AQA GCSE Biology | 8461

SPECIFICATION POINT 4.5.3.3

# Maintaining water and nitrogen balance in the body (biology only)

## Past-paper questions

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **49** |
| Available paper years | **2007–2025** |

## Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

**Name:** _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 01**

March 2007 | BLY1A | Original Q4 | Legacy

## QUESTION FOUR

This question is about water loss from the body.

The table shows the volume of water lost from the body.

| Organ | Water loss in $cm^3$ per day |
|---|---|
| kidney | 1300 |
| lungs | 300 |
| skin | 900 |
| large intestine | 100 |

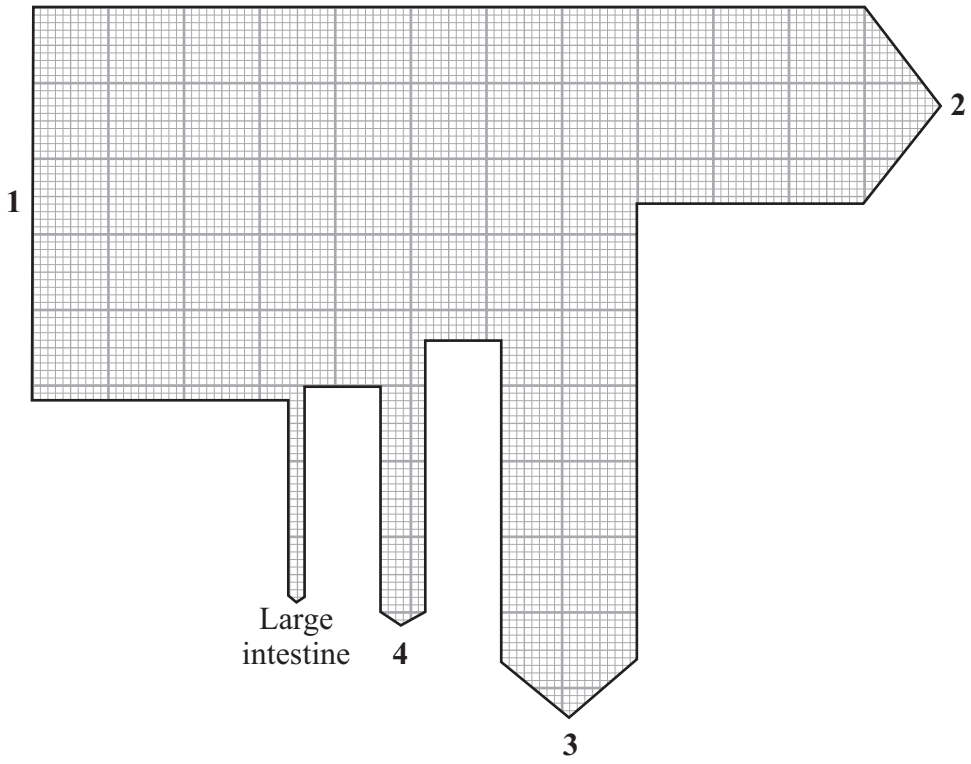
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** on the Sankey diagram.

**A** total water loss from the body

**B** water loss from the kidneys

**C** water loss from the lungs

**D** water loss from the skin




(On the Sankey diagram, the thicker the arrow the greater the proportion)

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 02**

January 2008 | BLY1F | Original Q3 | Legacy

**3** (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 mark)*

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

*(1 mark)*

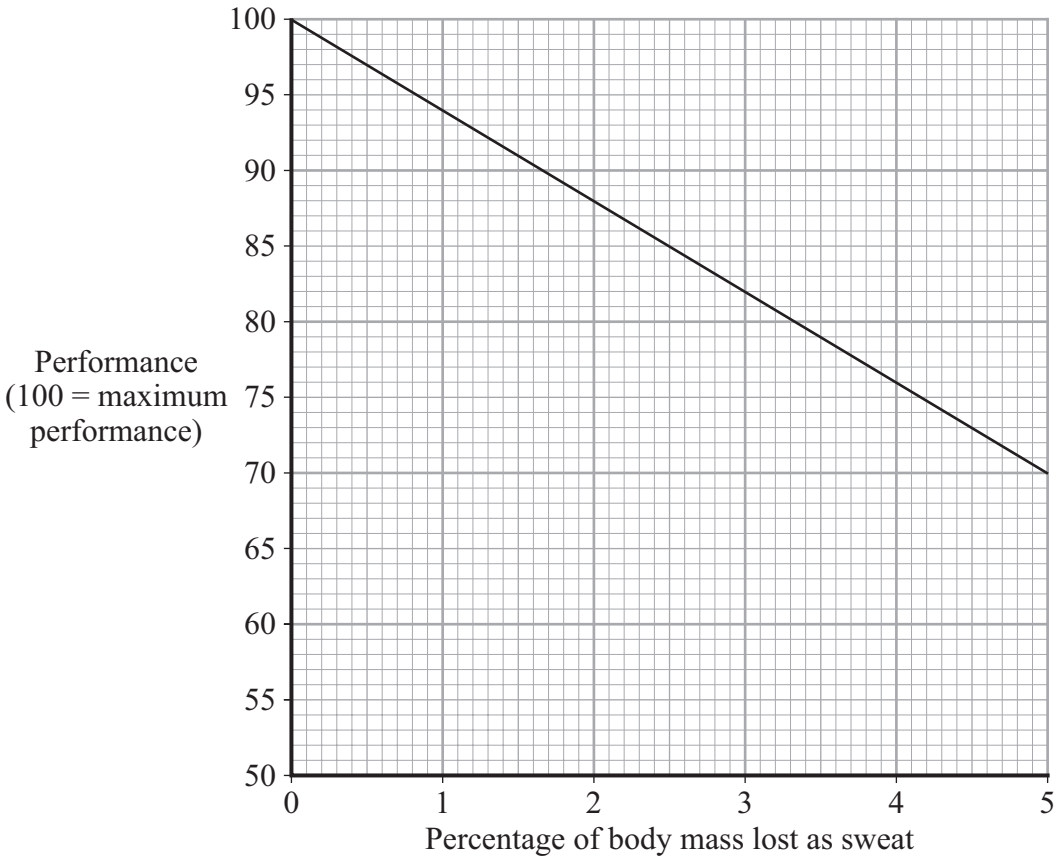
(iii) Excess water leaves the body in a liquid called urine.

Urine is produced by the ..... .

*(1 mark)*

(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.



**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 02 · continued**



*BLANK*

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

.....

.....

*(1 mark)*

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

.....

.....

*(1 mark)*

5

**Turn over for the next question**

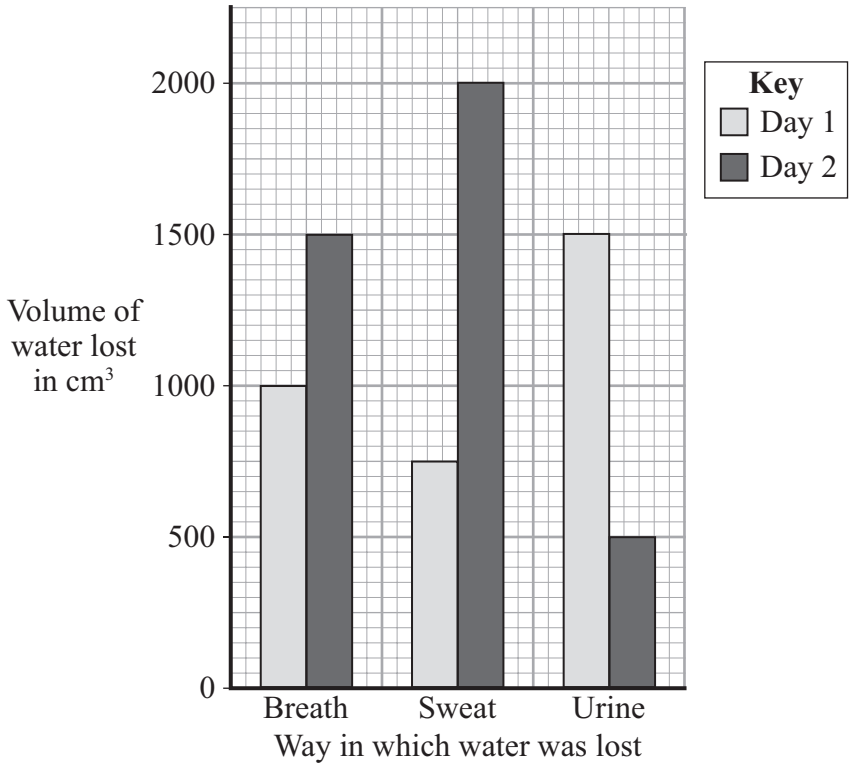
**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 03**

January 2008 | BLY2F | Original Q2 | Legacy

**2** 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 marks)*

(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 marks)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 03 · continued**



*BLANK*

(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 mark)*

(ii) How does sweating help the body?

.....

.....

*(1 mark)*

(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 mark)*

7

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 04**

January 2008 | BLY3F | Original Q6 | Legacy

**6** (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 mark)*

(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 marks)*

(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.

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 04 · continued**



*BLANK*

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 marks)*

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

.....

.....

*(1 mark)*

(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 mark)*

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

..... grams per $dm^3$

*(1 mark)*

8

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 05**

June 2008 | BLY1AP | Original Q2 | Legacy

## QUESTION TWO

Different organs produce different substances.

