HOMEOSTASIS (PART II)

Q1.

In diabetics blood glucose concentrations are sometimes abnormal.

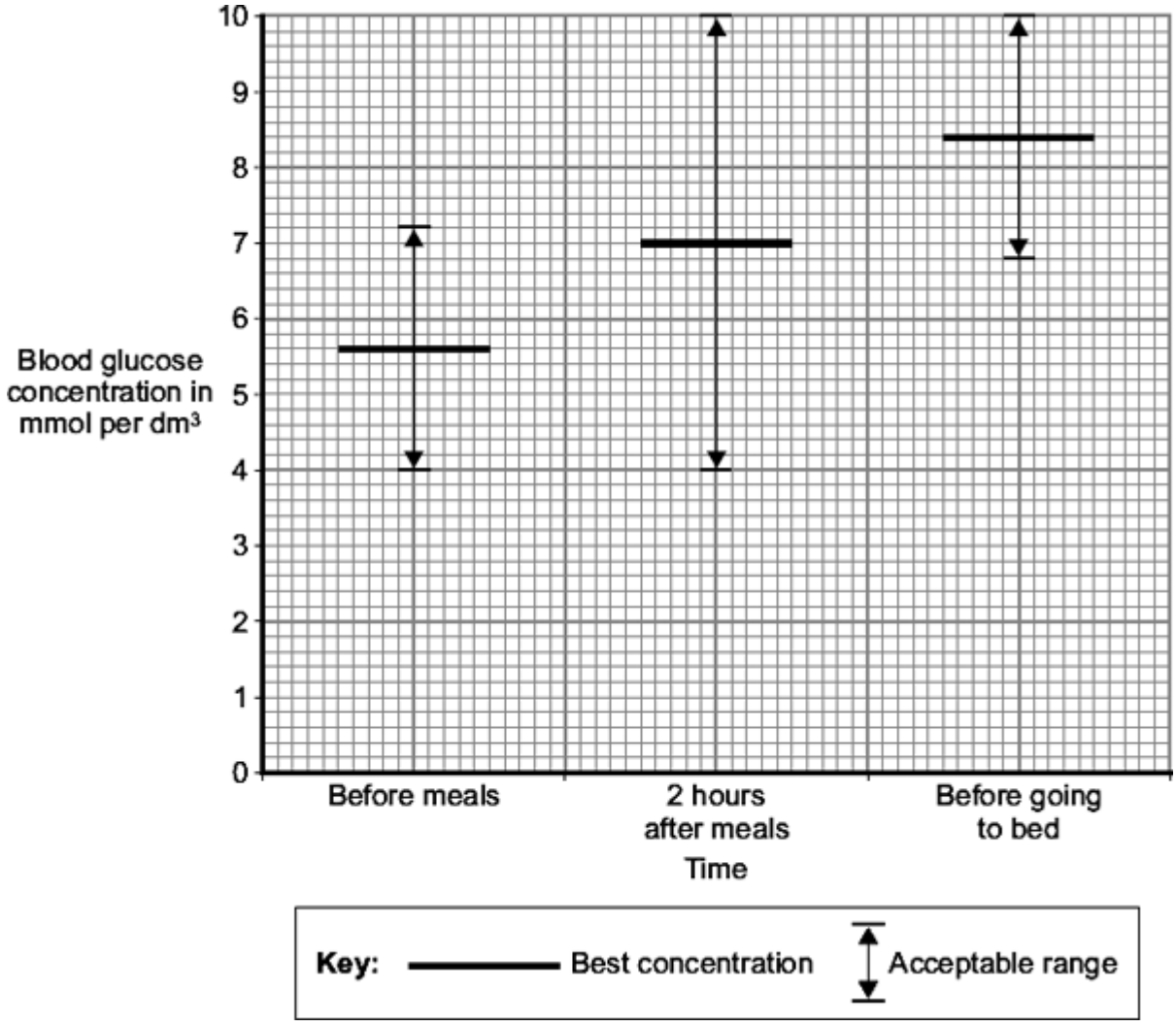
(a) Name the organ that monitors the concentration of glucose in the blood.

_____

(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)

Q2.

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)

Q3.

(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)

Q4.

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)

Q5.

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

carbohydrase.

hormone called | 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.

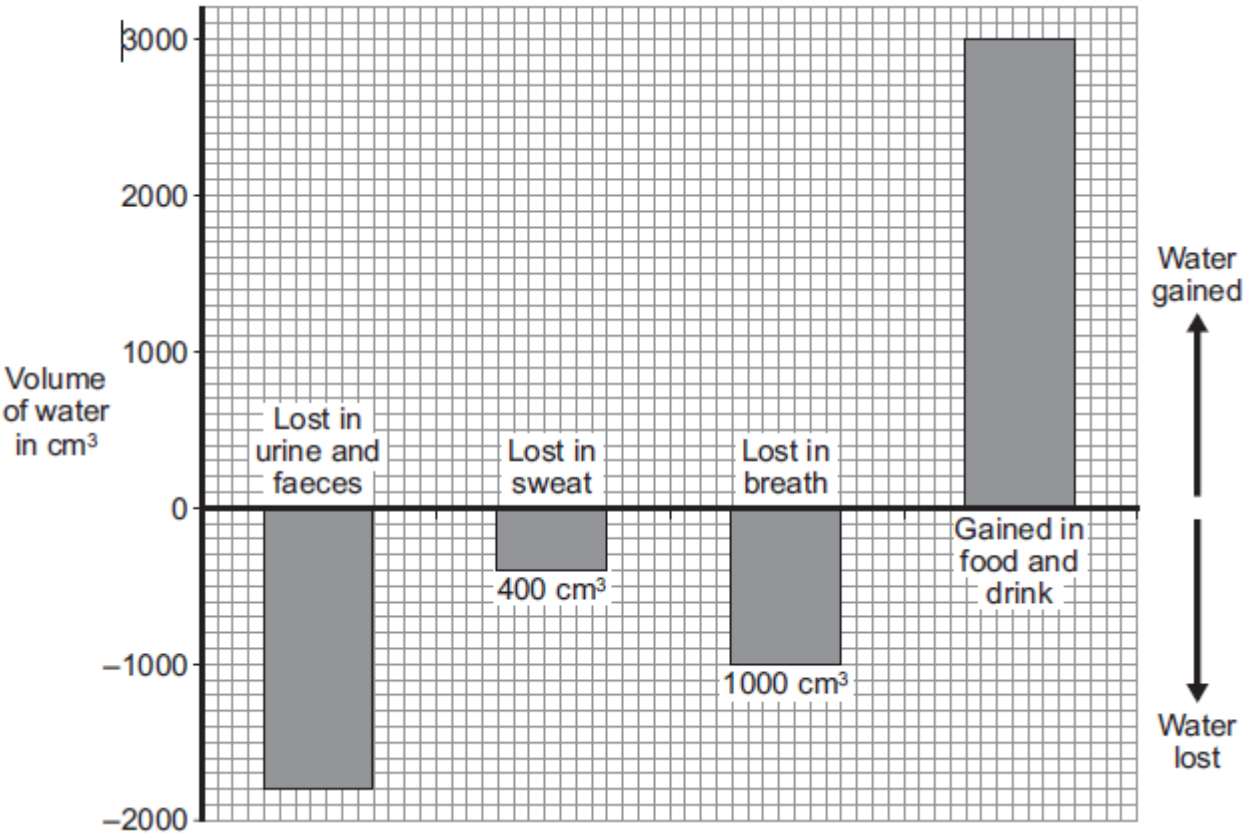
(1)

(Total 3 marks)

Q6.

