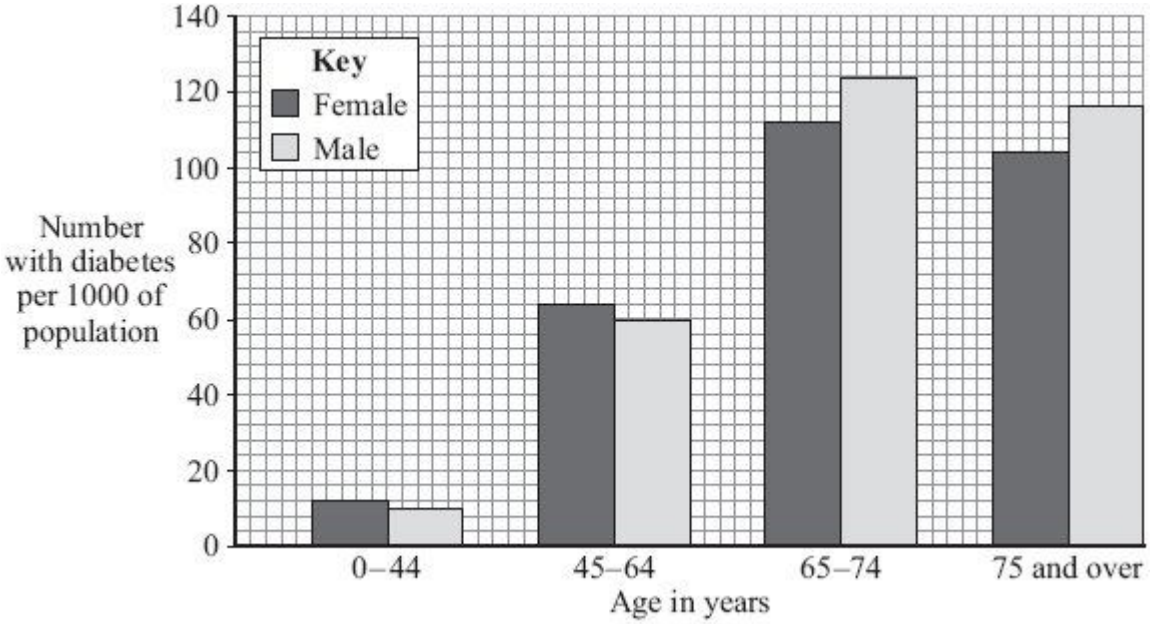
1 Diabetes is caused when the body does not produce enough insulin.

(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.

.....

.....

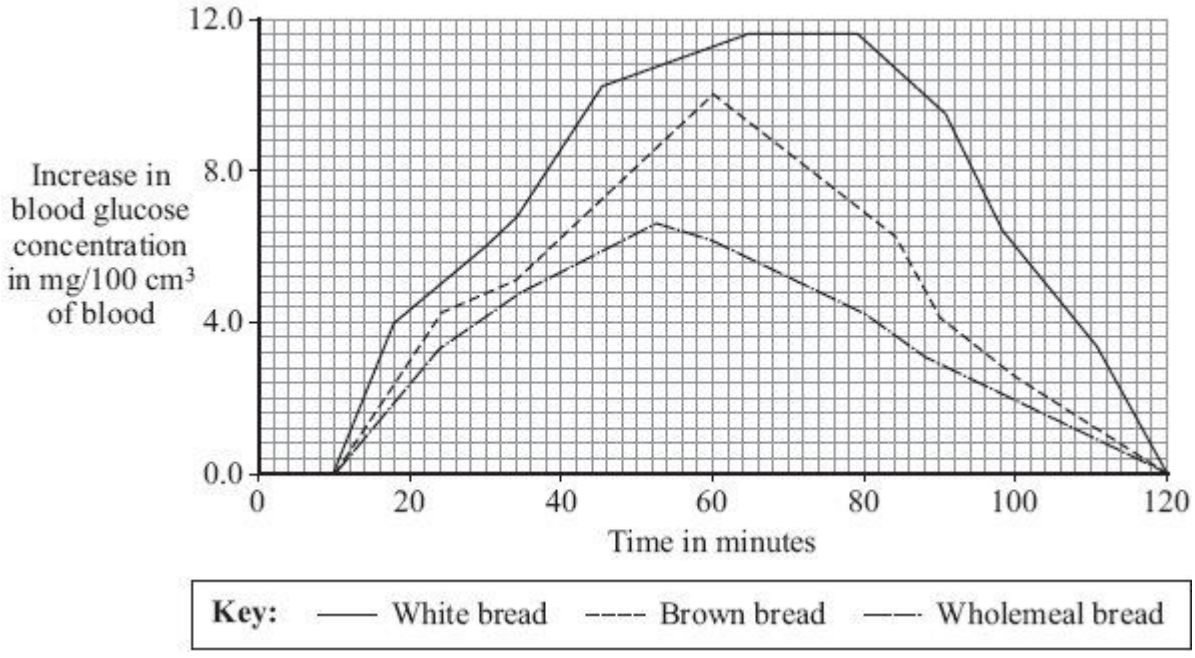
(1)
(Total 6 marks)

2 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.

.....

.....

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.....

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.....

.....

(3)
(Total 9 marks)

3

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

Tick (✓) **two** boxes.

Glucose ☐

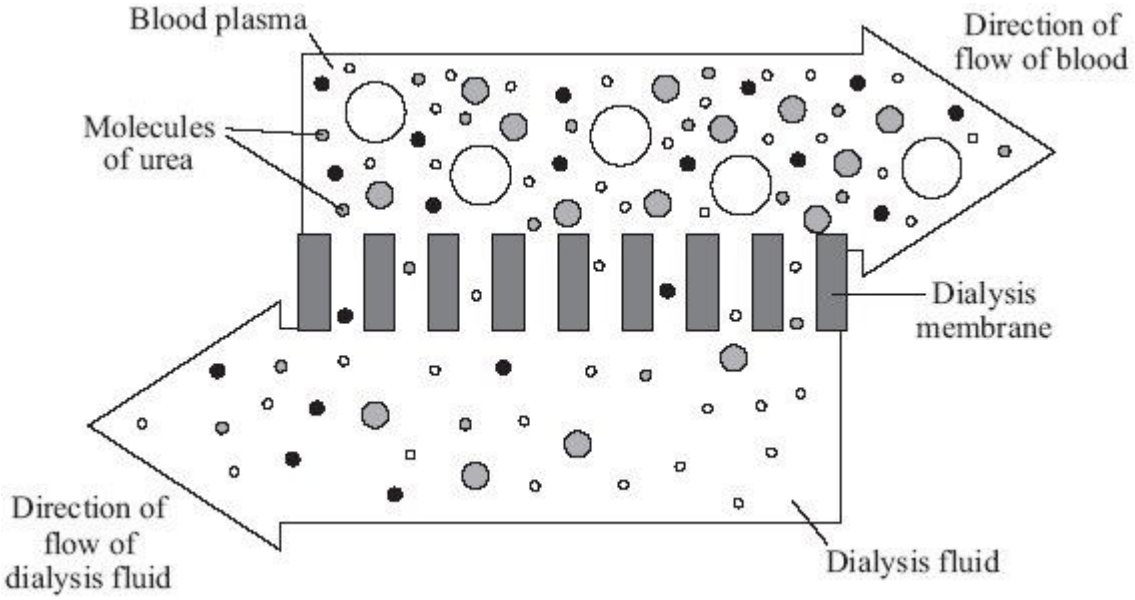
Mineral ions ☐

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

the urea molecules are

large
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. ☐

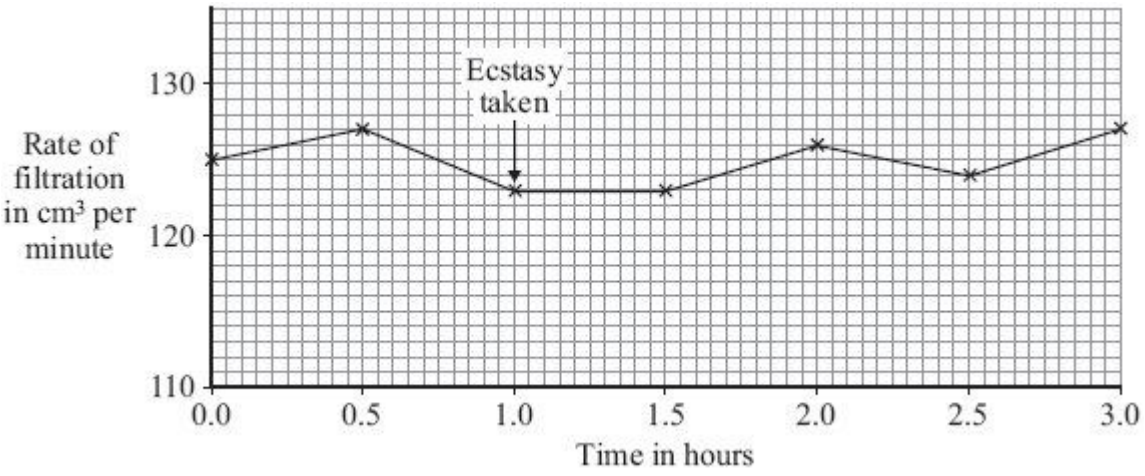
(1)
(Total 8 marks)

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

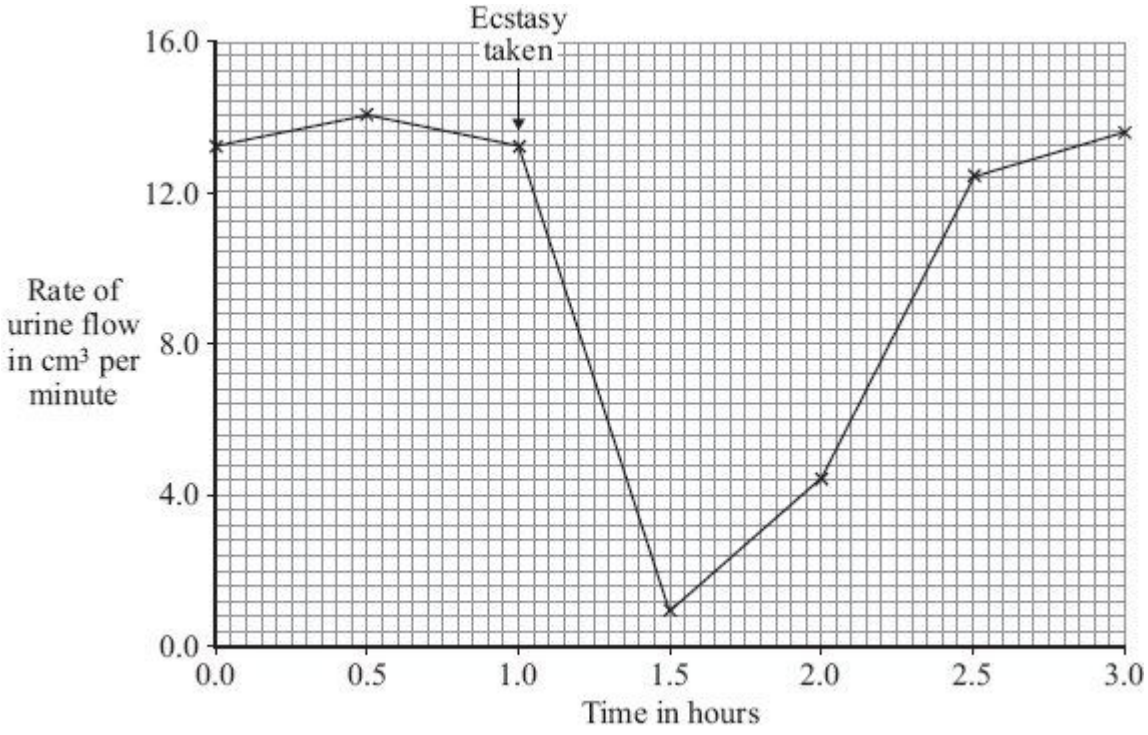
Graph 1 shows the rate of filtration by the kidneys of a healthy person.
Graph 2 shows the rate of urine flow from the kidneys of the same person.