Match organs, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

**A** skin

**B** liver

**C** kidney

**D** gland

| | |
|---|---|
| **1** | produces urine |
| **2** | produces hormones |
| **3** | produces sweat |
| **4** | produces cholesterol |

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 06**

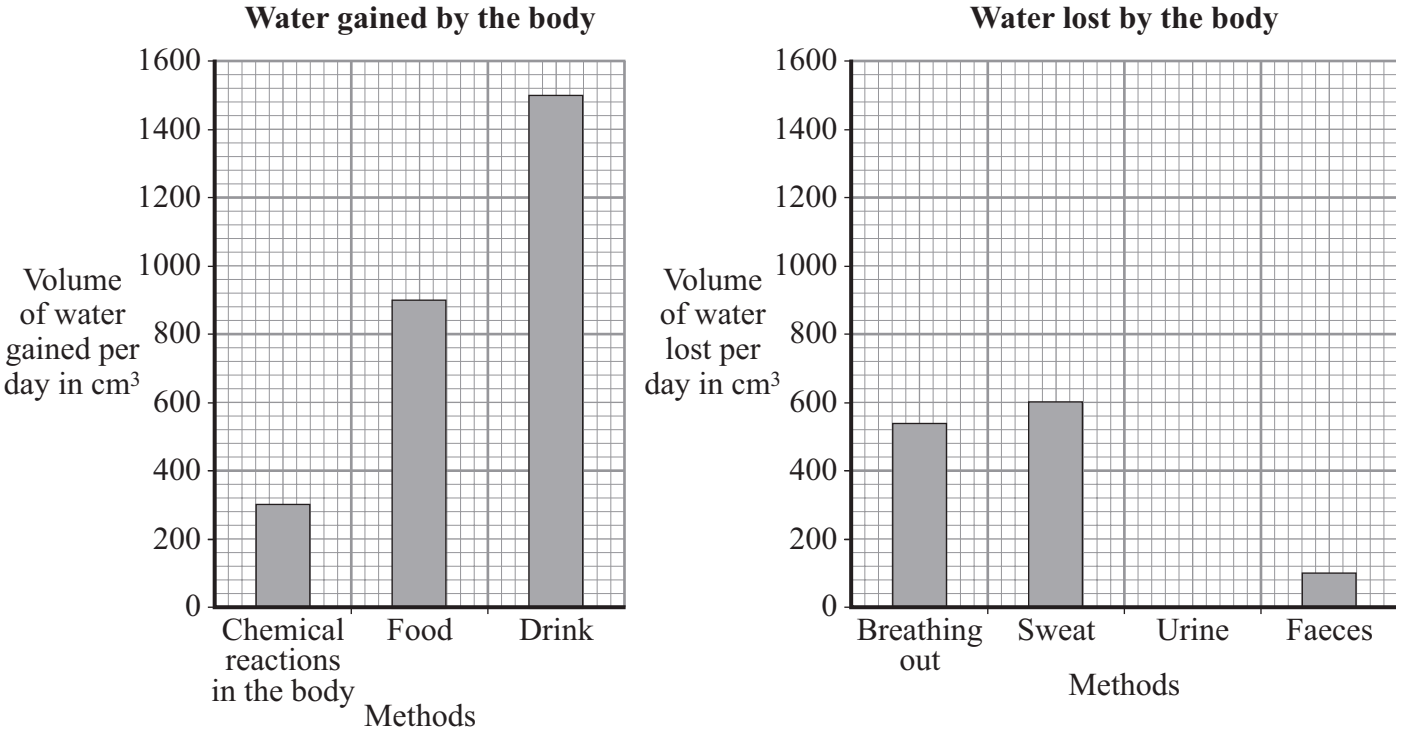
June 2008 | BLY1AP | Original Q5 | Legacy

## QUESTION FIVE

This question is about the water balance of the body.

The volume of water gained by the body must be the same as the volume of water lost by the body over the same time.

The bar charts show the volume of water gained and the volume of water lost per day.




Match volumes, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

**A** 540 $cm^3$

**B** 1460 $cm^3$

**C** 1500 $cm^3$

**D** 2700 $cm^3$

| | |
|---|---|
| **1** | the volume of water gained in drinks |
| **2** | the total volume of water gained |
| **3** | the volume of water lost by breathing out |
| **4** | the volume of water that would be lost in the urine to balance the water gained by the body with the water lost |

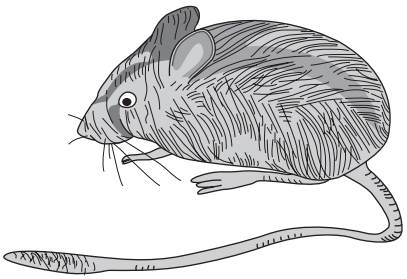
**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 07**

June 2008 | BLY1F | Original Q2 | Legacy

**2** The drawing shows a kangaroo rat.

This rat lives in hot, dry deserts.



**2** (a) Explain how each of the following features helps the kangaroo rat to survive in a hot, dry desert.

**2** (a) (i) It does not produce urine.

.....

.....

*(1 mark)*

**2** (a) (ii) It lives in a burrow during the day, but comes out at night to search for food.

.....

.....

*(1 mark)*

**2** (a) (iii) Its feet and its tail each have a large surface area.

.....

.....

*(1 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 07 · continued**



*for mark*

**2** (b) The kangaroo rat does **not** sweat.

Explain why **not** sweating could be dangerous for the animal.

.....

.....

*(1 mark)*

4

**Turn over for the next question**

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 08**

June 2008 | BLY2F | Original Q4 | Legacy

**4** 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 | 100 |
| urine | |
| **Total** | **2400** |

**Table 2**
**Gains of water by the body**

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

**4** (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 marks)*

**4** (a) (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 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

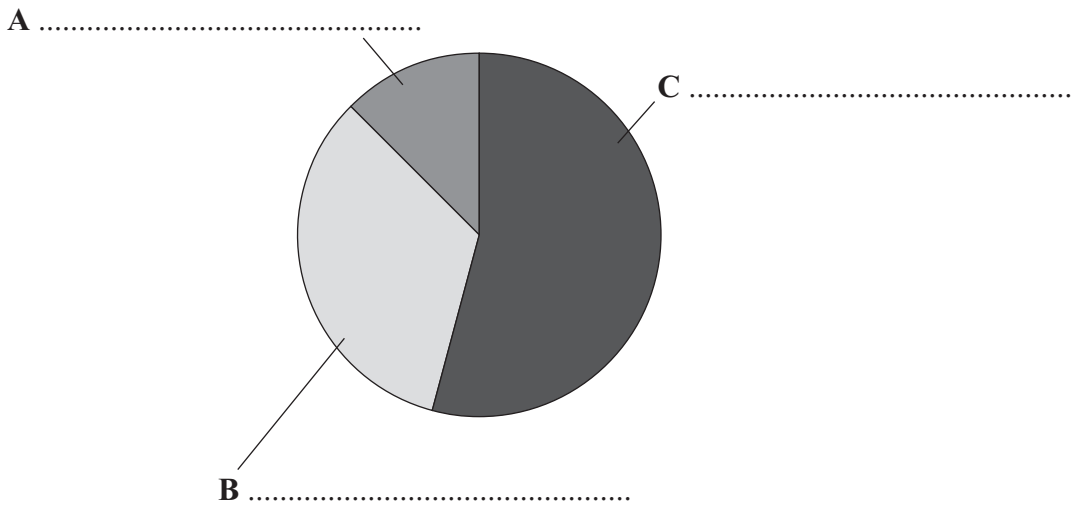
**Question 08 · continued**



*for mark*

**4** (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 mark)*

**4** (c) How does sweating help the body?

.....

.....

*(1 mark)*

**4** (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 marks)*

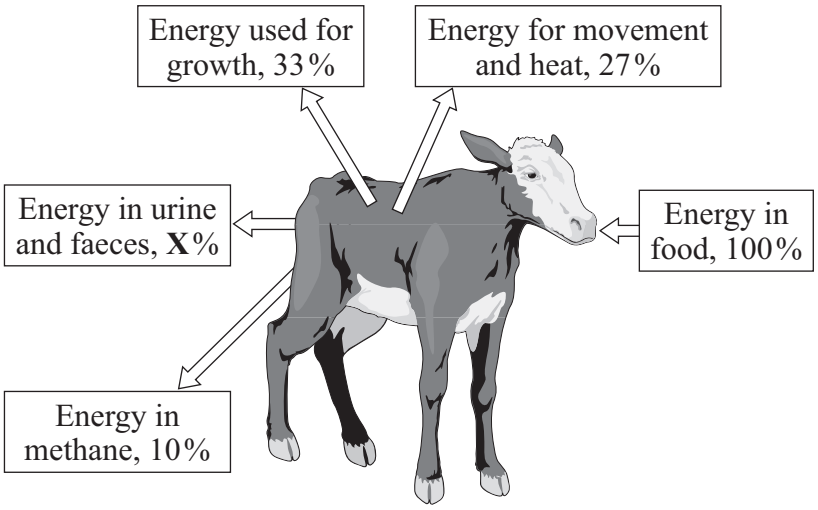
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**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 09**

June 2008 | BLY2F | Original Q6 | Legacy

**6** The diagram shows what happens to the energy in the food that a calf eats.




**6** (a) Calculate the % energy lost as urine and faeces (**X**).
Show clearly how you work out your answer.

.....

.....

Energy lost as urine and faeces ..... %
*(2 marks)*

**6** (b) The energy in the food eaten by the calf in one day is 6 megajoules.

Calculate the amount of this energy that would be used for growth.
Show clearly how you work out your answer.

.....

.....

Energy used for growth ..... megajoules.
*(2 marks)*

**6** (c) Which process in the body transforms energy in food into heat?

.....
*(1 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 09 · continued**

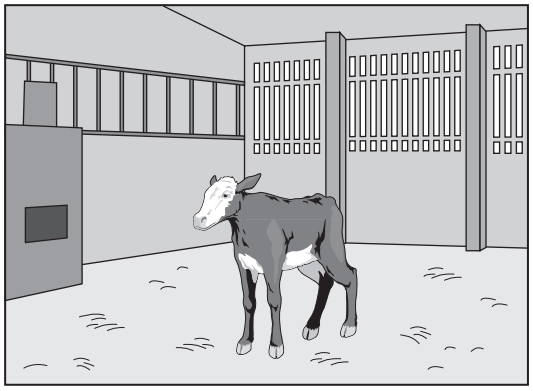


*for mark*

**6** (d) The pictures show two methods of raising calves indoors.

**Method 2** is now banned.

**Method 1**



**Method 2**



**6** (d) (i) Calves raised indoors grow faster than calves raised outdoors.

Suggest **one** reason why.

.....

.....

*(1 mark)*

**6** (d) (ii) **Method 2** was banned after public campaigns.

Suggest **one** reason why people campaigned against this method of rearing calves.

.....

.....

