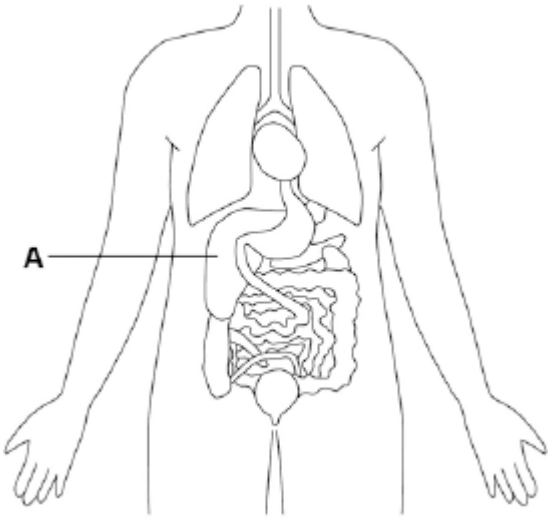
**Q1.** Humans control their internal environment in many ways.

Look at the diagram below.




(a) Name organ **A**.

.....

**(1)**

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

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

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

.....

**(1)**

(c) Which organ produces urine?

Tick **one** box.

Brain ☐

Lungs ☐

Kidney ☐

Thyroid ☐

**(1)**

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

Explain why.

.....

.....

.....

.....

**(2)**

**(Total 5 marks)**

**Q2.** Doctors use dialysis to treat patients with kidney failure.

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

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

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

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

Explain why.

.....

.....

.....

.....

**(2)**

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

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

Which substance was this? .....

**(1)**

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

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

The substance passed through because the

membrane was

| |
|---|
| mpermeable. |
| partially permeable. |
| surrounded by capillaries. |

**(1)**

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

Kidney transplants have some disadvantages.

Give **two** disadvantages of kidney transplants.

1 .....

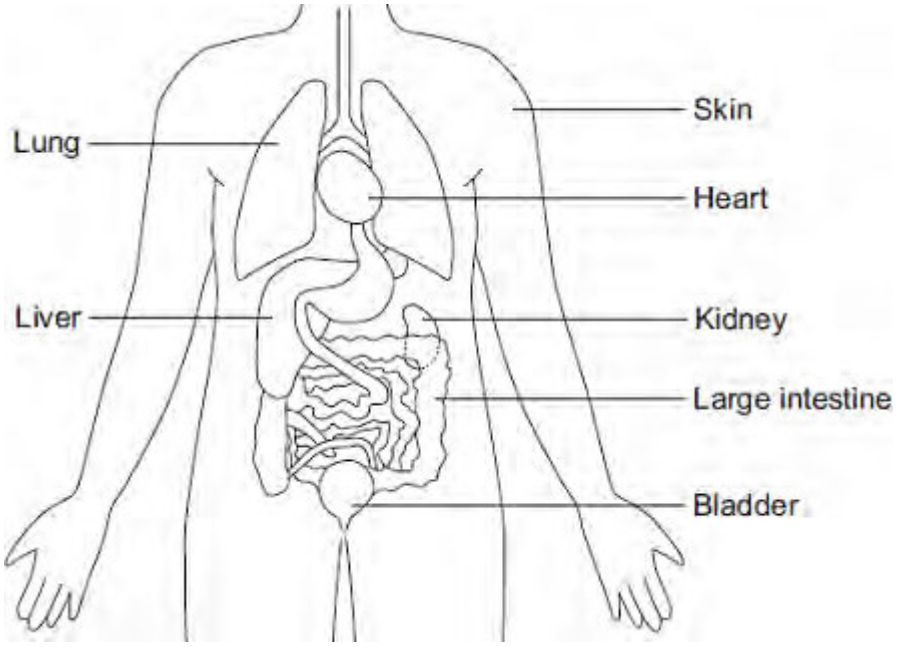
.....

2 .....

.....