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)

5 (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)

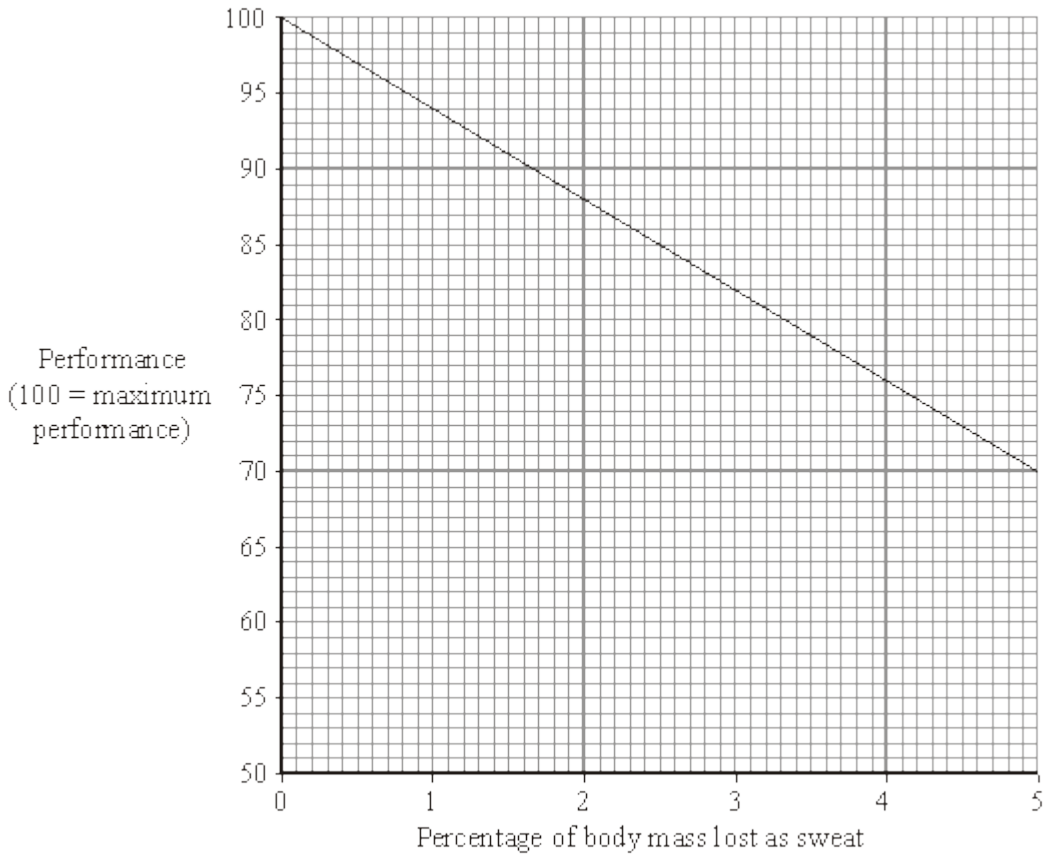
(iii) Excess water leaves the body in a liquid called urine.

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?

.....

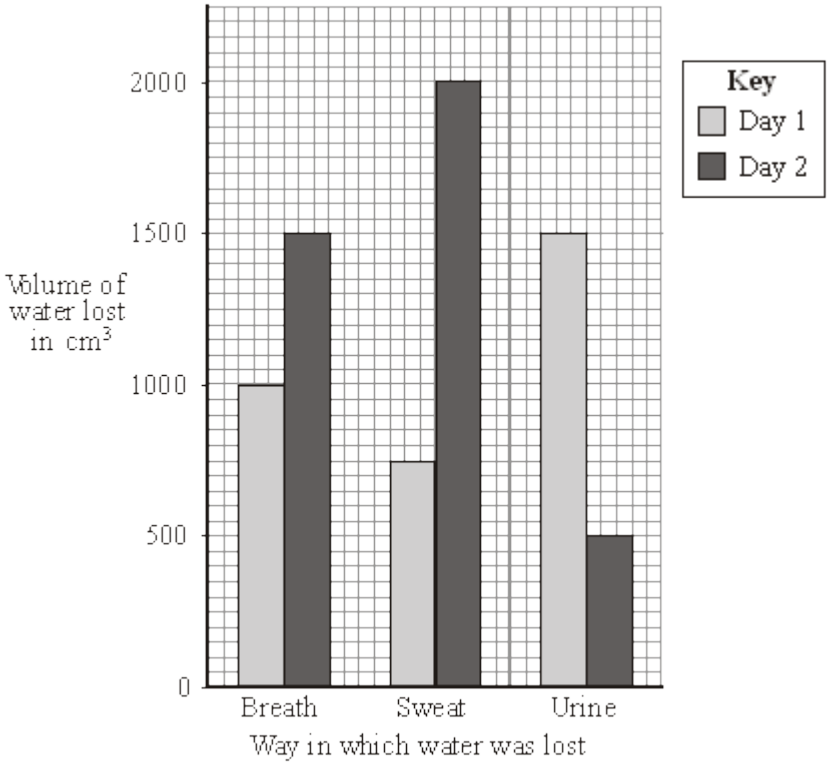
.....

(1)
(Total 5 marks)

6

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)

7 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)

8 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

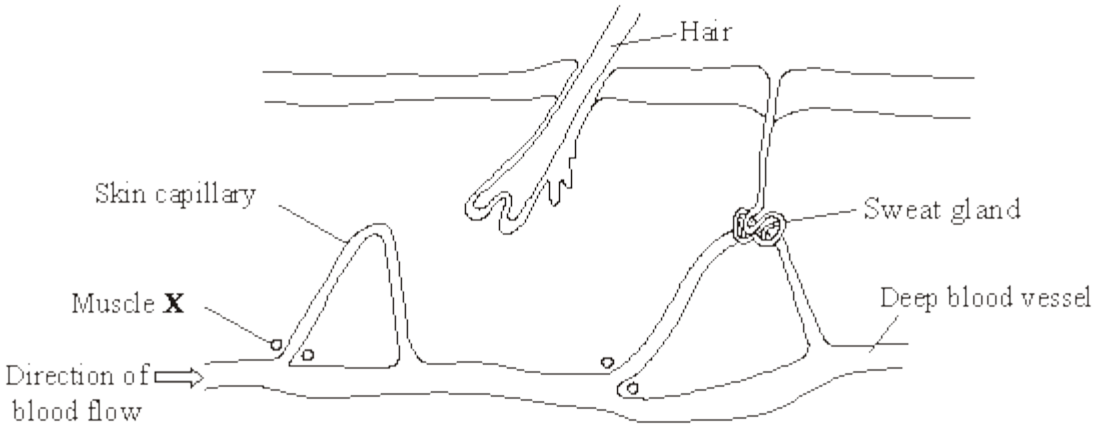
.....

.....

(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.

.....

.....

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.....

.....

.....

.....

(3)
(Total 6 marks)

9

(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)

10 (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)

11 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.

$\frac{1}{4}$ ☐

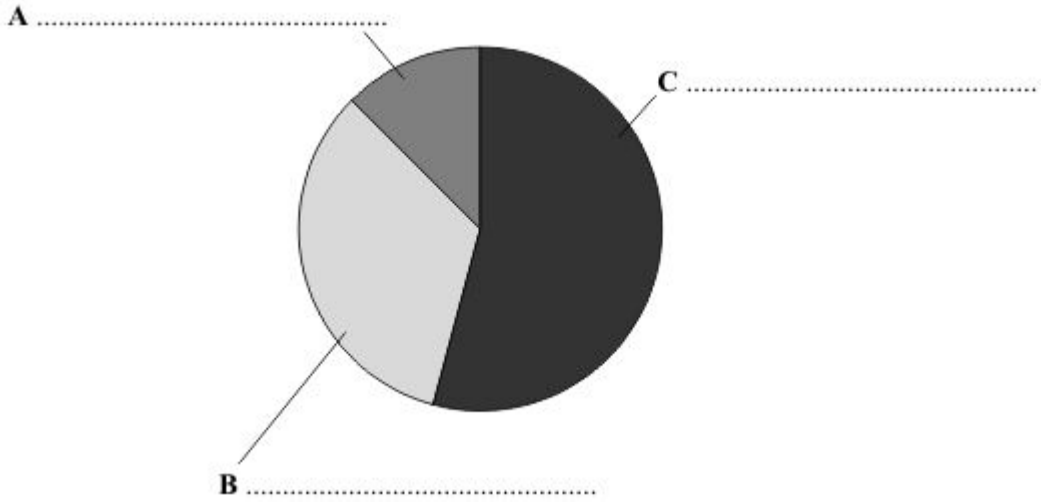
$\frac{1}{3}$ ☐

$\frac{1}{2}$ ☐

(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)

12 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.

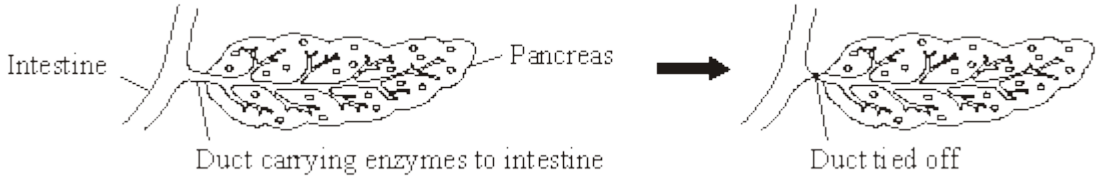
Banting thought that an enzyme produced in the pancreas of dog **A** had digested the hormone before it was injected.

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.