*(1 mark)*

7

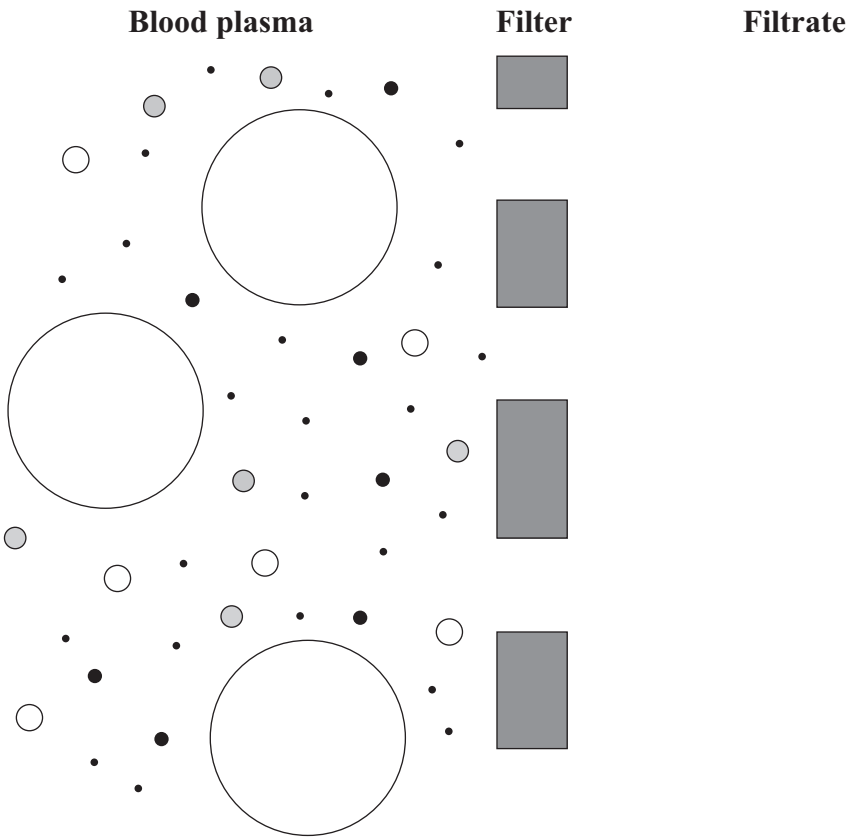
**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 10**

June 2008 | BLY3F | Original Q2 | Legacy

**2** The kidneys filter the blood.

The diagram shows the site of filtration in the kidney.



**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 10 · continued**



*for mark*

**2** (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 marks)*

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

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

.....

.....

*(1 mark)*

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

After filtration, all the glucose is

reabsorbed
released
respired

.

*(1 mark)*

**Question 2 continues on the next page**

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 10 · continued**



*for mark*

**2** (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.

**2** (c) (i) On the hot day, the athlete would produce [less / more / the same amount of] urine.

*(1 mark)*

**2** (c) (ii) This is because he would produce [less / more / the same amount of] sweat.

*(1 mark)*

**6**

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 11**

November 2008 | BLY1AP | Original Q3 | Legacy

## QUESTION THREE

Different human organs have different functions.

Match words, **A**, **B**, **C** and **D**, with the organs **1–4** in the table.

**A** produces cholesterol

**B** produces sweat

**C** produces urine

**D** produces hormones

| | |
|---|---|
| **1** | pituitary gland |
| **2** | liver |
| **3** | skin |
| **4** | kidney |

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 12**

January 2009 | BLY2F | Original Q4 | Legacy

**4** 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.

**4** (a) Carbon dioxide is produced by breathing / diffusion / respiration .

*(1 mark)*

**4** (b) Most carbon dioxide leaves the body through the kidneys / lungs / skin .

*(1 mark)*

**4** (c) Urea is produced in the kidneys / liver / lungs .

*(1 mark)*

**4** (d) Urea is produced from the breakdown of amino acids / glucose / urine .

*(1 mark)*

**4**

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 13**

January 2009 | BLY3F | Original Q3 | Legacy

**3** (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 marks)*

**3** (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 marks)*

4

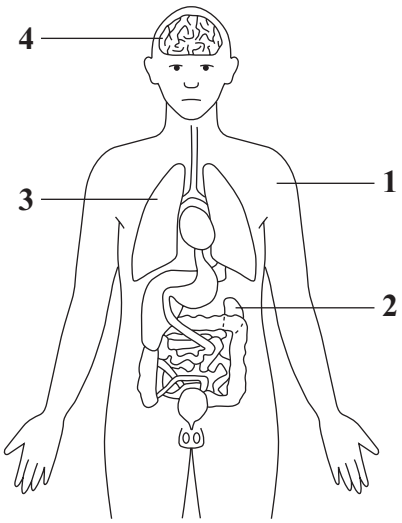
**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 14**

March 2009 | BLY1AP | Original Q1 | Legacy

## QUESTION ONE

The diagram shows some of the organs which help to keep conditions inside the human body constant.




Match statements, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram.

**A** the skin, which produces sweat

**B** a lung, which breathes out carbon dioxide

**C** the brain, which coordinates the other organs

**D** the kidney, which produces urine

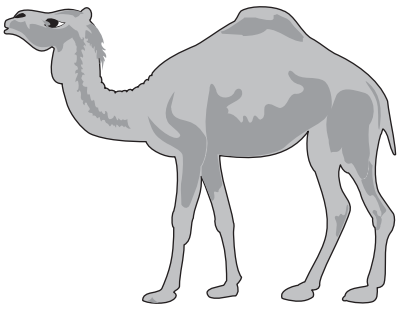
**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 15**

March 2009 | BLY1BP | Original Q2 | Legacy

## QUESTION TWO

Camels are adapted for living in hot, dry conditions.



Match the facts about camels, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

**A** The camel's stomach can hold 200 litres of water.

**B** The camel produces little urine and does not sweat.

**C** Camels store fat in a hump.

**D** Camels can withstand an increase in body temperature of 9 °C without harm.

| | |
|---|---|
| **1** | Camels lose very little water each day. |
| **2** | It is unlikely for a camel to die from being overheated. |
| **3** | Camels can go without drinking water for several days. |
| **4** | Camels can go without food for several days. |

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 16**

June 2009 | BLY1AP | Original Q3 | Legacy

**QUESTION THREE**

Water leaves your body from several organs.

Match organs, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

**A** glands

**B** kidneys

**C** lungs

**D** skin

When you breathe out, water vapour leaves your . . . **1** . . . .

When you sweat, water leaves the surface of your . . . **2** . . . .

Water is lost in urine produced by the . . . **3** . . . .

The total amount of water lost from the body is controlled by hormones.

Hormones are produced by . . . **4** . . . .

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 17**

June 2009 | BLY2F | Original Q3 | Legacy

**3** 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** |

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

Show clearly how you work out your answer.

.....

.....

Proportion = .....

*(2 marks)*

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

**3** (b) (i) Explain why.

.....

.....

*(1 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 17 · continued**



*for mark*

**3** (b) (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 marks)*

**3** (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.

**3** (c) (i) Urea is made in the.....

*(1 mark)*

**3** (c) (ii) Urea is removed from the blood by the .....

*(1 mark)*

**3** (c) (iii) Urine is stored in the .....

*(1 mark)*

**8**

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

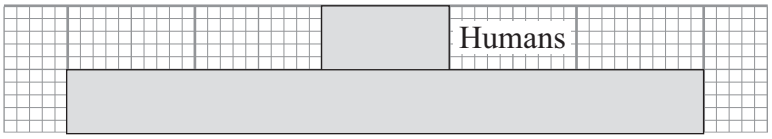
**Question 18**

June 2009 | BLY2F | Original Q4 | Legacy

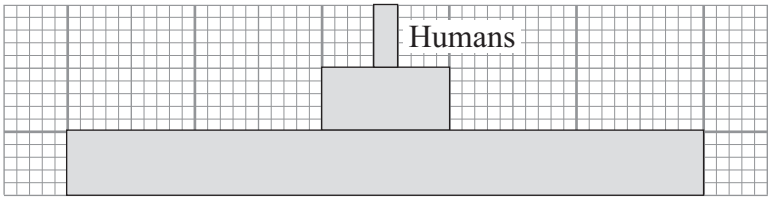
**4** (a) The diagrams show three pyramids of biomass.

**4** (a) (i) Which pyramid would be the most efficient in providing food for humans?

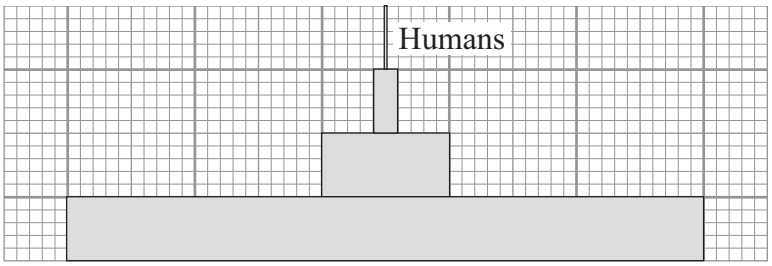
Tick (✓) **one** box.




☐




☐




☐

*(1 mark)*

**4** (a) (ii) Give **one** reason for your choice.

.....

.....

*(1 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 18 · continued**



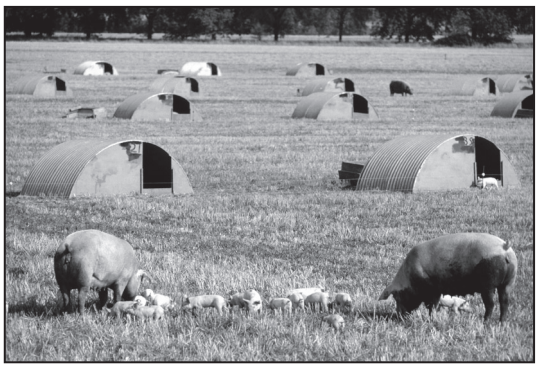
*for mark*

**4** (b) Pigs may be kept indoors or outdoors.

**Pigs kept indoors**

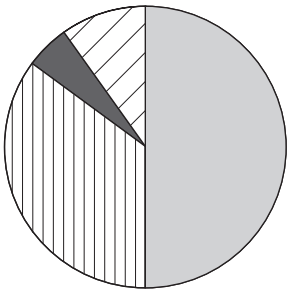


**Pigs kept outdoors**

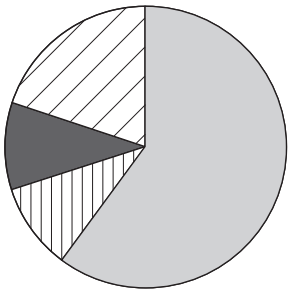


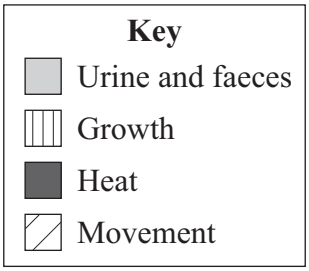
The pie charts show what happens to the energy in the food eaten by pigs kept indoors and pigs kept outdoors.

**Pigs kept indoors**



**Pigs kept outdoors**






**4** (b) (i) Farmers make more profit from keeping pigs indoors than from keeping pigs outdoors.

Use information from the pie charts to explain why.

.....

.....

.....

.....

*(2 marks)*

**4** (b) (ii) Meat from pigs kept outdoors may cost more than meat from pigs kept indoors.

Some people prefer to buy meat from animals that have been kept outdoors.

Suggest **one** reason why.

.....

.....

