases. ☐

The volume of water taken as food or drink increases. ☐

The volume of water breathed out decreases. ☐

(2)

(c) Use words from the box to complete the sentences.

bladder	**kidney**	**liver**	**stomach**

The body cannot store amino acids.

The body converts the amino acids it cannot use into urea.

(i) Urea is made in the _____

(1)

(ii) Urea is removed from the blood by the _____

(1)

(iii) Urine is stored in the _____

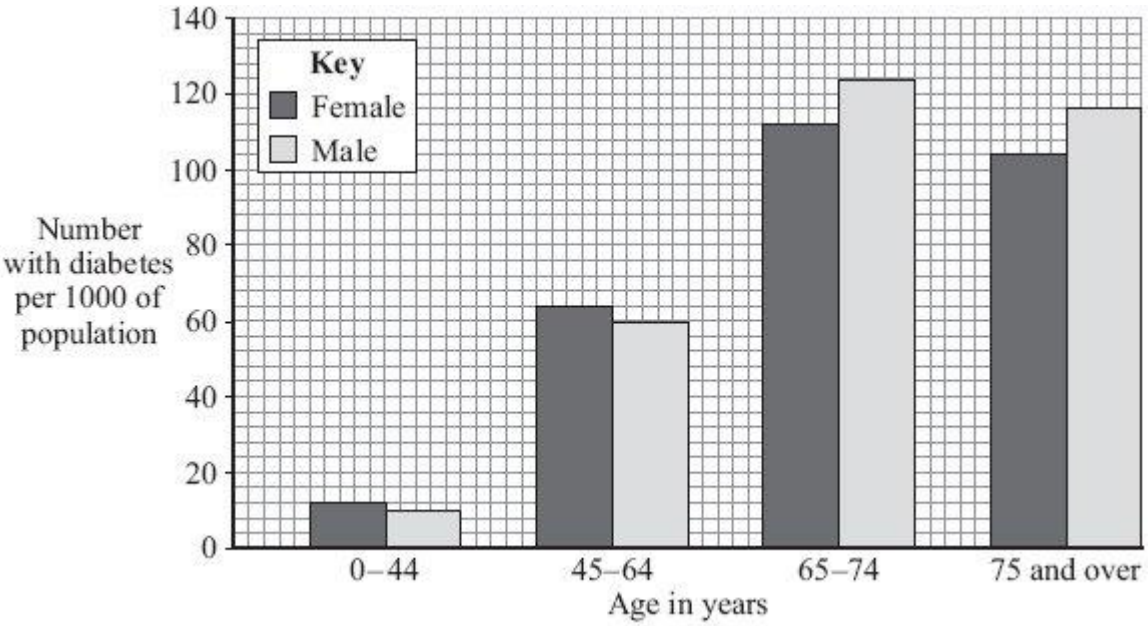
(1)

(Total 8 marks)

Q32.

Diabetes is caused when the body does not produce enough insulin.

(a) The bar graph shows the number of people with diabetes per 1000 of population.



(i) How many more males aged between 45 and 64 years of age have diabetes than males under 45 years of age?

Show clearly how you work out your answer.

_____

_____

Answer _____ per 1000 of population

(2)

(ii) Describe the way in which the number of females with diabetes changes with age.

_____

_____

_____

_____

_____

(2)

(b) One way of treating diabetes is by injecting insulin.

Insulin is a protein.

(i) If insulin is taken by mouth, it is broken down in the digestive system.

Where in the digestive system would insulin be broken down?

Draw a ring around your answer.

liver **mouth** **stomach**

(1)

(ii) Give **one** way of treating diabetes instead of using insulin.

_____

_____

(1)

(Total 6 marks)

Q33.

(a) Which **two** of the following substances are found in the urine of a healthy person?

Tick (✓) **two** boxes.

Glucose ☐

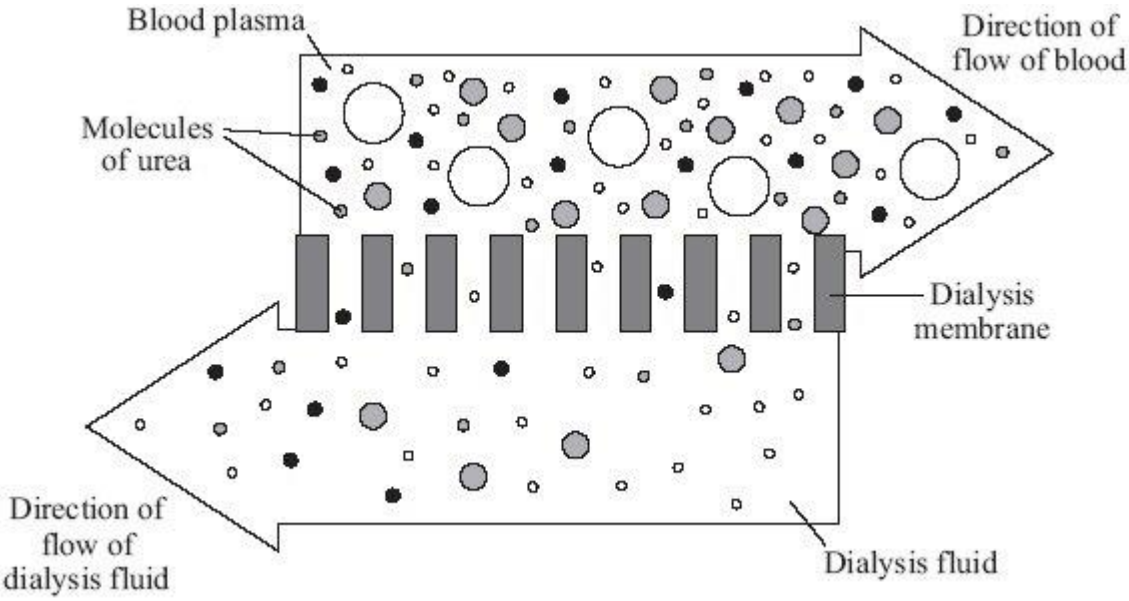
Mineral ions ☐

Proteins ☐

Water ☐

(2)

(b) A person with kidney disease can be treated by dialysis.
The diagram shows how dialysis works.
The circles represent molecules of different substances.



Draw a ring around the correct word or phrase to complete each sentence.

(i) During dialysis, urea moves out of the

blood cells
blood plasma
dialysis fluid

.

(1)

(ii) During dialysis, urea moves into the

blood cells
blood plasma
dialysis fluid

.

(1)

(iii) Urea moves by the process of

diffusion
digestion
transpiration

.

(1)

(iv) To allow the movement of urea, the dialysis membrane is

impermeable
partially permeable
thick

.

(1)

(v) The urea can pass through the membrane because

large

the urea molecules are [round / small] .

(1)

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

Tick (✓) **one** box to complete the sentence.

One major problem with a kidney transplant is that

drug treatment is needed to suppress the immune system. ☐

hospital visits are needed three times a week. ☐

yearly costs are higher than for dialysis. ☐

(1)

(Total 8 marks)

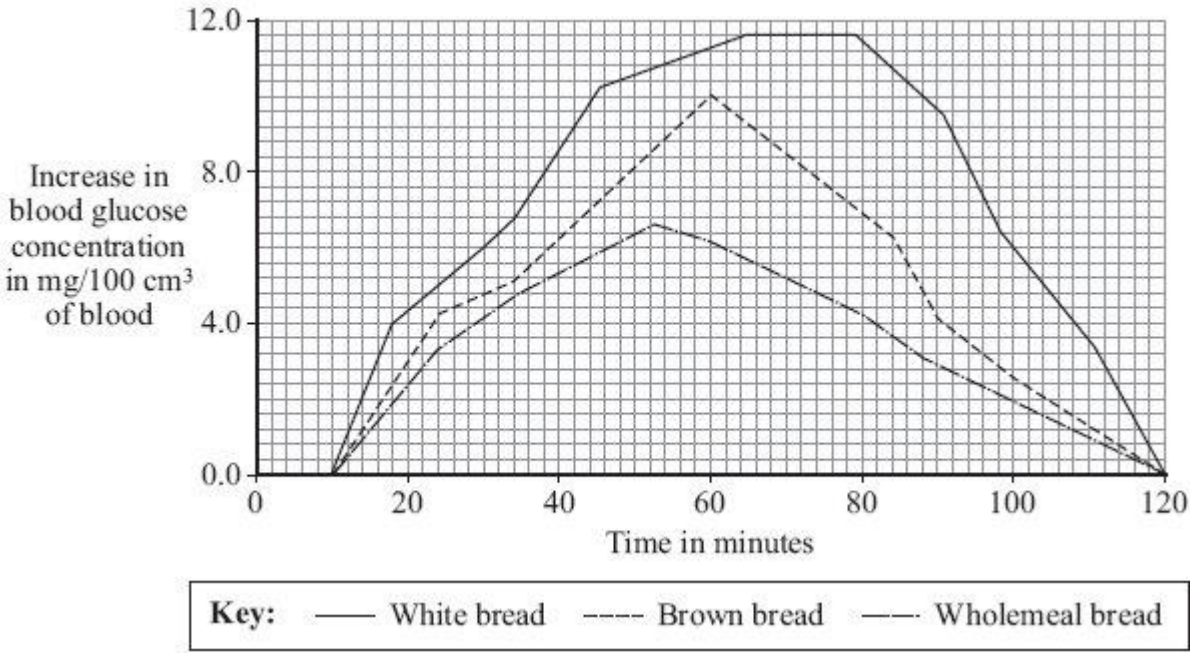
Q34.

Insulin controls blood glucose concentration.

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

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

The graph shows the results of the three experiments.



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

Type of bread _____

Give **two** reasons for your answer.

1. _____

_____

2. _____

_____

(2)

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

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

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

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

(3)

(Total 9 marks)

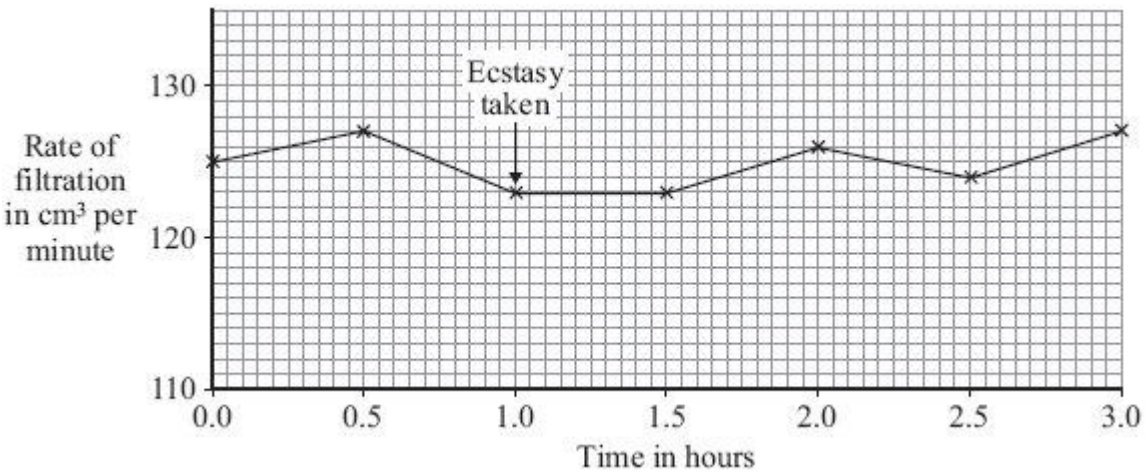
Q35.

Taking the drug ecstasy affects the rate of urine flow from the kidneys.

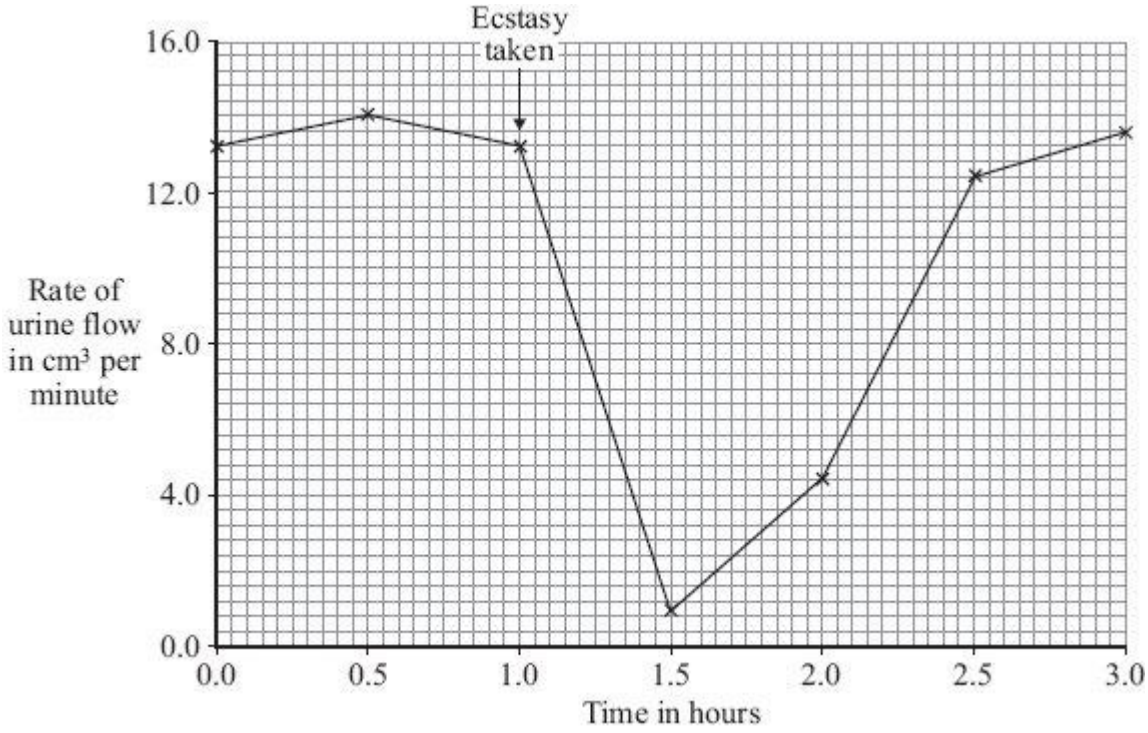
Graph 1 shows the rate of filtration by the kidneys of a healthy person.
Graph 2 shows the rate of urine flow from the kidneys of the same person.

One hour after the first measurement, the person took ecstasy.

Graph 1



Graph 2



(a) Describe the effect of taking ecstasy on

(i) the rate of filtration

_____

_____

(1)

(ii) the rate of urine flow.

_____

_____

(1)

(b) Use information from the graphs and your understanding of how the kidney works to answer the following questions.

(i) Suggest an explanation for the change in the rate of urine flow after the person took ecstasy.

_____

_____

_____

_____

(2)

(ii) After a person has taken ecstasy, the concentration of ions in the blood changes.

Suggest an explanation for this.

_____

_____

_____

_____

(2)

(Total 6 marks)

Mark schemes

Q1.

(a) (i) insulin

accept glucagon (correct spelling only)

1

(ii) pancreas

accept phonetic spelling

allow pancrease

1

(b) (i) 11(.0)

accept in range 10.5-11 (.0)

1

(ii) any **two** from:

ignore numbers unless comparative

- high(er) concentration (of blood glucose) (anywhere / any time)
  accept 115 <u>not</u> 88
  139 <u>not</u> 99
- large(r) increase (in concentration after the drink)
  accept increase by 24 <u>not</u> 11 / their b(i)
- fast(er) / steep(er) rise
  accept it takes 3 hours <u>not</u> 1 ¼ hours to get back to original level
  accept it takes a long time to get back to normal
- slow(er) fall

2

(iii) any **one** from:

- insulin present / produced
  accept glucagon not produced
- (used in) respiration
  allow exercise
- taken into cells
  allow converted to glycogen
  allow taken into liver (cells) / muscle (cells)
  allow produce / make energy

1

[6]

Q2.

(a) in rainforest:

accept converse

(water from) sweat does not evaporate (as much)

*max **1** if not clear whether desert or rainforest*

1

any **one** from:

- (due to) less wind / higher moisture / humidity
- less cooling effect

ignore references to temperature

1

(b) blood vessels supplying capillaries dilate / widen **or** vasodilation

*do **not** award mark if candidate refers only to blood vessels dilating **or** to capillaries dilating.*

*accept 'arteries' or 'arterioles' for 'blood vessels supplying, capillaries' but do **not** accept 'veins'.*

ignore expand / get bigger / relax / open

*do **not** accept idea of blood vessels moving*

1

more blood (through skin / surface capillaries) leads to greater <u>heat loss</u>

1

[4]

Q3.

(a) (i) 94.9

correct answer with or without working

*if answer is incorrect 100 - (2.5 + 2.6) gains **1** mark*

2

(ii) protein molecules in the plasma cannot pass through the filter in the kidney

1

(b) (i) partially permeable

1

(ii) the same as

1

(c) any **one** from

- hazards of operation / named example
- may be rejected / need to use immunosuppressant drugs / need to find (tissue) match

allow long term drug use

- not enough donors

allow a long waiting list

- transplants have a limited life

1

[6]

Q4.

(a) any **two** from:

*allow 2 correctly named substances for **2** marks*
ignore water

- urea
- ions / salt(s) / correct named example
  ignore minerals
- second correct named example
- hormones / named example
- allow ammonia
- allow creatinine
- allow uric acid
- allow bile pigment

2

(b) (i) glucose filtered (into kidney tubule)
accept Bowman's capsule

1

glucose reabsorbed **or** glucose taken back into blood

1

all glucose taken back into blood / all reabsorbed

1

(ii) not all glucose reabsorbed

1

because not enough time / length **or** too high
a concentration in tubule / not enough carriers

1

[7]

Q5.

(a) (i) lung

1

(ii) kidney

1

(iii) bladder

1

(b) (i) more

1

the same

1

less

allow synonyms

1

(ii) cools / reduces temperature

or

prevent overheating

ignore reference to sweat

1

[7]

Q6.

(a) pancreas

allow phonetic spelling

1

(b) 4(.0) to 7.2 **or** 7.2 to 4(.0)

1

(c) 13 – 7 = 6

*working shows 6 = **1** mark*

1

6/2 = 3 units

*accept the correct answer to the calculation, 3 units, for **2** marks, irrespective of working*

1

increase (dose)

accept indication of increase, eg extra / more / + could be in working lines

1

[5]

Q7.

(a) any **two** from

- reference to role of thermoregulatory centre detecting rise in temperature (of blood or skin) **or** / causing increase in sweating
- more evaporation

*need to refer to more at least once to gain **both** marks*

- more cooling / heat loss

  *without reference to more only award max **1** mark if both ideas given, eg cooling alone gets no marks*

2

(b) blood vessels supplying (skin) capillaries

*do **not** accept capillaries / veins*

1

or

arteries

or

arterioles

1

dilate / widen

allow vasodilation

do not accept idea of blood vessels moving

note: marks are awarded independently

*accept shunt vessels close for **2** marks*

1

(c) (i) muscle contraction

ignore relaxing

*do **not** allow vasoconstriction*

1

(ii) respiration

(respiration) releases / produces heat

reference to respiration is required for this mark

1

[7]

Q8.

(a) in table, in sequence:

allow descriptions for increase / decrease

decrease

1

increase

1

(b) **No**

older have lower % / less chance of rejection (than younger) (1)

allow figures

older have higher % / more chance of still working (after 5 years than younger)

allow figures
allow in older patients kidney works for longer

1

or

Yes

*allow max **1** mark if Yes*

older have lower % / less chance of surviving (at least 10 years than younger)
allow older people are more likely to die

1

[4]

Q9.

(a) (i) A

1

(ii) (protein molecule is) too large to pass
through the filter / cannot pass through the filter

1

(b) RBC is too big to / cannot pass through filter

1

haemoglobin released when RBC bursts
or
haemoglobin inside RBC in a healthy person

1

haemoglobin is small enough to / can pass through filter
or
haemoglobin diameter < pore diameter
or
haemoglobin only 5.5 nanometres

1

[5]

Q10.

(a) insulin
extra ring drawn cancels the mark

1

(b) pancreas
extra ring drawn cancels the mark

1

(c) diabetes
extra ring drawn cancels the mark

1

[3]

Q11.

(a) 1800

allow - / minus 1800

1

(b) 3200

award both marks for correct answer irrespective of working

allow - / minus 3200

*award **2** marks for 200 or -200 irrespective of working*

allow ecf from part (a) for both routes to 2 marks

*if no answer **or** incorrect answer then indication of addition of 1800 **or** their (a), 1000 and 400 gains **1** mark*

2

(c) drink <u>more</u> / take in <u>more</u> from food & drink

allow ecf from (b), ie if answer to (b) is less than 3000 then accept drink less

if answer to (b) is exactly 3000 accept do nothing

1

200 (cm^3)

accept ecf from (b) answer should be difference between (b) and 3000 if answer to (b) is 3000 accept they are the same

***NB** drink / take in 3200 (cm^3) of water = **1** mark*

*drink / take in 200 (cm^3) of water = **2** marks*

ignore references to exercise / sweat

1

[5]

Q12.

(a) (i) thermoregulatory centre

allow thermoregulation centre

allow hypothalamus

1

(ii) it has receptors

ignore receptors in skin

1

reference to temperature of <u>blood</u>

allow plasma for blood

1

(b) muscles <u>contract</u>

ignore relax / expand

1

increased respiration **or** more heat released

allow more heat produced

if more not given allow respiration releases / produces heat

1

(c) (i) (blood vessels / arteries / arterioles) dilate / widen

*do **not** accept capillaries dilate*
ignore blood vessels get bigger / expand
*do **not** accept idea of blood vessels moving*

1

(ii) more blood close to / near surface

allow blood is closer to the surface
*do **not** accept idea of blood vessels moving*

1

more heat lost **or** heat lost faster **or** cools faster

*do **not** allow for idea of evaporation*

1

[8]

Q13.