**(2)**
**(Total 6 marks)**

**Q3.**The diagram shows some of the organs of the human body.




(a) Which organ labelled on the diagram:

(i) produces urine .....
**(1)**

(ii) stores urine .....
**(1)**

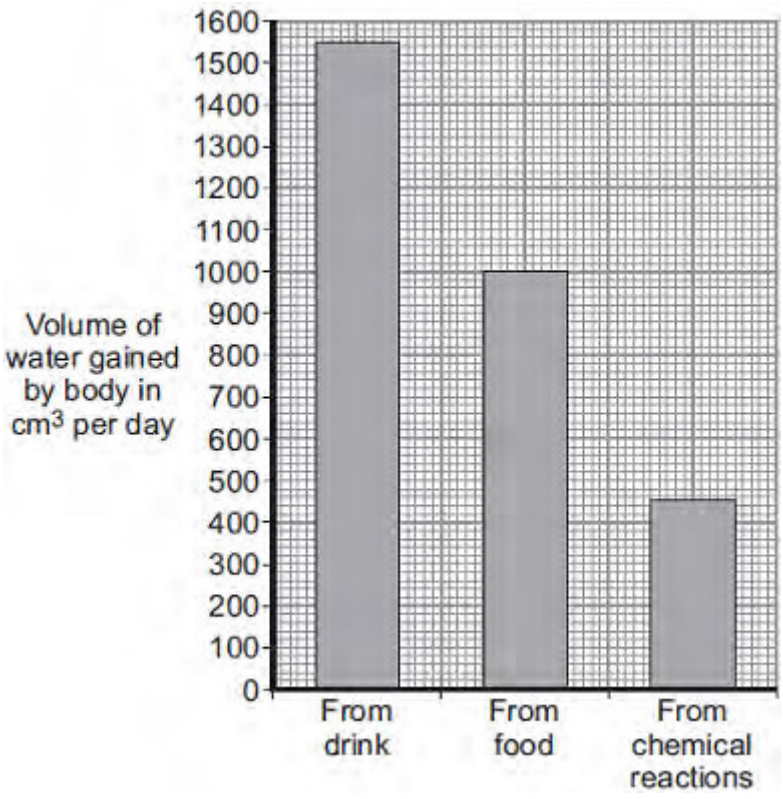
(iii) produces urea .....
**(1)**

(iv) gets rid of carbon dioxide .....
**(1)**

(v) helps to control body temperature? .....
**(1)**

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

**Bar chart 1**




Source of water gained by body

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

.....

.....

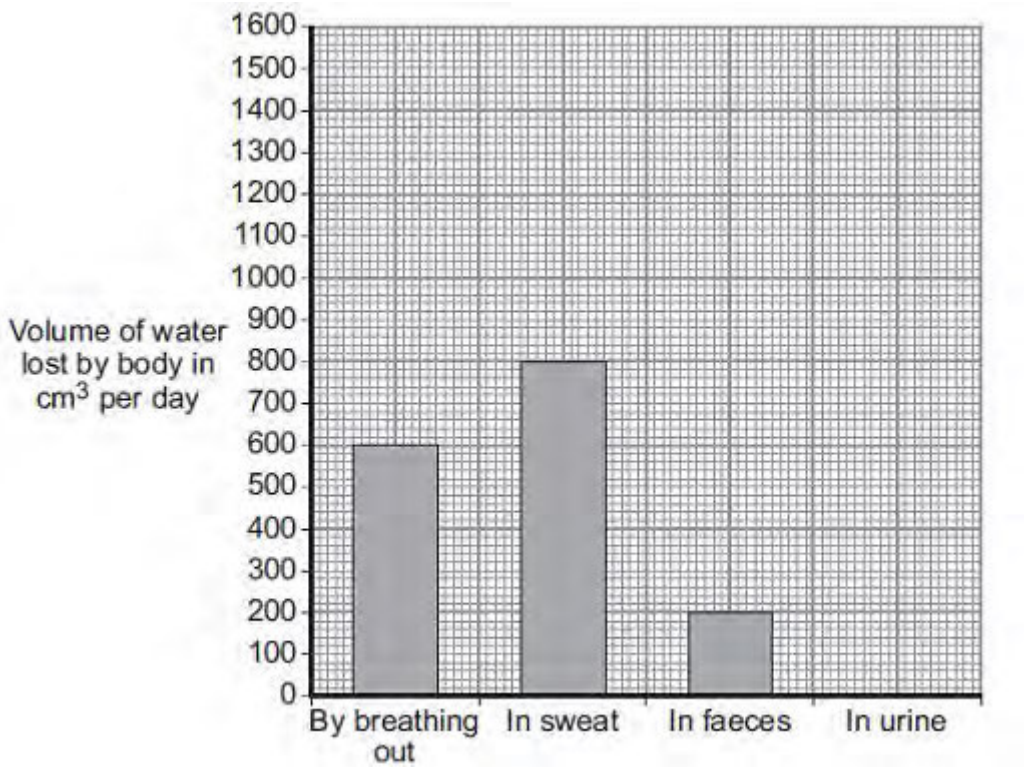
.....