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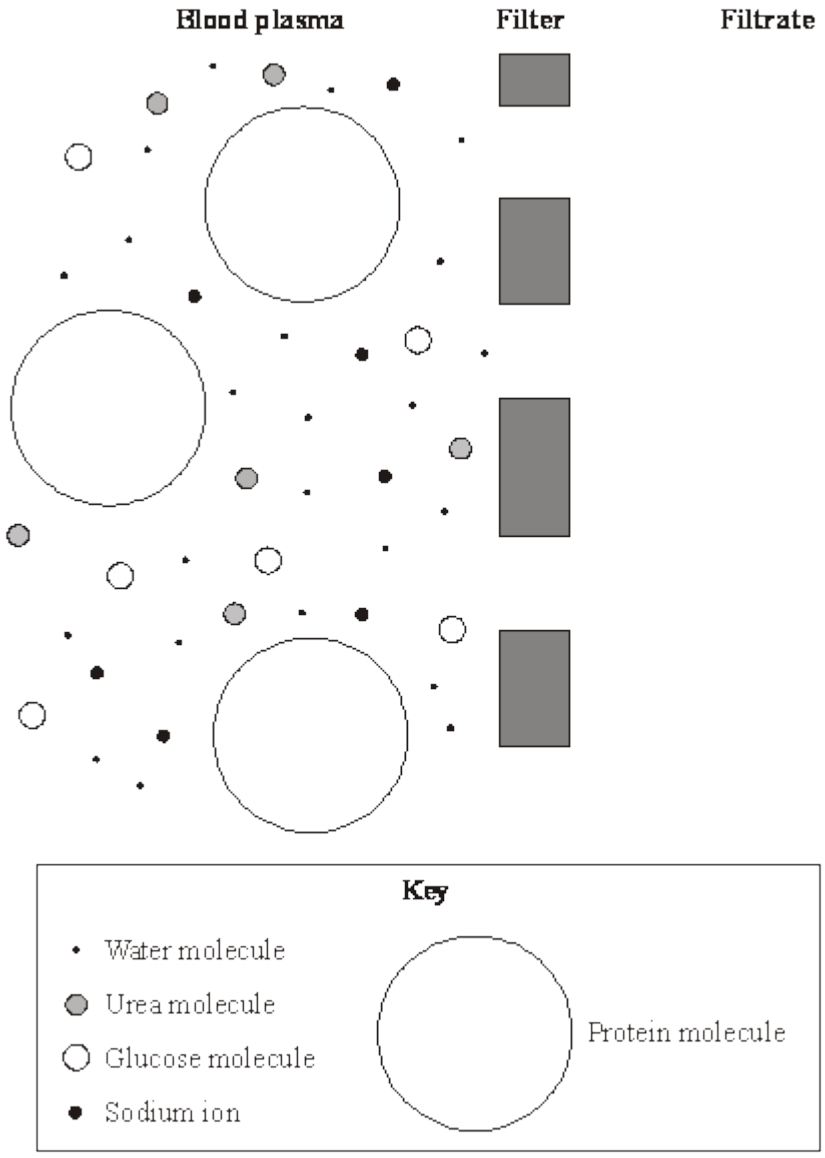
.....

(3)
(Total 7 marks)

13

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)

14 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)

15 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)

16 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.

.....

.....

.....

.....

.....

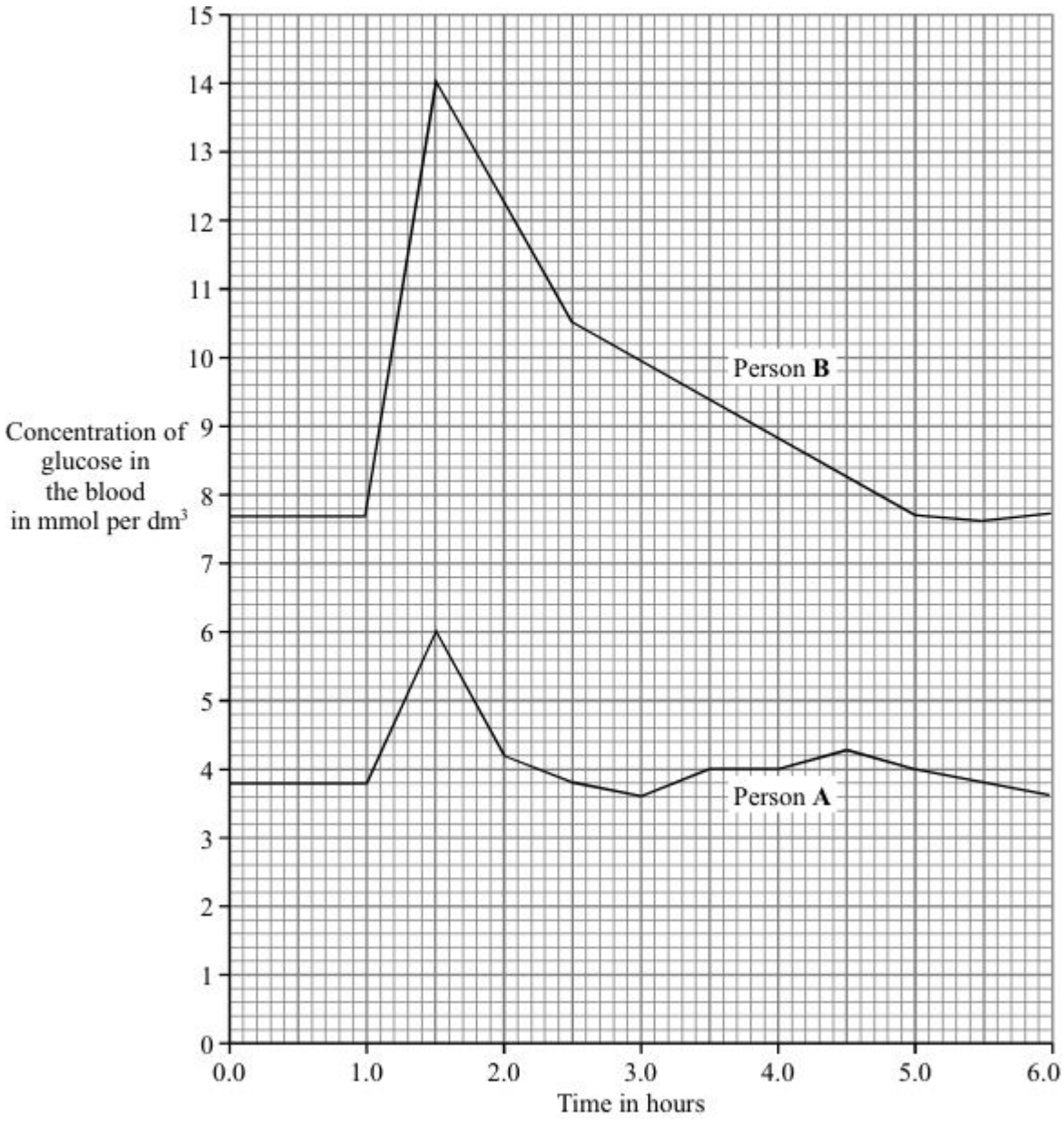
.....

.....

.....

(4)
(Total 5 marks)

17 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)

18 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)

19 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)

-

20 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.

.....

.....

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.....

.....

(4)
(Total 6 marks)

21 (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.

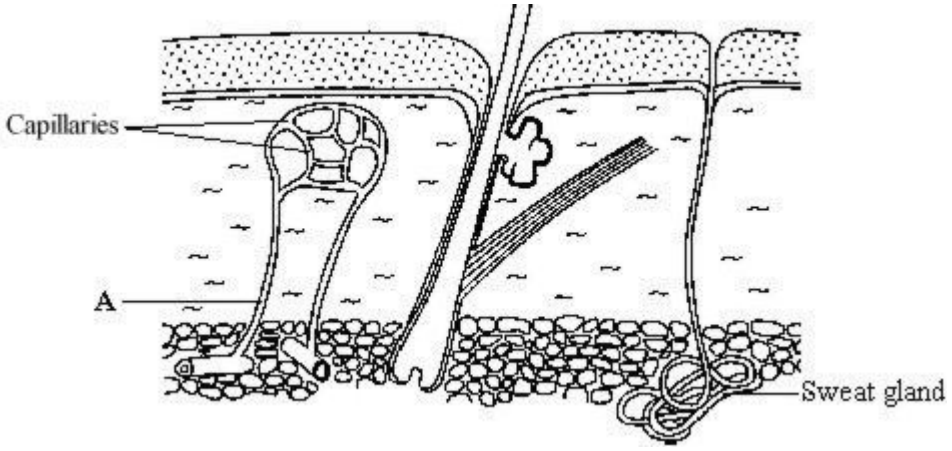
.....

.....

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)

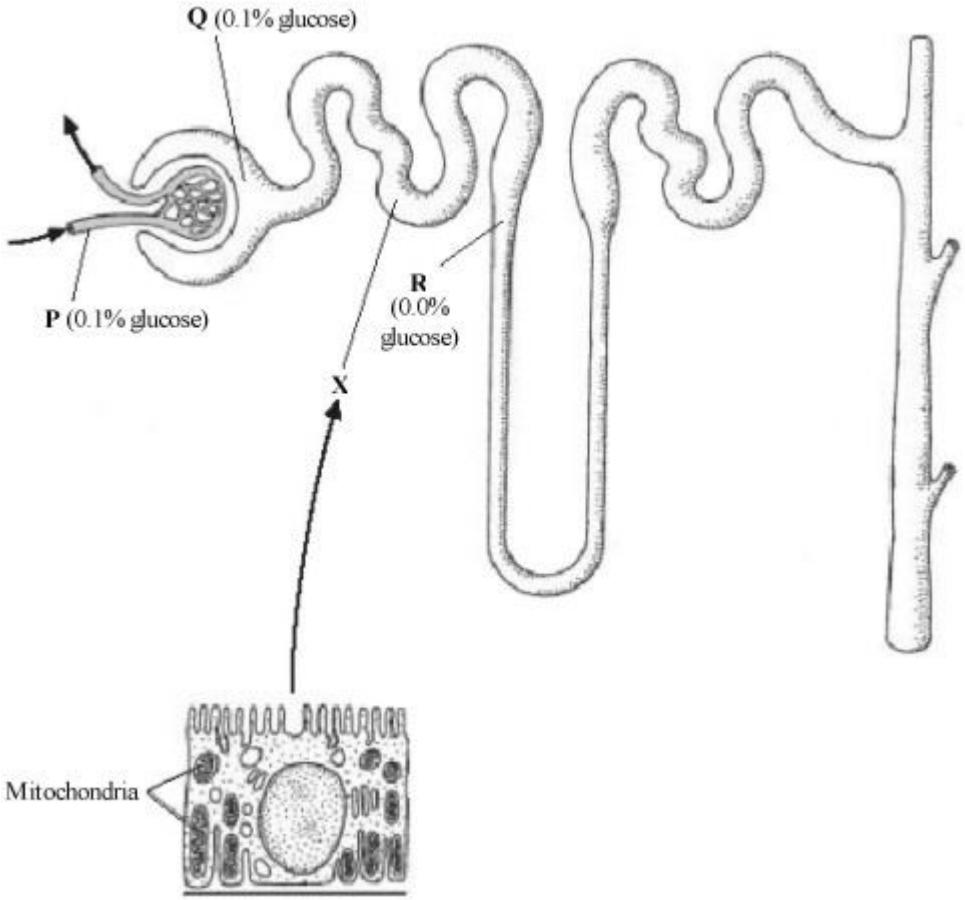
(c) Body temperature is monitored and controlled by the thermoregulatory centre. Where in the body is the thermoregulatory centre?