(a) (protein molecules too) big **or** larger than pore size

allow cannot fit through the pores / hole / gaps

1

(b) (i) diffusion

1

(ii) high to low concentration

ignore along gradient / across gradient

or high concentration in blood, low concentration in dialysis fluid

allow there is none in dialysis fluid

or down concentration gradient

or correct use of numbers

1

(c) any value between 3.15 and 3.25 (inclusive)

1

(d) (i) any **two** from:

- kidney works all the time **or** dialysis works for short time

  ignore enables an active life

  or
  dialysis needs regular trips to hospital / regular treatment / long term treatment

  accept kidney transplant is one off treatment

- kidney maintains correct concentration all the time **or** no build-up as between dialysis sessions

- no need to regulate diet **or** correct example – eg low salt / low protein / low fluid intake as with dialysis

- cheaper in the long term

2

(ii) any **two** from:

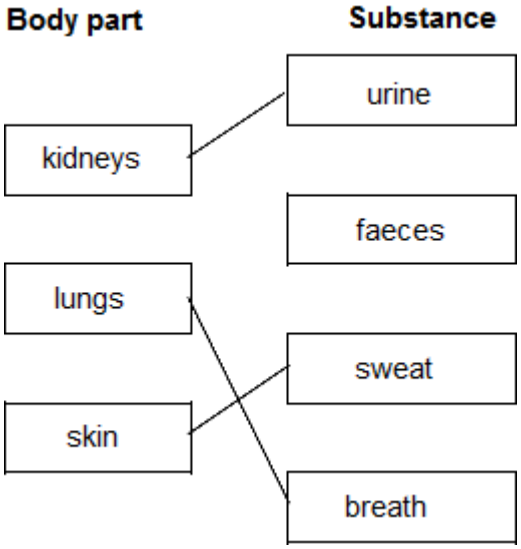
- rejection / described **or** need to use immunosuppressants **or** need to take drugs for life
  allow may need later replacement
- susceptible to other infections
- hazards of operation / anaesthetic
- shortage of donors / match
- high initial cost

2

[8]

Q14.

(a)



1 *mark per correct line*
extra line from a body part cancels the mark

3

(b) (i) 1800 cm^3

1

(ii) decreases

1

(iii) any **one** from:

- less / no sweat
- less / no cooling (needed)

- less / reduce / no heat loss / keep warm

1

(c) increases

1

[7]

Q15.

(a) pancreas

1

(b) the diabetic should get more energy from fat

1

the diabetic should get less energy from carbohydrate

1

(c) (use) insulin

allow pancreas / stem cell transplant
*do **not** allow injection / transplant /stem cells / tablets alone*
ignore exercise

1

[4]

Q16.

(a) three layer triangular pyramid

either way up (as blocks or triangle)

1

(soya / beans / food – trout / fish – people / human (in sequence)

ignore reference to producers /herbivores / consumers
*award **1** mark only for a correct food chain with 2 correct arrows showing energy flow*

1

(b) the trout release energy when they respire

1

some energy will be lost in waste from the trout

1

(c) any **one** from eg

- easy / easier to catch / more caught
  allow easy / easier to monitor
- easy / easier to feed
  allow control food
- no / less predation
  allow less fishing / poaching
- less energy loss

allow grow faster

- less movement
  ignore less space to move
  *do **not** allow easier to farm*

1

(d) any **two** from:

- microorganisms / bacteria /decomposers / microbes / fungi /detritus feeders
- decay / rot / decompose / digest /break down
  ignore biodegrade
- (microorganisms) respire
  *do **not** award this mark if response implies the trout respire*
- turned into fossil fuels / named fossil fuels
- carbon dioxide / $CO_{2\ released}$

2

[7]

Q17.

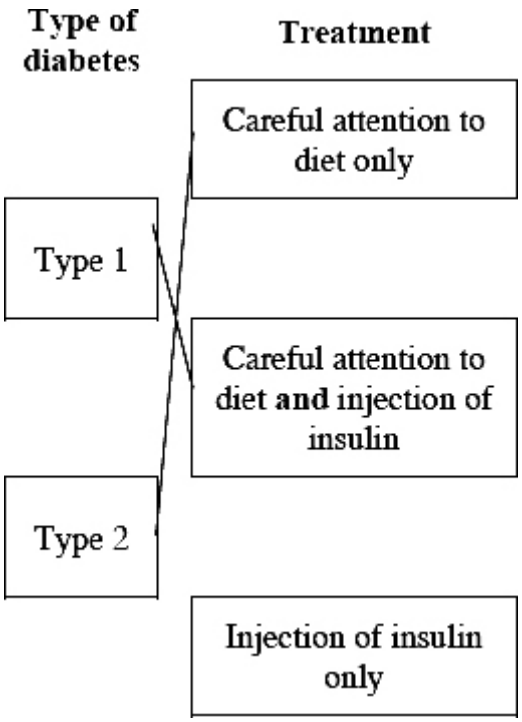
(a) (i) pancreas
allow phonetic spelling

1

(ii) (increases movement of) glucose into cells / organs / named
allow (glucose) converted to glycogen / fat
allow (glucose) used in (increased) respiration
*do **not** allow hybrid spellings of glycogen*

1

(b)



1 *mark per correct line*
extra line from a type of diabetes cancels the mark

2

(c) (i) protein

1

(ii) gene / allele

1

(iii) any **three** from:
*max **2** if any one process goes on in the wrong organ*

- (amino acids) broken down /converted
- (amino acids) form / into urea
- (break down / convert / urea formed) in liver
- (urea / broken down amino acids) removed / filtered by kidney
- (urea / broken down amino acids) in urine
- (urine / urea / broken down amino acids) stored / held in bladder

3

[9]

Q18.

(a) (i) water

1

(ii) small

1

(iii) 3.15

1

(b) (i) 21 000

1

(ii) 2 years

1

(iii) prevent rejection

1

[6]

Q19.

(a) (i) protein

1

(ii) (protein molecules too) large

1

cannot pass through filter **or** can't leave blood **or** can'it pass into kidney tubule / named part

*NB holes in the filter are too small = **2** marks*

1

(b) any **four** from:

- use of partially permeable membrane **or** only small molecules can pass through membrane
- dialysis fluid has 'ideal' concentrations of solutes

  allow correct named example
- diffusion of waste substances out of blood

  accept named example – eg urea

  or
  waste passes from <u>high to low concentration</u>
- reference to equilibrium (between plasma & dialysis fluid)

  accept reference to counterflow to maintain concentration gradient

4

[7]

Q20.

only 24 students tested **or** only one test **or** reference to lack of controls eg gender / age

1

students could drink as much water as they wanted

or

some students drank more water than others

or

some students drank water and beer

1

differences only slight

ignore effects of beer or promotion of beer drinking

1

[3]

Q21.

(a) pancreas

1

(b) any **one** from

- (controlling / changing) diet

  accept descriptions as to how diet could be changed eg eat less sugar(y foods) ignore reference to fat / protein

- exercise

  accept example eg go for a run

- pancreas transplant

  accept named drug eg metformin

1

(c) (i) increase

ignore reference to women

1

then fall

1

relevant data quote (for male)

max at ages 65 - 74

eg starts at 10 (per thousand) ***or*** *max at 130 (per thousand)* ***or*** *ends at 120 (per thousand)*

accept a difference between any pairs of numbers in data set

quoting of scale or per thousand but not 'thousands'
accuracy ± 2

1

(ii) *ignore numbers*

(between 0 and 64) more females (than males) / less males

allow eg females more diabetic than males

1

(over 65) more males (than females) / less females

1

[7]

Q22.

(a) (i) liver

1

(ii) kidney

allow urethra / bladder

ignore ureter

1

(iii) (excess) protein / named / amino acids

accept amino / ammonia

1

(b) less / no sweating

allow ideas of how sweat glands change in order to reduce sweating

1

less heat lost / evaporation

1

(c) (i) become narrower / constrict

allow contract / get smaller etc

allow less blood flows through vessels

*do **not** allow capillaries become narrower **or** reference to movement of vessels*

1

(ii) reduced / no heat loss

allow heat gained from room

1

[7]

Q23.

(a) (i) too large to pass through the filter

1

(ii) passed through the filter, then reabsorbed into blood

1

(iii) water is reabsorbed from the filtrate into the blood

1

(iv) water, urea and sodium ions

1

(b) (i) less urine

1

(ii) more concentrated

1

[6]

Q24.

(a) (i) movement of atoms / molecules / ions

accept particles

allow dissolved substances

ignore reference to membranes

1

(substance) moves from high to low concentration

allow down the gradient ignore

across / along / with a gradient

1

(ii) any **two** from:

- movement of molecules / ions

  accept particles

  allow dissolved substances this point <u>once</u> only in (a)(i) and (a)(ii)

- from low to high concentration

  allow up / against the gradient

  ignore across / along / with a gradient

- requires energy / respiration

  accept requires ATP

2

(b) • **<u>filtration</u>** of blood **or**
described re small (molecules)through / large not

ignore diffusion

1

max **four** from:

- **<u>reabsorption</u>** / substances taken back into blood
- (reabsorption) of <u>all</u> of the sugar / glucose
- (reabsorption) of <u>some</u> of ions / of ions <u>as needed</u> by body
- (reabsorption) of <u>some</u> of water / of water <u>as needed</u> by the body
- urea present in urine

  accept urea not reabsorbed

- reabsorption of water by <u>osmosis</u> / <u>diffusion</u> **or** reabsorption of sugar / ions by <u>active transport</u>

4

[9]

Q25.

(a) respiration

clear indication eg tick, underlining, others crossed out

1

(b) lungs

1

(c) liver

1

(d) amino acids

1

[4]

Q26.

(a) the sun / light / sunshine / solar

allow radiation <u>from the sun</u>
ignore photosynthesis / respiration
apply list principle
*do **not** allow water / minerals / heat*

1

(b) 2.5 (:1)

correct answer with or without working

ignore rounding with correct working
*do **not** allow other equivalent ratios for both marks*
*evidence of selection of 10(insects) **and** 4(frogs) **or** 50 **and** 20 **or** 1 **and** 0.4 for **1** mark*

if no other working allow **1** mark for 0.4:(1) on answer line

2

(c) any **two** from:

*allow for insects **or** frogs*
allow energy for biomass

- some parts indigestible / faeces
- waste / examples of waste eg urea / nitrogenous compounds / urine / excretion
- movement / eg of movement
  allow keeping warm
- heat
- not all eaten / eg of not all eaten
- respiration
  do not accept energy for respiration

2

(d) any **four** from:

- (bodies) consumed by animals / named / scavengers / detritus feeders
- microorganisms / bacteria / fungi / decomposers
- reference to enzymes
- decay / breakdown / decompose / rot
  ignore digest(ion)
- respiration
- carbon dioxide produced
- photosynthesis
- sugar / glucose produced
  accept other organic molecules
- fossilisation / fossil fuels / named
- combustion / burning
  must be linked with fossilisation / fossil fuels
- (burning) produces carbon dioxide
  allow carbon dioxide produced once only

4

[9]

Q27.

(a) (i) pancreas
allow phonetic spelling

1

(ii) glucose into cells / liver / muscles
allow any named organ / cell
allow turned into / stored as glycogen
but
*do **not** allow hybrid spellings for glycogen*
allow increases respiration
allow stored as / turned into fat

1

(b) (i) reference to “98.6% of all people who used Diacure reported an improvement in their condition”.
*allow claim **1** / **1** / the first one*

1

(ii) (only) 30 patients **or** not enough / not many patients
*allow only one trial **or** only done once **or** not repeated*
ignore bias

1

(iii) little effect / difference

allow no effect

allow only drops by 4 (±1)

1

suggest drug is not effective (in long term)

allow wouldn't persuade people to take it

1

(iv) avoid bias / owtte

eg company could change / ignore results / might lie

ignore fair / accurate / reliable / valid

1

[7]

Q28.

(a) respiration

*allow muscle contraction **or** muscle movement **or** exercise of muscles*

allow metabolism / chemical reactions

1

(b) (i) any **two** from:

- less / no water (available) for sweat

  allow dehydrated so less sweat

  allow converse if evident that response refers to athletes who have drunk liquid

- less / no heat lost / less / no cooling

  only need to refer to less / no once

- less / no evaporation (of sweat)

2

(ii) **either**

blood vessels supplying the skin **or**
blood vessels in skin

*do **not** allow first mark if implied that skin capillaries dilate*

1

dilate / widen / muscles relax

ignore enlarge / open

*vasodilation in skin = **2** marks*

*allow hairs lie flat for **1** mark*

*allow less insulation for **1** mark if linked to hairs*

*allow more blood in skin for **1** mark if no other marks awarded*

1

(c) (i) cold / 15°C cools the body / blood (more)

or *reverse argument*

ignore reference to values for body temperature derived from graph

1

(ii) any **two** from:

- cools slower at 15°C cold / 15°C
  allow converse arguments
- cold / 15°C causes reduced blood flow to surface / skin
  ignore reference to capillaries
- blood not cooled as much / as quickly
- cold / 15°C causes shivering
- muscles contract / more respiration / heat made

2

[8]

Q29.

(a) 178

ignore working or lack of working

correct working: 180 – 2 but no answer / wrong answer = ***1*** *mark*

2

(b)

Man A	Man B
higher	lower
lower	higher
lower	higher

all 4 cells correct = **2** marks
2 or 3 cells correct = **1** mark
0 or 1 cells correct = **0** mark

2

[4]

Q30.

(a) (i) **A**

1

(ii) (protein) molecule is large

ignore letters

1

cannot pass through filter

*(protein is) too big to get through the filter = **2** marks*

1

(b) **B** is taken back into the blood **or B** is reabsorbed

1

reabsorbed completely
or reabsorbed after filtration

1

(c) RBC is too big to pass through filter

1

Haemoglobin is inside red blood cells
or haemoglobin released when red blood cell bursts

1

Haemoglobin is small enough to pass through filter
or haemoglobin diameter < pore diameter

1

[8]

Q31.

(a) $\frac{1}{5}$ / 20% / 1 in 5 / 1 : 4 / 0.2 /

any correct proportion
ignore working
*do **not** allow 1 : 5*

$\frac{600}{3000}$ / 600 : 2400 / 600 in 3000

*award **1** mark for*
*selection of 3000 **and** 600*

2

(b) (i) sweat / sweating / perspiring

allow cooling / for cooling / to lose heat / to cool

1

(ii) the volume of water in the urine decreases.

1

the volume of water taken as food or drink increases.

1

(c) (i) liver

apply list principle

1

(ii) kidney

apply list principle

1

(iii) bladder

apply list principle

1

[8]

Q32.

(a) (i) 50

*award **2** marks for correct answer irrespective of working*
*award **1** mark for selection of 60 **and** 10*

2

(ii) any **two** from:

- increases
- (then) decreases
- highest at 65 – 74 (years old) **or** maximum 112 (per thousand)

allow peaks at 65 - 74
ignore comparisons with men

2

(b) (i) stomach

1

(ii) any sensible reference to diet **or** carbohydrate intake **or** pancreas / stem cell transplant

*eg eat less / no sugary food **or** eat more fibre **or** go on a diet **or** watch what you eat*
ignore eat more protein
*do **not** accept reduce salt*

1

[6]

Q33.

(a) mineral ions

1

water

*each extra box ticked cancels **1** mark*

1

(b) (i) blood plasma

1

(ii) dialysis fluid

1

(iii) diffusion

1

(iv) partially permeable

1

(v) small

1

(c) drug treatment is needed to suppress the immune system

1

[8]

Q34.

(a) (i) (wholemeal bread)
any **two** from:

lower maximum / peak / less change

1

slower rise / change

*ignore references to rate of fall **or** first to peak*

need to take less insulin / less likely to hyper

*no mark for identifying the type of bread but max **1** mark if not identified*

1

(ii) any **four** from:

- amylase / carbohydrase
- starch to sugar
  allow starch to glucose
- (sugar) absorbed / diffused / passes into blood
- correct reference to pancreas
  allow once only as rise or fall
- insulin produced
- glucose (from blood) into cells / tissue / organ **or** named tissue / organ
  allow glucose to glycogen
- glucose used in respiration / for energy
  max 3 for explaining rise
  max 3 for explaining fall

4

(b) any **three** from:

advantages (compared to insulin injections):

- (may be) permanent / cure
- no / less need for self monitoring
- no / less need for insulin / injections

ignore reference to cost

- no / less need for dietary control

disadvantages (compared to insulin injections):

- low success rate
- (may) still need insulin / dietary control
- operation hazards
- risk of infection from donor
- rejection / need for drugs to prevent rejection

*max **2** if only advantages **or** only disadvantages discussed*
can give converse if clear that it relates to insulin injections

3

[9]

Q35.

(a) (i) no effect / little effect

1

(ii) reduced

ignore reference to later increase

1

(b) (i) more (re)absorption

do not allow if extra incorrect reference to filtration made

1

or more (material) taken into blood

of water

*allow **only** if linked to reabsorption*
*do **not** accept water if in a list of substances*

1

(ii) ions in blood diluted

1

or concentration of ions decreases

increased water reabsorption

do not allow if extra incorrect reference to filtration made

or more water present in blood

accept sensible alternative suggestion
eg reabsorption of ions disrupted

1

[6]

Q1.

(a) Use words from the box to complete the sentences about controlling conditions in our bodies.

kidneys	liver	lungs	skin

(i) When we breathe out, water leaves the _____

(1)

(ii) When we sweat, water leaves the body through the _____

(1)

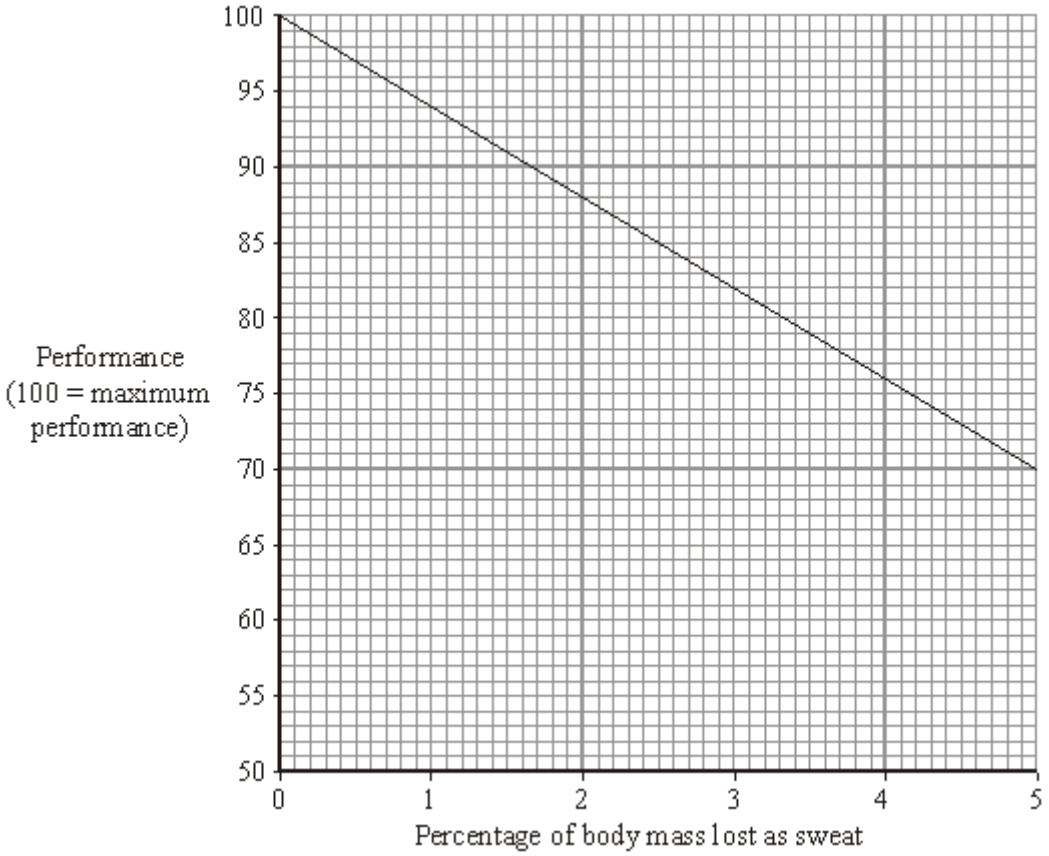
(iii) Excess water leaves the body in a liquid called urine.

Urine is produced by the _____

(1)

(b) We lose a lot of sweat during exercise. When this happens, we cannot perform as well as we could at the start of the exercise.

The graph shows the effect of losing sweat on the performance of an athlete.



(i) Describe the effect of losing sweat on performance.

_____

_____

(1)

(ii) How can athletes reduce this effect on performance?