Total volume of water gained = ..... $cm^3$

**(2)**

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

**Bar chart 2**




Water lost by body

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

.....

.....

Volume = ..... $cm^3$

**(1)**

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

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

.....

.....

Volume of water lost in urine = ..... $cm_3$

**(1)**

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

**(1)**

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

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

.....

.....

**(1)**

**(Total 11 marks)**

**Q4.** Type 1 diabetes develops when the body does not produce enough insulin.

(a) Which organ produces insulin?

.....

**(1)**

(b) One treatment for diabetes is to inject insulin.

The table gives the properties of four different types of insulin, **A**, **B**, **C** and **D**.

| Type of insulin | Time taken for the insulin to begin to work in minutes | Time taken for insulin to reach maximum concentration in the blood in minutes | Time when insulin is no longer effective in hours |
|---|---|---|---|
| **A** | 15-20 | 30-90 | 3-4 |
| **B** | 30-60 | 80-120 | 4-6 |
| **C** | 120-240 | 360-600 | 14-16 |
| **D** | 240-360 | 600-960 | 18-20 |

(i) Some people with diabetes need to inject insulin just before a meal to stop a big increase in blood sugar concentration.

Which type of insulin, **A**, **B**, **C** or **D**, should these people with diabetes inject just before a meal?

.....

Give the reason for your answer.

.....

.....

**(2)**

(ii) A person with diabetes is told to inject type **B** insulin immediately after breakfast at 09.00.
The person with diabetes is told to then inject a second type of insulin at lunchtime at 12.00.
The second type of insulin should keep the blood sugar level under control for the rest of the 24 hours.

Which type of insulin, **A**, **C** or **D**, should this person with diabetes inject at lunchtime?

.....

Give the reason for your answer.

.....

.....

**(2)**

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

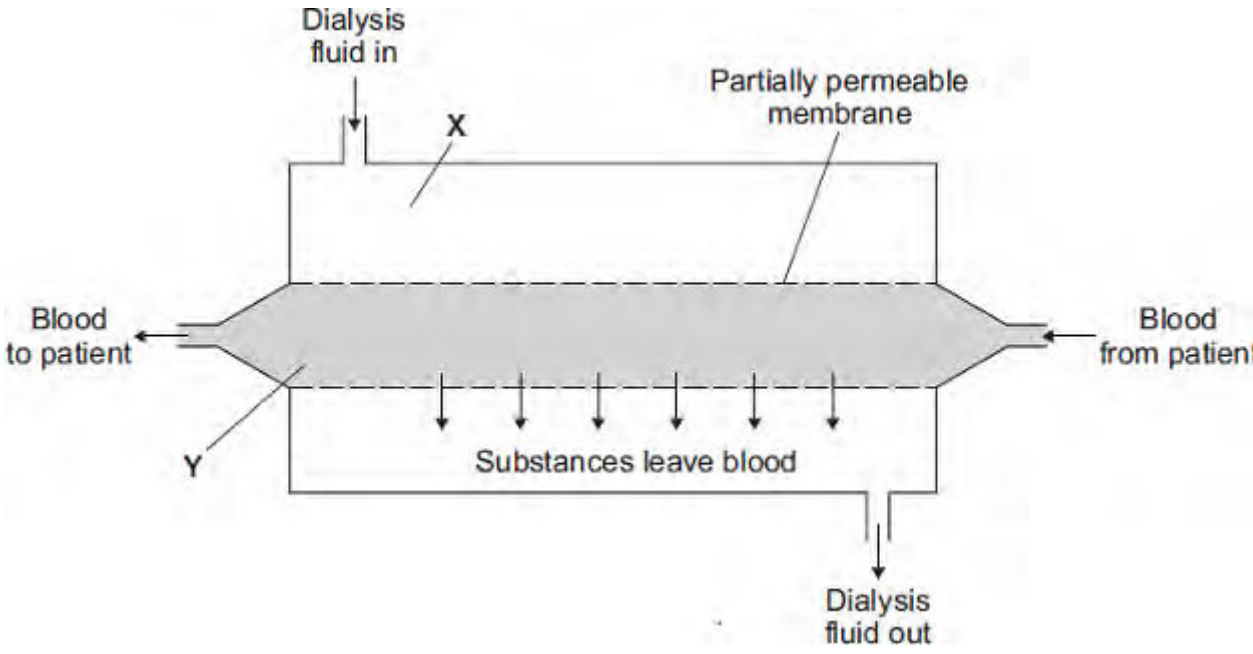
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**(1)**