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? _____ cm^3

(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 = _____ cm^3

(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)

Q7.

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.

_____

_____

_____

_____

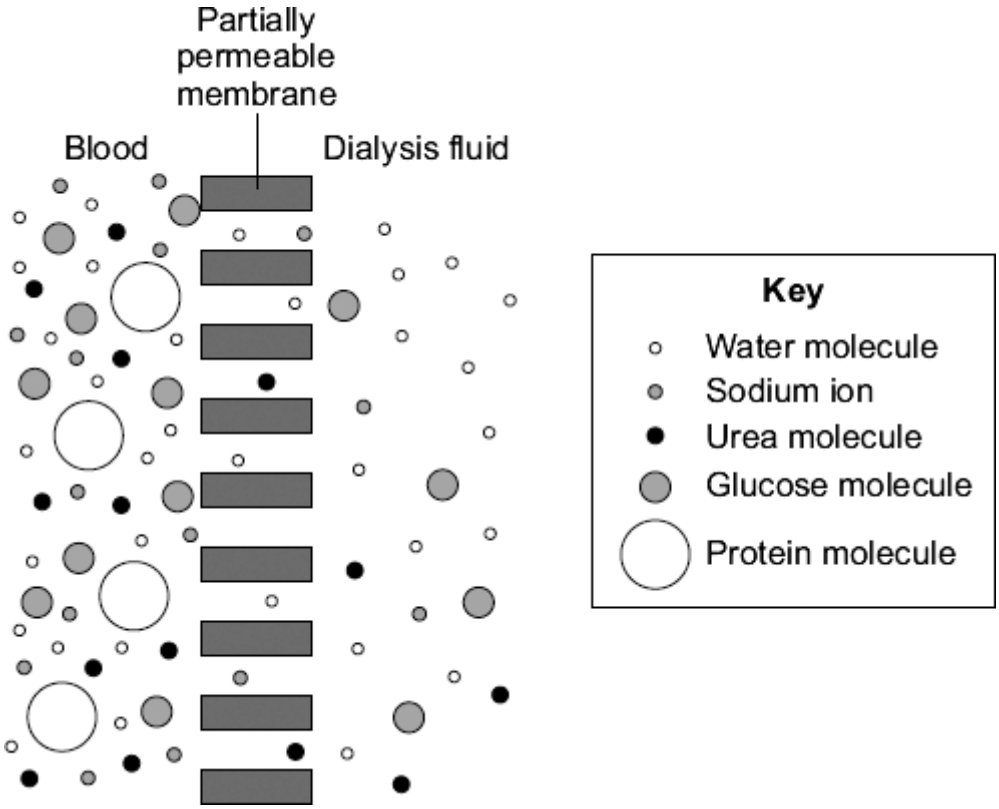
(2)

(Total 8 marks)

Q8.

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)

Q9.

Water is lost from several parts of the body.

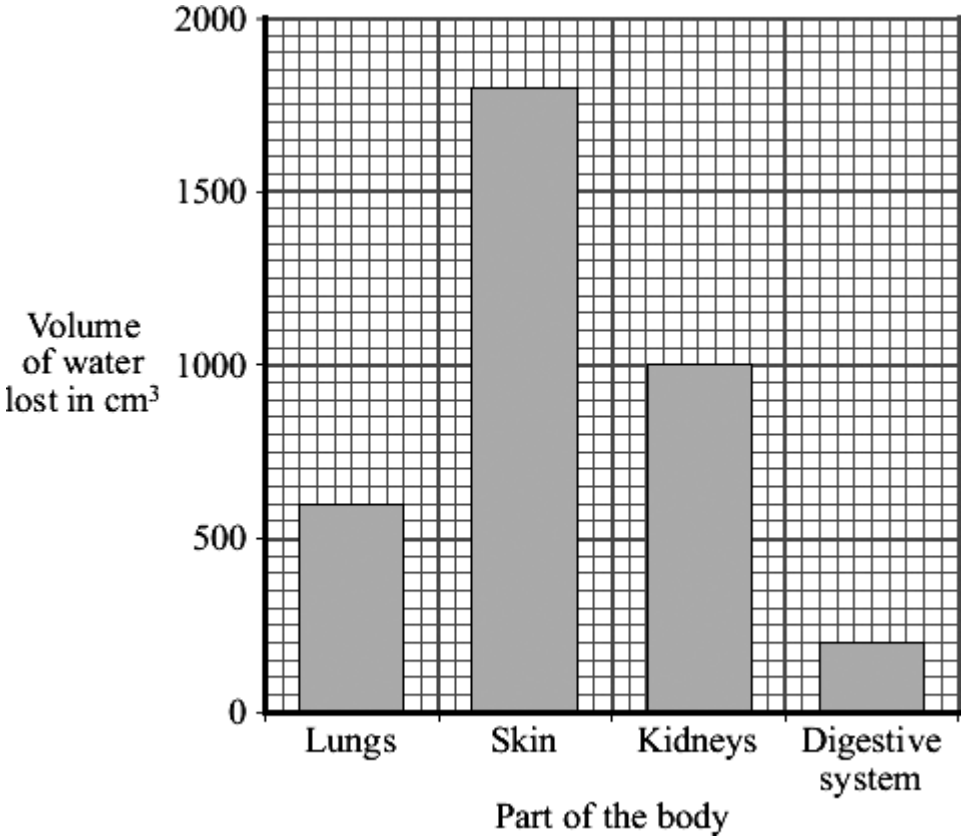
(a) Draw **one** line from each body part to the substance in which water is lost.

Body Part	**Substance**
Kidneys	Urine

Lungs	Faeces
Skin	Sweat
	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 cm^3 ☐

1600 cm^3 ☐

1800 cm^3 ☐

(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)

Q10.

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

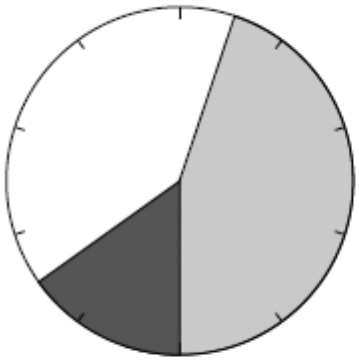
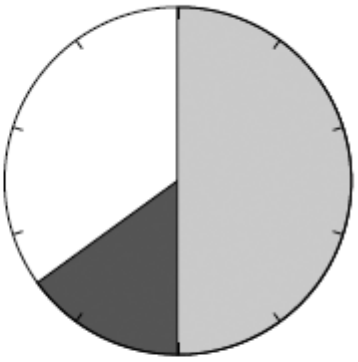
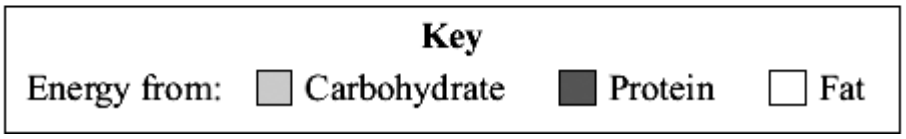


Chart 2 Person without diabetes





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.