_____

_____

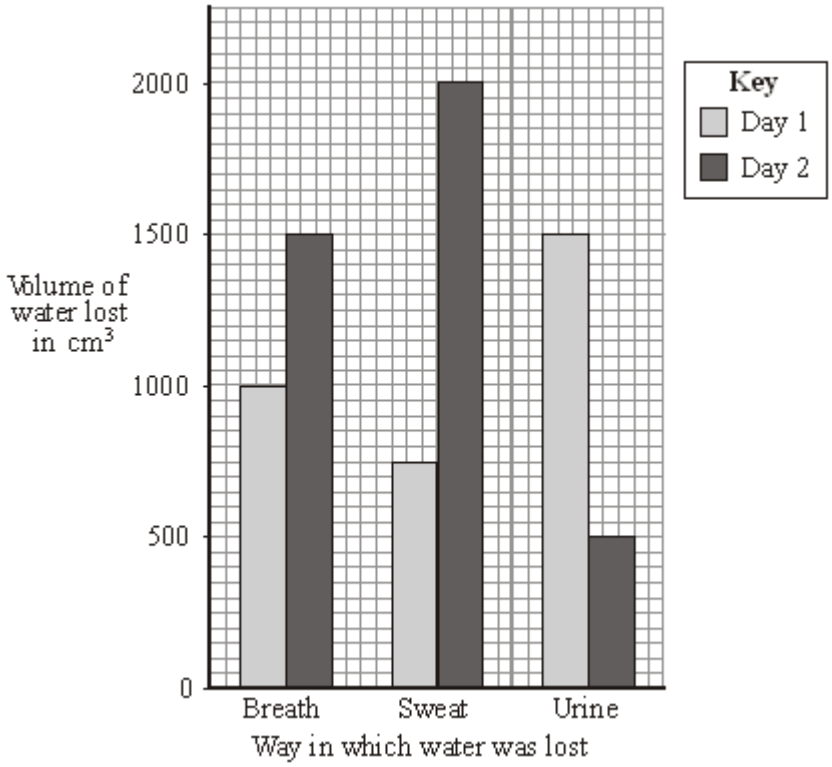
(1)

(Total 5 marks)

Q2.

The bar chart shows the amount of water lost from the body of a student on two different days.

The student ate the same amount of food and drank the same amount of liquid on the two days. The temperature of the surroundings was similar on the two days.



(a) The total volume of water lost on day 1 was 3250 cm^3.

How much water was lost on day 2? Show all your working.

_____

_____ cm^3

(2)

(b) The student did much more exercise on one of the days than on the other.

On which day did he do more exercise? Day _____

Give **two** reasons for your answer.

1. _____

_____

2. _____

_____

(2)

(c) (i) Which **one** of these is a chemical reaction that produces water in the body?

Put a tick (✓) in the box next to your choice.

Breathing	☐
Osmosis	☐
Respiration	☐
Sweating	☐

(1)

(ii) How does sweating help the body?

_____

_____

(1)

(iii) If the body loses more water than it gains, it becomes dehydrated.
The concentration of the solution surrounding the body cells increases.
This causes the cells to lose water.

By which process do cells lose water?

Put a tick (✓) in the box next to your choice.

Breathing	☐
Osmosis	☐
Respiration	☐
Sweating	☐

(1)

(Total 7 marks)

Q3.

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)

Q4.

The brain and the skin are involved in monitoring and controlling body temperature.

(a) Describe the parts played by the brain and the skin in monitoring body temperature.

(i) The brain

_____

_____

_____

_____

(2)

(ii) The skin

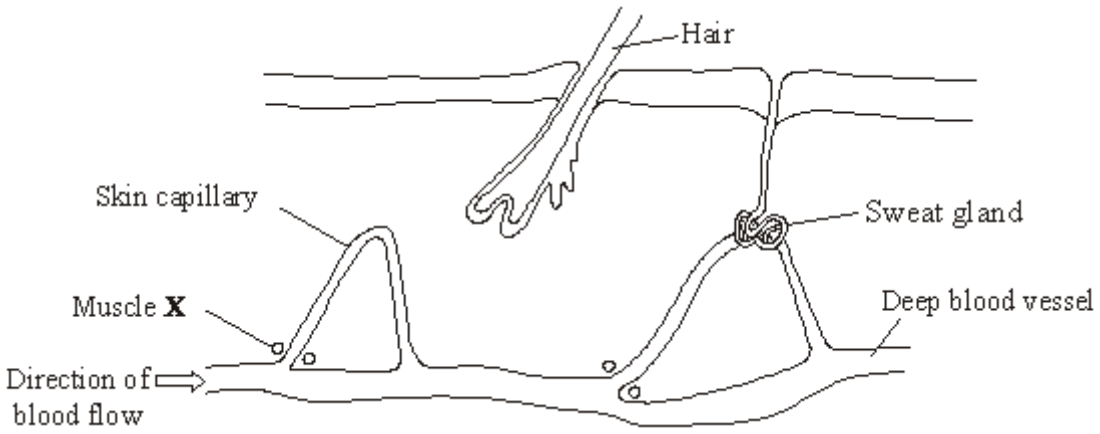
_____

_____

(1)

(b) The diagram shows a section through part of the skin.

The muscle labelled **X** controls the flow of blood into the skin capillary. When muscle **X** contracts, the flow of blood into the skin capillary is reduced.



Explain the role of muscle **X** in the control of body temperature.

_____

_____

_____

_____

_____

_____

(3)

(Total 6 marks)

Q5.

(a) (i) Urine is made in the kidneys and stored for a few hours before being released from the body.

In which organ of the body is urine stored? Draw a circle around **one** answer.

bladder **large intestine** **liver**

(1)

(ii) Which **two** of the following substances are **not** found in the urine of a healthy person?

Tick (✓) **two** boxes.

glucose ☐

mineral ions ☐

protein ☐

urea ☐

(2)

(b) A person with kidney disease may be treated by dialysis or by having a kidney transplant.

Read the information about dialysis and kidney transplants.

- A person needs 3 dialysis sessions a week, each lasting about 8 hours.
- Intake of protein and salt in the food is kept low between dialysis sessions.
- For each patient, dialysis costs £30 000 per year.
- The use of a general anaesthetic can sometimes cause brain damage.
- Drugs to suppress the immune system are given after a kidney transplant.
- A transplant costs £20 000 in the first year plus £6500 in each of the following years for drugs.

Use this information to answer the questions.

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

1. _____

_____

2. _____

_____

(2)

(ii) Give **one** disadvantage of treatment by having a kidney transplant.

_____

_____

(1)

(c) The table shows the amounts of some substances in the blood of one patient before dialysis and after dialysis.

Substance	**Concentration in blood plasma in grams per dm^3**	
	Before dialysis	**After dialysis**
Sodium ions	2.88	3.00
Potassium ions	0.22	0.14
Urea	4.50	0.30

During dialysis, substances are removed from the blood.

(i) Which substance in the table decreased in concentration the most during dialysis?

_____

(1)

(ii) By how much did the concentration of this substance decrease?

_____ grams per dm^3

(1)

(Total 8 marks)

Q6.

(a) Why is glucose found in the blood but not in the urine? Use your knowledge of how the kidney works to explain your answer as fully as you can.

_____

_____

_____

(3)

(b) The table shows the concentrations of dissolved substances in the urine of a healthy person and the urine of a person with one type of kidney disease.

Substance	Concentration in grams per dm^3	
	Urine of healthy person	**Urine of person with kidney disease**
Protein	0	6
Glucose	0	0
Amino acids	0	0
Urea	21	21
Mineral ions	19	19

(i) Suggest an explanation for the difference in composition of the urine between the healthy person and the person with the kidney disease.

(2)

(ii) The person with the kidney disease could be treated either by using a dialysis machine or by having a kidney transplant operation.

What are the advantages and disadvantages of having a kidney transplant operation rather than dialysis?

_____

_____

_____

(4)

(Total 9 marks)

Q7.

The volume of water that the body loses must balance the volume of water that it gains.

Tables 1 and **2** show losses and gains of water by the body in one day.

Table 1
Losses of water by the body

Method	Volume in cm^3
breathing	300
sweating	600
faeces	
urine	100
Total	**2400**

Table 2
Gains of water by the body

Method	Volume in cm^3
drinking	1300
food	800
chemical reactions	300
Total	**2400**

(a) (i) Calculate the volume of urine lost by the body.

Show clearly how you work out your answer.

_____

_____

Volume of urine lost by the body = _____ cm^3

(2)

(ii) What proportion of water gained by the body comes from food?

Put a tick (✓) in the box next to your choice.

$\frac{1}{4}$ ☐

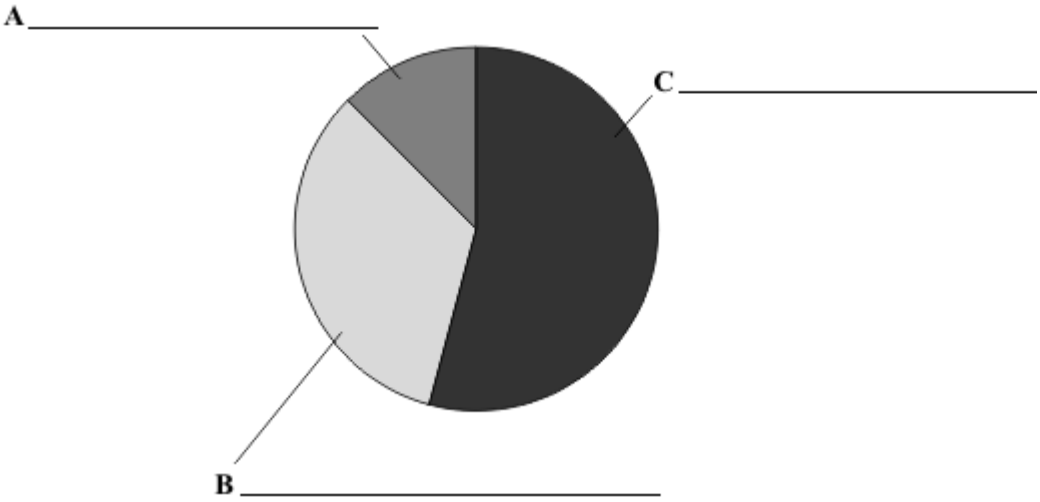
$\frac{1}{3}$ ☐

$\frac{1}{2}$ ☐

(1)

(b) One pupil decided to show the figures from **Table 2** as a pie chart.

Label sections **A**, **B** and **C** of the pie chart.



(1)

(c) How does sweating help the body?

_____

_____

(1)

(d) On a hotter day, the volumes of water lost and gained will be different.

What differences will there be?

Tick (✓) **two** answers from the list.

- More sweat produced ☐
- More faeces produced ☐
- More food eaten ☐
- Less urine produced ☐
- Less liquid drunk ☐

(2)

(Total 7 marks)

Q8.

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

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

_____

(1)

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

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

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

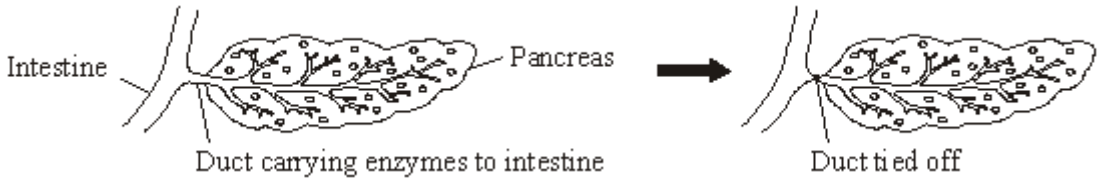
Banting thought that an enzyme produced in the pancreas of dog **A** had digested the hormone before it was injected.

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

_____

(1)

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



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

Explain why the dog survived.

_____

_____

_____

(1)

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

Insulin is used to treat humans with diabetes.

The amount of insulin injected needs to be carefully controlled.

Explain why.

_____

_____

_____

(1)

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

Remember to include a conclusion to your evaluation.

_____

_____

_____

_____

_____

_____

_____

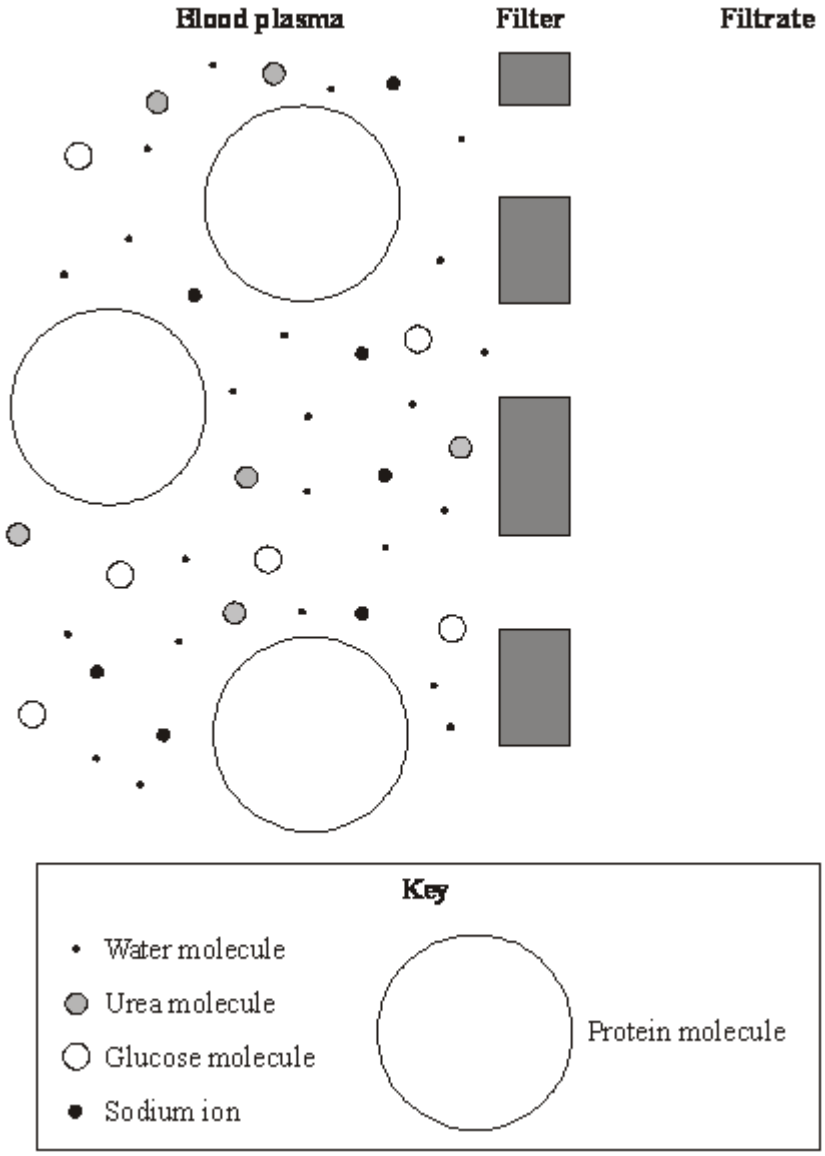
(3)

(Total 7 marks)

Q9.

The kidneys filter the blood.

The diagram shows the site of filtration in the kidney.



(a) Use information from the diagram to answer this question.

Put a tick (✓) in the box next to every substance that will pass through the filter from the blood plasma into the filtrate.

One has been done for you.

glucose	✓
urea	
water	
sodium ions	

protein ☐

(2)

(b) Proteins and glucose are not present in the urine of a healthy person.

(i) Use information from the diagram to explain why protein is not found in the urine of a healthy person.

_____

_____

(1)

(ii) Complete the sentence by drawing a ring around the correct answer.

After filtration, all the glucose is

reabsorbed
released
respired

(1)

(c) An athlete trained on a hot day and on a cold day. On each day, he did the same amount of exercise and drank the same volume of water.

Complete the sentences by drawing a ring around the correct answer.

(i) On the hot day, the athlete would produce

less
more
the same amount of

urine.

(1)

(ii) This is because he would produce

less
more
the same amount of

sweat.

(1)

(Total 6 marks)

Q10.

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

Substance	Concentration in grams per dm^3		
	Plasma	Filtrate	Urine

Water	900.0	900.0	950.0
Protein	78.0	0.0	0.0
Glucose	0.8	0.8	0.0
Amino acids	0.4	0.4	0.0
Urea	0.3	0.3	20.0
Sodium ions	2.8	2.8	3.5

(a) (i) Protein is **not** present in the filtrate.

Explain why.

_____

_____

(1)

(ii) Glucose is filtered out of the blood by the kidney and is then completely reabsorbed back into the blood.

What is the evidence for this in the table?

_____

_____

_____

_____

(2)

(iii) Glucose is reabsorbed into the blood by active transport.

Give **two** ways in which active transport differs from diffusion.

1. _____

_____

2. _____

_____

(2)

(b) The concentration of urea is much higher in the urine than in the filtrate.

Explain what causes this.

_____

_____

(1)

(Total 6 marks)

Q11.

A runner might drink a special 'sports drink' at intervals during a marathon race. The table shows the substances present in a sports drink.

Substance	Percentage
Water	
Sugar	5.0
Ions	0.2

(a) Complete the table to show the percentage of water in the sports drink.

(1)

(b) The runner sweats and also breathes heavily during the race.

(i) Why does the runner need to sweat?

_____

(1)

(ii) Which **two** substances in the table are lost from the body in sweat?

_____

(1)

(iii) Which substance in the table is lost from the body during breathing?

_____

(1)

(c) How does the sugar in the sports drink help the athlete during the marathon?

_____

_____

(2)

(Total 6 marks)

Q12.

Kidney transplants were introduced in the twentieth century as one way of treating patients with kidney failure.

(i) Give **one** other way of treating kidney failure.

_____

(1)

(ii) The patient's body may reject a transplanted kidney unless doctors take precautions.

Some of these precautions are listed below.

- A donor kidney is specially chosen.
- The recipient's bone marrow is treated with radiation.
- The recipient is treated with drugs.
- The recipient is kept in sterile conditions.

Explain how **each** of these precautions may help the patient to survive.

_____

_____

_____

_____

_____

_____

_____

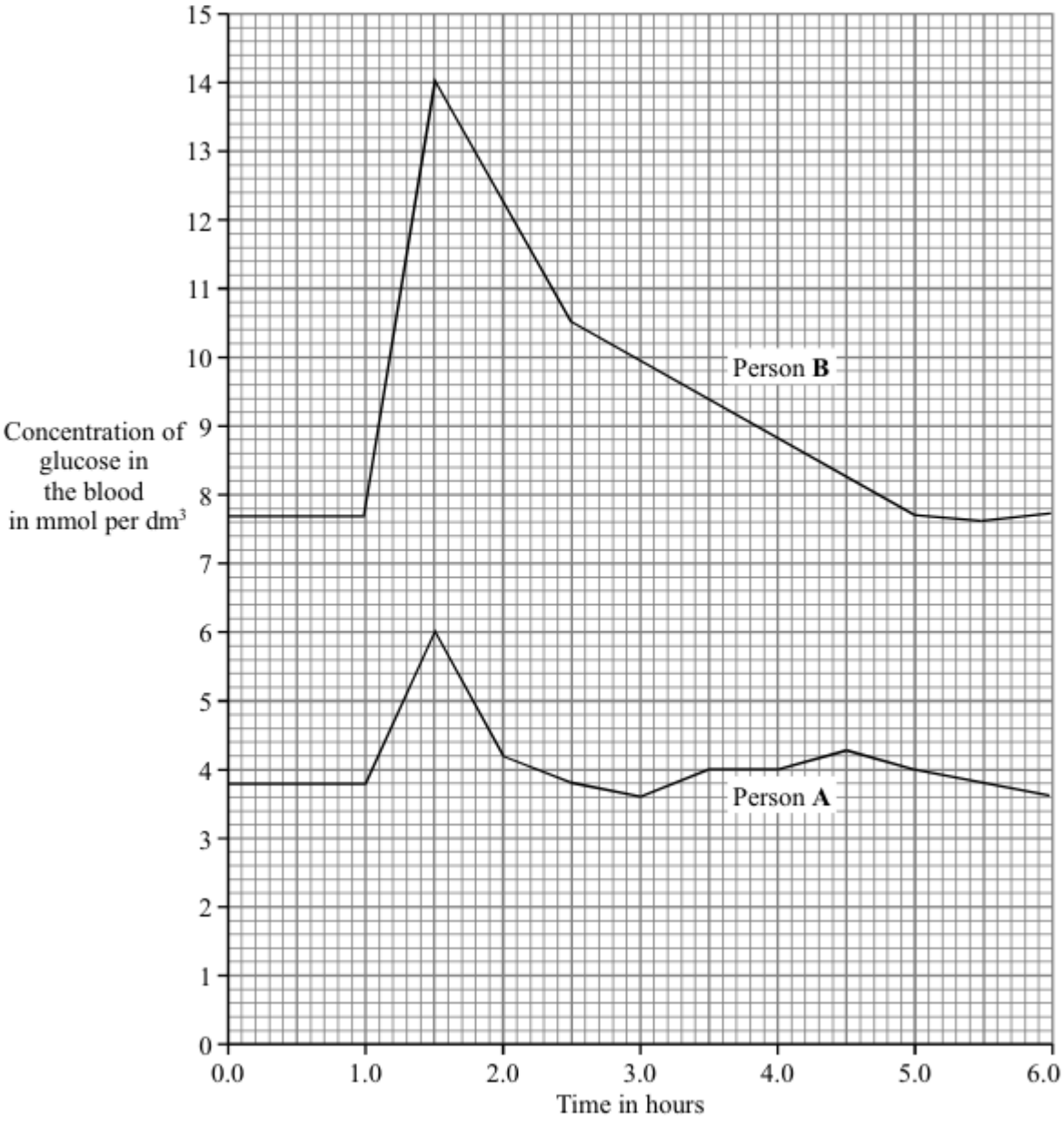
_____

(4)

(Total 5 marks)

Q13.

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.

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q14.

The table shows the concentrations of some substances in human blood plasma, in the filtrate produced by the kidney and in the urine.

	Concentration in grams per dm^3		
Substance	**Blood plasma**	**Filtrate**	**Urine**
Glucose	1.0	1.0	0.0
Amino acids	0.5	0.5	0.0
Urea	0.3	0.3	20.0
Protein	80.0	0.0	0.0
Ions	7.2	7.2	15.0
Water	912.0	990.0	970.0

(a) Explain why:

(i) the concentration of glucose in the filtrate is the same as in the blood plasma;

_____

_____

(1)

(ii) there is no glucose present in the urine.

_____

_____

(1)

(b) Suggest why there is no protein present in either the filtrate or the urine.