**(Total 6 marks)**

**Q5.**People with kidney disease may be treated by dialysis.

The diagram shows a dialysis machine.




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

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

(i) This person lost mass mainly because

| |
|---|
| salt |
| urea |
| water |

was removed from the blood.

**(1)**

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

because its molecules are

| |
|---|
| large. |
| round. |
| small. |

**(1)**

(iii) The concentration of sodium ions at **X** is 3.15 grams per $dm_3$.

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

at **Y** would be

| |
|---|
| 0.00 |
| 3.15 |
| 6.30 |

grams per $dm_3$.

**(1)**

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

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

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

How much cheaper is the dialysis treatment? ..... pounds

**(1)**

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

How many years would it take?

Draw a ring around **one** answer.

**2 years** **3 years** **4 years**

**(1)**

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

Why is it necessary to suppress the immune system ?

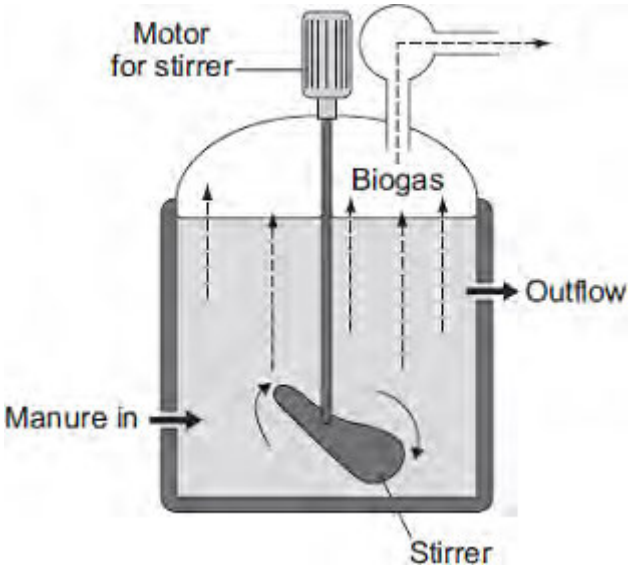
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.....

**(1)**

**(Total 6 marks)**

**Q6.** The diagram shows one type of biogas generator.




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

Suggest **one** reason for this.

Tick (✓) **one** box.

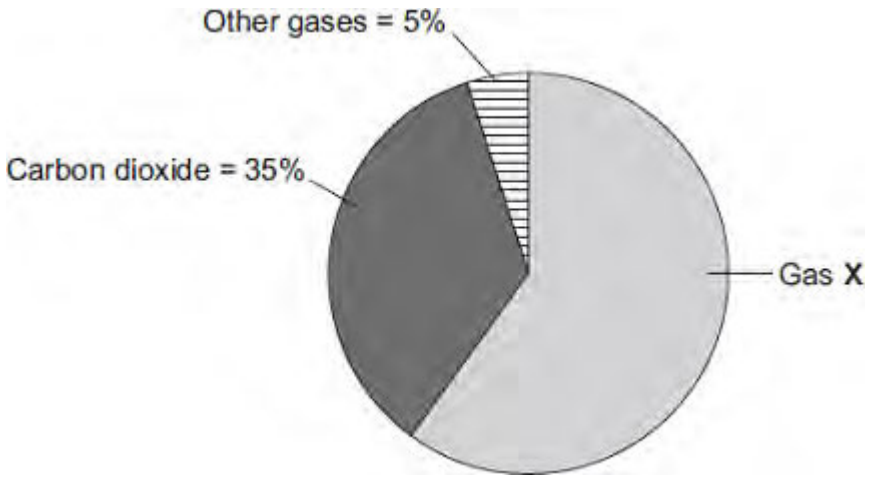
A higher concentration contains too little oxygen. ☐

A higher concentration would be difficult to stir. ☐

A higher concentration contains too much carbon dioxide. ☐

**(1)**

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




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

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

Draw a ring around **one** answer.