_____

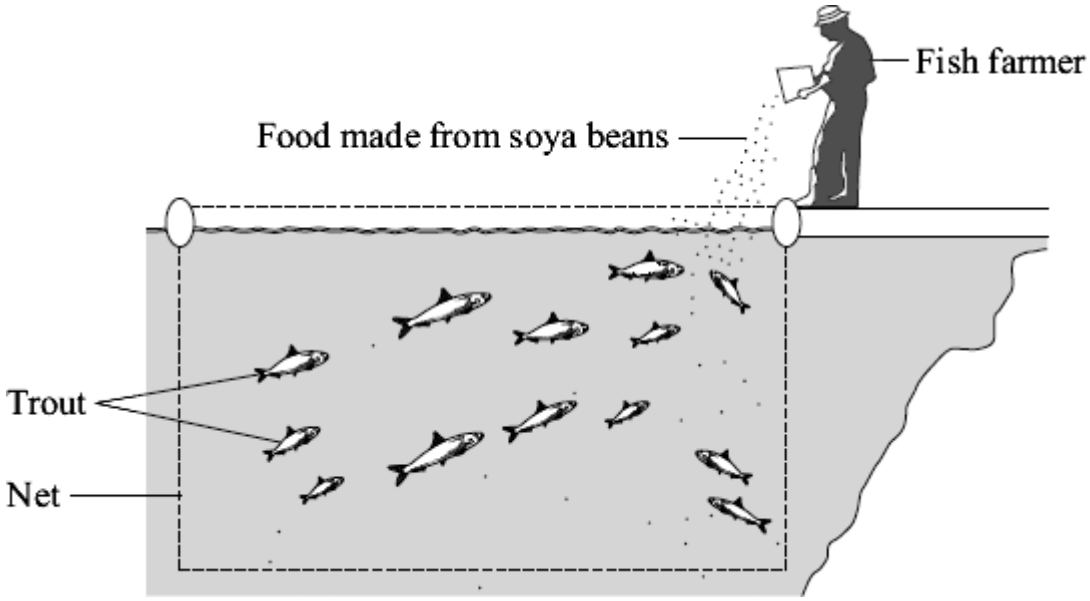
_____

(1)

(Total 4 marks)

Q11.

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)

Q12.

(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**

_____

_____

_____

_____

_____

_____

_____

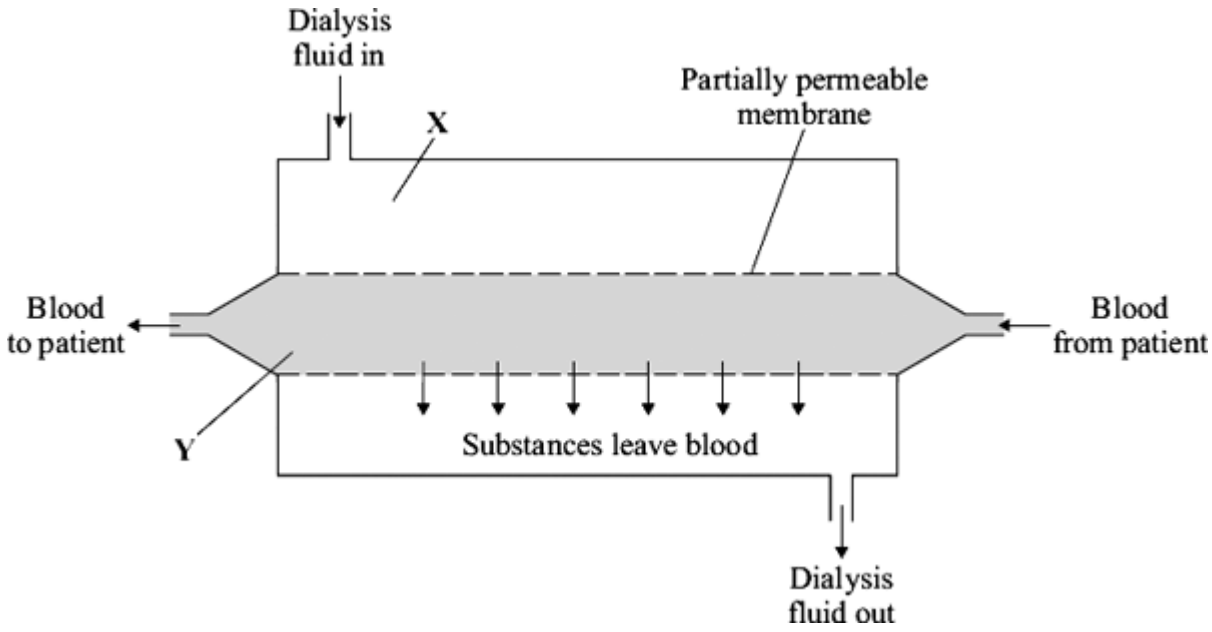
_____

(3)

(Total 9 marks)

Q13.

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)

Q14.

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)

Q15.

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)

Q16.

Diabetes is a disease in which the concentration of glucose in a person's blood may rise

to fatally high levels. Insulin controls the concentration of glucose in the blood.

(a) Where is insulin produced?

Draw a ring around **one** answer.

gall bladder **liver** **pancreas**

(1)