_____

_____

(1)

(c) The volume of water removed in the urine is variable. Explain how the human body reduces the volume of urine produced when less water is consumed.

_____

_____

_____

_____

_____

_____

(3)

(Total 6 marks)

Q15.

When people suffer from kidney failure, they may be treated with a dialysis machine. The patients' blood is passed through the machine where the composition of the blood is adjusted.

(a) Name a waste substance, carried in the blood, which is removed by the dialysis machine.

_____

(1)

(b) Doctors sometimes give these patients dialysis treatment, rather than a kidney transplant.

Suggest **four** reasons for this.

_____

_____

_____

(4)

(Total 5 marks)

Q16.

Hormones are sometimes used to regulate human reproduction.

(a) (i) What is a hormone?

(1)

(ii) How are hormones transported around the body?

(1)

(b) Describe the benefits and possible problems that may result from the use of hormones to regulate human reproduction. You should refer to fertility drugs and contraceptives in your answer.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

(4)

(Total 6 marks)

Q17.

(a) Each day, a boy ate food containing 12 000 kilojoules of energy. The boy's body used 80 per cent of this energy to maintain his core temperature.

(i) Name the process which releases energy from food.

_____

(1)

(ii) Calculate the amount of energy that the boy would use each day to maintain his core body temperature. Show clearly how you work out your final answer.

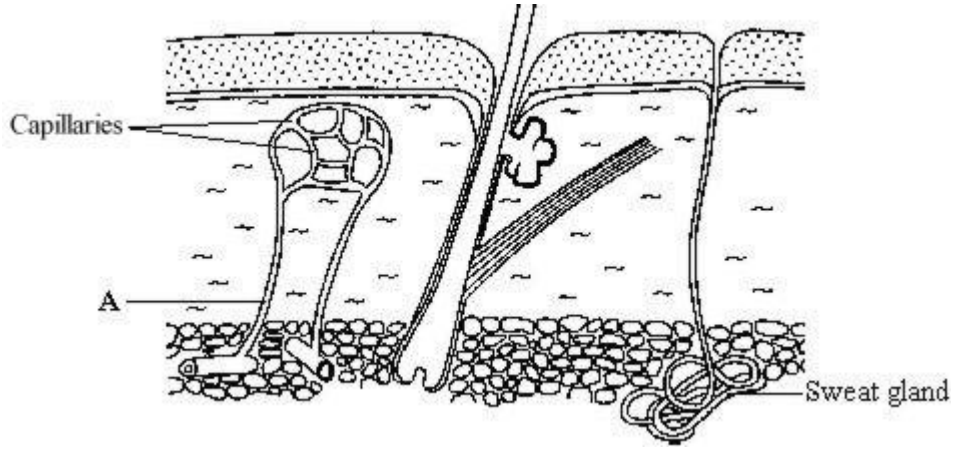
_____

_____

Amount of energy used each day = _____ kJ

(2)

(b) The diagram shows a section through human skin.



Explain how structure **A** helps to cool the body on a hot day.

_____

_____

_____

_____

_____

(3)

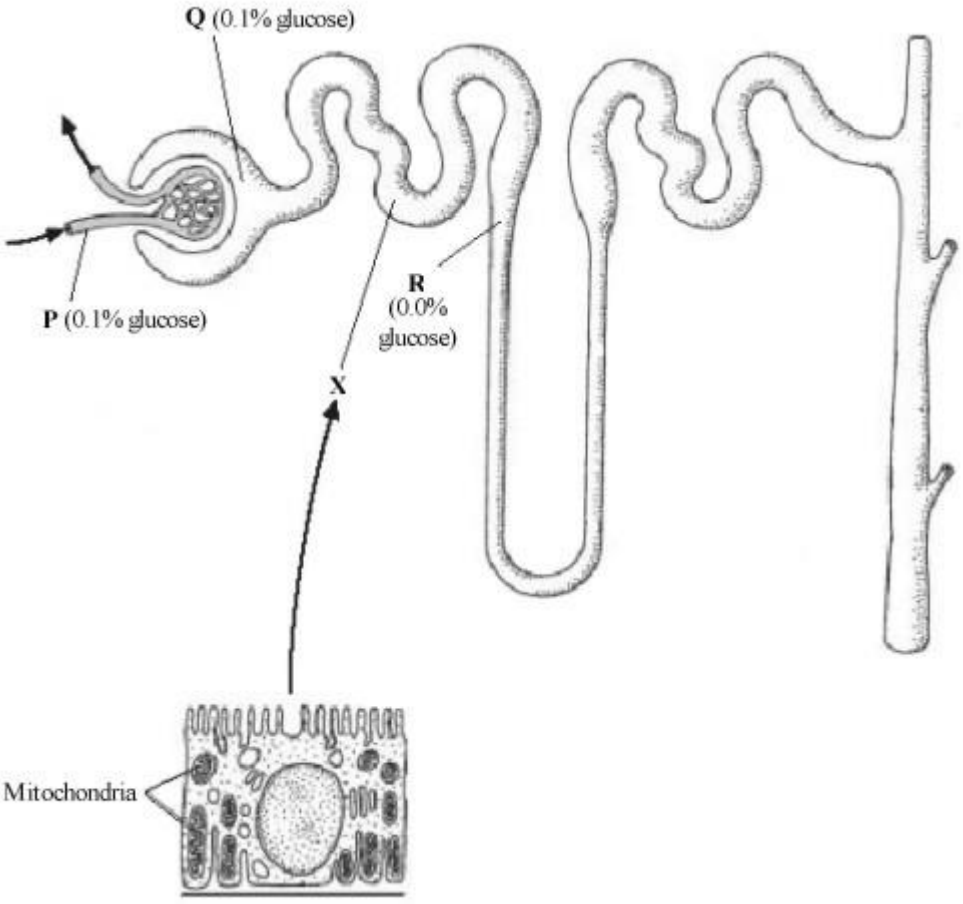
(c) Body temperature is monitored and controlled by the thermoregulatory centre. Where in the body is the thermoregulatory centre?

(1)

(Total 7 marks)

Q18.

The diagram shows the structure of a kidney tubule.



Cell in wall of Region X.

All of these cells have **large numbers** of mitochondria.

(a) Give the full name of the process which takes place in the mitochondria.

(2)

(b) The concentration of glucose in the blood at **P**, and in the fluid at **Q**, is 0.1 per cent. The concentration of glucose in the fluid at **R** is 0.0 per cent.

Use information from the diagram, and your own biological knowledge, to explain the change in glucose concentration from point **P** through to point **R**.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(5)

(Total 7 marks)

Q19.

Figure 1 shows a food chain containing three organisms.

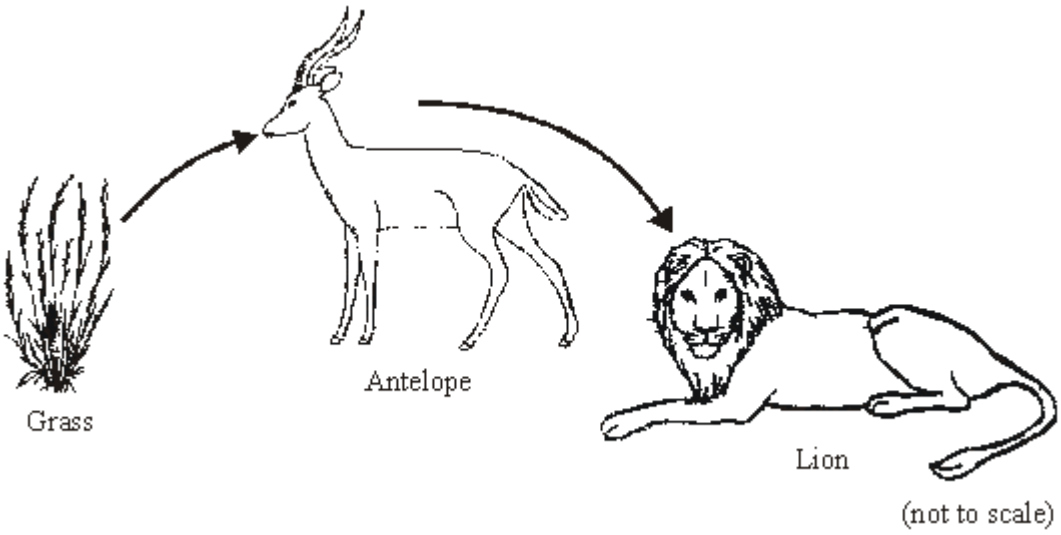


Figure 1

(a) (i) In this food chain, name:

the predator; _____

the prey. _____

(2)

(ii) What is the source of energy for the grass?

Draw a ring around **one** answer.

carbon dioxide **light** **nitrates** **water**

(1)

(iii) **Figure 2** shows a pyramid of biomass for the organisms in **Figure 1.**

Write the names of the organisms on the correct lines in **Figure 2.**

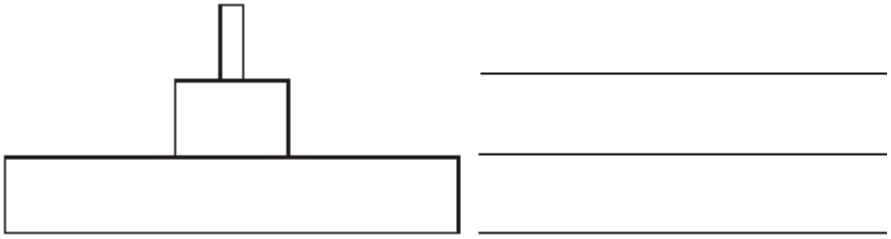


Figure 2

(1)

(b) Waste materials, like faeces from the animals, will decay,

(i) What sort of organisms cause decay?

_____

(1)

(ii) **Three** of the following conditions help decay to occur rapidly.

Which conditions do this?

Draw a ring around each of the **three** answers.

aerobic **anaerobic** **cold** **dry** **moist** **warm**

(3)

(iii) The list below gives four substances. Two of these substances are produced by decay and can be used by the grass.

Which **two** substances are these?

Tick (✓) **two** boxes.

Carbon dioxide ☐

Mineral salts ☐

Oxygen ☐

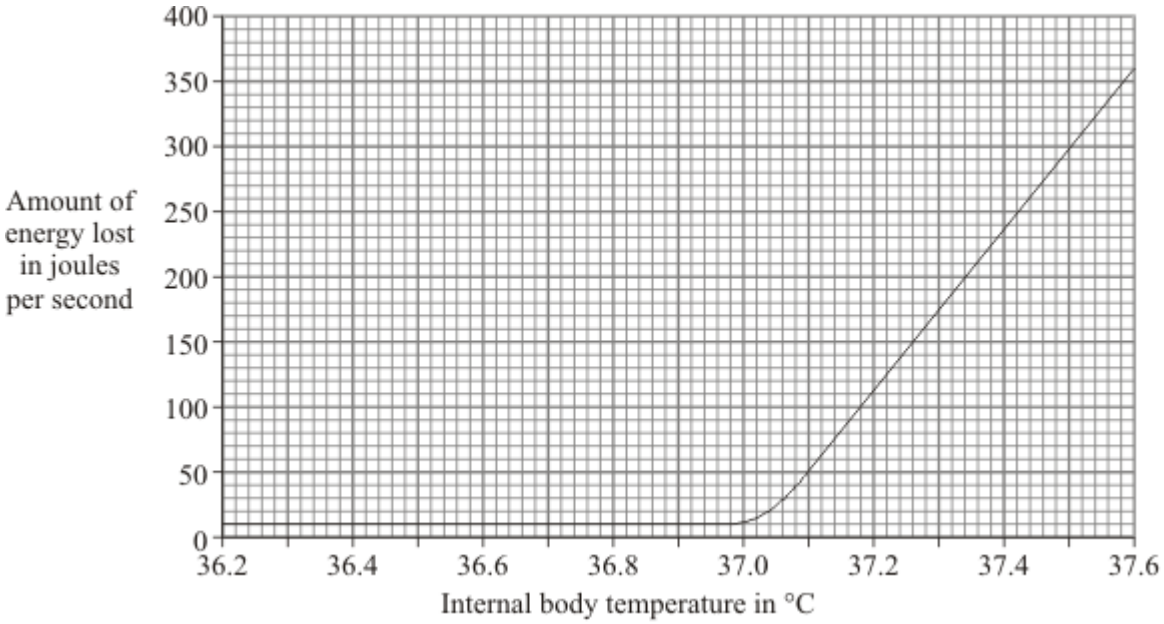
Protein ☐

(2)

(Total 10 marks)

Q20.

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.

(2)

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

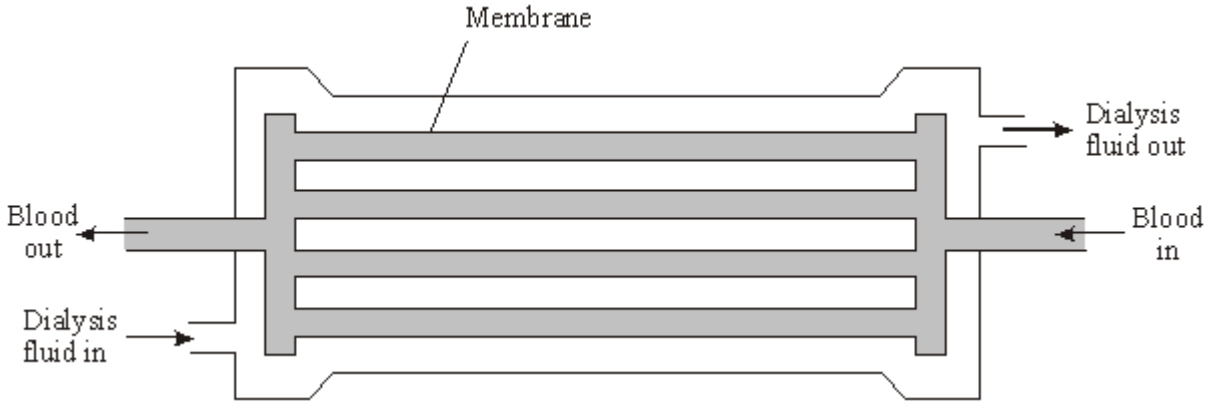
(3)

(Total 7 marks)

Q21.

A woman suffers a minor infection that affects her kidneys. She is sent to hospital for treatment with a dialysis machine.

A simplified diagram of a dialysis machine is shown below.



(a) Explain why the membrane is important in the dialysis machine.

(2)

(b) Some of the components of the woman's blood and of the dialysis fluid entering the machine are shown in the table.

Component	Woman's blood entering machine	Dialysis fluid entering machine
Blood cells	✓	✗
Glucose	✓	✓
Urea	✓	✗

Key: ✓ = present ✗ = absent

Use the information in the table to explain the composition of the dialysis fluid entering the machine.

(4)

(c) One alternative to treatment with a dialysis machine is to have a kidney transplant.

Suggest why a kidney transplant might **not** be suitable in this woman's case.

(2)

(d) Before dialysis treatment begins, the dialysis machine must be filled with blood. The woman has blood group **O**.

(i) What features of her blood make it group **O**?

(2)

(ii) Why must the blood in the dialysis machine, before her treatment begins, also be blood group **O**?

(1)

(Total 11 marks)

Q22.

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

(1)

(b) Why is homeostasis important in the body?

_____

_____

_____

(1)

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

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

_____

_____

_____

_____

_____

(2)

(Total 4 marks)

Q23.

The pictures show three mammals and their average body temperature in ˚C.

Hamster | Horse | Sheep

36.8 °C | 38.0 °C | 39.2 °C

NOT TO SCALE

Describe **three** different ways by which most mammals are able to maintain a constant body temperature when the temperature of the environment falls.

_____

_____

_____

_____

_____

_____

_____

(Total 6 marks)

Q24.

Coordination of the body can be affected by chemicals called hormones

(a) (i) Where are hormones produced?

_____

(1)

(ii) How do hormones move around the body?

_____

(1)

(b) Insulin is a hormone.

(i) Where is insulin produced?

_____

(1)

(ii) Explain the role of insulin in controlling blood sugar levels.

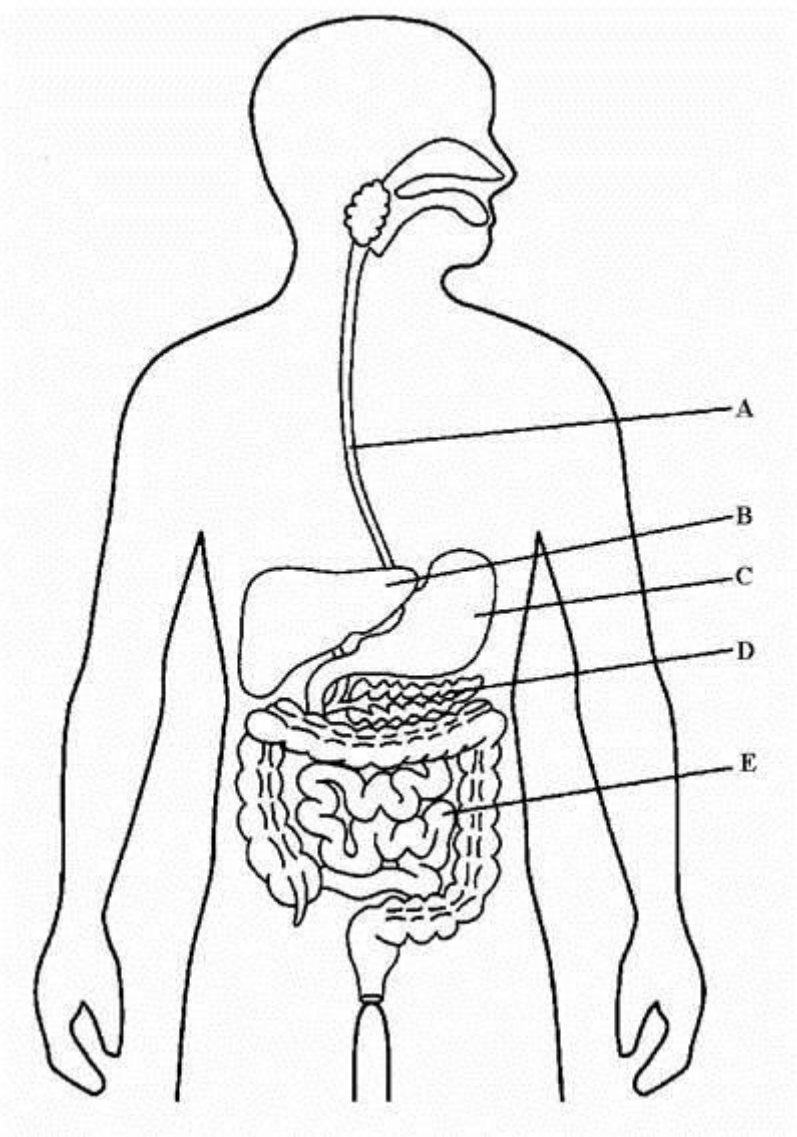
_____

(4)

(Total 7 marks)

Q25.

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.

_____

_____

_____

_____

_____

(2)

(Total 3 marks)

Q26.

(a) One food chain in the wood is:

Hazel tree nuts → squirrels → owls

(i) What does this food chain tell us?

_____

_____

(2)

(ii) Which **one** of the organisms in the food chain is a producer?

_____

(1)

(iii) This year the hazel bushes have produced very few nuts.

Explain, as fully as you can, how this might affect the populations of:

1. squirrels;

_____

_____

_____

_____

2. owls.

_____

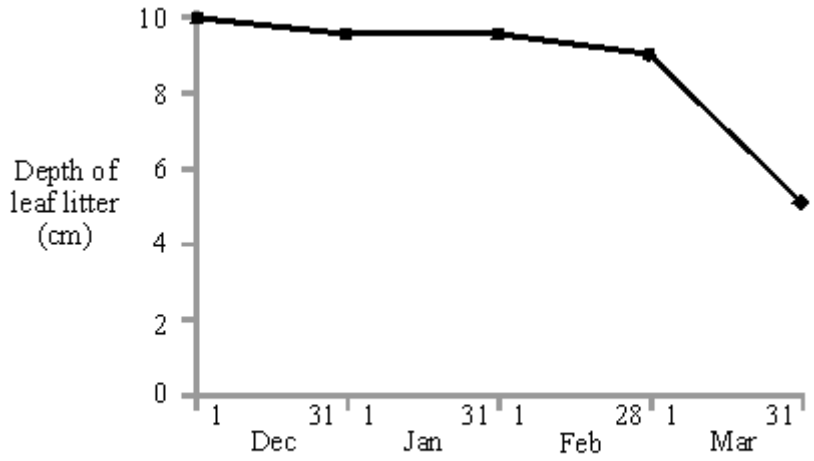
_____

_____

_____

(4)

(b) An area of the floor of the wood 1 m^2 was fenced off so that animals could not reach it. The graph below shows the depth of leaf litter (dead leaves) inside the fence over the next few months.



Explain, as fully as you can,

(i) why the depth of the leaf litter decreased;

_____

_____

_____

(1)

(ii) how this decrease happened.

_____

_____

_____

(1)

(iii) In which month does leaf litter disappear fastest? Explain why.

_____

_____

_____

_____

(2)

(Total 11 marks)

Q27.

(a) During respiration, sugar is oxidised to release energy. Complete the equation for respiration.