**methane** **nitrogen** **oxygen**

**(1)**

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

Show clearly how you work out your answer.

.....

.....

Percentage of gas **X** = .....

**(2)**

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

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

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

aerobic respiration.

anaerobic respiration.

fermentation.

**(1)**

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

ammonia.

nitrogen.

oxygen.

**(1)**

**(Total 6 marks)**

**Q7.** Diabetes is a disease in which the concentration of glucose in a person's blood may rise to fatally high levels.

Insulin controls the concentration of glucose in the blood.

(a) Where is insulin produced?

Draw a ring around **one** answer.

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

**(1)**

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

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

What type of substance is insulin?

Draw a ring around **one** answer.

**carbohydrate** **fat** **protein**

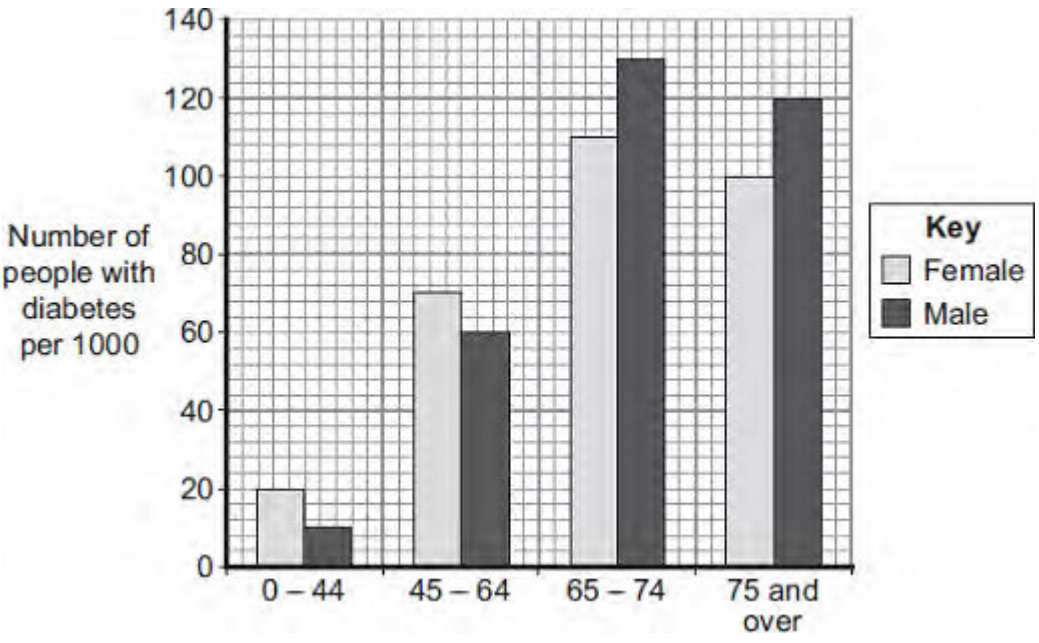
**(1)**

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

.....

**(1)**

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




Age in years

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

.....

.....

.....

.....

.....

.....

.....

.....

**(3)**

(ii) Compare the number of males and females with diabetes:

between the ages of 0 and 64 years

.....

.....

.....

over the age of 65 years.

.....

.....

.....

**(2)**

**(Total 8 marks)**

**Q8.**Human body temperature must be kept within narrow limits.

The image shows a cyclist in a race.



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

| | | | | |
|---|---|---|---|---|
| **blood** | **brain** | **kidney** | **sweat** | **urine** |

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

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

If the cyclist's body temperature increases, his body increases

the production of ..... .

**(3)**

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

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

| | **Sports drink** | | |
|---|---|---|---|
| | **A** | **B** | **C** |
| **Ratio of glucose (g per dm3) to ions (mg per $dm_3$)** | 15:14 | 12:1 | 2:7 |

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

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

**(1)**

(ii) Why should sports drinks contain ions?

.....

.....

**(1)**

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

.....

.....

**(1)**

**(Total 6 marks)**