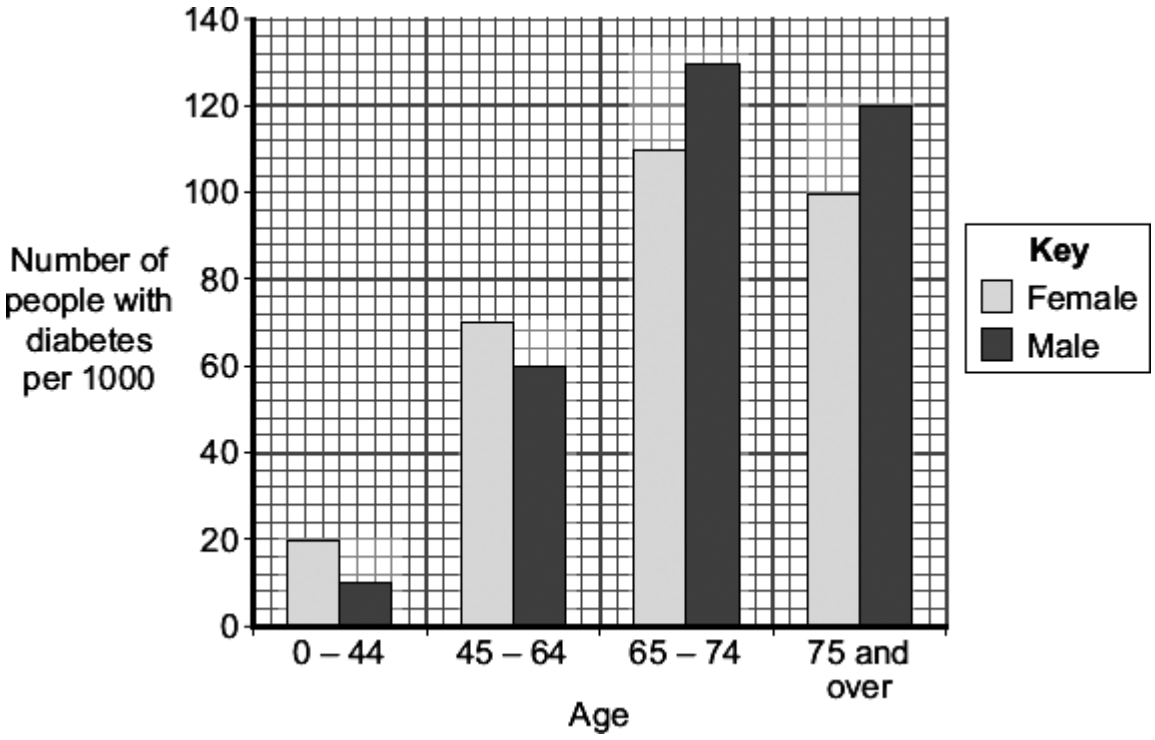
(b) Diabetics may control their blood glucose by injecting insulin.

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)

Q17.

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?

_____

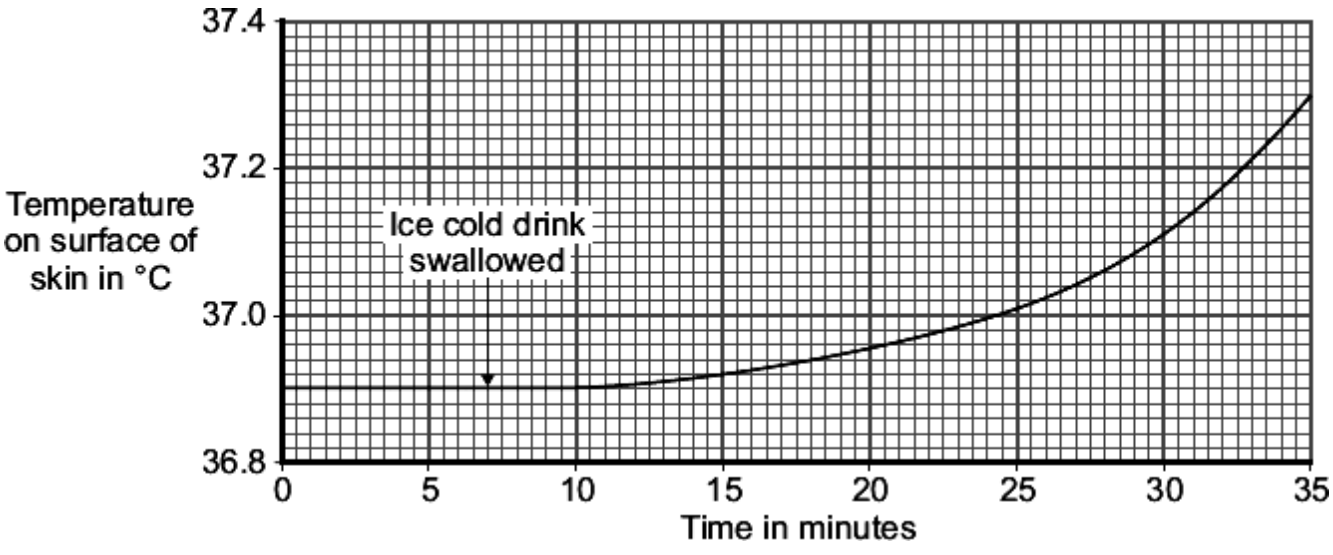
(1)

(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)

Q18.

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

will contain

- water, protein, glucose, urea and sodium ions.
- 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)

Q19.

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)

Q20.

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

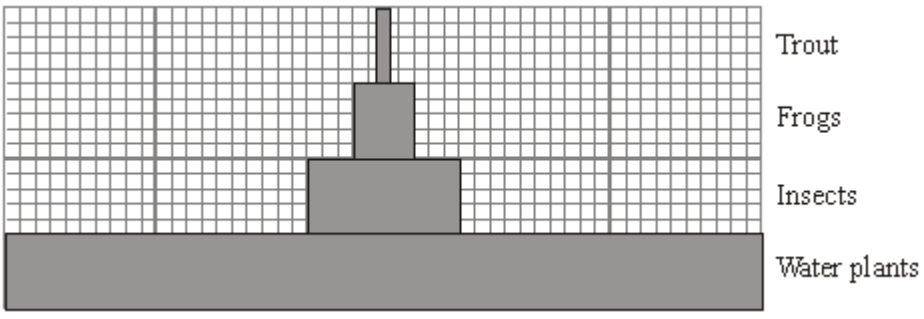
.

(1)

(Total 4 marks)

Q21.

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)

Q22.

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)

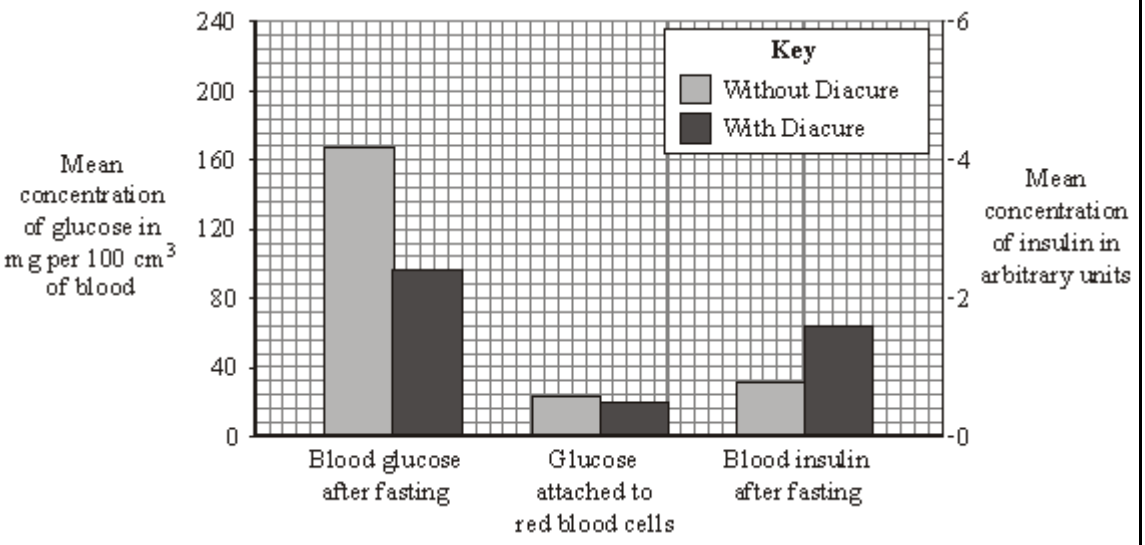
(b) A person with diabetes can be monitored in three ways:

- 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)

Q23.