Sugar + _____ = _____ + _____ + energy

(3)

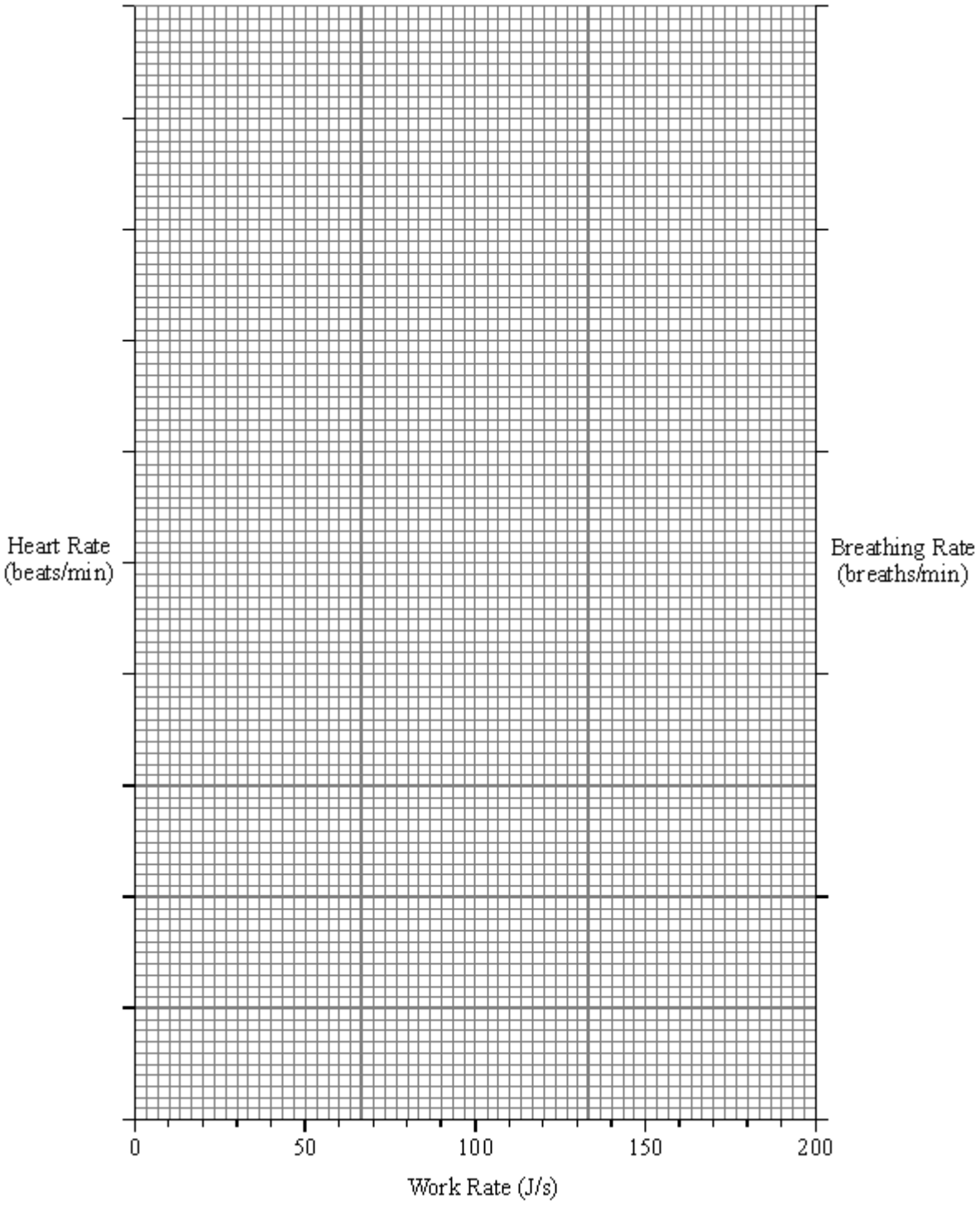
(b) The photograph below shows an athlete using an exercise machine. The machine can be adjusted to vary the rate at which the athlete is required to work.

The athlete's heart rate and breathing rate were measured at different work rates.

The table below shows the results which were obtained.

WORK RATE (J/s)	HEART RATE (beats/min.)	BREATHING RATE (breaths/min.)
0	86	9.6
60	106	10.0
80	112	10.4
100	122	10.4
120	135	11.4
140	143	14.5
160	156	15.8
200	174	30.5

Plot the data on the graph paper below.



(3)

(c) Explain, as fully as you can, the advantages to the body in the change in breathing and heart rates.

(6)

(d) This increase in the rate of heart-beat is a response to a stimulus. For this response suggest:

(i) the stimulus; _____

(ii) the co-ordinator; _____

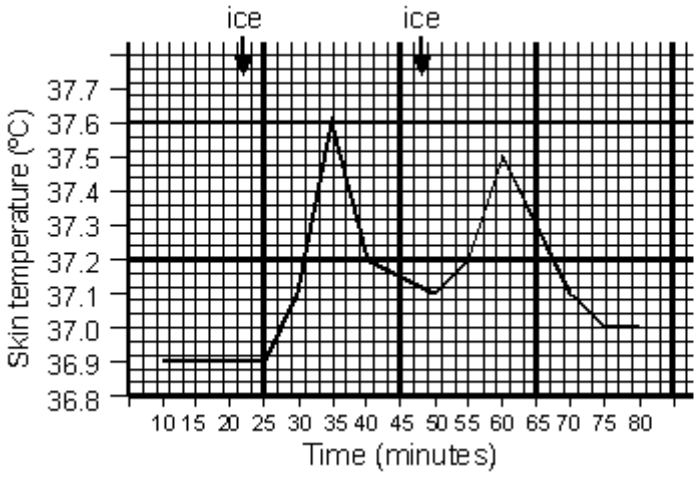
(iii) the effector. _____

(3)

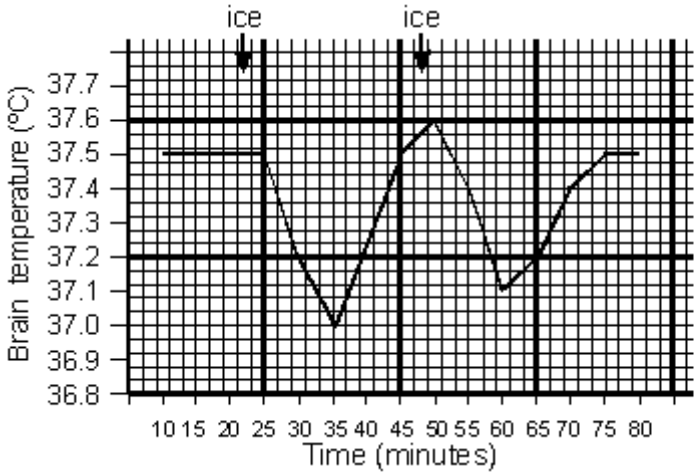
(Total 15 marks)

Q28.

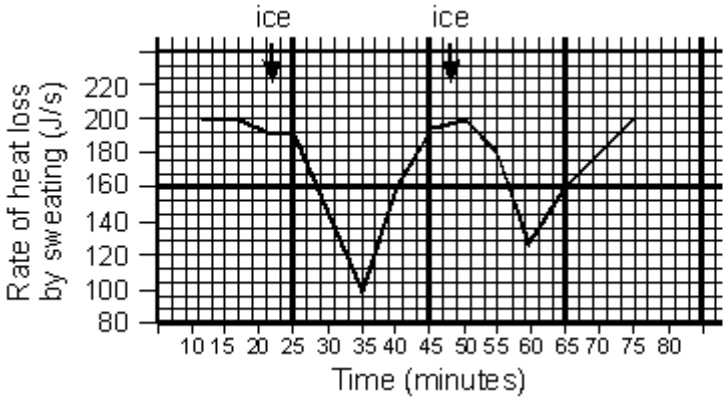
The graphs show the results of an investigation into the control of sweating in humans. The subject was placed in a chamber where the temperature was maintained at 45ºC. The subject swallowed ice at the times indicated on the graphs.



Skin Temperature



Brain Temperature



Rate of Heat Loss by Sweating

(a) What was the relationship between swallowing ice and the subject's

(i) skin temperature?

_____

_____

(1)

(ii) brain temperature?

_____

_____

(1)

(iii) rate of heat loss by sweating?

_____

_____

(1)

(b) Explain, as fully as you can, why the subject's brain temperature, skin temperature and rate of heat loss by sweating were affected by swallowing ice in the way shown by the graphs.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

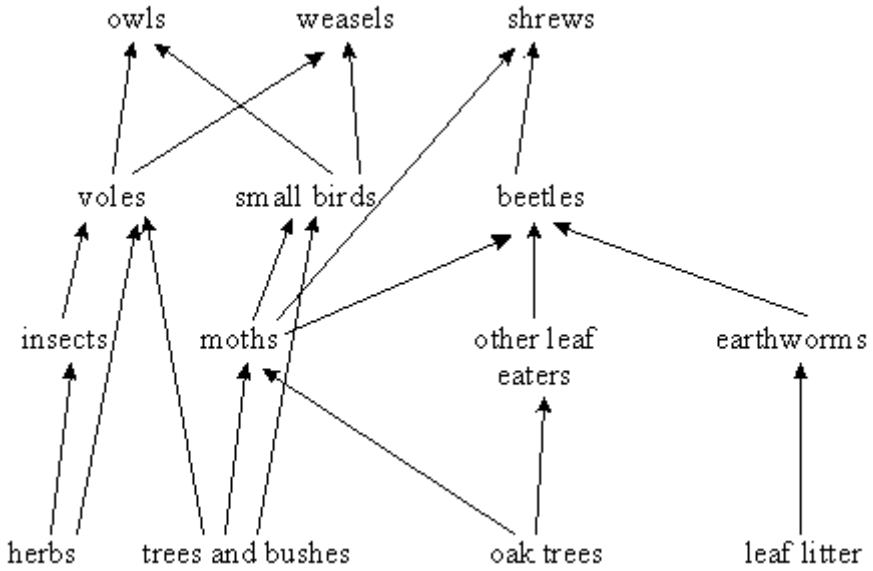
_____

(8)

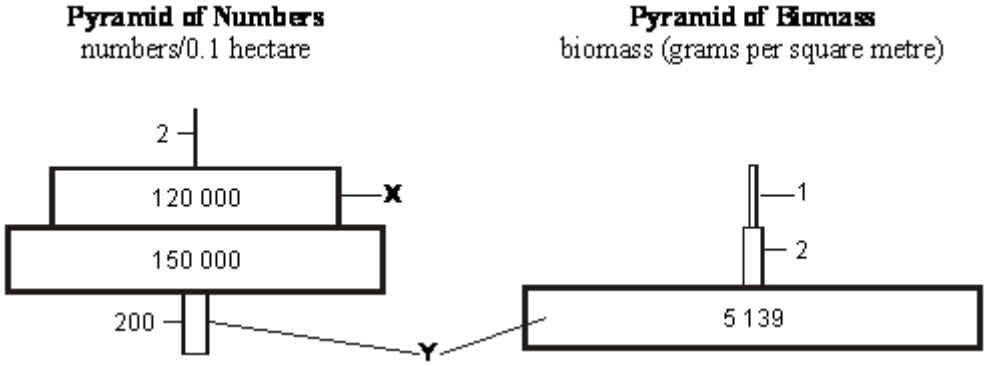
(Total 11 marks)

Q29.

The diagram below shows a food web for a wood.



(a) The diagrams below show a pyramid of the numbers and a pyramid of the biomass for 0.1 hectare of this wood.



(i) Name **one** organism from the level labelled X.

_____

(1)

(ii) Explain, as fully as you can, why the level labelled Y is such a different width in the two pyramids.

_____

_____

_____

_____

(3)

(b) Explain, as fully as you can, what eventually happens to energy from the sun which is captured by the plants in the wood.

_____

(10)

(Total 14 marks)

Q30.

(a) Describe, as fully as you can, the job of

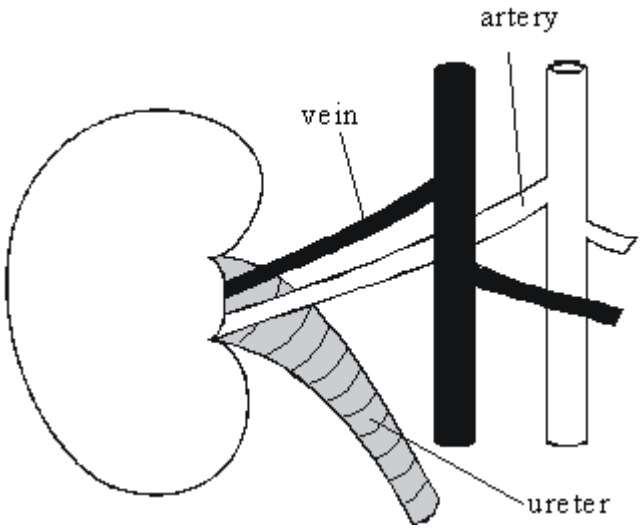
(i) the circulatory system.

(2)

(ii) the digestive system.

(3)

(b)

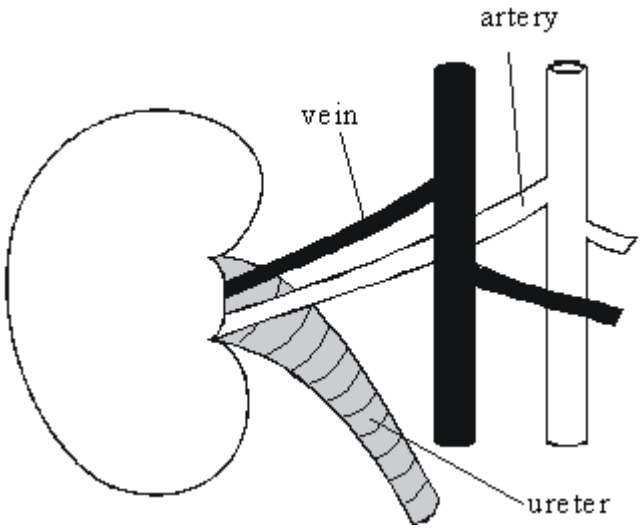


The drawing shows a kidney, its blood supply and the ureter (a tube which carries urine from the kidney to the bladder). The amount and composition of the urine flowing down the ureter change if the blood in the artery contains too much water. Describe these changes and explain how they take place.

(4)

(Total 9 marks)

Q31.



(a) The drawing shows a kidney, its blood supply and the ureter (a tube which carries urine from the kidney to the bladder). The amount and composition of the urine flowing down the ureter changes if the blood in the artery contains too much water. Describe these changes and explain how they take place.

(4)

(b) (i) Describe, as fully as you can, **two** methods of treating patients who suffer from kidney failure.

1.

2.

(4)

(ii) Compare the advantages and disadvantages of the two methods of treatment which you have described.

_____

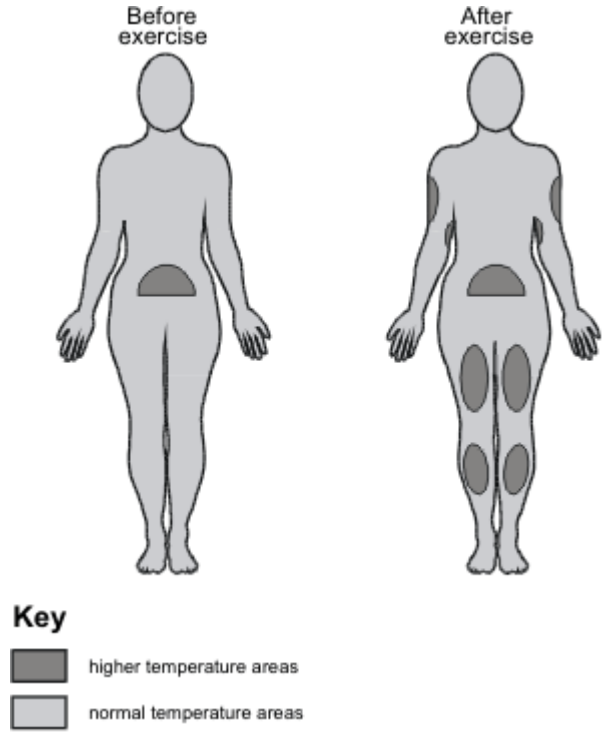
_____

(5)

(Total 13 marks)

Q32.

The temperature at the surface of the skin can be measured by using a technique called thermography. Areas with higher temperature appear as a light shade on the thermographs. The drawings below show the results of an investigation in which thermographs were taken before and after exercise.

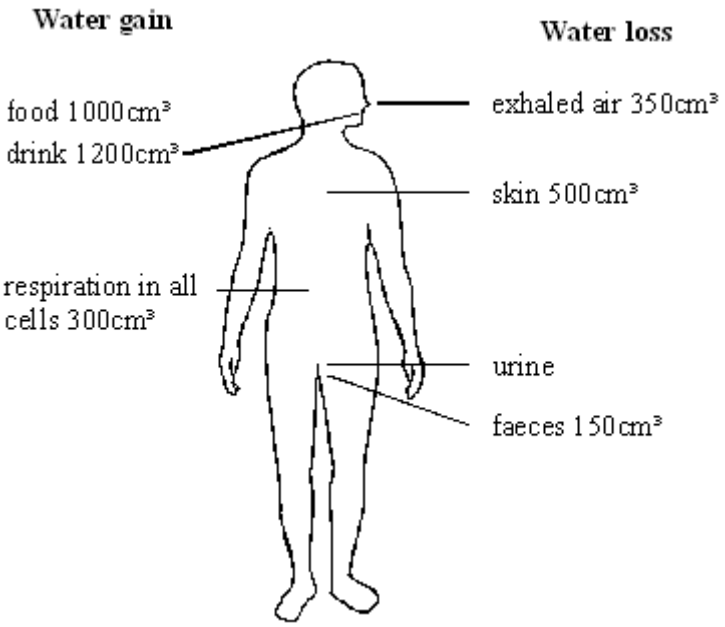


Explain, as fully as you can, the body mechanisms which affected the skin temperature to give the results shown in the drawings.

(Total 8 marks)

Q33.

The diagram shows the mean daily input and output of water for an adult.



The kidneys keep the water content of the body constant by controlling the volume of water passed out in the urine.

(i) Use data from the diagram to calculate the mean daily output of water in urine. Show your working.

Answer _____ cm^3

(2)

(ii) Describe how the amount of water in the body is controlled by the kidneys.

_____

_____

_____

_____

(3)

(Total 5 marks)

Q34.

Read the following passage which is from an advice book for diabetics.

Insulin Reactions

Hypoglycaemia or 'hypo' for short, occurs when there is too little sugar in the blood.
It is important always to carry some form of sugar with you and take it immediately you feel a 'hypo' start. A hypo may start because:

- you have taken too much insulin, or
- you are late for a meal, have missed a meal altogether, have eaten too little at a meal, or
- you have taken a lot more exercise than usual.

The remedy is to take some sugar.

An insulin reaction usually happens quickly and the symptoms vary – sweating, trembling, tingling of the lips, palpitations, hunger, pallor, blurring of the vision, slurring of speech, irritability, difficulty in concentration.

Do not wait to see if it will pass off, as an untreated 'hypo' could lead to unconsciousness.

(a) Many diabetics need to take insulin.

(i) Explain why.

_____

_____

_____

_____

(2)

(ii) Explain why there is too little sugar in the blood if too much insulin is taken.

_____

_____

_____

_____

(3)

(iii) Explain why there is too little sugar in the blood if the person exercises more than usual.

_____

_____

_____

_____

(3)

(b) Suggest why sugar is recommended for a ‘hypo’, rather than a starchy food.

_____

_____

_____

_____

(3)

(c) Explain how the body of a healthy person restores blood sugar level if the level drops too low.

_____

_____

_____

_____

(3)

(d) Explain, using insulin as an example, what is meant by negative feedback.

_____

_____

_____

_____

(3)

(Total 17 marks)

Q35.

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)

Mark schemes

Q1.

(a) (i) lungs

1

(ii) skin

1

(iii) kidneys

1

(b) (i) (as sweat lost,) performance falls

1

(ii) drink water / sports drink

ignore antiperspirant

1

[5]

Q2.

(a) 4000

*award **both** marks for correct answer, irrespective of working*

*1500 + 2000 + 500 gains **1** mark*

2

(b) day 2 (no mark)

any **two** from:

*max **1** mark if correct day not identified or if no day given*

- more (water in) breath / breathing
- more (water in) sweat / sweating

accept a lot of sweating

- less (water in) urine

*if no other marks awarded allow **1** mark for more water lost on day 2*

2

(c) (i) respiration

1

(ii) cools / removes heat owtte

ignore 'maintains body temperature' unqualified

1

(iii) osmosis

1

[7]

Q3.

(a) any **two** from:

- amylase / carbohydrase
- protease
  allow trypsin
- lipase

2

(b) (i) high / above normal blood sugar
or cannot control blood sugar
allow other symptoms
*eg frequent / plentiful urination **or** sugar in urine **or** thirst **or** weight loss **or** coma*
ignore consequential effects eg blood pressure / circulation / glaucoma / tiredness

1

(ii) any **one** from:

- small / regular meals
- low sugar (meals) or low GI / GL **or** carbohydrates as starch
  allow high fibre
  ignore reference to low carbohydrate

1

(iii) any **one** from:

- keep constant(blood) sugar **or** prevent high (blood) sugar **or** reduces surge / rush of sugar into blood
- reduce the need for insulin

1

(iv) (take) insulin
allow pancreas transplant

1

(c) protein / hormone / enzyme synthesis **or** synthesis of named example
or combine amino acids

1

[7]

Q4.

(a) (i) thermoregulatory centre (in brain)
accept hypothalamus

1

(receptors sensitive to/measures) temperature of blood

1

(ii) any **one** from:

- receptors (in skin)
- (skin) sends information / signals / impulses / messages to brain / thermoregulatory centre

1

(b) any **three** from:

(cold conditions)

- muscle (X) contracts when cold
- no / less blood through capillaries
- no / less heat lost / radiated
- no / less sweat produced

(hot conditions)

- muscle (X) relaxes/does not contract when hot

  NB X contracts when cold and relaxes when hot = ***2 marks***
- (more) blood through capillaries
- more heat lost / radiated
- more sweat produced

  all other points must be clearly identified by correct conditions

  max ***2*** *if idea of capillaries moving but ignore capillaries dilate*

3

[6]

-

Q5.