.....

(1)

(Total 7 marks)

22 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**.

.....

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.....

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.....

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.....

.....

(5)
(Total 7 marks)

23 **Figure 1** shows a food chain containing three organisms.

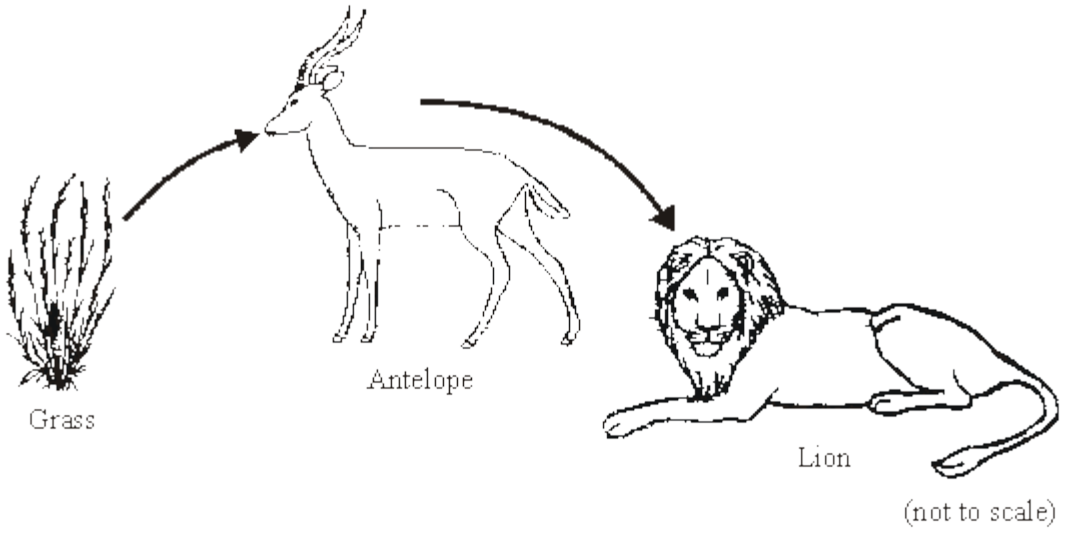


Figure 1

(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 ☐

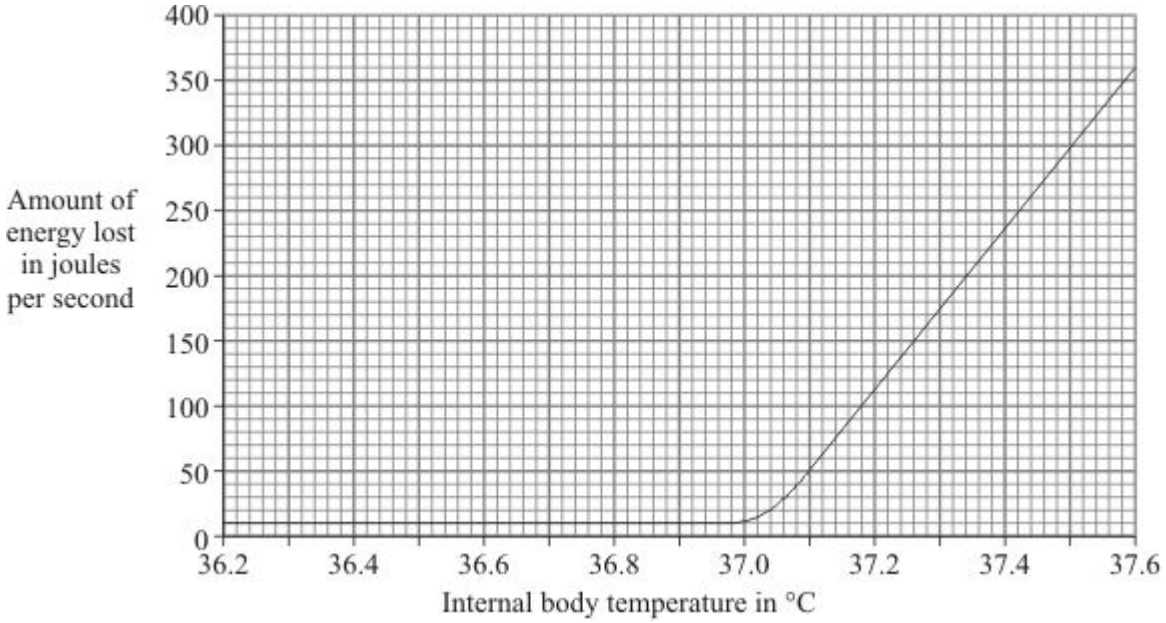
Mineral salts ☐

Oxygen ☐

Protein ☐

(2)
(Total 10 marks)

24 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.

.....

.....

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.....

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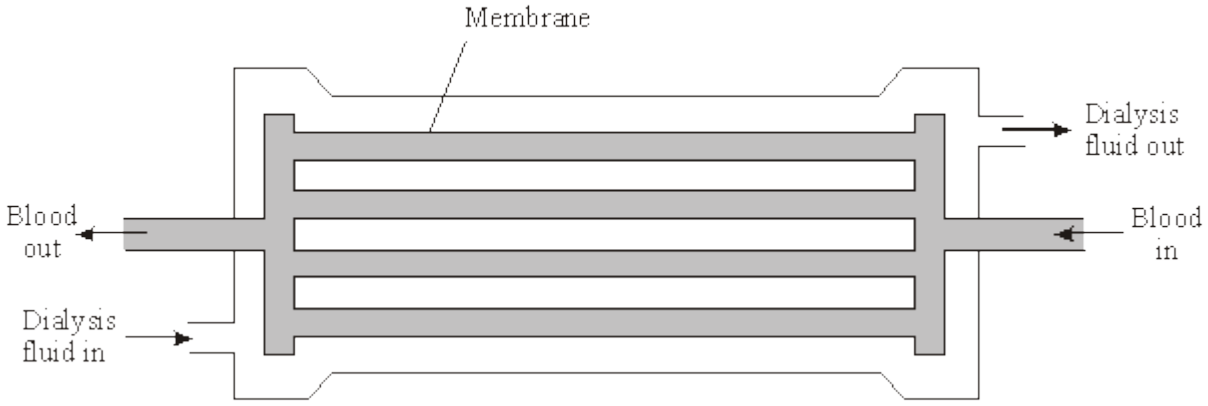
(3)

(Total 7 marks)

25 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.

.....

.....

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.....

.....

.....

.....

(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)

26 (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)

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

Hamster

36.8 °C

Horse

38.0 °C

Sheep

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.

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.....

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(Total 6 marks)

28

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)

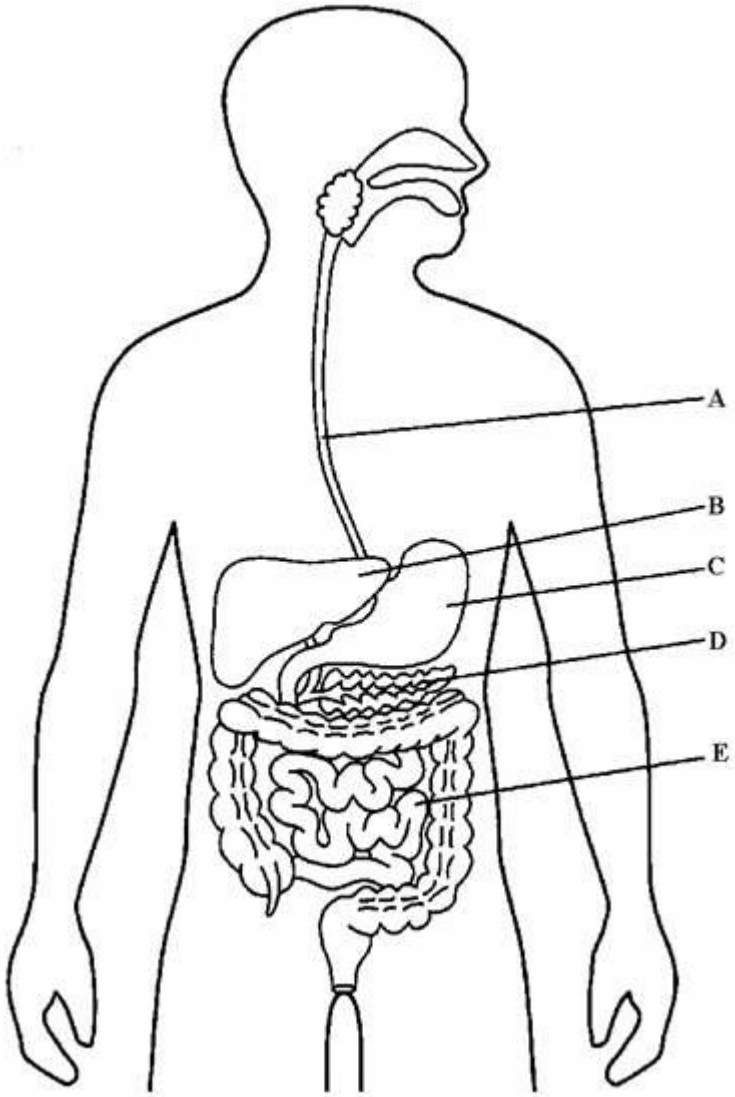
(ii) Explain the role of insulin in controlling blood sugar levels.

.....

(4)

(Total 7 marks)

29 The diagram shows part of the human digestive system.



(i) Name part **B**.

.....

(1)

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

.....

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(2)
(Total 3 marks)

30 (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.

.....

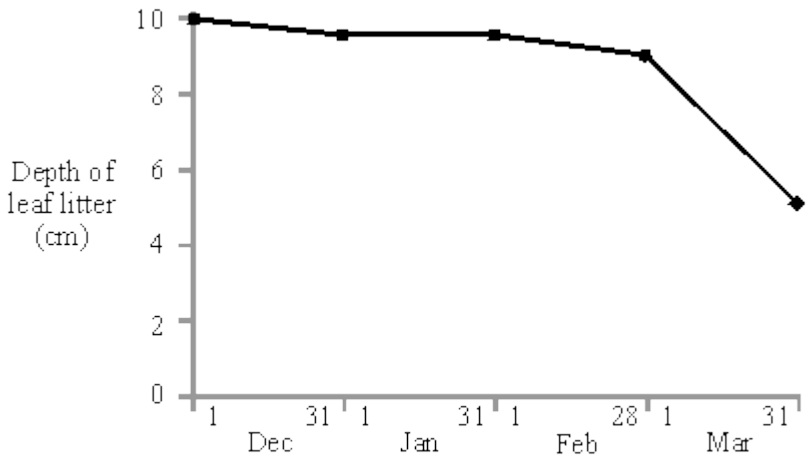
.....

.....

.....