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.

_____

_____

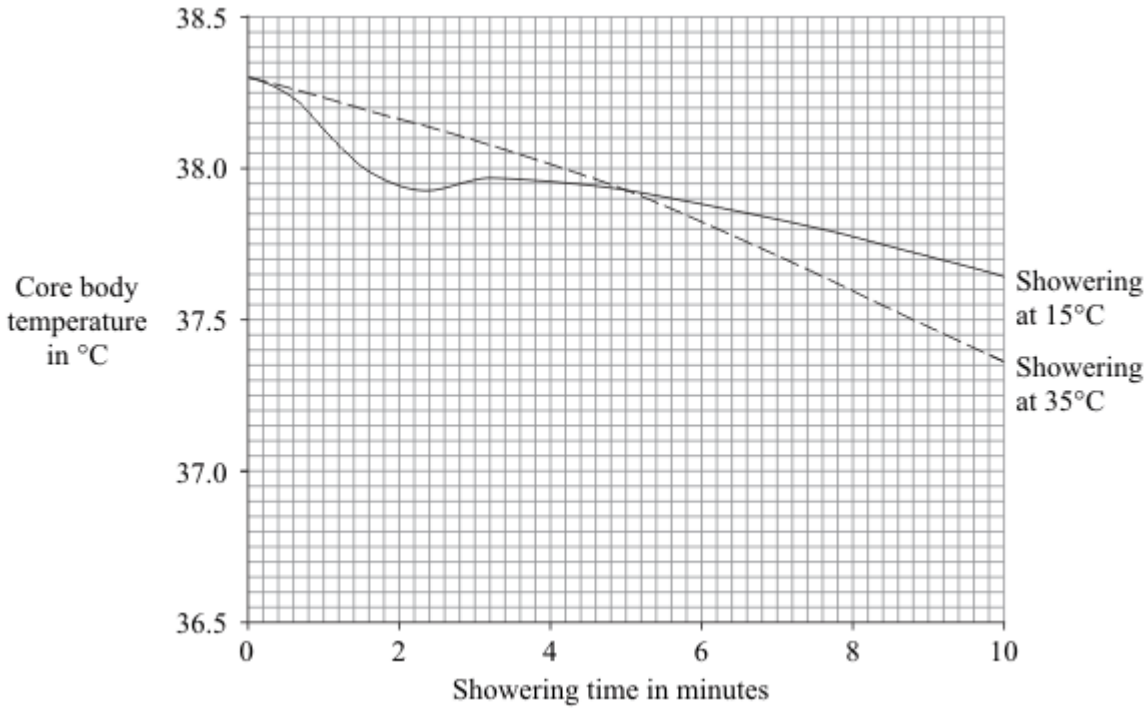
_____

_____

_____

(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)

Q24.

(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)

Q25.

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)

Q26.

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 _____

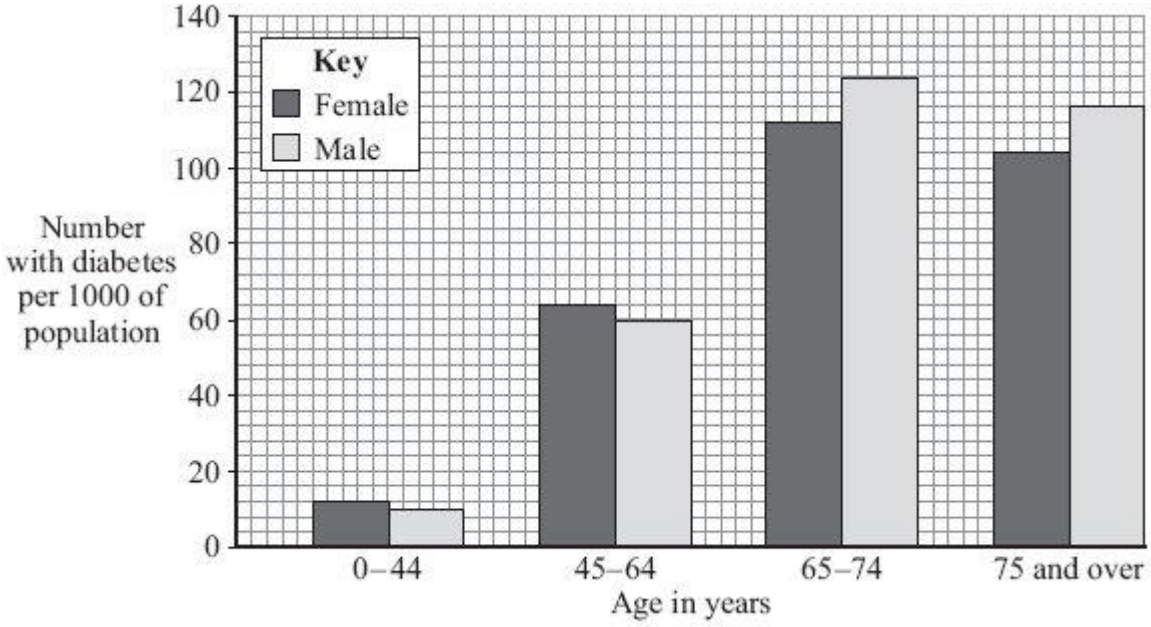
(1)

(Total 8 marks)

Q27.

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)

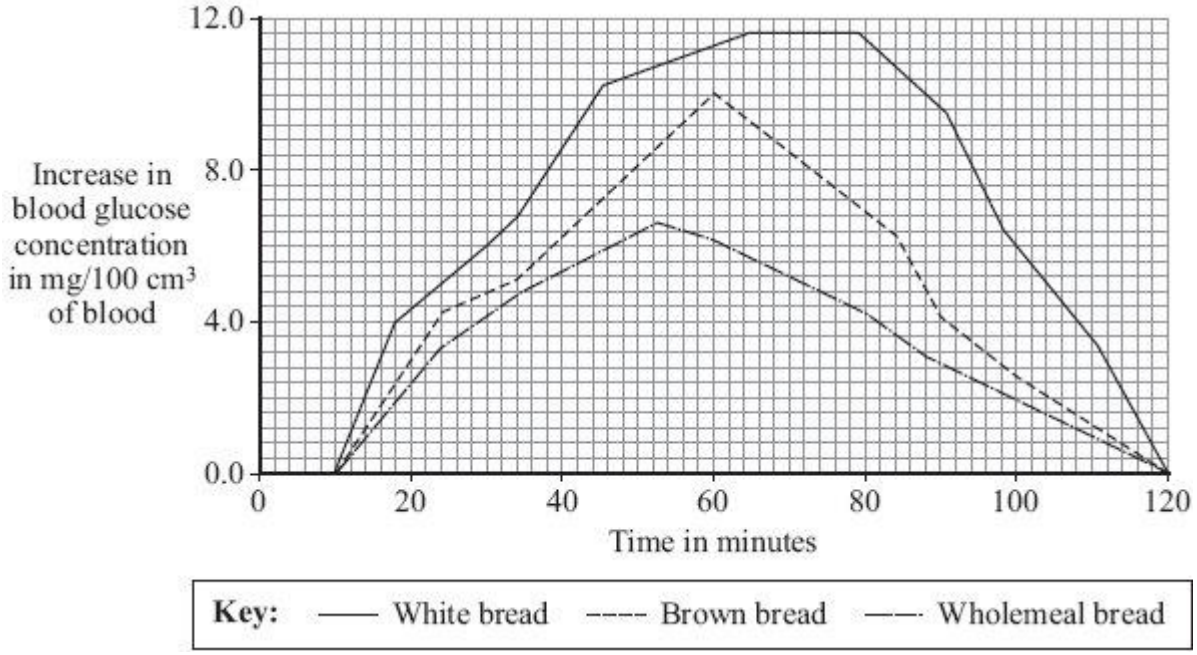
Q28.