(a) (i) bladder

1

(ii) glucose

1

protein

extras – CANCEL

1

(b) (i) any **two** from:

- kidney functions all the time / not just 3 × 8 h sessions a week
  allow direct quotation of correct points from the list
- can eat high-protein foods / high salt foods
  allow can eat anything
- cheaper
- waste of time

2

(ii) have to take (immunosuppressant) drugs / consequence of this
eg catch infections / may suffer brain damage / possible rejection of kidney **or** become ill more easily
or
risk of brain damage (due to anaesthetic)
allow direct quotation of correct points from the list

1

(c) (i) urea

1

(ii) 4.2

1

[8]

Q6.

(a) any **three** from:

- glucose enters blood from gut / liver / glycogen
- glucose is <u>filtered out</u> of the blood
  ignore 'diffusion'
- glucose is (a) small (molecule)
- taken / etc back into the blood / reabsorbed
  *allow absorbed into the blood but **not** absorbed unqualified*
- by active transport
  ignore diffusion

3

(b) (i) <u>in a healthy person</u>

protein not present because proteins are large (molecules)
or because cannot pass through (filter)

1

<u>in person with disease</u>

lets protein through (filter) owtte

1

(ii) advantages:
up to any **three** from:

- no build-up of toxins / keeps blood conc. ± constant
  ignore 'kidney works all the time'
- prevent high blood pressure
- don't need restricted diet / restricted fluid intake
  or time wasted on dialysis
- blood clots may result from dialysis
- infection may result from dialysis
- with dialysis, blood may not clot properly
  due to anti-clotting drugs
- cost issues (ie transplant cheaper)

3

disadvantages: **at least one** from:

- rejection / problem finding tissue match
- use of immuno-suppressant drugs → other infections
- dangers during operation / example described
  must have at least one advantage and at least one disadvantage for full marks

1

[9]

Q7.

(a) (i) 1400

*award **2** marks for correct answer if no working shown*
*2400 – (300 + 600 + 100) or equivalent for **1** mark*

2

(ii) $\frac{1}{3}$

1

(b) **A**: chemical reactions

B: food

C: drinking

*all **three** required for **1** mark*

1

(c) cools / reduces temperature

allow 'maintaining body temperature' owtte

*do **not** allow regulate unqualified*

ignore reference to urea

numerical references to temperature should be correct

1

(d) more sweat produced

1

less urine produced

1

[7]

Q8.

(a) pancreas

1

(b) protease

allow proteinase

1

(c) (i) (same) enzymes / named enzymes produced in other parts / named parts of digestive system

if named, enzymes and part must be correct

1

(ii) diet / activity varies / amount of glucose in blood varies

accept too much insulin leads to coma / hypo / low blood sugar

accept too little insulin leads to coma / hyper / high blood sugar

1

(d) any **two** from:

pros

- less / no experimentation on humans
- dogs (more) similar to humans (than lower / named organisms)
- it allows us to find a treatment **or** improves medical understanding

accept allows us to find a cure

cons

- harmful / cruel to dogs

accept kills dogs

- dogs may not be (metabolically) like humans

2

conclusion justified by argument

1

[7]

Q9.

(a)

glucose	☑
urea	☑
water	☑
sodium ions	☑
protein	☐

*all 3 correct = **2** marks*
*2 correct = **1** mark*
*0 or 1 correct = **0** marks*

max 2

(b) (i) protein cannot pass through filter

or

protein (too) large

or

protein stays in the blood

1

(ii) reabsorbed

1

(c) (i) less

1

(ii) more

1

[6]

Q10.

(a) (i) protein is large (molecule) / too big to pass through filter

1

(ii) glucose is present in the filtrate

ignore units

1

or

0.8 in filtrate

no glucose is present in the urine

or

0 in urine

1

(iii) active transport – up / against (concentration) gradient

it = active transport throughout

1

or

from low to high (concentration)

uses energy / ATP

*accept needs specific carrier / specific protein (in cell membrane) for **1** mark*

1

(b) water reabsorption / taken out

other substances cancel mark

or

water taken into blood / body

1

[6]

Q11.

(a) 94.8

1

(b) (i) to cool (the body) / maintain (body) temperature

*do **not** accept let out heat*

1

(ii) water **and** ions

1

(iii) water ignore CO_2, and vapour

1

(c) any **two** from:

used in respiration

provides energy

(energy) needed for movement / running / muscle action

2

[6]

Q12.

(i) dialysis (machine) or kidney machine

1

(ii) (specially chosen kidney) similar tissue type

accept same blood group

1

(irradiation of bone marrow) to stop white cell production

allow any named white blood cell

1

(treated with drugs) suppress immune system

1

(sterile conditions) avoid exposure to pathogens / infection

1

[5]

Q13.

(a) (i) 6

1

(ii) 4

1

(b) (i) pancreas

ignore islets of langerhans

1

(ii) 'X' anywhere between >1 and ≤ 2 hours

anywhere in that column

1

(c) any **four** from:

water movement

*do **not** accept solution*

out of cells

dilute to concentrated solution

accept reference to correct gradient -
*high ☿ to low ☿ **or** high to low 'water concentration'*
*must be unambiguous – i.e. **not** 'high to low concentration'*
accept low to high concentration

reference to partially / selectively
permeable membranes **or** described

cells shrink / get smaller

allow crenated
ignore plasmolysed / flaccid / floppy
etc

4

[8]

Q14.

(a) (i) glucose passes through the filter / from plasma to filtrate

ignore diffuses

1

(ii) glucose is reabsorbed or glucose taken back into the blood

ignore filtered

1

(b) protein (molecules) are (too) large (to pass through the filter)

1

(c) any **three** from:

blood becomes more concentrated / too salty / has lower water potential **or** too little water in the blood

hypothalamus detects this

release of ADH

by pituitary

increased **re**absorption of water

3

[6]

Q15.

(a) urea

1

(b) any **four** from:

- suitable for short term

  accept reverse arguments with respect to transplants

- no long term drug treatment
- no rejection chance
- no / less risk during surgery

  accept risk of anaesthetic

- operations unsuitable / risky for weakness / old age

- risk of infection
- no (suitable) kidneys available for transplant / long waiting list /
- ess painful

4

[5]

Q16.

(a) (i) any **one** from:

- <u>chemical</u> messenger
- <u>chemical</u> / <u>substance</u> released in one part to have effect elsewhere in body
- <u>chemical</u> / <u>substance</u> which affects another / target organ / tissues / cells

allow <u>chemical</u> from <u>endocrine</u> gland

1

(ii) in blood / circulatory system / any named part including plasma

extra wrong answer would cancel example

***not** red blood cells*

1

(b) **Quality of written communication**:
correct use of at least two relevant scientific term**s** spelt phonetically

e.g. pregnancy, ovulation, FSH, oestrogen, progesterone, ovary, follicle, circulation, thrombosis, feminisation, sperm count, STD

Q ✓ or Q ✗

1

any **three** from:

<u>Oral contraceptives:</u>

(benefit)

- prevent (unwanted) pregnancy **or** prevent egg release
- regulate menstrual cycle / periods

(problems)

- prolonged use may prevent later ovulation / cause infertility
- named side-effect on female body
  e.g. circulatory problems / weight gain / nausea / headache / breast cancer / mood swings
- increased promiscuity / increase in STD's / STI's

- named side-effect on environment
  e.g. feminisation of fish **or** lowered sperm count in human males

Fertility drugs:

(benefit)

- can enable woman to have children **or** to become pregnant
  or stimulates egg release

(problem)

- multiple births

*for full marks must score at least **one** re contraceptives **and** at least **one** re fertility drugs*

*if unclear which type of hormone maximum **2** marks from 3*

3

[6]

Q17.

(a) (i) respiration

1

(ii) 9600

if correct answer, ignore working / lack of working

$\frac{80 \times 12000}{100}$ *for **1** mark*

2

(b) any **three** from:

- dilates / widens **or** muscle in wall relaxes **or** sphincter opens
  *do **not** accept expands or just gets bigger*
- more blood flows near skin surface **or** more blood through capillaries
- heat lost by radiation / convection / conduction
  ignore evaporation
- heat loss from blood / cools blood

3

(c) hypothalamus / brain

1

[7]

Q18.

(a) aerobic

1

respiration

*'anaerobic respiration' = **1** mark*

1

(b) any **five** from:

- glucose is a small molecule
- glucose passes through filter **or** glucose is filtered out of blood **or** glucose enters the capsule / kidney tubule / Q
- glucose reabsorption **or** glucose taken (back) into blood
  *do **not** accept 'filtered' into blood / out of tubule*
- cells lining tubule have microvilli / shape described **or** cells lining tubule have large surface area
- active transport
- up concentration gradient
- use of energy / ATP
- long tubule for more reabsorption

5

[7]

Q19.

(a) (i) (predator) lion

1

(prey) antelope

1

(ii) light

accept other positive indications

1

(iii) in sequence (top to bottom):

lion
antelope
grass

1

(b) (i) bacteria / fungi / saprotrophs

accept moulds / decomposers / microorganisms / microbes / saprophytes / saprobionts

1

(ii) aerobic

1

moist

1

warm

accept other positive indications1

1

(iii) carbon dioxide

1

mineral salts

1

[10]

Q20.

(a) 345 to 350

ignore working or lack of working
use of 355 to 360 ***and*** *10 for* ***1*** *mark*

2

(b) any **two** from:

more sweating (at 37.6 °C)

'more' at least once in the first 2 points

more water loss **or** dehydration occurs

do ***not*** *accept prevents dehydration only*

blood becomes (more) concentrated / (more) salty **or** need to replace water

stimulation of the hypothalamus

2

(c) any **three** from:

evaporation

of water

do ***not*** *accept just water loss unqualified*

cools skin **or** uses heat from skin

cools blood / heat from blood (passing through skin)

related to sweating
cooling the blood
ignore vasodilation

3

[7]

Q21.

(a) semi / selectively / partially / differentially permeable

1

separates blood and dialysis fluid

1

(b) any **four** from:

blood cells cannot pass through membrane

glucose retained in blood

to stop water passing into blood / osmosis

no (net) diffusion

urea removed from blood by diffusion

accept excreted

4

(c) problem may be temporary **or** has minor infection **or** problem could be cured by other means

1

operation / transplants carry risk

accept rejection

1

(d) (i) no antigens

1

on (the surface) of red blood cells

1

(ii) would cause agglutination / clumping if different

ignore clotting and coagulation

1

[11]

Q22.

(a) water content (within the body/blood) is kept constant/ regulated/within very narrow limits/kept right

*do **not** accept general definition of homeostasis*

1

(b) because optimum conditions are needed for processes within the body / enzyme reactions
or
because there is a need to maintain a steady internal environment

1

(c) excretion is the removal from the body of waste **products**

n.b. faeces is not an excretory product but may be neutral

1

because waste products would (build up and) **become** toxic/poisonous/harmful

*do **not** accept makes us ill*
*do **not** accept block up system*
*do **not** accept unwanted products*

1

[4]

Q23.

vasoconstriction/blood vessels near surface get narrower/decreased blood supply near surface of the skin **or** closing sweat pores

any three pairs. 2 marks for each pair of features and explanations up to a maximum of 6 marks

(which) prevents the heat being lost from the blood/prevents heat lost due to evaporation

explanation must match feature to score the second mark

---

hair/fur stands on end **or** goosepimples

(this) increases the insulation effect

---

shivering/increased muscular activity/movement/increased metabolism

(this) generates heat

*do **not** accept raise body temperature*

---

behavioural changes/find somewhere warm/put on clothes / huddling / hibernate / grow **extra** fat / fur

(this) prevents/reduces heat loss

*do **not** accept keep warm*

[6]

Q24.

(a) (i) endocrine glands **or** endocrine system

allow a specific named gland

1

(ii) (dissolved) in the blood(stream) **or** plasma

1

(b) (i) pancreas **or** islets of Langerhans

1

(ii) (it **or** insulin) lowers blood sugar level [1]

(by) (speeding up **or** increasing) conversion of glucose to glycogen [1]

in the liver [1]

(and) speeding up **or** increasing uptake of glucose by body cells [1]

4

[7]

Q25.

(i) liver

1

(ii) liver **or** B stores glycogen
or pancreas **or** D makes insulin

1

clear description of link

1

[3]

Q26.

(a) (i) squirrels eat nuts;
each for 1 mark

owls eat squirrels
(2 marks for energy flow)

2

(ii) hazel tree
gains 1 mark

1

(iii) 1 squirrel population would decrease;
because fewer nuts available as food
each for 1 mark

2

2 owl population would decrease;
because fewer squirrels available as food
each for 1 mark

2

(b) (i) digested/broken down;

(ii) by microbes/reference to worm action;
each for 1 mark

2

(iii) March
warmer/increased activity of worms/microbes;
each for 1 mark

2

[11]

Q27.

(a) oxygen;)
carbon dioxide;) *allow symbols*
water)
each for 1 mark

3

(b) graph with reasonable vertical scales;
accurate plotting of all points (ignore lines) and labelling lines
histogram – must be coded

gains 3 marks

3

(c) 6 of:
during exercise the level of CO_2 (in the blood) rises;
increased breathing to remove excess CO_2;
increased oxygen supply to muscles;
or increased breathing takes in more O_2
or increased heart rate takes more O_2 to muscles;
increased supply of sugar to muscles;
increased respiration rate;
enable faster rate of energy release;
reference to lactic acid (allow even though not on syllabus)/O_2 debt;
to avoid cramp;
anaerobic reference;
reference to removal of 'heat';

6

(d) high carbon dioxide concentration;
brain/central nervous system;
heart muscles (both)

3

[15]

Q28.

(a) (i) increased shortly after ingestion then drops;

(ii) decreased shortly after ingestion then rises;

(iii) decreased shortly after ingestion then rises

each for 1 mark

3

(b) 8 of:
ingestion of ice cools blood flowing in (gut wall);
brain temperature lowered;
reduced blood temperature detected by brain;
impulses sent to sweat glands;
sweat production decreased/sweat pores close;
evaporation of sweat reduced;
it is evaporation of sweat which cools skin/heat loss is less;
therefore skin temperature rises;
because external temperature greater than body temperature;
sensibly linked example;

each for 1 mark

8

[11]

Q29.

(a) (i) vole/small bird/beetle

gains 1 mark

1

(ii) oak trees are large organisms;
therefore their biomass is large; but their numbers are small

each for 1 mark

3

(b) 8 of:
energy stored in chemicals in cells/tissues/growth;
passed up food chain;
less energy stored at each stage in food chain/pyramid level;
because only part of energy taken in used for growth;
some lost in waste;
some used for repair;
used to main body systems;
some lost in respiration;
some converted into other forms of energy;
e.g. movement;
much lost as heat;
by time detritus feeders have used remains;
all returned to environment

each for 1 mark

8

c1 → animals
c2 → decomposers

2 marks for sequencing and organising the information

2

[14]

Q30.

(a) (i) transport of substances **or** named substance **or** blood around the body

each for 1 mark

2

(ii) breaks down ***(not digests)*** food absorption (into blood)

each for 1 mark

3

(b) water filtered from blood
smaller proportion reabsorbed
therefore larger volume
of dilute urine produced

each for 1 mark

4

[9]

Q31.

(a) water filtered from blood
smaller proportion reabsorbed therefore larger volume of dilute urine produced

each for 1 mark

4

(b) (i) use of dialysis machine which restores concentrations of substances in blood to normal levels
transplant of healthy kidney **or** compatible kidney

each for 1 mark

4

(ii) 5 of e.g.:
dialysis needs much time attached to machine
consequent effect on lifestyle (qualified) need for special diet
transplant gives 'normal' life (qualified)
transplant cheaper in long term
risk attached to transplant operation
shortage of donors etc.

each for 1 mark

5

[13]

Q32.

8 of e.g.:
muscles release energy as heat
blood flowing through muscles heated increased blood temperature sensed by centre in brain
impulses to skin blood vessels
particularly overlying muscles used in exercise to dilate
increased surface flow in these regions
gives pattern shown on thermographs

each for 1 mark

[8]

Q33.

(i) 2500 – 1000
= 1500

for 1 mark each

2

(ii) 3 of
filter blood
reabsorb water
in sufficient quantities to keep body water content constant
produce dilute urine if water content of body high/reverse argument

any 3 for 1 mark each

3

[5]

Q34.

(a) (i)
- blood sugar rises because
- insufficient insulin secreted by body

for 1 mark each

2

(ii)
- increase in rate of conversion
- of glucose to glycogen
- in liver

for 1 mark each

3

(iii)
- muscles use more glucose from blood
- in respiration
- to release energy needed for exercise

for 1 mark each

3

(b) 3 of

sugar soluble
therefore absorbed
quicker than starch
which has to be digested

any 3 for 1 mark each

3

(c)
- increased secretion of glucagons
- by pancreas
- results in increases rate of conversion of glycogen into glucose

for 1 mark each

3

(d) 3 of e.g.

higher blood sugar level results in increased secretion of insulin
effect of insulin is to lower blood sugar
which in turn reduces rate of insulin secretion
overall result is to keep fluctuations in sugar level to a minimum

any 3 for 1 mark each

3

[17]

Q35.

(a) urine

for 1 mark

1

(b) (i) protein

for 1 mark

1

(ii) e.g. molecules too large

for 1 mark

1

(c) reabsorbed into blood

for 1 mark

1

(d) e.g. most of water reabsorbed but little urea

for 1 mark

1

[5]

Q1.

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

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

(a) (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)

(b) 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)

(c) (i) Describe how a kidney dialysis machine works.

_____

_____

_____

_____

_____

_____

(3)

(ii) Use the data in the table to suggest the concentration that the salt in the dialysis fluid should be. Explain your answer.

Concentration _____

Explanation _____

_____

_____

(2)

(Total 8 marks)

Q2.

(a) Explain, as fully as you can, why respiration has to take place more rapidly during exercise.

_____

_____

_____

(2)

(b) During exercise the process of respiration produces excess heat. Explain how the body prevents this heat from causing a rise in the core (deep) body temperature.

_____

_____

_____

_____

_____

_____

_____

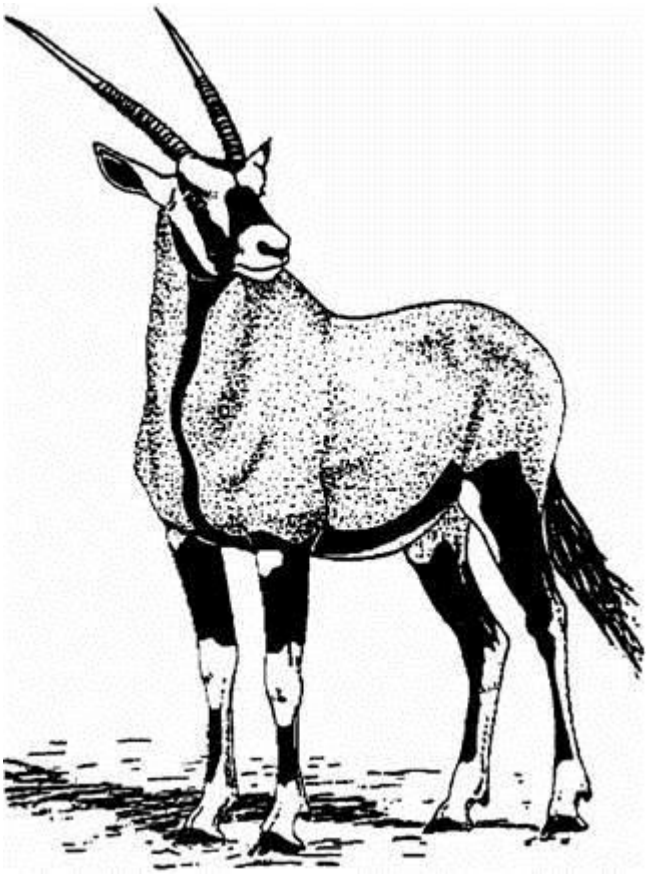
_____

(4)

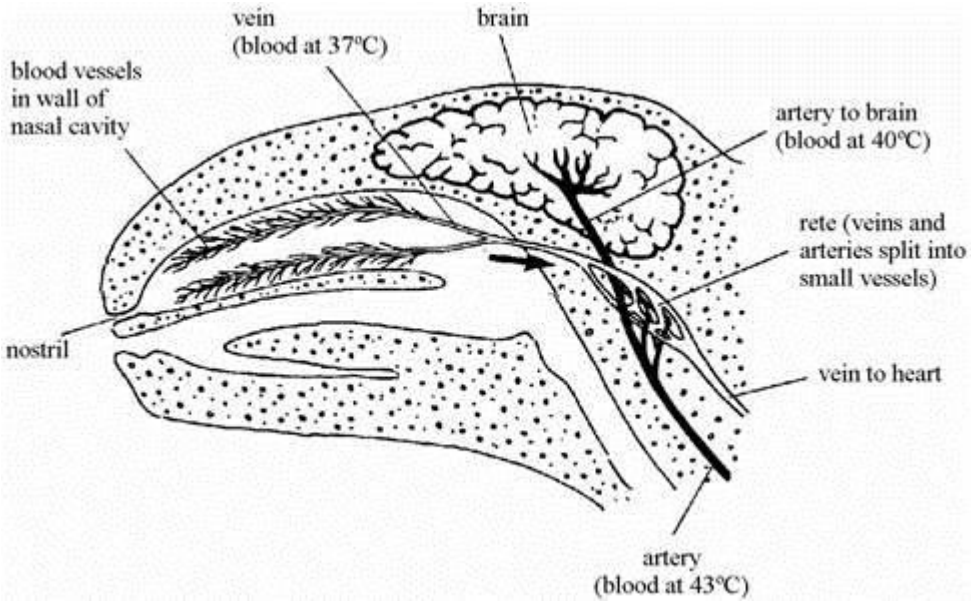
(Total 6 marks)

Q3.