*(1 mark)*

**5**

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 19**

June 2009 | BLY3F | Original Q2 | Legacy

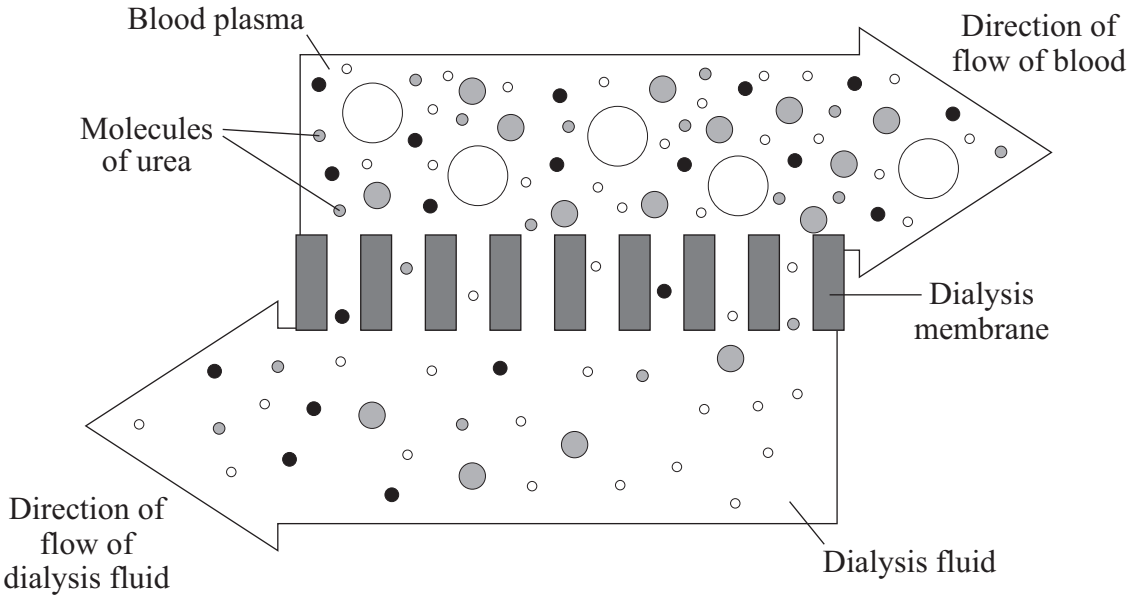
**2** (a) Which **two** of the following substances are found in the urine of a healthy person?

Tick (✓) **two** boxes.

| | |
|---|---|
| Glucose | ☐ |
| Mineral ions | ☐ |
| Proteins | ☐ |
| Water | ☐ |

*(2 marks)*

**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.

**2** (b) (i) During dialysis, urea moves out of the

blood cells
blood plasma
dialysis fluid

.

*(1 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 19 · continued**



*for mark*

**2** (b) (ii) During dialysis, urea moves into the [ blood cells / blood plasma / dialysis fluid ] .

*(1 mark)*

**2** (b) (iii) Urea moves by the process of [ diffusion / digestion / transpiration ] .

*(1 mark)*

**2** (b) (iv) To allow the movement of urea, the dialysis membrane is [ impermeable / partially permeable / thick ] .

*(1 mark)*

**2** (b) (v) The urea can pass through the membrane because

the urea molecules are [ large / round / small ] .

*(1 mark)*

**2** (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 mark)*

8

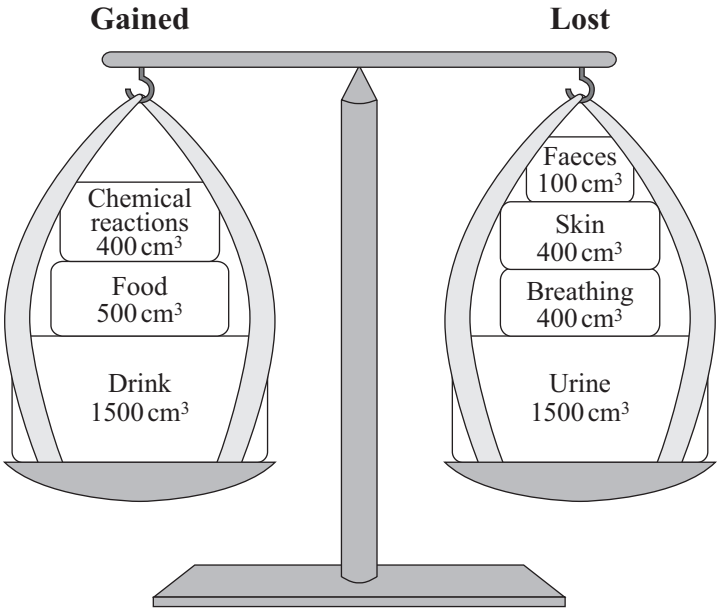
**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 20**

November 2009 | BLY1AP | Original Q2 | Legacy

## QUESTION TWO

The diagram represents water balance in the body.




Match numbers, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

**A** 100

**B** 400

**C** 900

**D** 2400

| | **Volume of water in $cm^3$** |
|---|---|
| **1** | volume of water lost in the faeces |
| **2** | total volume of water gained |
| **3** | total volume of water gained from food and chemical reactions in the body |
| **4** | volume of water lost by sweating |

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 21**

January 2010 | BLY2F | Original Q1 | Legacy

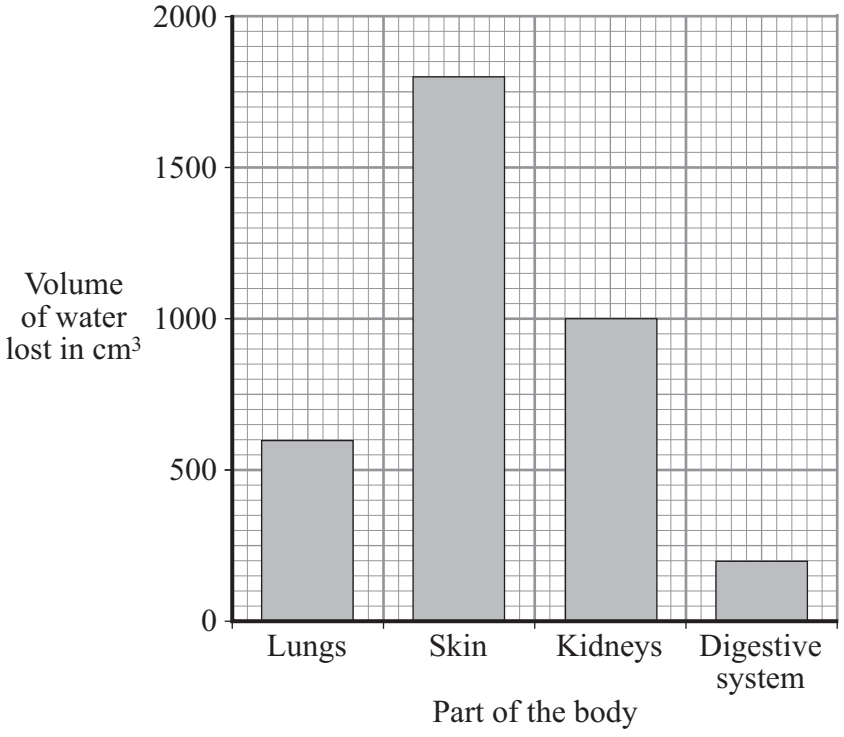
**1** Water is lost from several parts of the body.

**1** (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 marks)*

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



**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 21 · continued**



*for mark*

**1** (b) (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 mark)*

**1** (b) (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 mark)*

**1** (b) (iii) Give a reason for your answer.

.....

.....

*(1 mark)*

**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 mark)*

7

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 22**

January 2019 | BLY3F | Original Q5 | Legacy

**5** (a) (i) Which **two** antibiotics from **A**, **B**, **C**, **D**, **E** and **F**, did **not** kill this species of bacterium?

☐ and ☐

*(1 mark)*

**5** (a) (ii) Which would be the best antibiotic, **A**, **B**, **C**, **D**, **E** or **F**, to treat an infection caused by this species of bacterium? ☐

*(1 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

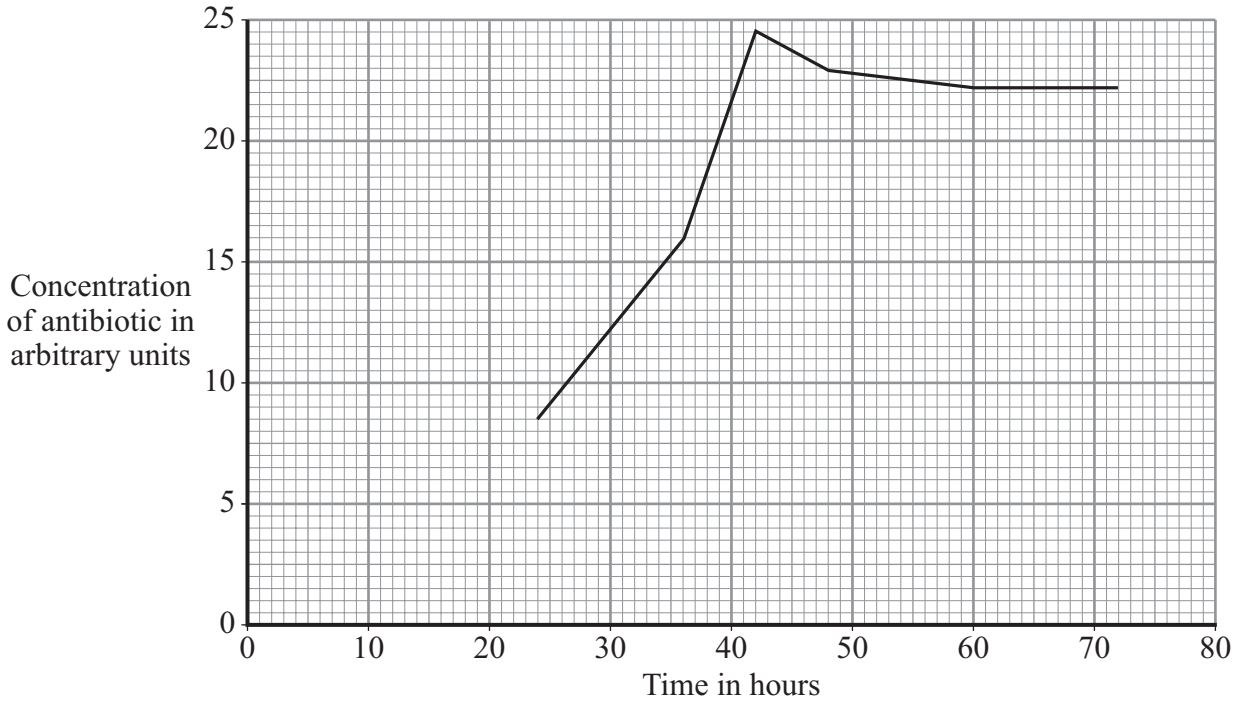
**Question 22 · continued**



*for mark*

**5** (b) The scientists measured the production of an antibiotic by a mould.

The graph shows their results.