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)

Q29.

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

Tick (✓) **two** boxes.

Glucose ☐

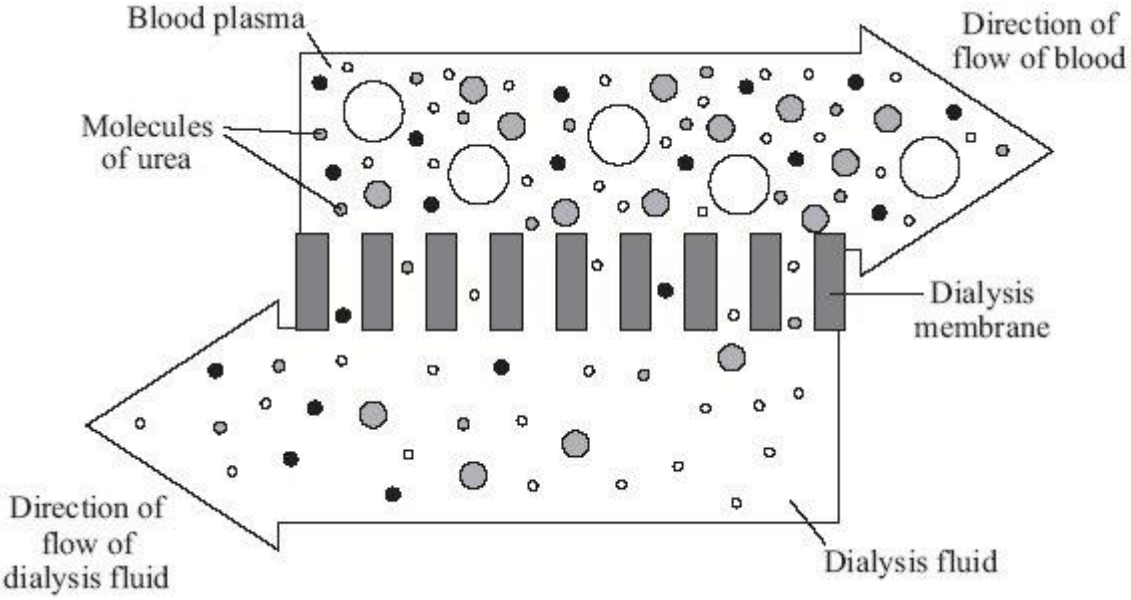
Mineral ions ☐

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)

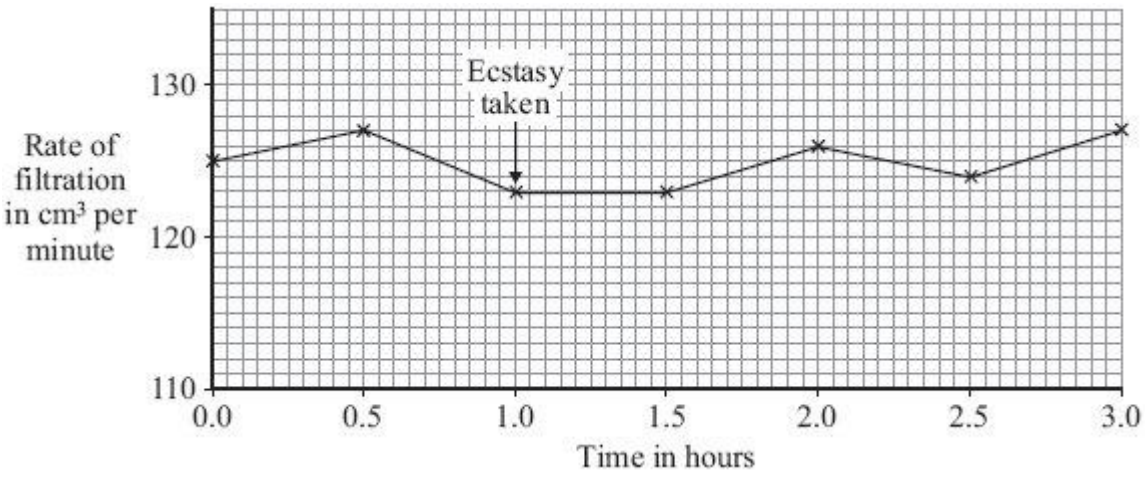
Q30.

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

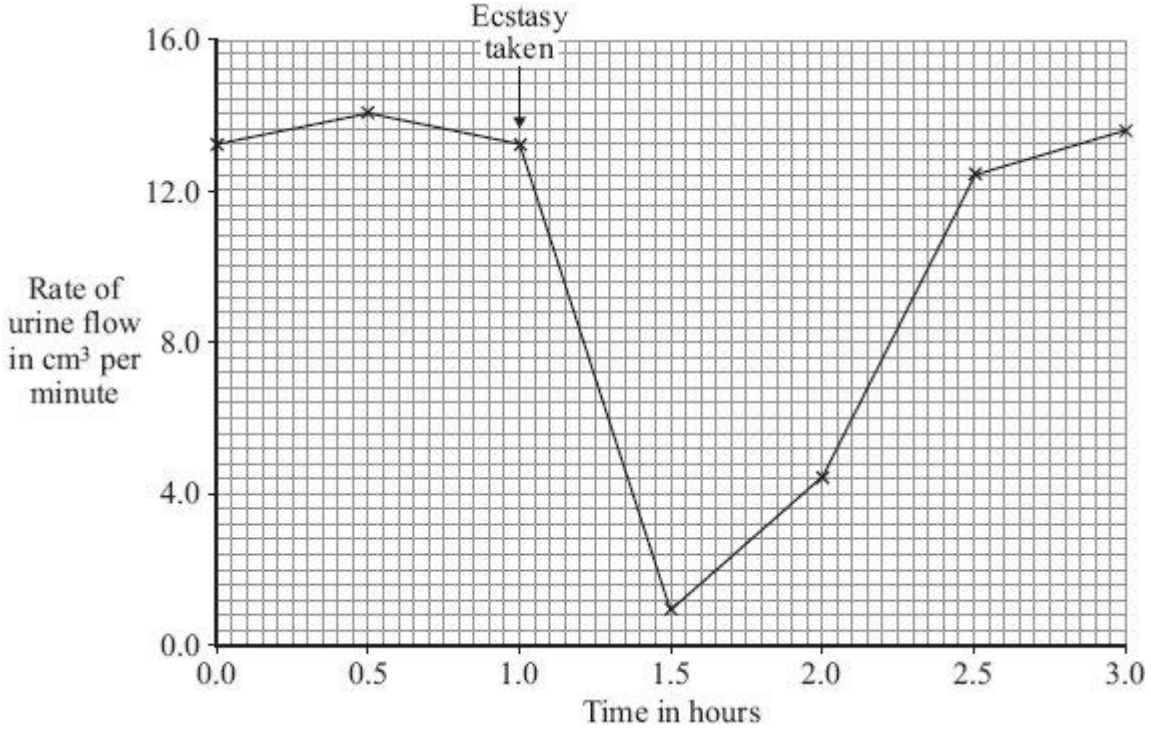
Graph 1 shows the rate of filtration by the kidneys of a healthy person.
Graph 2 shows the rate of urine flow from the kidneys of the same person.