The gemsbok is a large herbivore that lives in herds in desert areas of South Africa. Gemsboks feed on plants that are adapted to living in dry conditions. There are not many rivers, lakes or ponds that can provide drinking water for the animals. The desert areas are hot during the day but cool at night. As the air cools at night it becomes moist, and the plants absorb the moisture.



Although the gemsbok lives in hot conditions, it does not sweat. During the day its body temperature can rise, but it is important that blood reaching the brain does not rise above 40°C. The drawing shows how the blood system is adapted to cool the blood which flows to the brain.



(i) Suggest an advantage to the gemsbok of **not** sweating.

_____

_____

(1)

(ii) Explain how the blood is cooled in the cavities of the nose.

_____

_____

_____

_____

(2)

(iii) How does the structure of the rete help in keeping the brain cool?

_____

_____

_____

_____

(2)

(Total 5 marks)

Q4.

The table shows four ways in which water leaves the body, and the amounts lost on a cool day.

	WATER LOSS (cm^3)	
	COLD DAY	HOT DAY
Breath	400	the same
Skin	500	
Urine	1500	
Faeces	150	

(a) (i) Fill in the table to show whether on a hot day the amount of water lost would be

less **more** **the same**

The first answer has been done for you.

(3)

(ii) Name the process by which we lose water from the skin.

_____

(1)

(b) On a cool day the body gained 2550 cm^3 of water.
1500 cm^3 came directly from drinking.
Give **two** other ways in which the body may gain water.

1. _____

2. _____

(2)

(Total 6 marks)

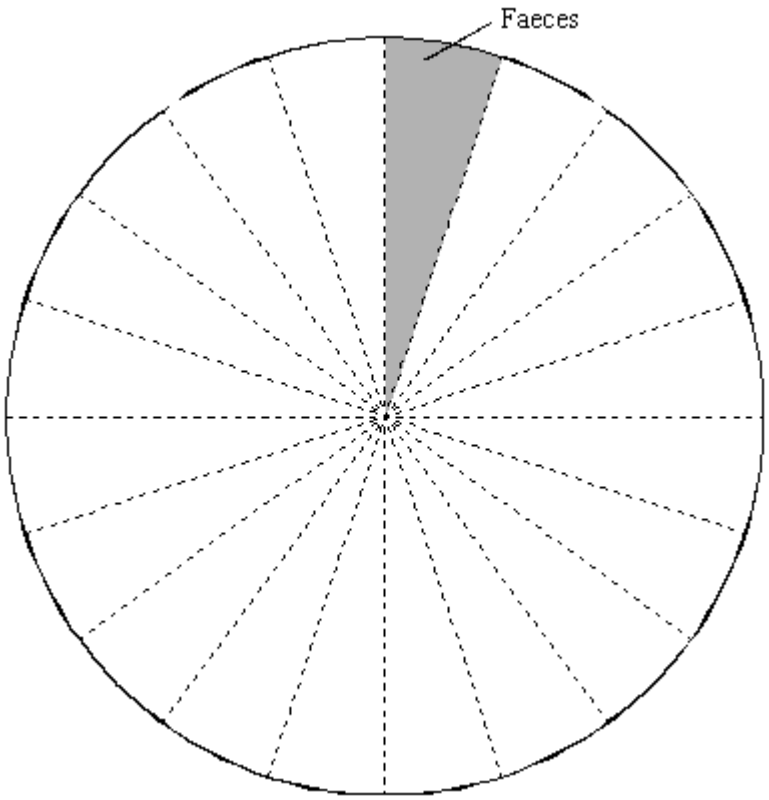
Q5.

The table shows how much water is lost in different ways from a student's body.

Way in which water is lost	**Percentage of total**
Breath	15
Faeces	5
Sweat	50
Urine	30

(a) Complete the pie chart.

One part has been done for you. Remember to label the pie chart.



(3)

(b) The table is about waste products which are removed from the student's body.

Complete the table by using the correct words from the box.

amino acids	breath	circulation	digestion	fatty acids
glucose	respiration	sweat	urine	

Waste product	How it is produced	How it leaves the body
carbon dioxide	by _____	in _____
urea	from _____	in _____

(4)

(Total 7 marks)

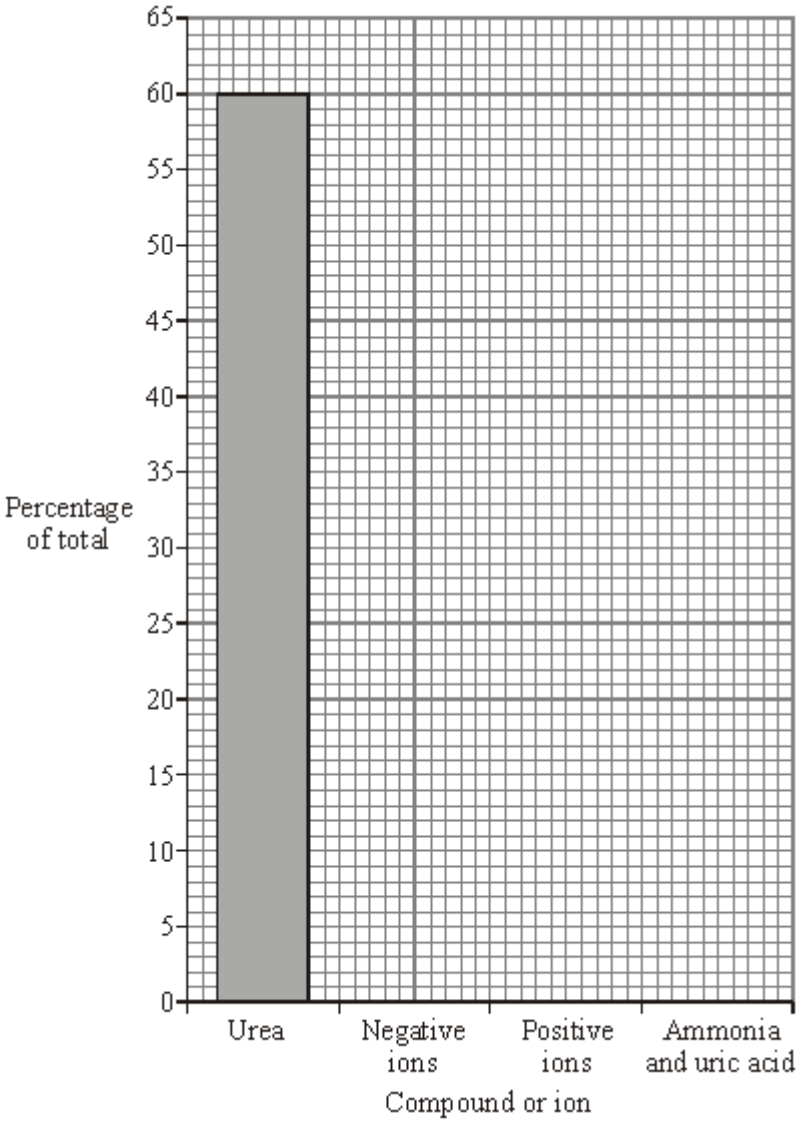
Q6.

(a) The table shows the compounds and ions dissolved in a student's urine.

Compound or ion	Percentage of total

urea	60
negative ions	25
positive ions	10
ammonia and uric acid	5

(i) Complete the bar chart. One bar has been drawn for you.



(2)

(ii) There is a total of 10 g of compounds and ions dissolved in a sample of this student's urine. Calculate the mass of urea in the sample. Show clearly how you work out your answer.

_____

_____

Mass of urea _____ g

(2)

(b) Use words from the box to complete the sentences.

anus	bladder	kidneys	liver	lungs

Plasma transports carbon dioxide from the body to the _____ .

Plasma transports urea from the _____ to the _____ .

(3)

(Total 7 marks)

Q7.

The table shows the amounts of some of the substances filtered, reabsorbed and excreted by the kidneys in one day.

Substance	Amount filtered	Amount reabsorbed	Percentage reabsorbed	Amount excreted
water		178.5 litres	99.2 %	1.5 litres
urea	56 g	28 g	50 %	28 g
glucose	800 units	800 units	100 %	0
sodium	25 200 units	25 050 units		150 units
chloride	18 000 units	17 850 units	99.2 %	150 units

(a) Calculate the amount of water filtered by the kidneys in one day.

Amount _____ litres

(1)

(b) Calculate the percentage of the filtered sodium that was reabsorbed. Show clearly how you work out your answer.

Percentage reabsorbed _____

(1)

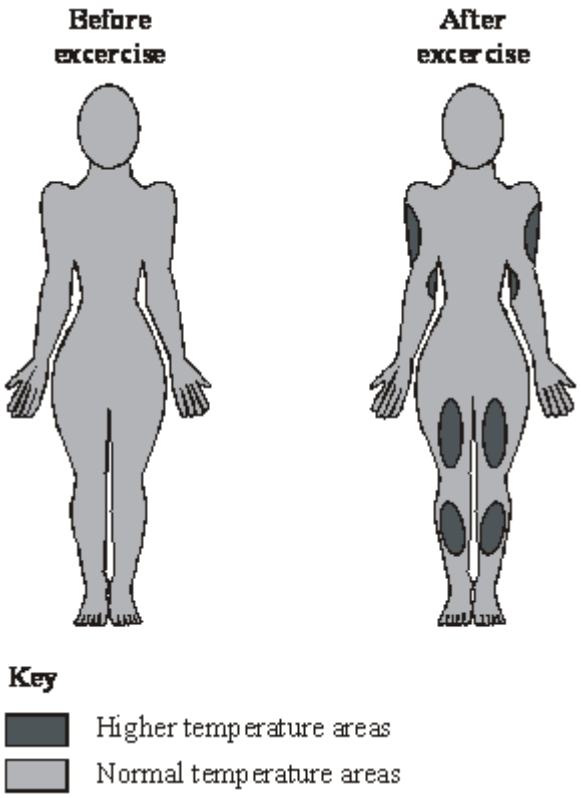
(Total 2 marks)

Q8.

The temperature at the surface of the skin can be measured by using a technique called thermography.

In this technique, areas with higher temperature appear as a different colour on the thermographs.

The drawings below show the results of an investigation in which thermographs were taken from a person before and after exercise.



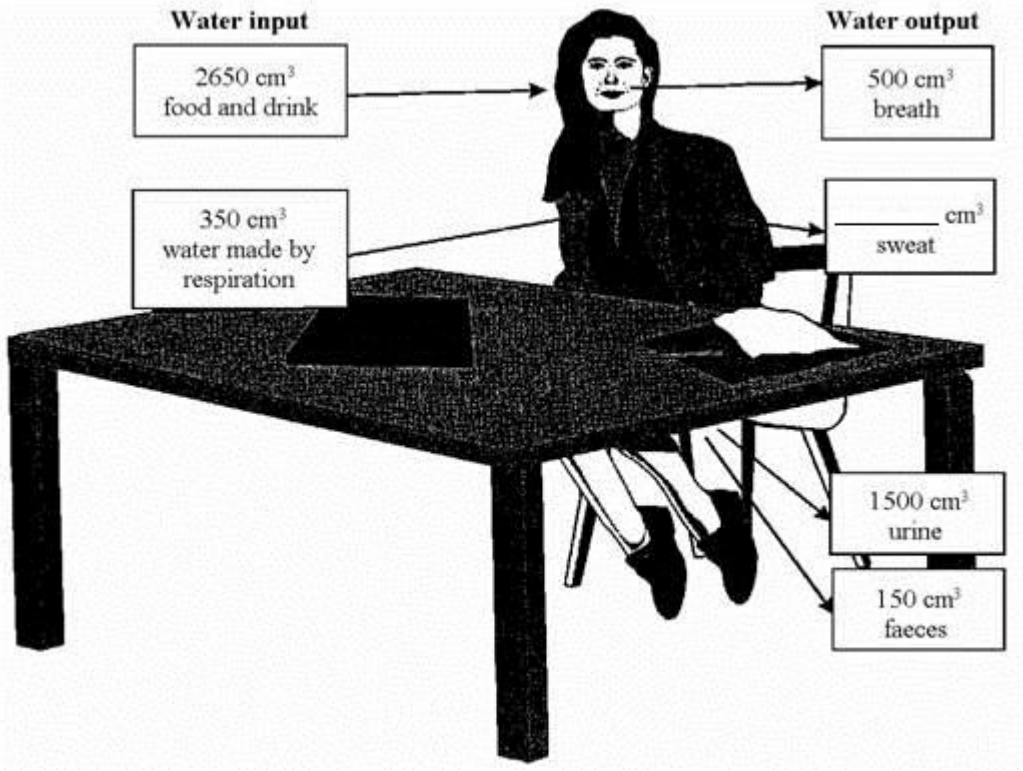
Describe and explain, as fully as you can, the effects of exercise on skin temperature.

(Total 3 marks)

Q9.

The diagram shows a water balance for a girl who spends most of the day working at a desk. It is not complete.

(a) Complete the diagram by writing in the volume of sweat produced.



(1)

(b) The next day she spent much of the day training, doing many different types of exercise.

State how **each** of the following would change and why it would be different from the previous day.

(i) The amount of water given off as sweat.

_____

_____

_____

(2)

(ii) The amount of water breathed out.

_____

_____

_____

(2)

(iii) The amount of urine passed, if she had the same water intake as on the previous day.

_____

_____

_____

(2)

(c) Which organ controls the amount of water in the body?

_____

(1)

(Total 8 marks)

Q10.

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.

_____

_____

_____

_____

(3)

(Total 5 marks)

Q11.

The table compares the percentages of various substances in a person's blood and their urine.

Substance	Blood	Urine
Water	92.00%	95.00%
Glucose	0.10%	0

Salt	0.37%	0.60%
Urea	0.03%	2.10%

(a) How does the level of urea in urine compare with the level of urea in the blood?

_____

(2)

(b) The kidney produces urine by filtering the liquid part of blood and then re-absorbing some of the filtered substances.

Use this information to explain the difference in the level of urea in urine compared to the level of urea in blood.

_____

_____

_____

_____

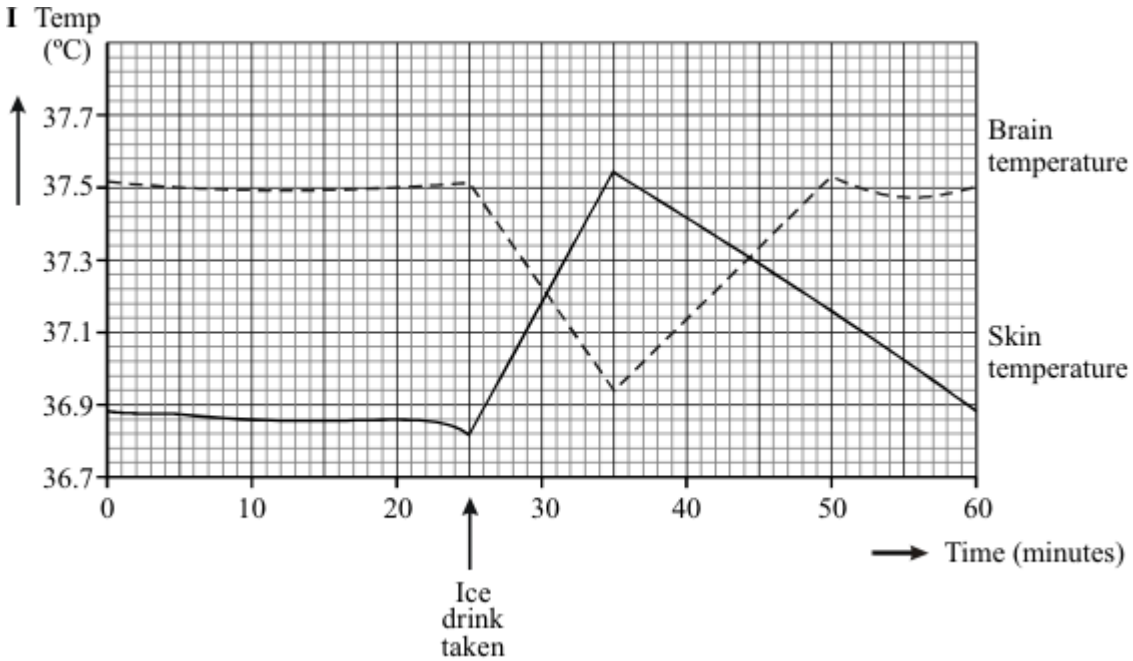
(2)

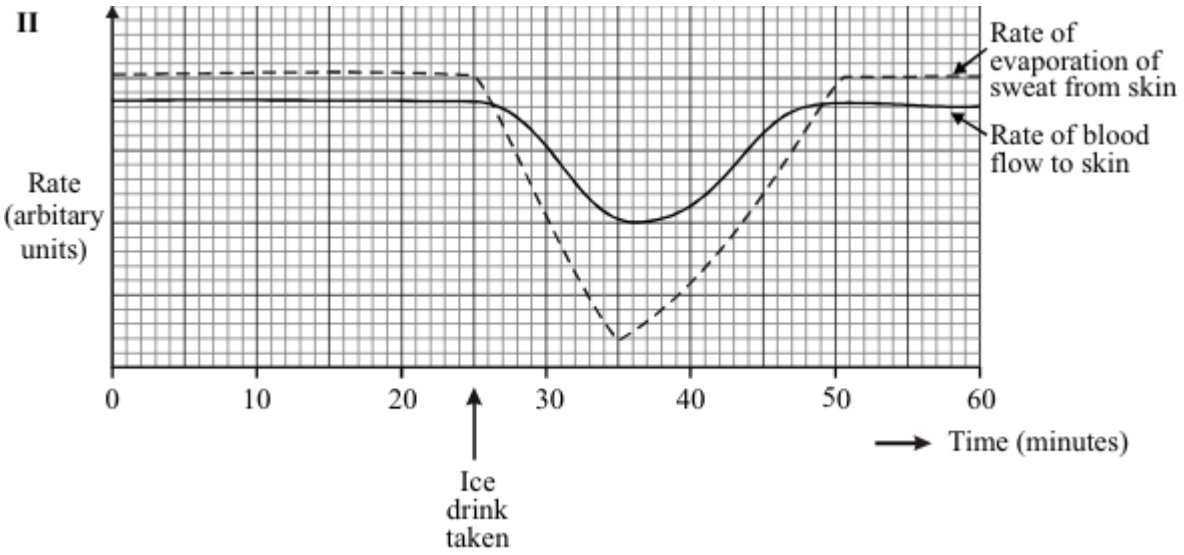
(Total 4 marks)

Q12.

On a hot day, a student has an iced drink.

Graphs I and II show some of the changes to the student's body produced by the iced drink.





Use the information from the graphs to explain, as fully as you can, why the temperature of the student's skin rises after she has taken the iced drink.

_____

_____

_____

_____

_____

_____

(Total 4 marks)

Q13.

Mushrooms can be grown on compost. The compost is made by mixing straw and manure which rot down.

(a) Write down **three** things which are needed for the straw and manure to rot.

1. _____

2. _____

3. _____

(3)

(b) Some substances, like plastic, are not biodegradable.

What does this mean?

_____

_____

(1)

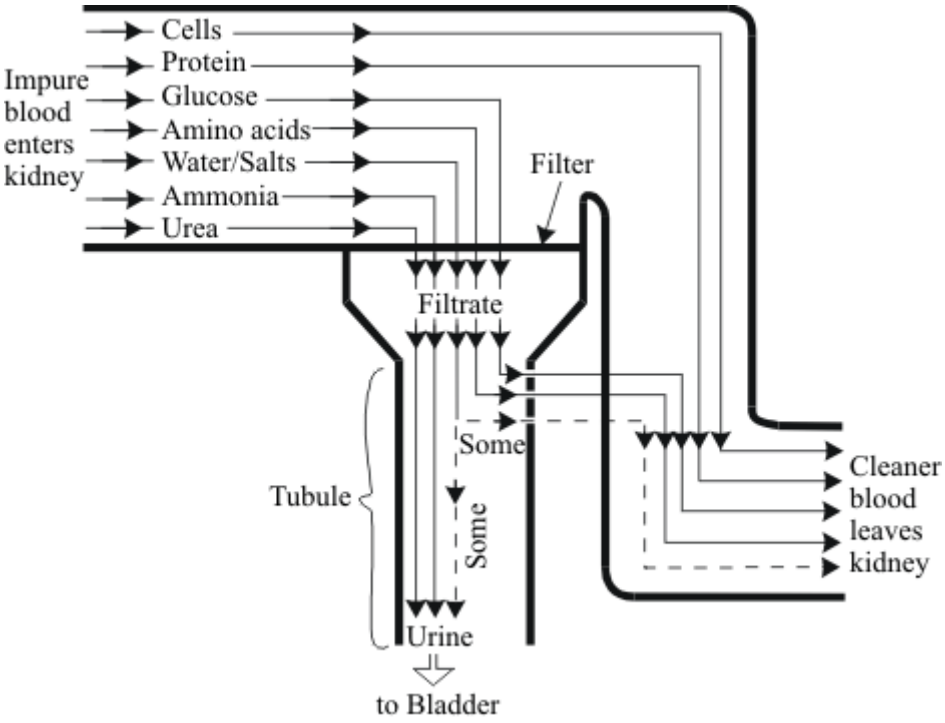
(Total 4 marks)

Q14.

The job of our kidneys is to remove unwanted substances from our blood.

Substances which are needed in the blood must not be lost.

The flow-diagram below shows how the kidneys do this job.



(a) Describe what happens to the glucose and amino acids in the kidney.

_____

_____

_____

_____

(4)

(b) A man has 5 litres of blood in his body.