(4)

(b) An area of the floor of the wood 1 m² 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)

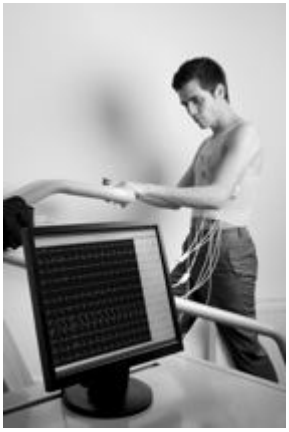
(Total 11 marks)

31 (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.

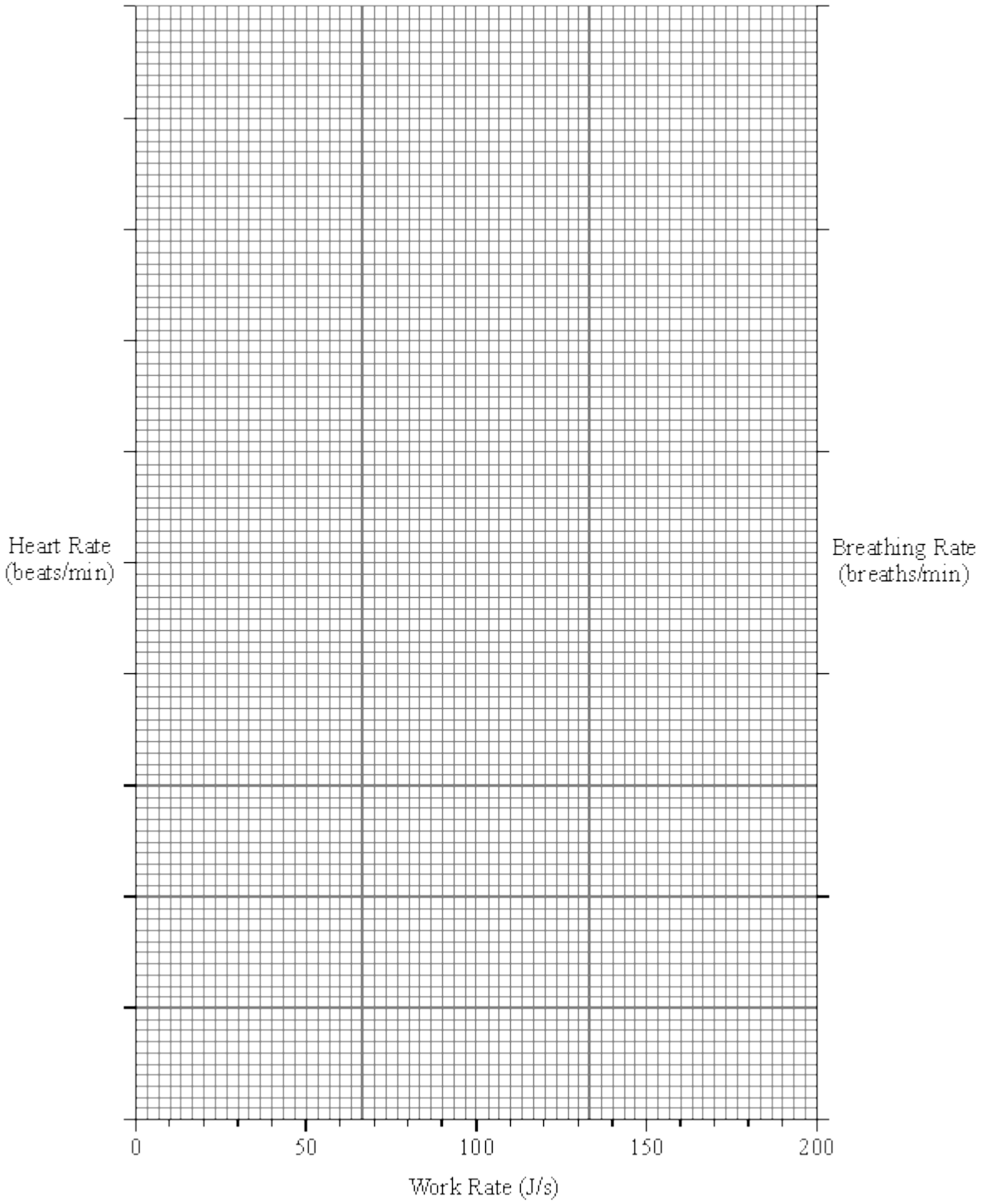


The athlete's heart rate and breathing rate were measured at different work rates.

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.

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(6)

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

(i) the stimulus; .....

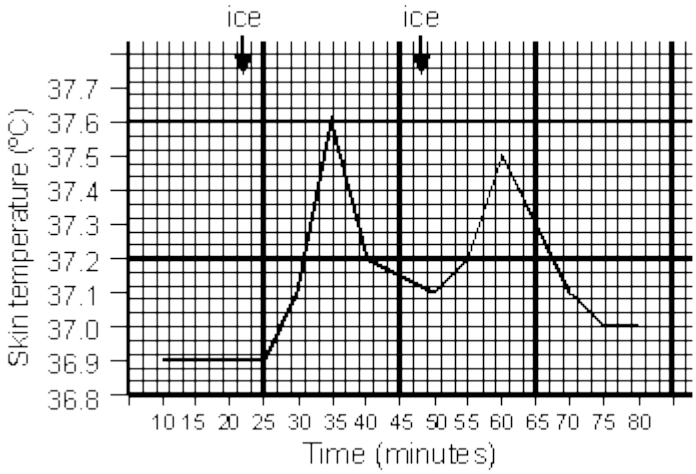
(ii) the co-ordinator; .....

(iii) the effector. .....

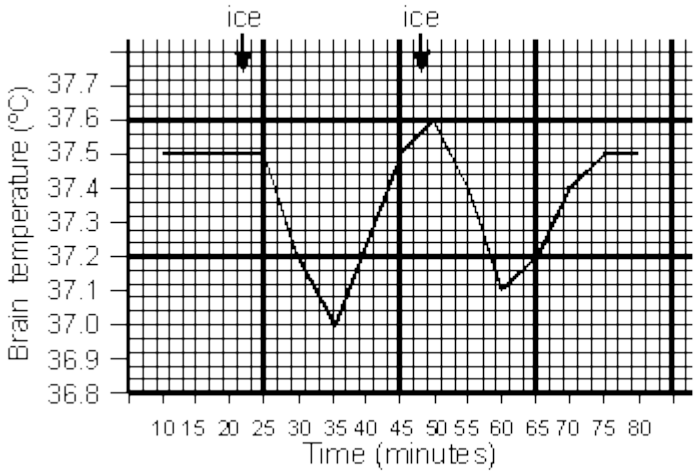
(3)

(Total 15 marks)

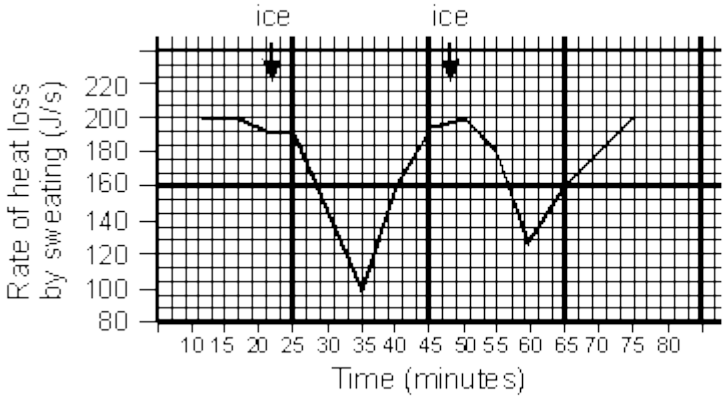
32 The graphs show the results of an investigation into the control of sweating in humans. The subject was placed in a chamber where the temperature was maintained at 45ºC. The subject swallowed ice at the times indicated on the graphs.



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.

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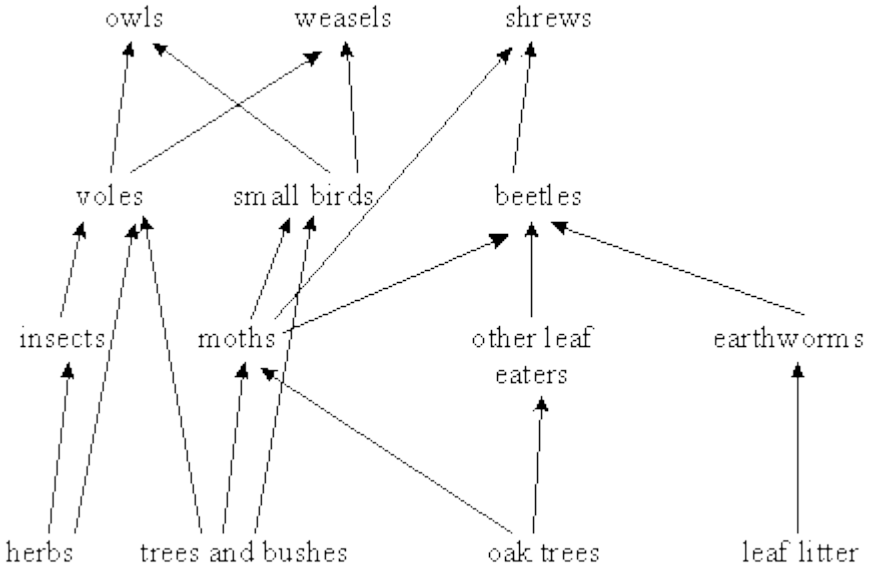
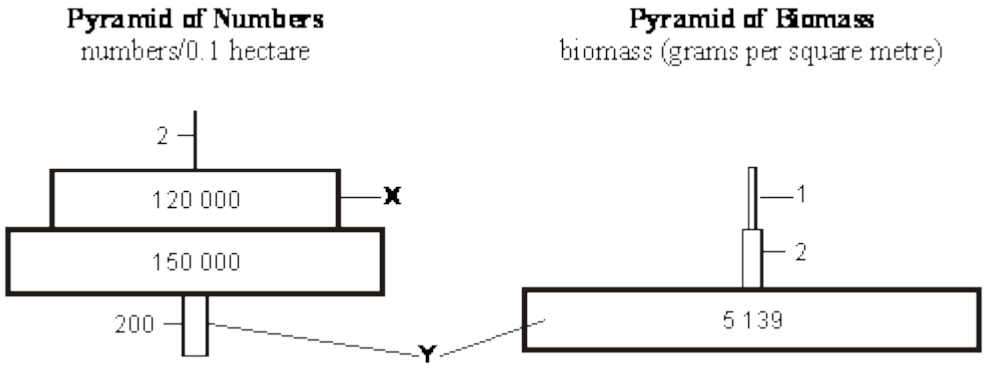
(8)
(Total 11 marks)

33 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.

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(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.

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(10)
(Total 14 marks)

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

(i) the circulatory system.

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.....

(2)

(ii) the digestive system.