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)

Q31.

(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)

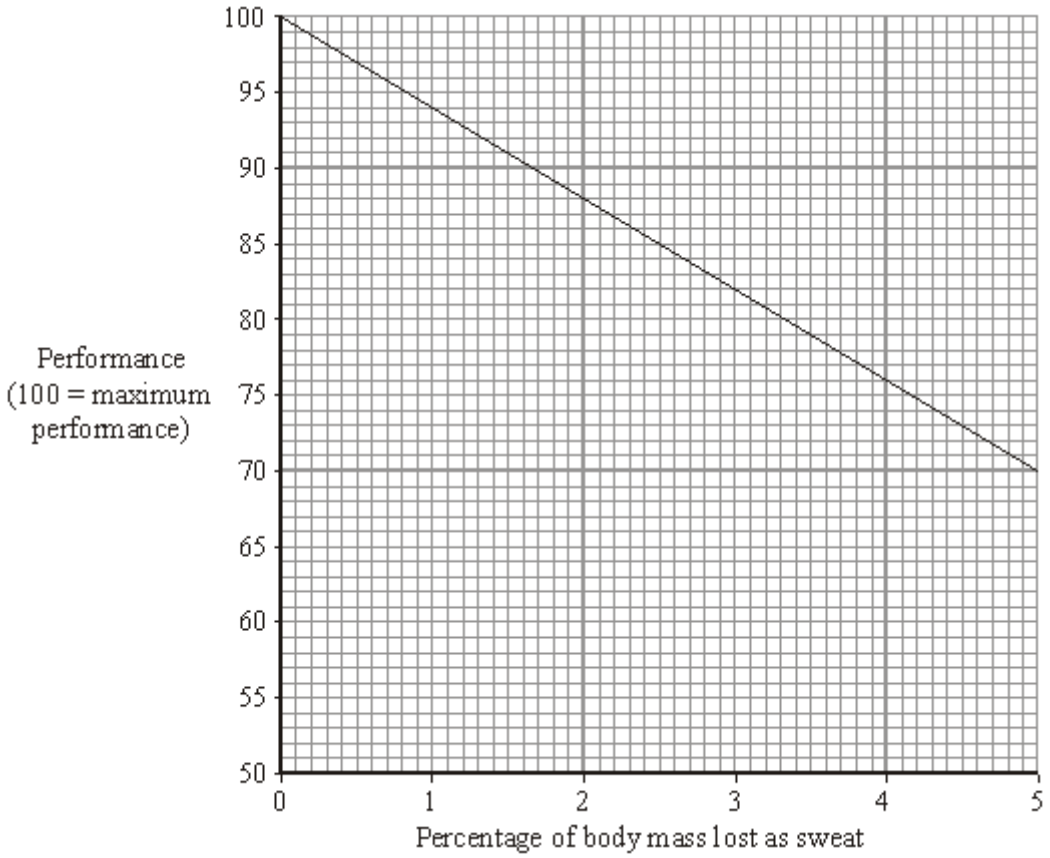
(iii) Excess water leaves the body in a liquid called urine.

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?

_____

_____

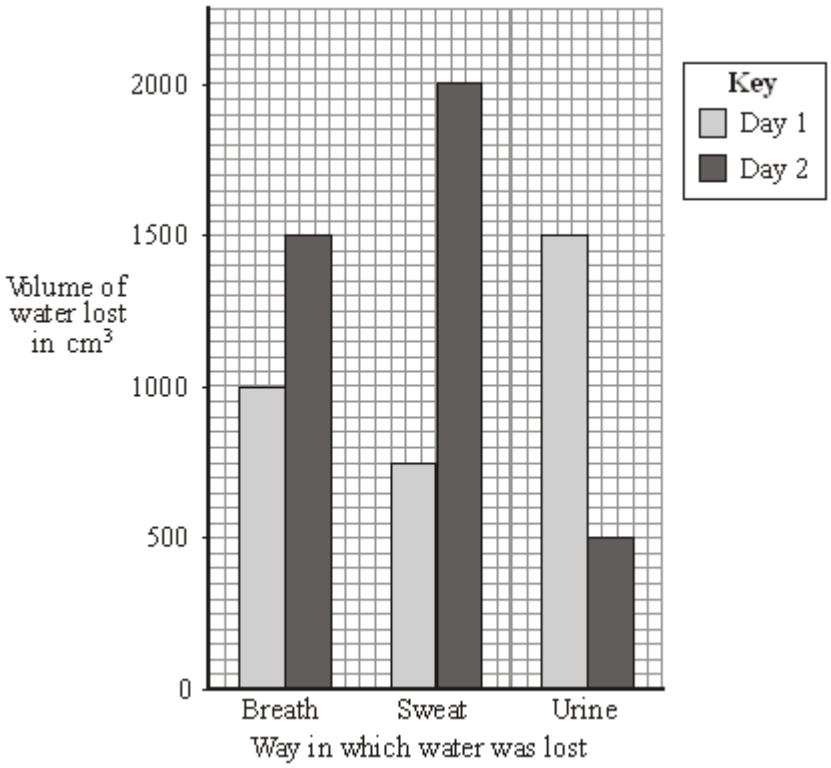
(1)

(Total 5 marks)

Q32.

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)

Q33.

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)

Q34.