**5** (b) (i) Describe what happened to the concentration of antibiotic between 24 and 72 hours.

.....

.....

.....

.....

*(2 marks)*

**5** (b) (ii) The scientists decided to grow the mould for 42 hours in future.

Why did they choose this time?

.....

.....

*(1 mark)*

5

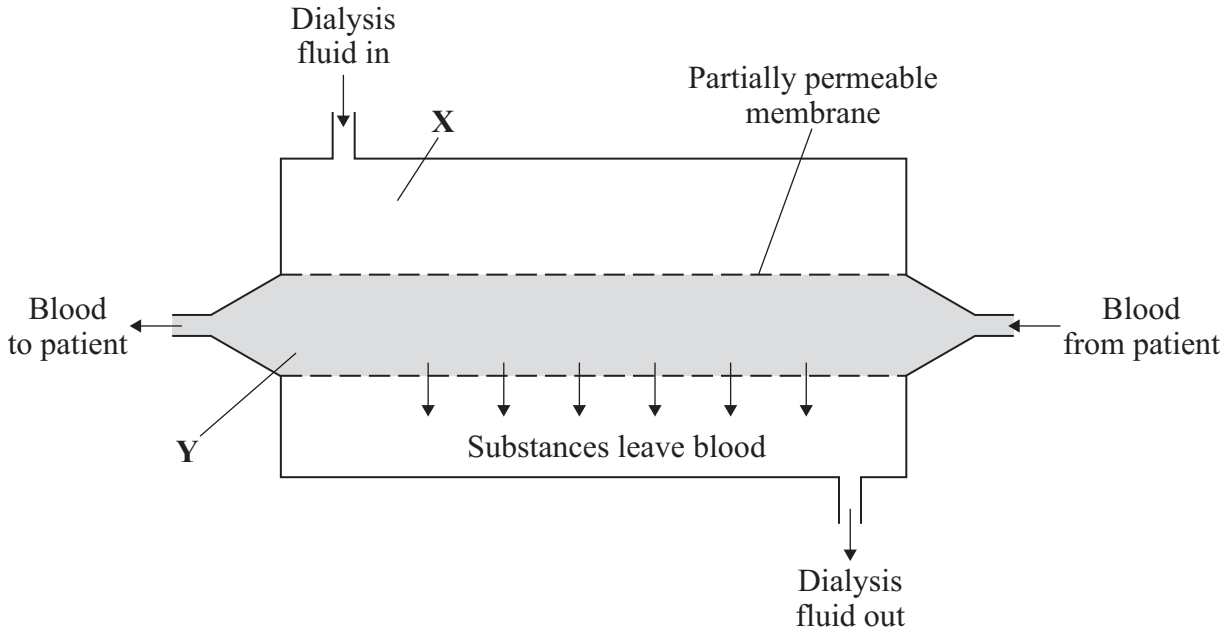
**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 22 · continued**



*for mark*

**6** People with kidney disease may be treated by dialysis.
The diagram shows a dialysis machine.



### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 23**

January 2019 | BLY3F | Original Q6 | Legacy

**6** (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.

**6** (a) (i) This person lost mass mainly because the substance [salt / urea / water] was removed from the blood.

*(1 mark)*

**6** (a) (ii) This substance was able to pass through the partially permeable membrane because its molecules are [large. / round. / small.]

*(1 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 23 · continued**



*for mark*

**6** (a) (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 mark)*

**6** (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 |
| Kidney transplant: medical care in each further year | 5 000 |

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

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

*(1 mark)*

**6** (b) (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 mark)*

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

Why is this necessary?

.....

.....

*(1 mark)*

6

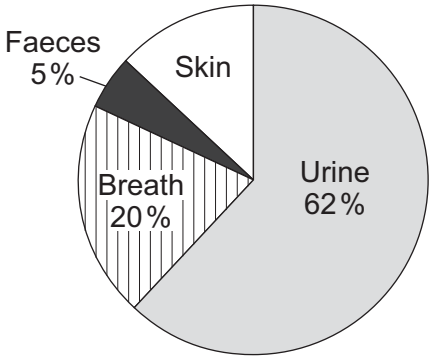
### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 24**

June 2010 | BLY1AP | Original Q6 | Legacy

**QUESTION SIX**

The pie chart shows the percentages of water lost from different parts of the body on a cold day.




**6A** What is the percentage of water lost from the skin?

**1** 10%

**2** 13%

**3** 15%

**4** 17%

**6B** The total volume of water lost from the body was 2000 $cm^3$.

How many $cm^3$ of water would be lost from the body in the breath?

**1** 20 $cm^3$

**2** 100 $cm^3$

**3** 400 $cm^3$

**4** 500 $cm^3$

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 24 · continued** June 2010 | BLY1AP | Original Q6 | Legacy

**6C** More water is lost from the skin on a hot day than on a cold day.

Why is this useful to the body?

**1** It gets rid of excess water.

**2** It moisturises the skin.

**3** It helps to control blood sugar levels.

**4** It helps to control body temperature.

**6D** The volume and composition of the urine would be different on a hot day compared with a cold day.

Which row in the table shows these differences?

| | Concentration of ions in urine on a hot day | Volume of urine produced on a hot day |
|---|---|---|
| **1** | increased | increased |
| **2** | increased | decreased |
| **3** | decreased | increased |
| **4** | decreased | decreased |

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 25**

June 2019 | BLY3F | Original Q6 | Legacy

**6** 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 |

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

**6 (a) (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 mark)*

**6 (a) (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 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 25 · continued** June 2019 | BLY3F | Original Q6 | Legacy

**6 (a) (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 mark)*

**6 (a) (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 mark)*

**6 (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.

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

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

*(1 mark)*

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

- more concentrated.
- less concentrated.
- the same concentration.

*(1 mark)*

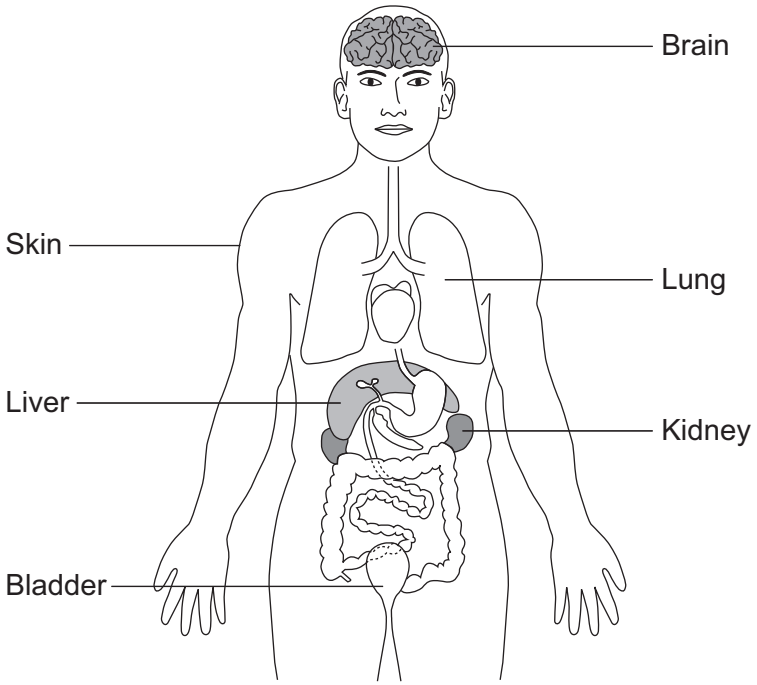
6

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 26**

January 2011 | BLY2F | Original Q2 | Legacy

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




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

**2 (a) (i)** Carbon dioxide is removed from the body by the

kidney.
lung.
skin.

*(1 mark)*

**2 (a) (ii)** Urine is made in the

kidney.
lung.
skin.

*(1 mark)*

**2 (a) (iii)** Urine is stored in the

bladder.
liver.
skin.

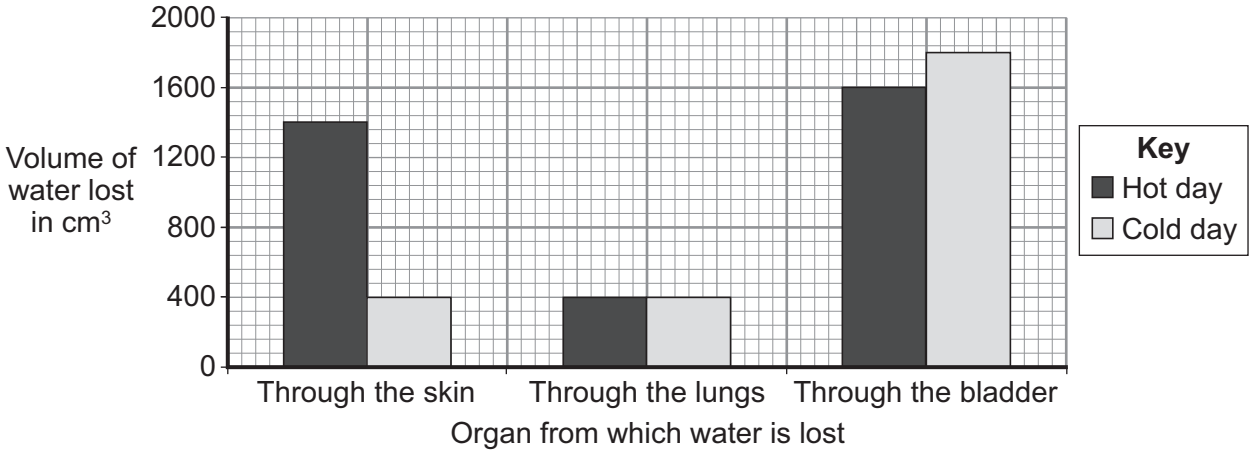
*(1 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 26 · continued**



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




**2 (b) (i)** Look at the bar chart.

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

Complete the table using words from the box.

| | | |
|---|---|---|
| **the same** | **less** | **more** |

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

*(3 marks)*

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

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

.....

.....

*(1 mark)*

7

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

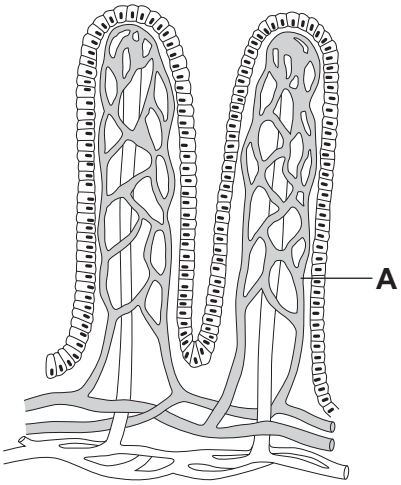
**Question 27**



**2** Villi are found in some parts of the digestive system.

**Diagram 1** shows two villi.

**Diagram 1**




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

**2 (a) (i)** Structure **A** is a

muscle.

nerve.

capillary.