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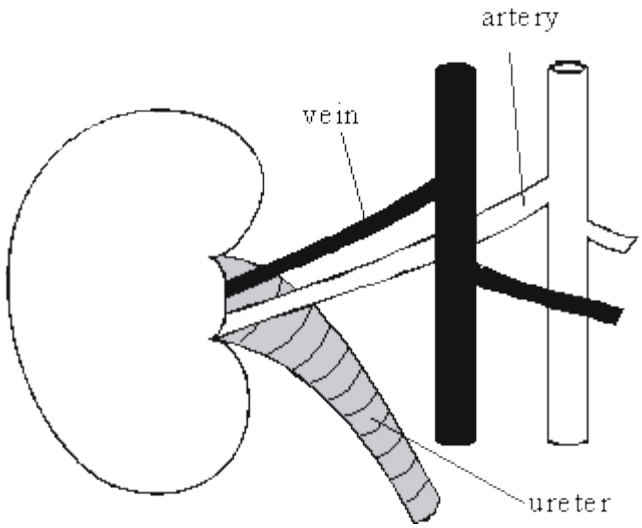
.....

(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.

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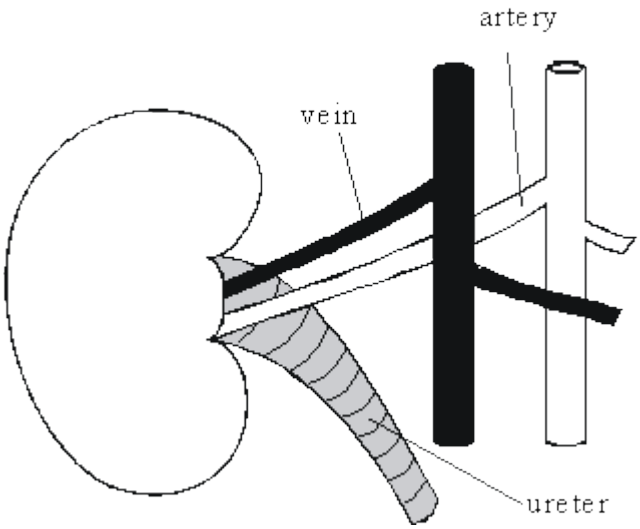
(4)
(Total 9 marks)

35



(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.

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.....

.....

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.....

(4)

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

1. .....

.....

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.....

2. .....

.....

.....

.....

(4)

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

.....

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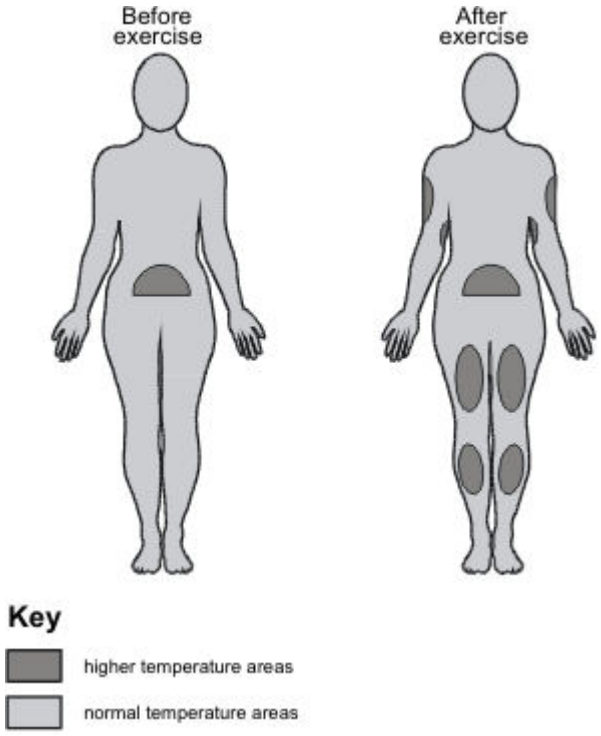
.....

(5)
(Total 13 marks)

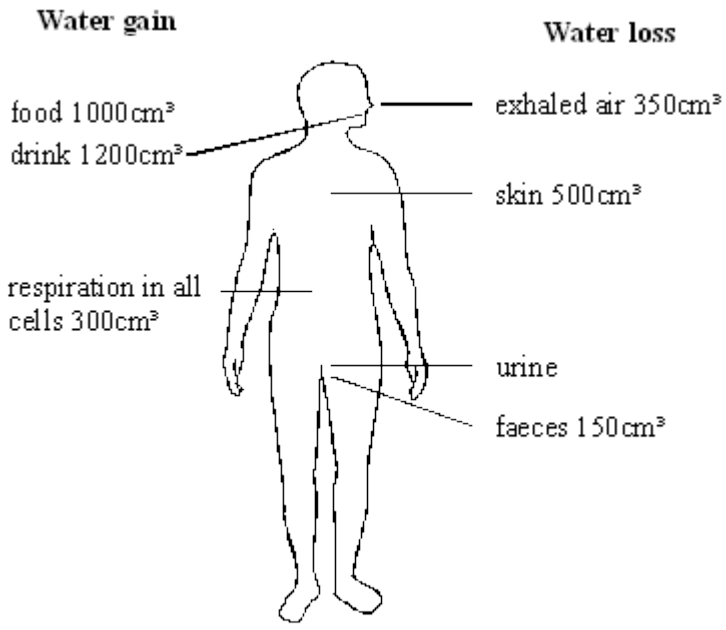
36 The temperature at the surface of the skin can be measured by using a technique called thermography. Areas with higher temperature appear as a light shade on the thermographs. The drawings below show the results of an investigation in which thermographs were taken before and after exercise.



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)

37 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)

38 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)

39 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)

40 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)

41 (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.

.....

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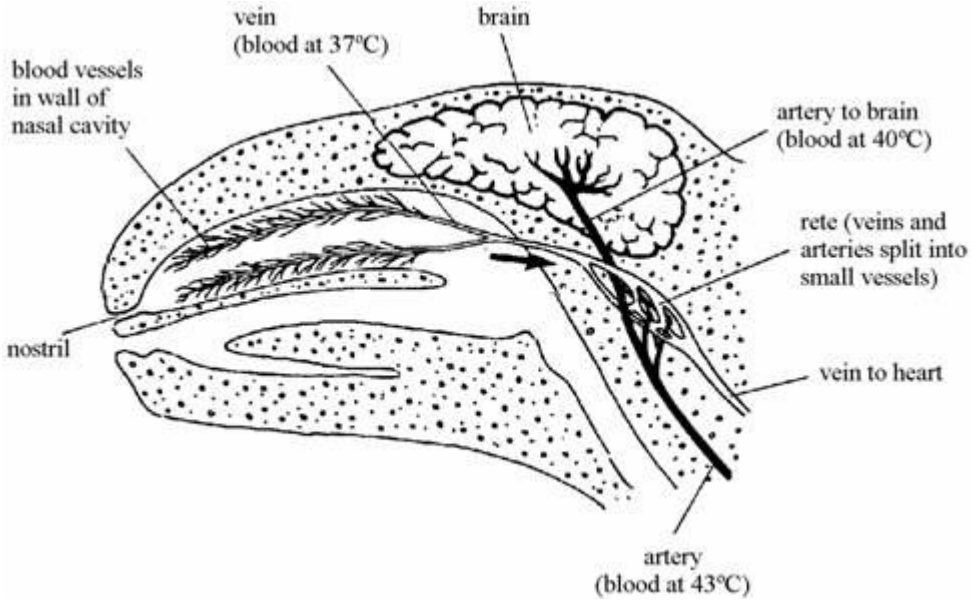
.....

.....

(4)
(Total 6 marks)

42 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)

43 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 .....

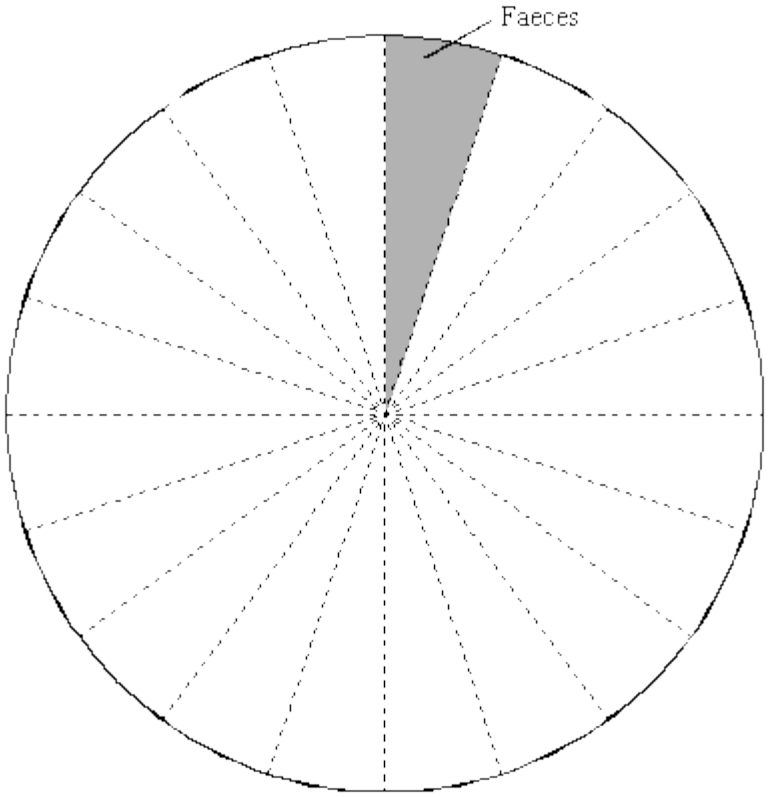
(2)
(Total 6 marks)

44 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	

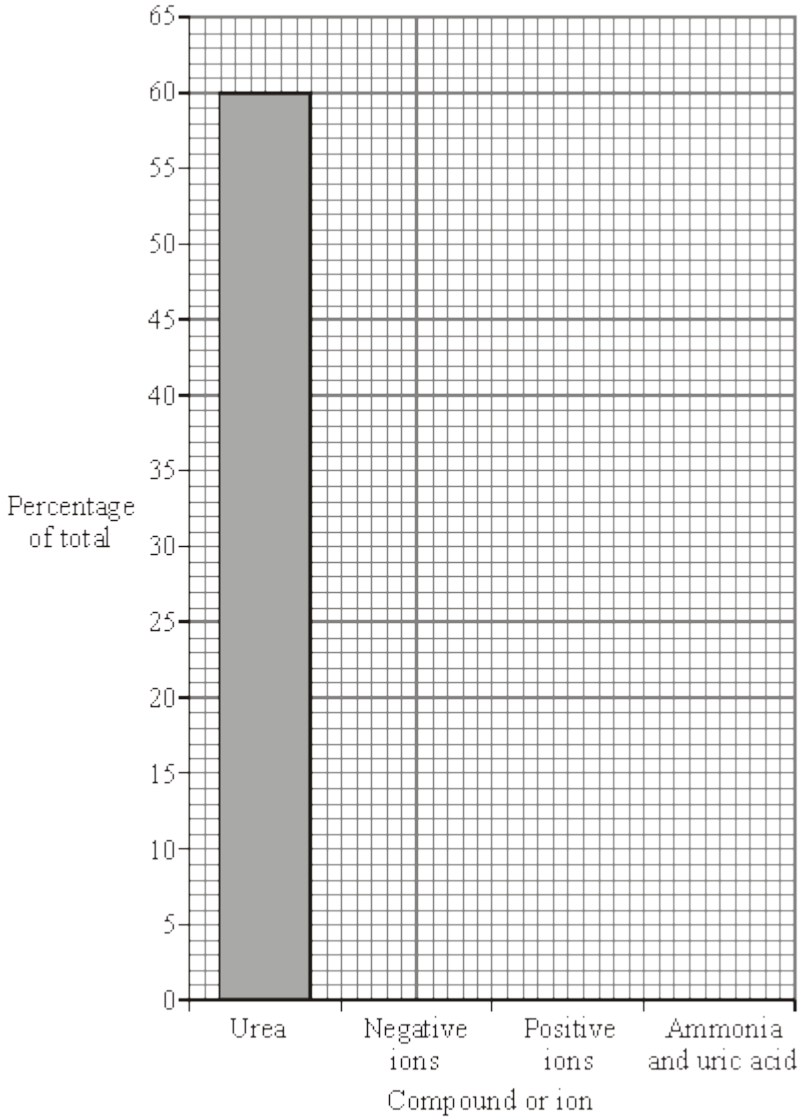
Waste product	How it is produced	How it leaves the body
carbon dioxide	by	in .....
urea	from	in .....