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

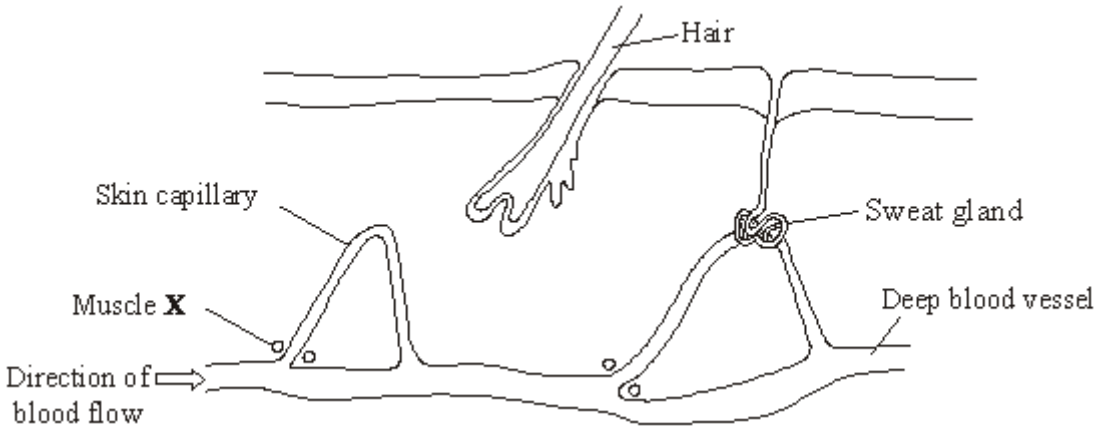
_____

_____

(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)

Q35.

(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)

Q36.

(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)

Q37.

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.

$\frac{1}{4}$ ☐

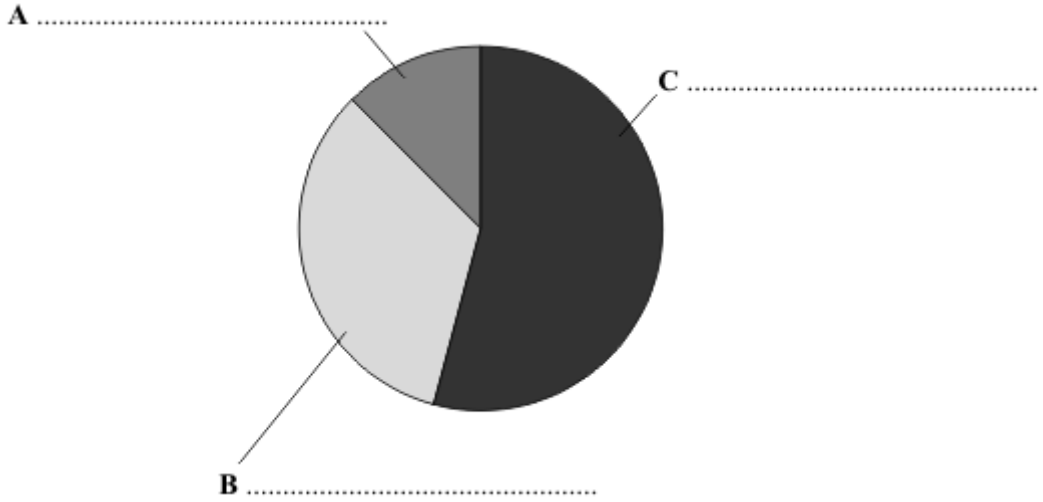
$\frac{1}{3}$ ☐

$\frac{1}{2}$ ☐

(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)

Q38.

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.

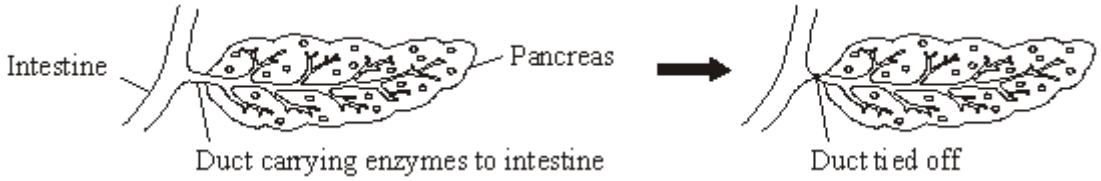
Banting thought that an enzyme produced in the pancreas of dog **A** had digested the hormone before it was injected.

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.

_____

_____

_____

_____

_____

_____

_____

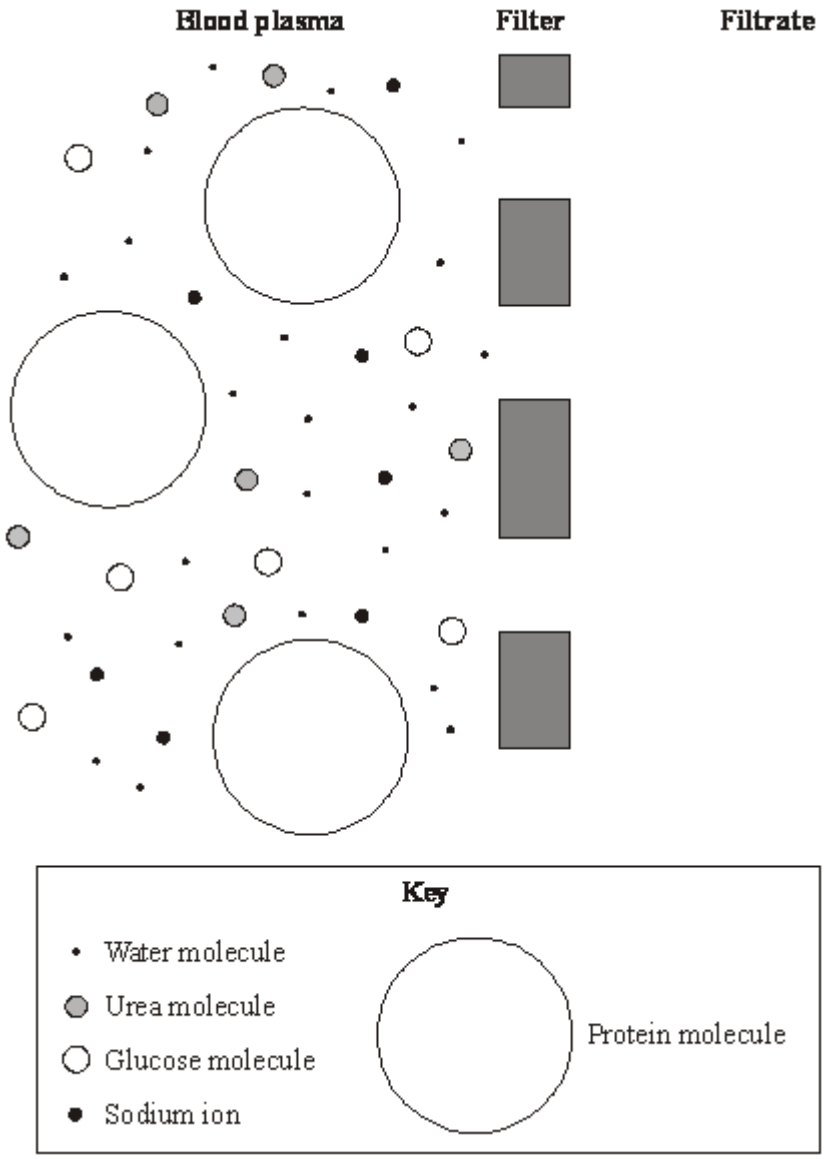
(3)

(Total 7 marks)

Q39.

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)