*(1 mark)*

**2 (a) (ii)** The villi absorb the products of digestion by

dialysis.

diffusion.

osmosis.

*(1 mark)*

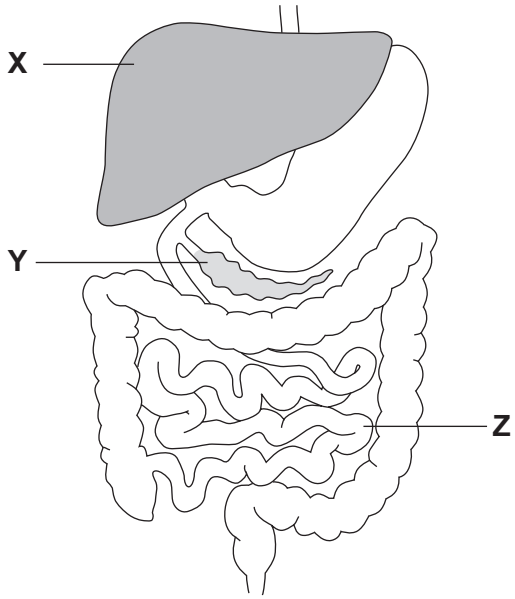
**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 27 · continued**



**2 (b)** **Diagram 2** shows the digestive system.

**Diagram 2**




**2 (b) (i)** In which part of the digestive system, **X**, **Y** or **Z**, are most villi found?

*(1 mark)*

**2 (b) (ii)** There are about 2000 villi in each $cm^2$ of this part of the digestive system.

Why is it helpful to have lots of villi?

.....

.....

*(1 mark)*

4

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 28**

January 2011 | BLY3F | Original Q5 | Legacy

**5 (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 marks)*

**5 (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 |

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 28 · continued**



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 marks)*

4

**Turn over for the next question**

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 29**

January 2011 | BLY3F | Original Q7 | Legacy

**7** The table shows the volume of blood flowing through different organs at three levels of exercise.

| Organ(s) | Volume of blood flowing through organ(s) in $cm^3$ per minute | | |
|---|---|---|---|
| | **Light exercise** | **Moderate exercise** | **Heavy exercise** |
| Gut | 1 100 | 600 | 300 |
| Kidneys | 900 | 600 | 250 |
| Brain | 750 | 750 | 750 |
| Heart muscles | 350 | 750 | 1 000 |
| Skeletal muscles | 4 500 | 12 500 | 22 000 |
| Skin | 1 500 | 1 900 | 600 |
| Other | 400 | 500 | 100 |
| **Total** | **9 500** | **17 600** | **25 000** |

**7 (a) (i)** Which organ has a constant flow of blood through it?

.....

*(1 mark)*

**7 (a) (ii)** Which organ has the greatest reduction in the volume of blood supplied during heavy exercise compared with light exercise?

.....

*(1 mark)*

**7 (a) (iii)** What proportion of the blood flows through the heart muscle during heavy exercise?

.....

*(1 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 29 · continued**



**7 (b)** The volume of blood flowing through the skeletal muscles increases greatly during exercise.

Give **two** ways in which the body brings about this increase.

1 .....

.....

2 .....

.....

*(2 marks)*

**7 (c)** During exercise, the concentration of carbon dioxide in the blood increases.

Explain what causes this increase.

.....

.....

.....

.....

.....

.....

*(3 marks)*

8

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 30**

March 2011 | BLY1AP | Original Q5 | Legacy

**QUESTION FIVE**

We control conditions inside our bodies.

Match organs, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

**A** liver

**B** pituitary gland

**C** kidney

**D** skin

| | |
|---|---|
| **1** | produces the hormone FSH |
| **2** | gets rid of excess heat |
| **3** | removes excess water from the blood |
| **4** | produces cholesterol |

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 31

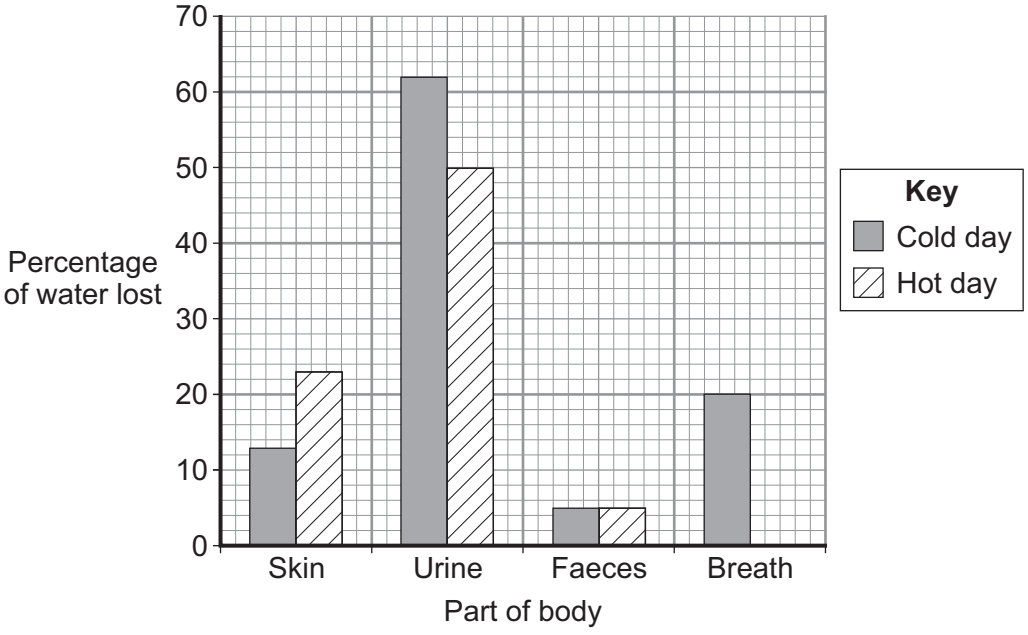
June 2011 | BLY1AP | Original Q2 | Legacy

**QUESTION TWO**

The bar chart shows the percentages of water lost from different parts of a man's body on a cold day and on a hot day.

The bar for the percentage of water lost in breath on a hot day has **not** been plotted.

The man's total water loss on each day was 1000 $cm^3$.




Match figures, **A**, **B**, **C** and **D**, with the statements **1**–**4** in the table.

**A** 12

**B** 13

**C** 22

**D** 62

| | |
|---|---|
| **1** | the percentage of water lost through the skin on a cold day |
| **2** | the difference in the percentages of water lost in the urine on a cold day and on a hot day |
| **3** | the highest percentage of water lost |
| **4** | the percentage of water lost in breath on a hot day |

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 32**

June 2011 | BLY1AP | Original Q5 | Legacy

**QUESTION FIVE**

This question is about human organs.

Match organs, **A**, **B**, **C** and **D**, with the functions **1**–**4** in the table.

**A** kidney

**B** liver

**C** ovary

**D** pituitary gland

| | Function |
|---|---|
| **1** | produces cholesterol |
| **2** | produces FSH |
| **3** | produces oestrogen |
| **4** | produces urine |

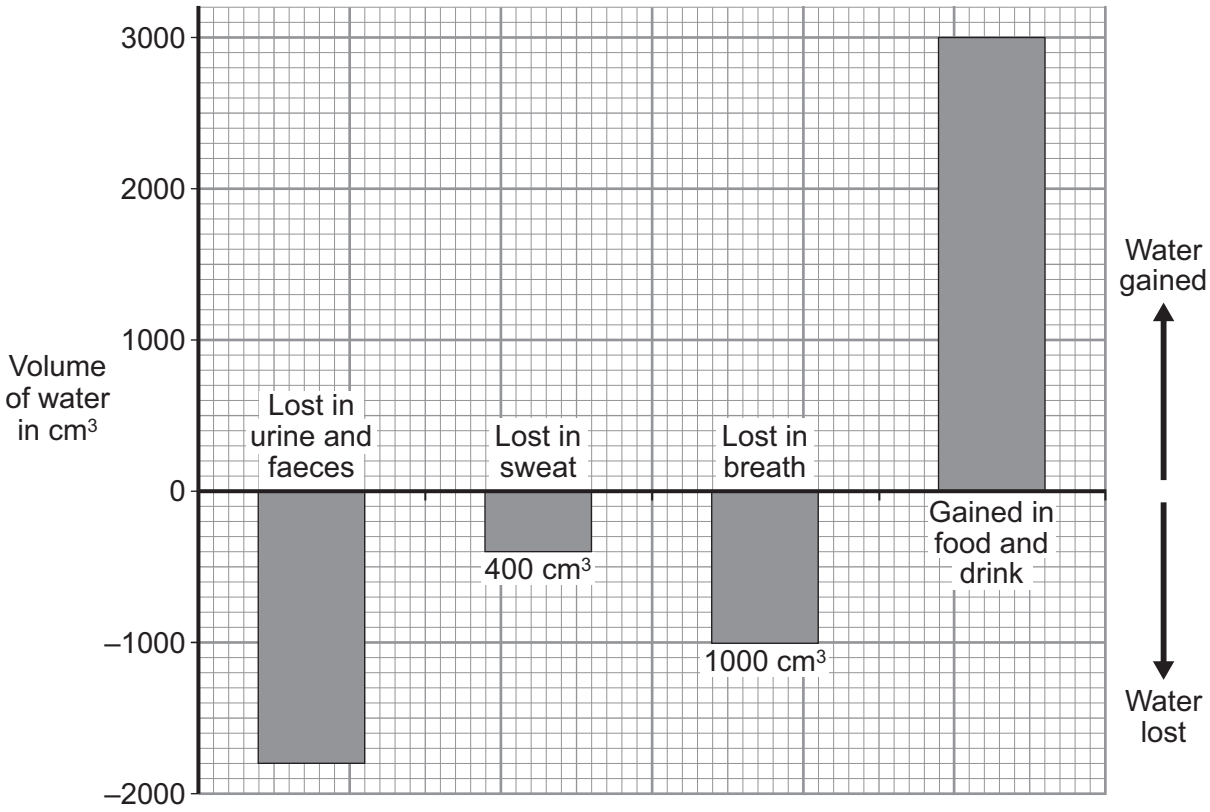
### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 33**