In one day:
- the kidneys filter out 170 litres of liquid from the blood.
- he produces 1.5 litres of urine.

(i) What % of the filtered liquid is reabsorbed?

_____

_____

(2)

(ii) The man became ill because his kidneys would not absorb as much of the filtered liquid.

Write down **two** ways the man would be affected by this.

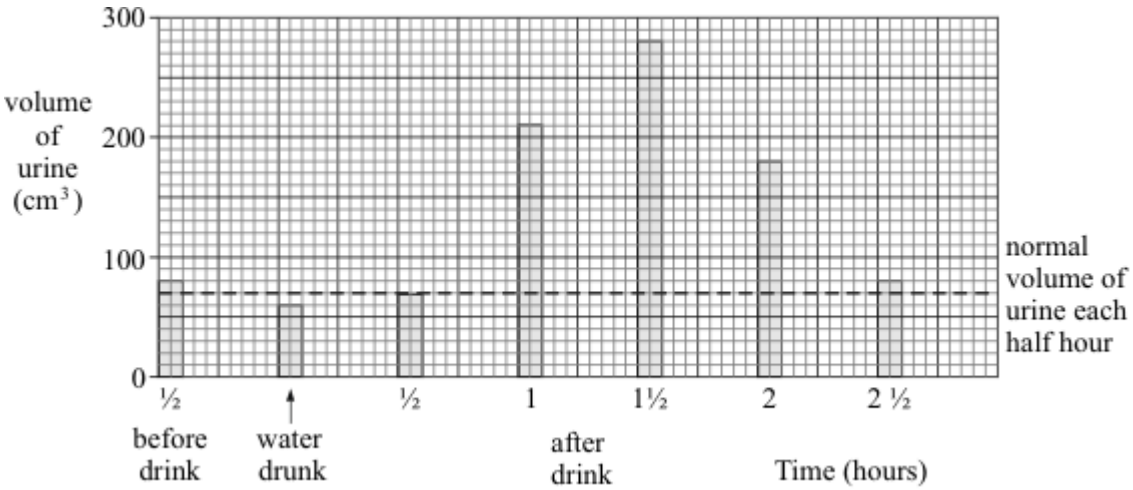
_____

_____

(2)

(c) In an experiment the man drank 800cm³ of water.

The diagram shows the effect this had on the volume of urine the man produced each 30 minutes.



Describe, in as much detail as you can, how drinking the water affected the volume of urine produced afterwards.

_____

_____

_____

_____

_____

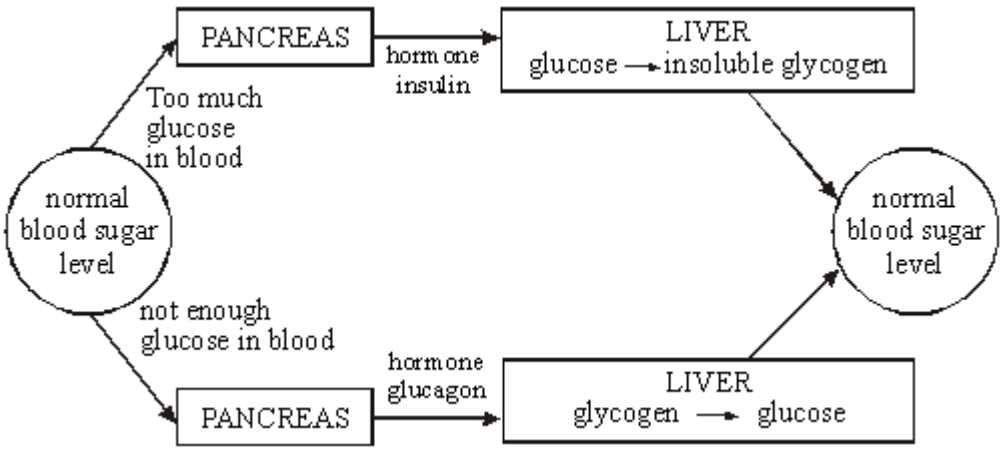
_____

_____

(5)

(Total 13 marks)

Q15.



The diagram shows how the blood sugar level is controlled in the body.

Explain fully what would happen if somebody ate some glucose tablets.

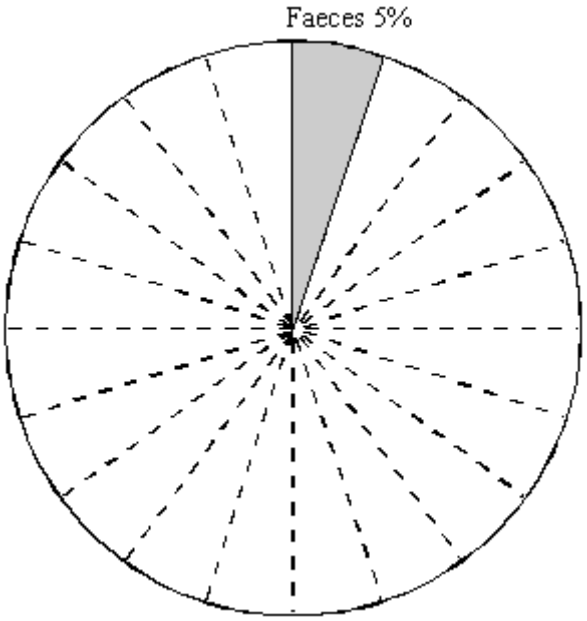
(Total 4 marks)

Q16.

The table below shows how the body loses water.

HOW WATER IS LOST	% (PERCENTAGE)
Breathing	10
Faeces	5
Sweat	45
Urine	40

Complete the diagram by showing the water loss for breathing, sweat and urine.



(Total 3 marks)

Q17.

Kidneys are important as they remove waste from blood and balance our water needs.

Kidney failure can be treated by transplant or dialysis using a kidney “machine”.

The money for expensive treatment for a few people could be used to provide more patients with less expensive treatment for other complaints.

Dialysis – kidney “machines”
Most expensive
Need own machine or share machine in hospital
Restricted life – special diet, must return to machine
Can be used while patient waits for transplant

Kidney transplant
Very expensive but cheaper than dialysis
Need kidney from relative or from “newly” dead person
Independent
Transplant may be rejected

Discuss the advantages and disadvantages of using dialysis or kidney transplants to keep people alive.

(Total 5 marks)

Q18.

The figures below show the levels of carbon dioxide in air from 150 000 years ago.

TIME	CARBON DIOXIDE CONCENTRATION
1500 years ago	270 parts per million
1800 AD	290 parts per million
1957	315 parts per million
1983	340 parts per million

(a) Explain why carbon dioxide levels in the atmosphere are changing.

(3)

(b) It is suggested that the increased level of carbon dioxide in the air is causing the atmosphere to warm up (the “Greenhouse Effect”).

Describe, as fully as you can, **two** major effects of global warming and how these may affect the human population.

(6)

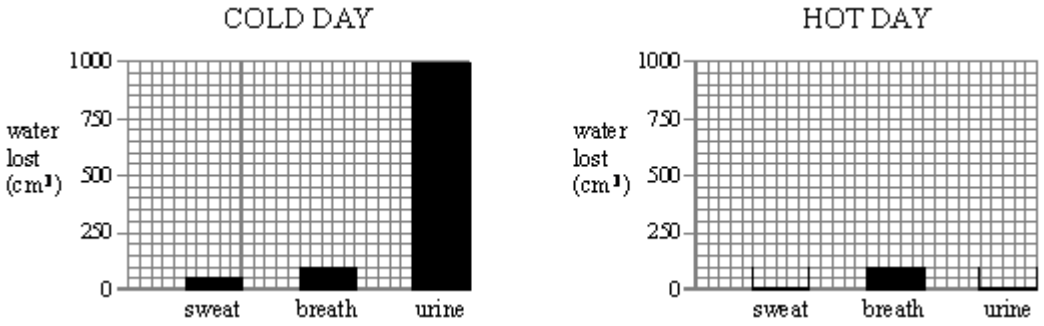
(Total 9 marks)

Q19.

The table shows how much water is lost from a boy's body on a cold day and on a hot day.

WATER LOST (cm^3)	COLD DAY	HOT DAY
in sweat	50	300
in breath	100	100
in urine	1000	750

(a) Use the figures in the table to complete the bar-chart for a hot day.



(2)

(b) How do the figures for the hot day compare with those for the cold day? Answer in as much detail as you can.

(4)

(c) The boy does the same things for the same amount of time on both days. Explain why the amounts of water lost in sweat and urine change.

Sweat _____

_____

Urine _____

_____

(2)

(Total 8 marks)

Q20.

The table shows how much water is lost from a boy's body on a cold day and on a hot day.

WATER LOST (cm^3)	COLD DAY	HOT DAY
in sweat	50	300
in breath	100	100
in urine	1000	750

(a) How do the figures for the hot day compare with those for the cold day? Answer in as much detail as you can.

_____

_____

_____

_____

_____

(2)

(b) The boy does the same things for the same amount of time on both days.

Explain why the amounts of water lost in sweat and urine change.

Sweat _____

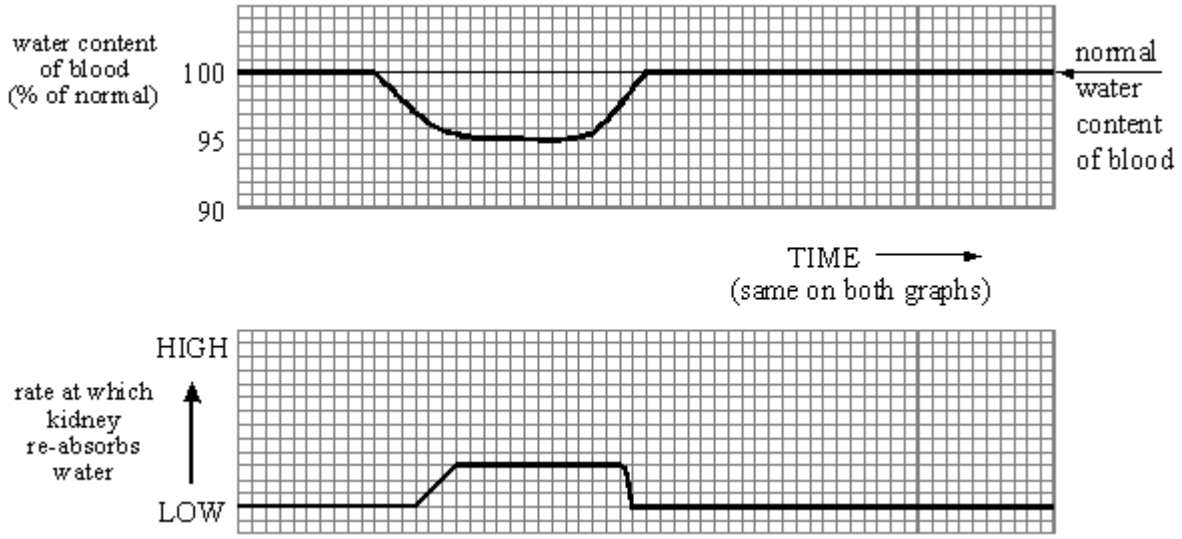
_____

Urine _____

_____

(2)

(c) The rate at which the kidney re-absorbs water depends on the percentage of water in the blood.



Describe, as fully as you can, what the graphs tell you.

_____

_____

_____

_____

(4)

(d) How does your body control the rate at which your kidney re-absorbs water?

_____

_____

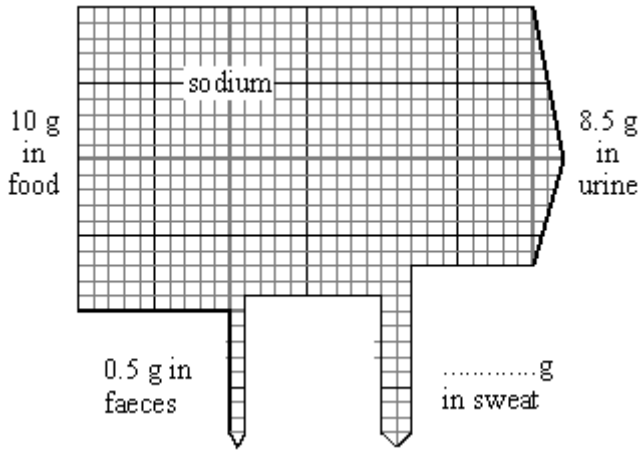
(2)

(Total 10 marks)

Q21.

To stay healthy, the amount of sodium in your body must not change very much.

On average, a girl takes in 10 grams of sodium a day in the food she eats.
The diagram shows what happens to this sodium.



(a) Add the missing figure to the diagram.

(1)

(b) The girl goes on holiday to a very hot place.
Her diet stays the same but she now loses 12g of sodium each day in sweat.

(i) How will this affect the amount of sodium she loses each day in her urine?

_____

(1)

(ii) What should the girl do to make sure that her body still contains enough sodium?

_____

(1)

(c) Usually, there is no glucose in urine. All of the glucose is re-absorbed from your kidney tubules back into your blood. Complete the following sentences to describe how this happens.

The glucose is re-absorbed by a process called _____

This process is needed because some of the glucose is re-absorbed against

_____

(2)

(Total 5 marks)

Mark schemes

Q1.

(a) (i) protein

for 1 mark

1

(ii) e.g. molecules too large

for 1 mark

1

(b) e.g. most of water reabsorbed, but little urea

for 1 mark

1

(c) (i) restores concentration of dissolved substances, to normal level,
wastes pass into dialysis fluid

for 1 mark each

3

(ii) the same (0.35) or slightly below (<0.35),
so that concentration of salts in blood remains constant

for 1 mark each

2

[8]

Q2.

(a) more energy needed,
for increased muscular activity

for 1 mark each

2

(b) increased sweat production,
evaporation of sweat cools body,
vasodilation OWTTE,
more heat loss (by radiation)

for 1 mark each

4

[6]

Q3.

(i) *idea that* reduce water loss (in dry area) / conserve water

for 1 mark

1

(ii) ideas of evaporation (of moisture) uses energy / heat
or
large surface area of blood vessels / dilation of blood vessels
for evaporation / radiation

each for 1 mark

2

(iii) ideas of large surface area of (small) vessels / intertwining results in close contact of vessels idea that cool venous blood cools arterial blood

each for 1 mark

2

[5]

Q4.

(a) (i) more
less
the same
(*accept* appropriate numbers)

for 1 mark each

3

(ii) sweating / evaporation / perspiration

for 1 mark

1

(b) in food / named solid food / eating
from respiration

for 1 mark each

2

[6]

Q5.

(a) all sectors correctly plotted – 2 marks one plotting error only – 1 mark
2 **or** more plotting errors 0 marks

breath = 3 sectors
urine = 6 sectors
sweat = 10 sectors

2

all sectors labelled

allow 2 labelled only

1

(b) respiration

1

breath

1

amino acids

1

urine

1

[7]

Q6.

(a) (i) all plots correct

Tolerance ± $\frac{1}{2}$ square
allow 1 mark for 2 correct plots

2

(ii) 6

correct answer with no working = 2
allow 1 mark for (60 ÷ 100) × 10
N.B. correct answer from incorrectly recalled relationship / substitution = 0

2

(b) lungs

1

liver

1

kidneys

1

[7]

Q7.

(a) 180 **or** 179.9

1

(b) 99.4

1

[2]

Q8.

any **three** from:

heat produced by muscles

during exercise

accept when working

by respiration

(skin) temperature over muscles rises / more blood to skin over muscles

*allow vasodilation **or** arterioles dilate over muscles*
reject capillaries dilate
sweating neutral

[3]

Q9.

(a) 850

1

(b) (i) more

because exercise makes us sweat **or** work harder

accept to cool the body

do not credit body hotter or giving off more heat

2

(ii) more

because she respires more

*accept she breathes (in and out) more **or** heavier **or** faster*

2

(iii) less

because (more) water has been lost by sweating **or** breathing out **or** other methods

accept arguments about conservation of water

2

(c) kidney

1

[8]

Q10.

(a) (i) in blood **or** the circulation system **or** plasma

*accept arteries and veins **or** blood vessels*
*do not accept slowly **or** in blood cells*

1

(ii) glands

*accept endocrine glands **or** endocrine*
do not accept a named gland

1

(b) the pancreas

accept islets of Langerhans

1

any **one** from

does not produce (sufficient) insulin
(blood) sugar is not (properly) controlled

1

insulin injections **or** inhalers

*accept diet **or** tablets to make the pancreas produce insulin*

1

[5]

Q11.

(a) increases

gains 1 mark

but
70 × more (concentrated)
gains 2 marks

2

(b) *idea that*
water is reabsorbed;
urea is not reabsorbed (as much)
each for 1 mark

(credit (much) more water reabsorbed than urea)
gains 2 marks

2

[4]

Q12.

ideas that
internal cooling/cooling of brain causes reduction in sweating and of blood flow to skin
less sweating = less loss of heat from skin (= X)
less blood flow = less heat supplied to skin (= Y)
X > Y (so temperature rises)
each for 1 mark

[4]

Q13.

(a) warmth/heat
oxygen/air
moisture
microbes/micro-organisms/fungi/moulds/bacteria
any three for 1 mark each

3

(b) do not rot
for 1 mark

1

[4]

Q14.

(a) *idea:*
filtered
for 1 mark

reabsorbed
gains 1 mark

but
all reabsorbed
gains 2 marks

correct reference to blood
for 1 mark

4

(b) (i) *evidence of* $\frac{170 - 1.5}{170} \times 100$

gains 1 mark

but
99(.1)(%)
gains 2 marks

2

(ii) *idea:*
more urine
for 1 mark

body dries out/dehydrates
or
needs to drink more
for 1 mark

2

(c) no effect for first half hour/until 1 hour
rises to 210cm^3/to 3x level after 1 hour
rises to 280cm^3/to 4x level after 1½ hour
reference to 280cm^3/1½ hour as maximum level
falls to (near) normal after 2½ hours
comparison of rates of change e.g. rapid then slower rise and/or steady fall
not all of 800cm^3 excreted (extra to normal)
each for 1 mark to max. of 5
(do not credit simply rises then falls)

5

[13]

Q15.

idea:
glucose level rises
pancreas releases insulin
glucose → glycogen (in liver)/removes xs glucose
glucose level falls/returns to normal
for 1 mark each

[4]

Q16.

1 sector correct

gains 1 mark

but all sectors correct B = 2 S = 9 U = 8

gains 2 marks

all sections labelled correctly (w.r.t. sector size)

for 1 mark

[3]

Q17.

- cost of dialysis and transplant <u>compared</u>

- *idea that* both expensive and may need to balance cost against other medical priorities
- restricted diet/movement with dialysis

and

- no restriction/independence for transplant

each for 1 mark

- *idea* that donated kidney may not be available
- transplant may be rejected/dialysis consistently reliable

[Credit problem of finding body access points for repeated dialysis over the long term]

[5]

Q18.

(a) *idea:*
more (fossil) fuel burned (do not credit simply more people/cars/industry)
deforestation = less photosynthesis
deforestation = more respiration/burning

each for 1 mark

3

(b) *idea*:
climate change

for 1 mark

warmer/colder/drier/wetter
food production affected/starvation
mayor ecosystems destroyed/damaged

any two for 1 mark each

6

<u>sea level rise</u>

for 1 mark

low land flooded
less food grown/starvation
homes/factories flooded

any two for 1 mark each

Allow

polar ice caps melt
sea water expands

[9]

Q19.

(a) sweat – 6 squares high
urine – 15 squares high

each to < half a square for 1 mark each

2

(b) for *hot day (assumed unless otherwise stated)*

- same in breath
- same total
- more in sweat* / sweats more
- less in urine* / urinates less
- correct quantification of either * eg **x**cm^3 more / less or **n** times more / less
  250 cm^3 more sweat 6 × more sweat
  250 cm^3 less urine ¼ / 25% less urine
  any four • for 1 mark each
  [Do not allow just figures quoted from the table]

4

(c) *ideas that*

- you sweat more **<u>to keep cool</u>** on a hot day
- urine adjusted (by kidneys) to keep balance / to keep same total loss

each for 1 mark
[Accept "more sweat therefore less urine"]
[Credit ideas from (c) if given in (b)]

2

[8]

Q20.

(a) breath same + sweat more* + urine less* (*All <u>three</u> needed)*
<u>or</u>
total same but split differently

for 1 mark

**either change correctly quantified eg*
x cm^3 more/less or **n** times more/less

for 1 further mark

sweat 250 more 6 x more
urine 250 less ¼/25%less

2

(b) *ideas that*

- you sweat (more) to keep cool on a hot day
- urine adjusted (by kidneys) to keep balance / to keep same total loss

each for 1 mark

(NB credit these answers if in (a) candidates have answered more fully than expected)

2

(c) *ideas that*

- when blood water normal/100% / steady kidney re-absorbs water at low/steady rate
- when blood water percentage falls, the rate at which kidney re-absorbs water rises
- when blood water percentage rises again, is high/normal the rate at which
  kidney re-absorbs water falls
- 97 / 97.5% / 98% (of normal) blood water is the point at which the kidney's reabsorption rate starts to increase / decrease

each for 1 mark

[allow idea that there is delay between blood water percentage changing and rate of re-absorption changing]

4

(d) *any reference to* hormone(s) / pituitary (gland)

gains 1 mark

but
ADH or hormone(s) from pituitary (gland)

gains 2 marks
(do not allow 'brain)

2

[10]

Q21.

(a) 1

for 1 mark

1

(b) (i) there will be less / no sodium (per day) (in her urine)

for 1 mark

1

(ii) *idea that*
she should take in more (sodium (chloride) / salt)
(*allow* stay indoors / in shade **or** be less active)

for 1 mark

1

(c) active transport / uptake
(*do not allow* diffusion / osmosis)
the concentration / gradient
for 1 mark each

2

[5]