(4)
(Total 7 marks)

45 (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)

46 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 .....

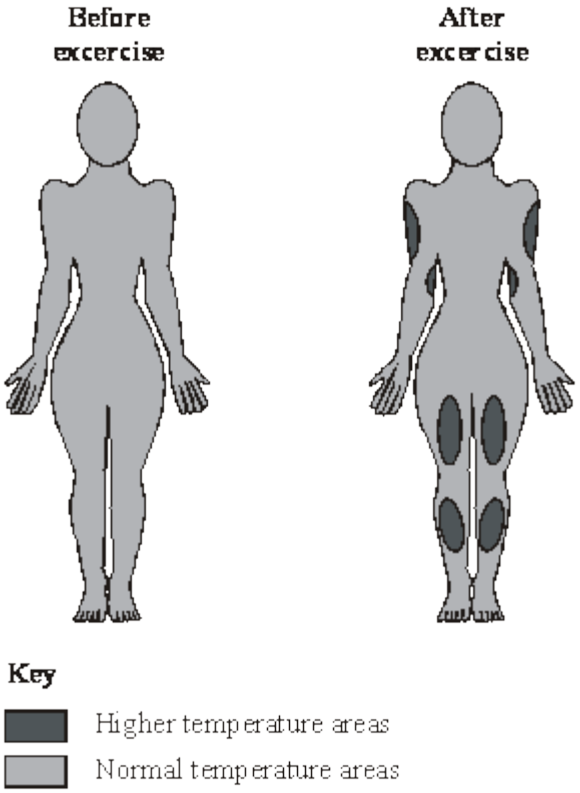
(1)

(Total 2 marks)

47 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.

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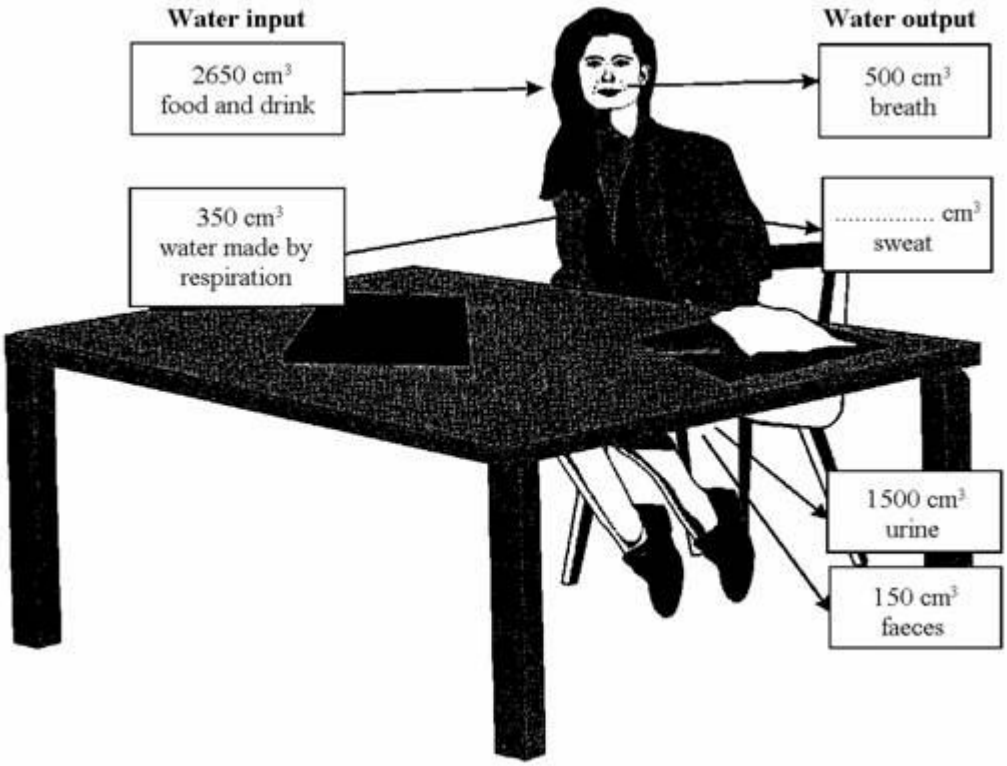
(Total 3 marks)

48 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.

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(2)

(ii) The amount of water breathed out.

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(2)

(iii) The amount of urine passed, if she had the same water intake as on the previous day.

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(2)

(c) Which organ controls the amount of water in the body?

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(1)

(Total 8 marks)

49 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?

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(1)

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

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(3)

(Total 5 marks)

50 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?

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(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.

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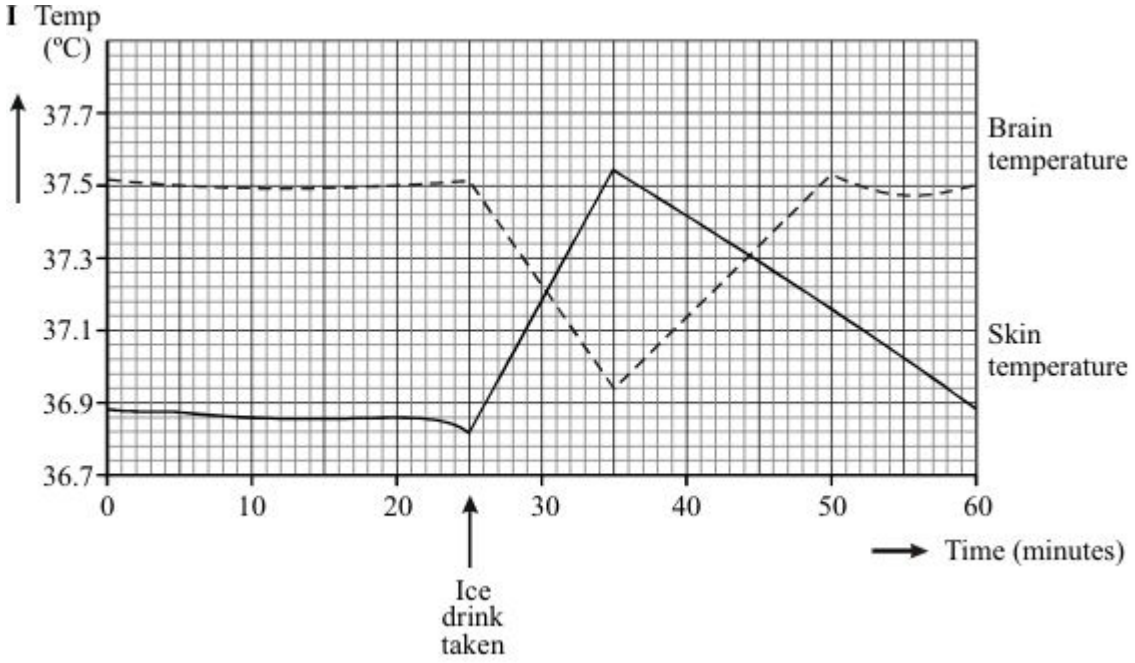
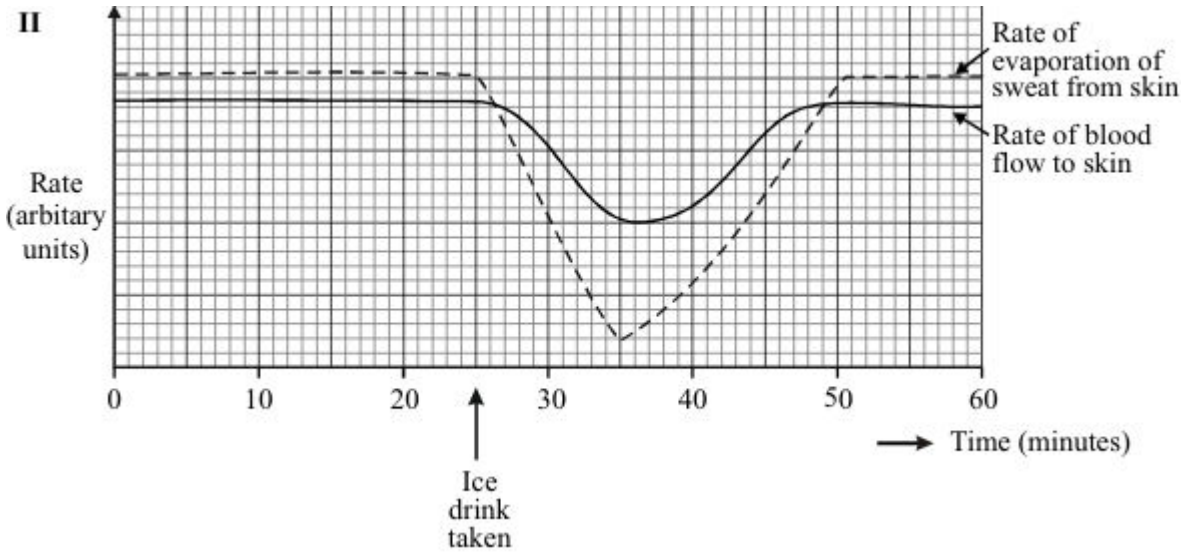
(2)

(Total 4 marks)

51 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.

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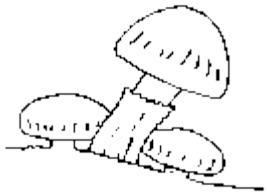
(Total 4 marks)

52 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?