June 2011 | BLY2F | Original Q6 | Legacy

**6** 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.




**6 (a)** How much water was lost in the urine and faeces? ..... $cm^3$

*(1 mark)*

**6 (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 marks)*

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 33 · continued



**6 (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 marks)*

5

**Turn over for the next question**

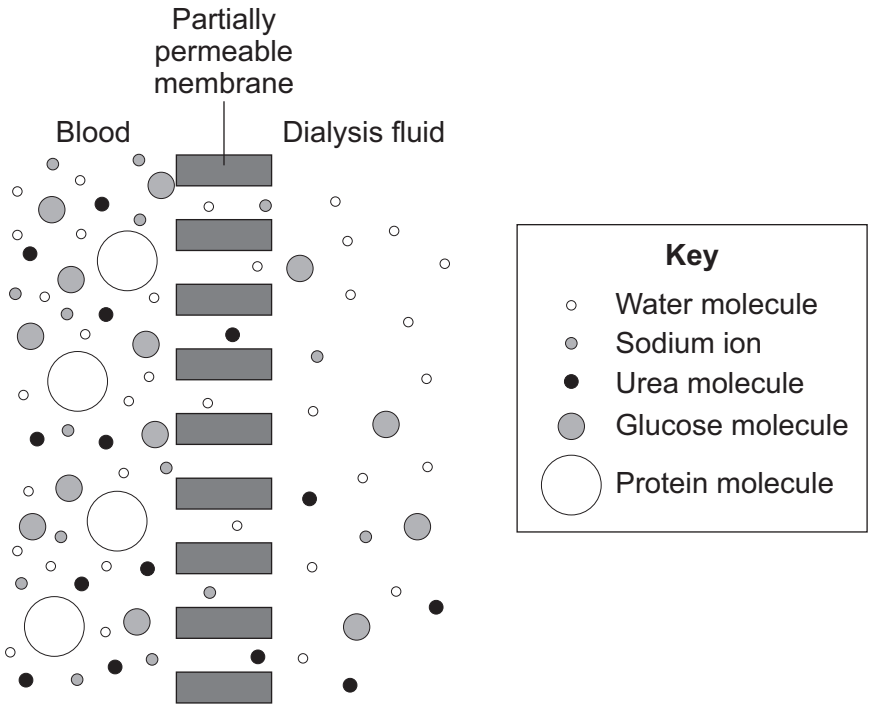
### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 34**

June 2011 | BLY3F | Original Q6 | Legacy

**6** 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 |

**6 (a)** Protein molecules are **not** able to move from the blood to the dialysis fluid.
Use information from the diagram to explain why.

.....

.....

*(1 mark)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 34 · continued** June 2011 | BLY3F | Original Q6 | Legacy

**6 (b)** Urea molecules move from the blood into the dialysis fluid.

**6 (b) (i)** Give the name of this type of movement. .....
*(1 mark)*

**6 (b) (ii)** Why do the urea molecules move in this direction?

Use information from the table to help you to answer this question.

.....

.....
*(1 mark)*

**6 (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 mark)*

**6 (d)** For most patients a kidney transplant is better than continued treatment by dialysis.

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

1 .....

.....

2 .....

.....
*(2 marks)*

**6 (d) (ii)** Give **two** possible disadvantages of having a kidney transplant.

1 .....

.....

2 .....

.....
*(2 marks)*

**8**

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 35**



**2** The body controls internal conditions.

**2 (a)** Use words from the box to complete the sentences about water loss from the body.

| | | | |
|---|---|---|---|
| **kidneys** | **liver** | **lungs** | **skin** |

**2 (a) (i)** Water is lost in sweat via the ..... .

*(1 mark)*

**2 (a) (ii)** Water is lost in urine via the ..... .

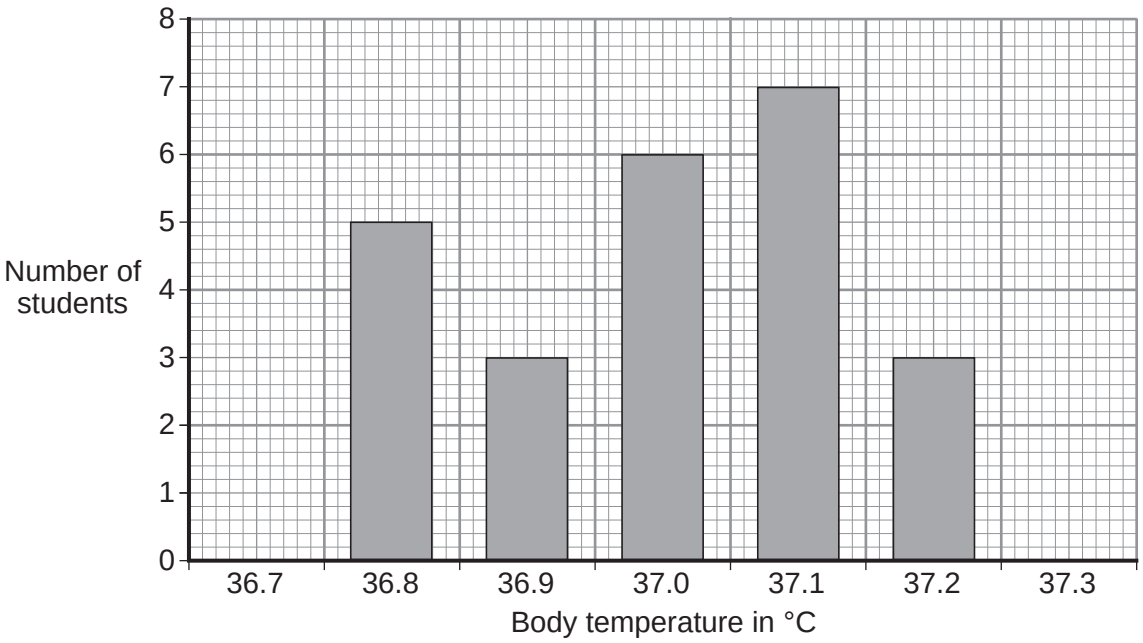
*(1 mark)*

**2 (a) (iii)** Water is lost in the breath via the ..... .

*(1 mark)*

**2 (b)** Students investigated body temperature in the class.

The bar chart shows the results.



**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 35 · continued**



**2 (b) (i)** One student used the bar chart to calculate the mean body temperature of the class. The student calculated the mean body temperature as 37.0 °C.

How did the student use the bar chart to calculate the mean?

.....

.....

.....

.....

*(2 marks)*

**2 (b) (ii)** How many students had a body temperature higher than the mean of 37.0 °C?

.....

*(1 mark)*

**2 (b) (iii)** Body temperature must be kept within a narrow range.

Why?

.....

.....

*(1 mark)*

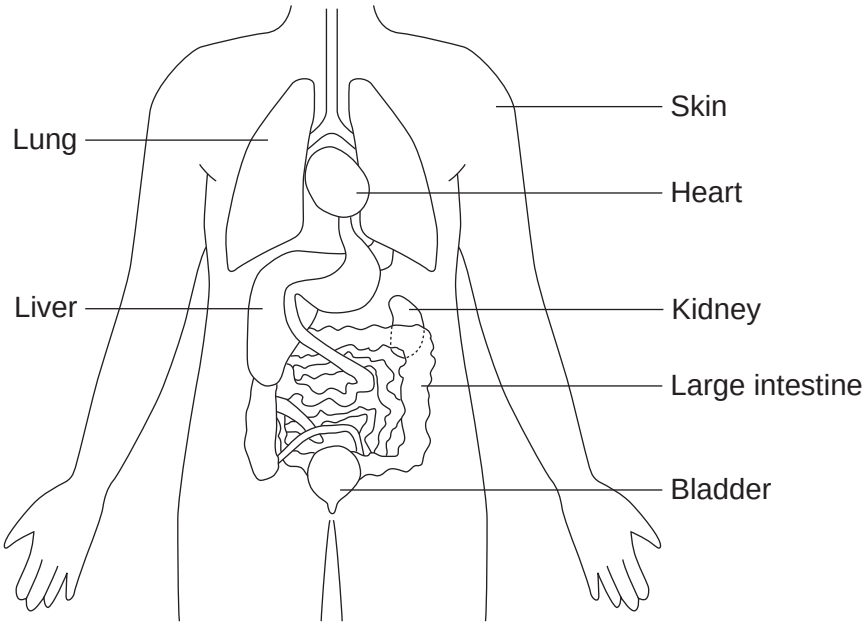
7

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 36**

June 2013 | BL3FP | Original Q3 | Legacy

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




**3 (a)** Which organ labelled on the diagram:

**3 (a) (i)** produces urine .....

*(1 mark)*

**3 (a) (ii)** stores urine .....

*(1 mark)*

**3 (a) (iii)** produces urea .....

*(1 mark)*

**3 (a) (iv)** gets rid of carbon dioxide .....

*(1 mark)*

**3 (a) (v)** helps to control body temperature? .....

*(1 mark)*

**Question 3 continues on the next page**

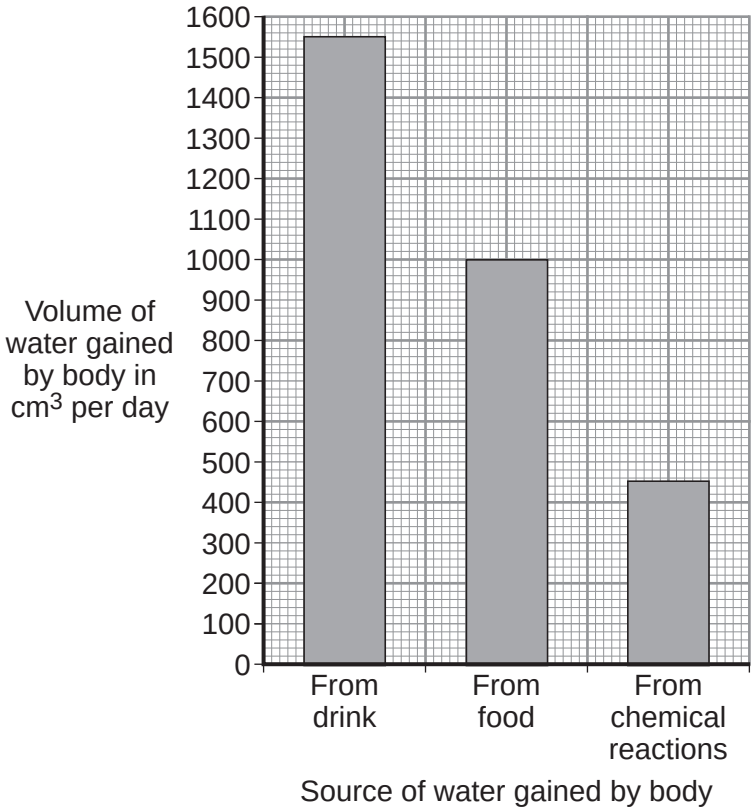
**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 36 · continued**



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

**Bar chart 1**




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

.....

.....

.....