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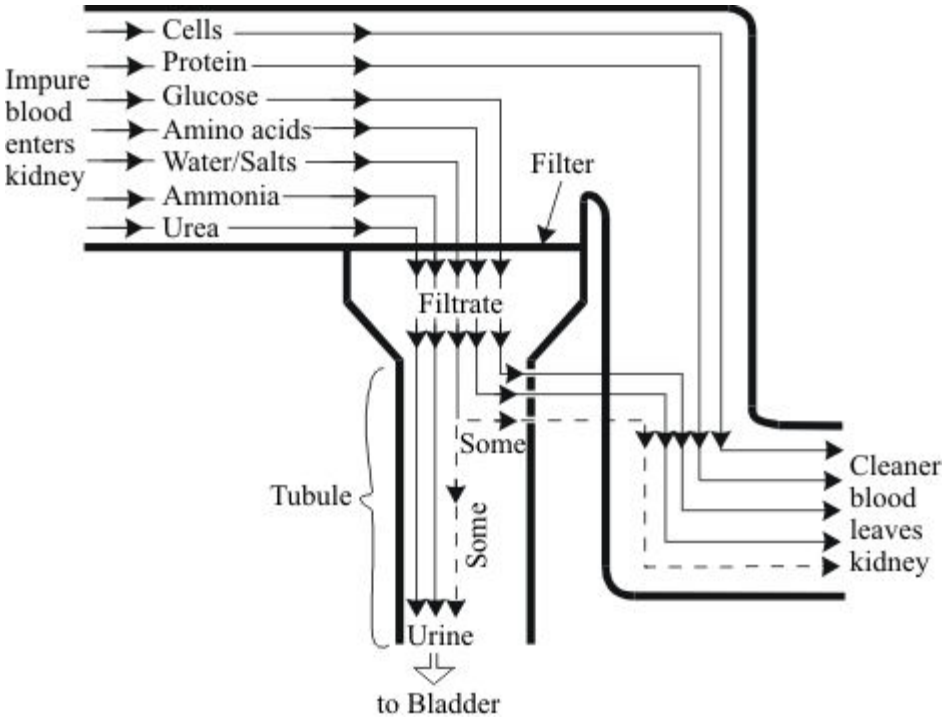
(1)

(Total 4 marks)

53 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.

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(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.

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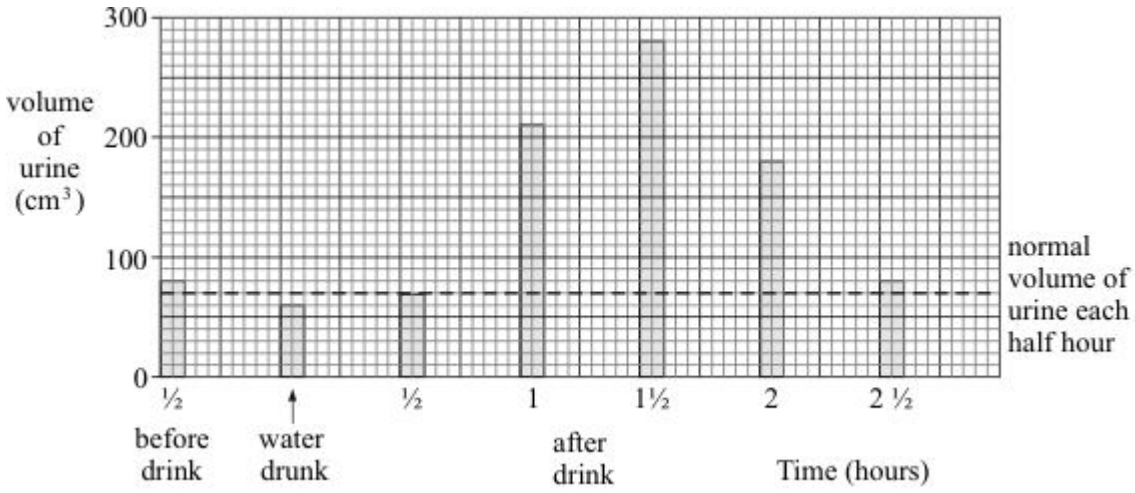
.....

(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.

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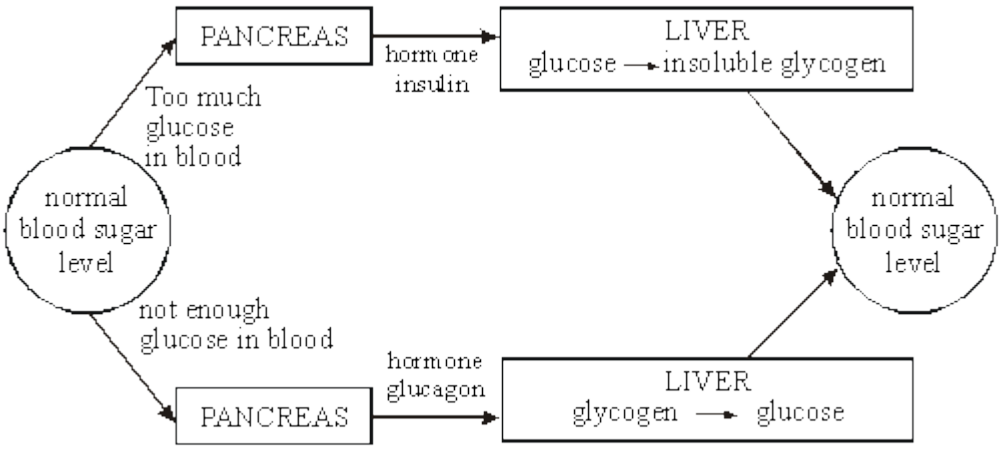
(5)

(Total 13 marks)

54



The diagram shows how the blood sugar level is controlled in the body.

Explain fully what would happen if somebody ate some glucose tablets.

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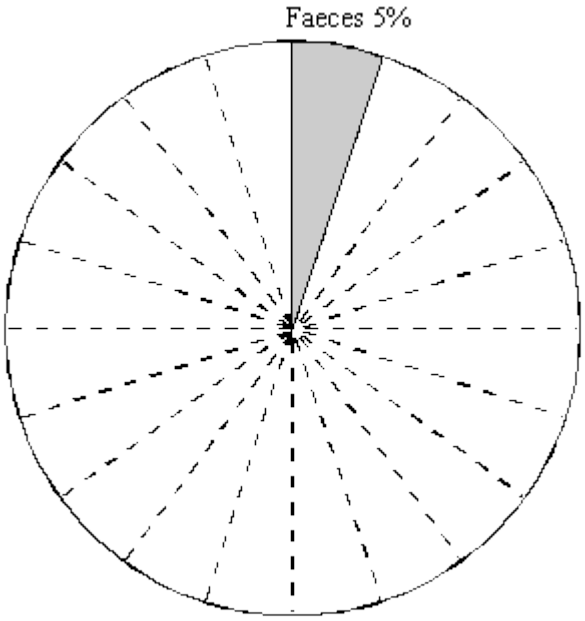
(Total 4 marks)

55 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)

56

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.

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(Total 5 marks)

57 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.

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(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.

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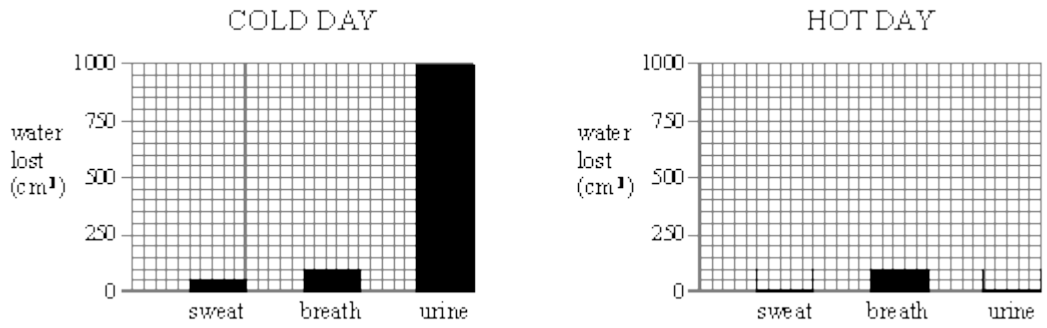
(6)
(Total 9 marks)

58 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.

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(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)

59 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.

.....

.....

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.....

.....

(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 .....

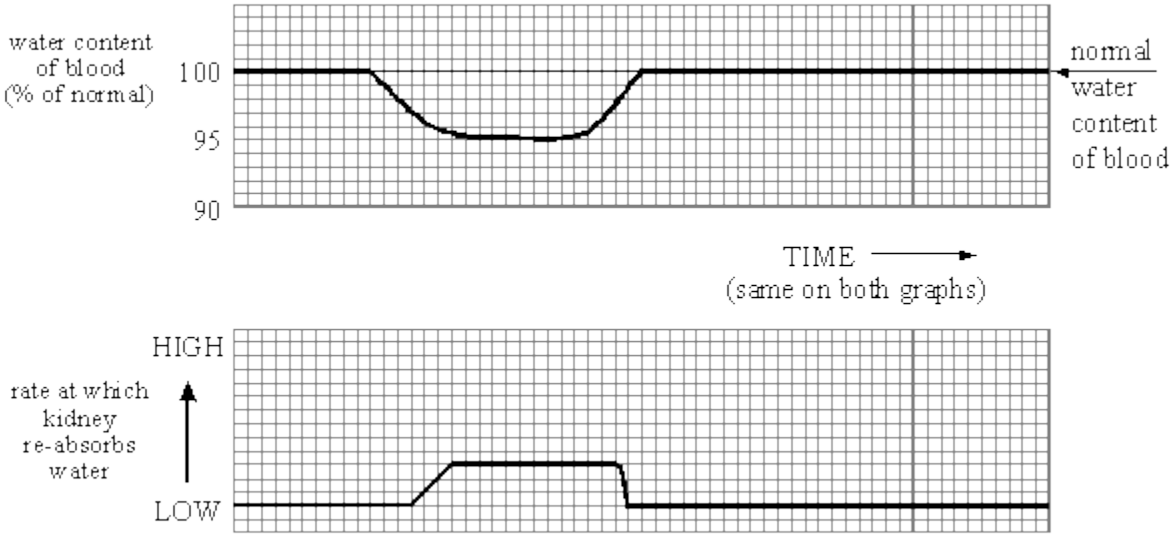
.....

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.

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(4)

(d) How does your body control the rate at which your kidney re-absorbs water?

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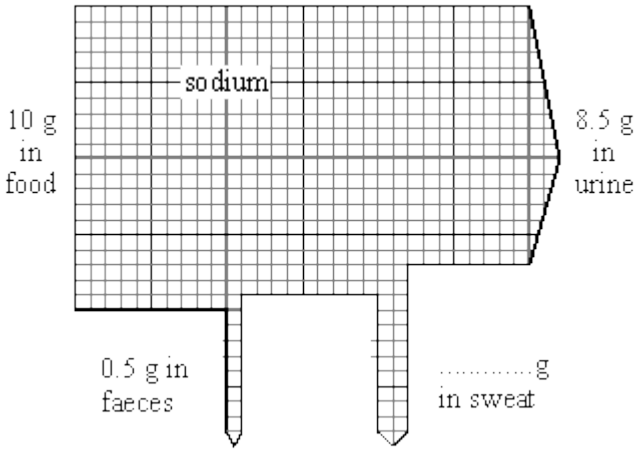
(2)

(Total 10 marks)

60 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?

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(1)

(ii) What should the girl do to make sure that her body still contains enough sodium?

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(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)