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

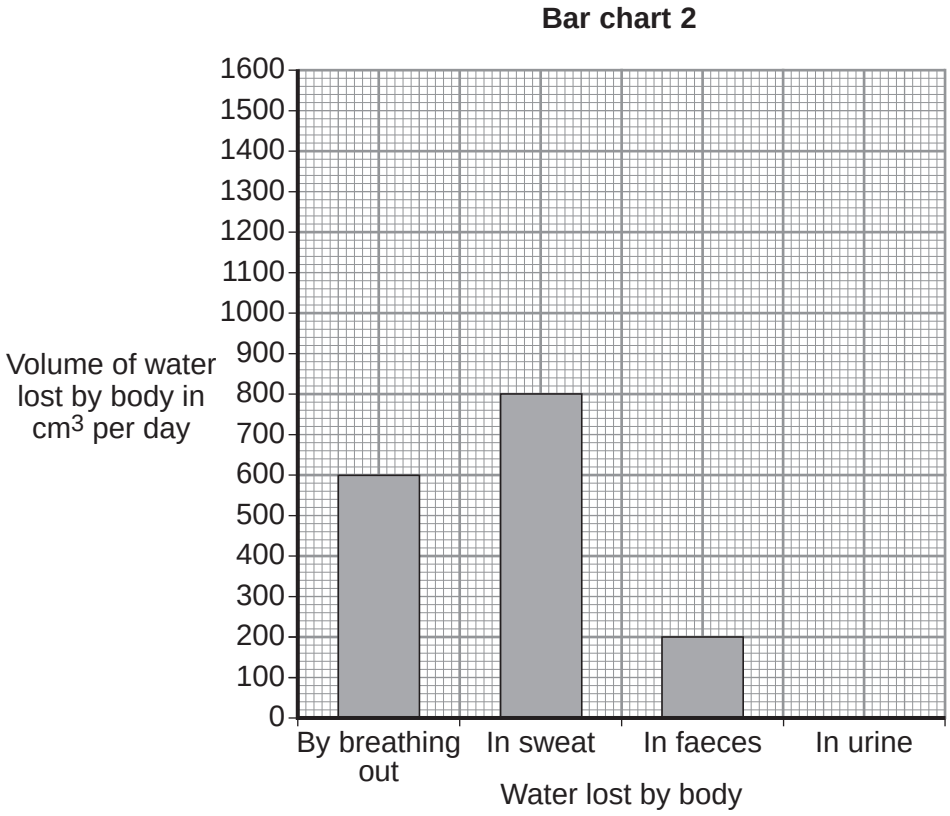
*(2 marks)*

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 36 · continued**



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




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

.....

.....

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

*(1 mark)*

**3 (b) (iii)** The volume of water the body loses must balance the volume of water the body gains.

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

.....

.....

Volume of water lost in urine = ..... $cm^3$

*(1 mark)*

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

*(1 mark)*

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 36 · continued**



**3 (b) (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 mark)*

11

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 37**

June 2014 | BL3FP | Original Q2 | Legacy

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

**Figure 4** shows a cyclist in a race.

**Figure 4**



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

**[3 marks]**

| | | | | |
|---|---|---|---|---|
| **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 ..... .

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 37 · continued** June 2014 | BL3FP | Original Q2 | Legacy

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

**Table 1** shows the ratio of glucose to ions in three sports drinks, **A**, **B** and **C**.

**Table 1**

| | Sports drink | | |
|---|---|---|---|
| | **A** | **B** | **C** |
| **Ratio of glucose (g per $dm^3$) to ions (mg per $dm^3$)** | 15:14 | 12:1 | 2:7 |

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

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

**[1 mark]**

**2 (b) (ii)** Why should sports drinks contain ions?

**[1 mark]**

.....

.....

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

**[1 mark]**

.....

.....

6

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 38**

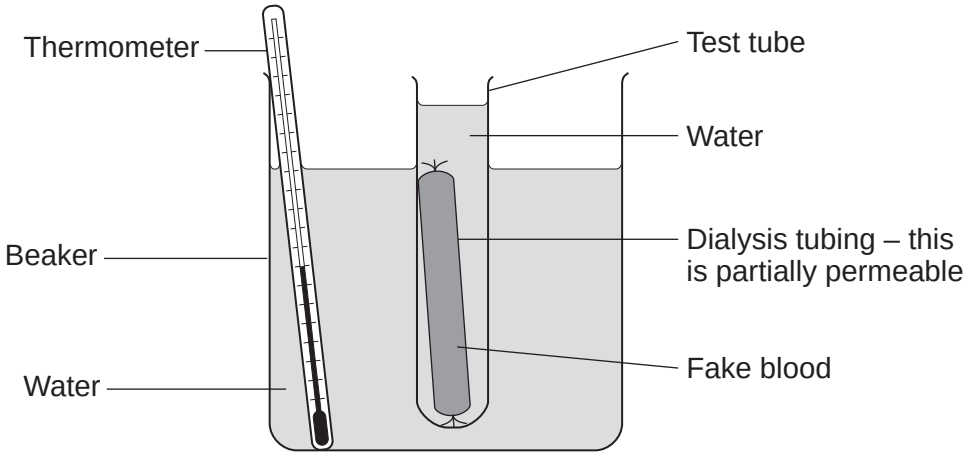
June 2014 | BL3FP | Original Q5 | Legacy

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

Some students made a model of a dialysis machine.

**Figure 8** shows the students' model.

**Figure 8**




The fake blood contained:

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

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

**[1 mark]**

.....

.....

**Question 5 continues on the next page**

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

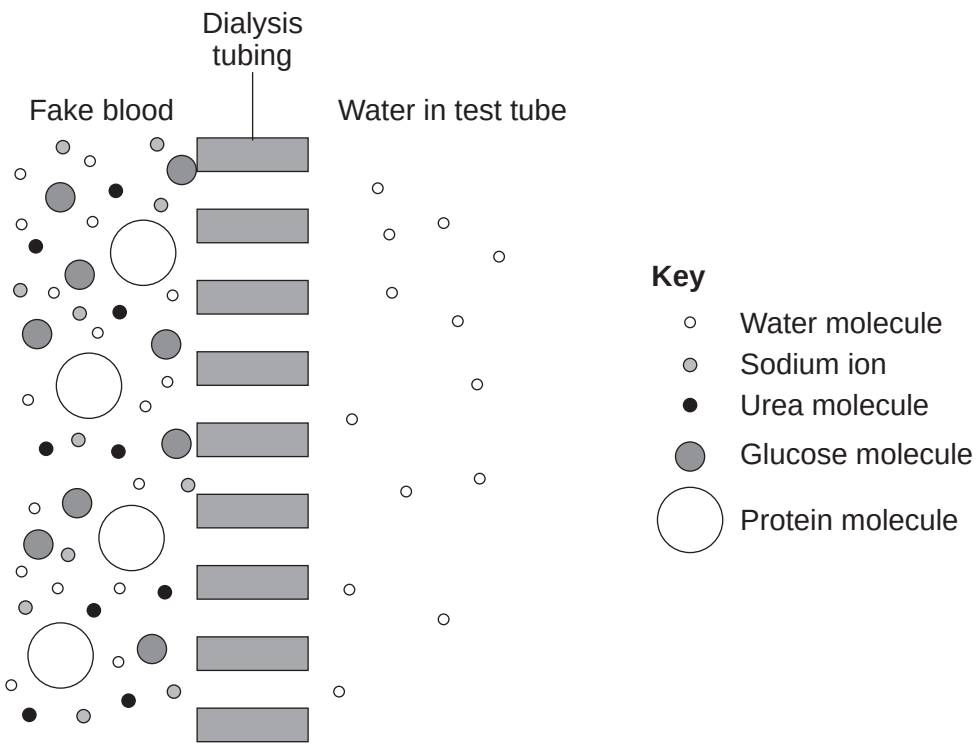
Question 38 · continued



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

**Figure 9** shows the fake blood, the dialysis tubing and the water in the test tube.

**Figure 9**




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

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

**[1 mark]**

.....

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

**[1 mark]**

.....

.....

.....

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 38 · continued**



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

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

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

Tick (✓) **one** box.

**[1 mark]**

Glucose ☐

Insulin ☐

Oxygen ☐

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

In CPD:

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

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

**[2 marks]**

1 .....

.....

2 .....

.....

6

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 39**

June 2015 | BL1FP | Original Q4 | Legacy

**4** Modern scientists use cloning techniques.

**4 (a)** Which **one** of the following is a method of producing cloned plants?

Tick (✓) **one** box.

**[1 mark]**

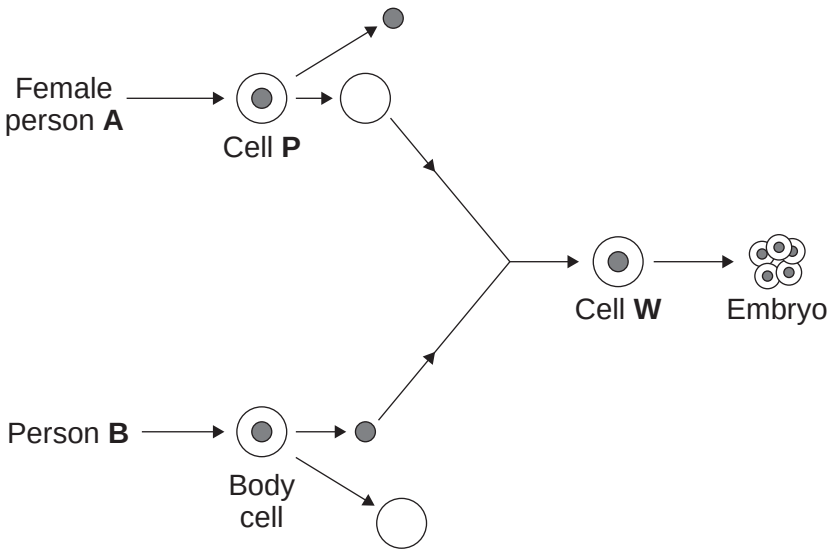
Joining male and female sex cells ☐

Taking cuttings from plants ☐

Transferring genes from one plant to another plant ☐

**4 (b)** **Figure 5** shows a method that could be used in the future to produce a human.

**Figure 5**




**4 (b) (i)** What is the name of the method shown in **Figure 5**?

Tick (✓) **one** box.

**[1 mark]**

Adult cell cloning ☐

Embryo transplant ☐

Tissue culture ☐

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 39 · continued



**4 (b) (ii)** What type of cell is cell **P**?

Draw a ring around the correct answer.

**[1 mark]**

**an egg cell** **a skin cell** **a sperm cell**

**4 (b) (iii)** Use the correct answer from the box to complete the sentence.

**[1 mark]**

| | | |
|---|---|---|
| **cell membrane** | **cytoplasm** | **nucleus** |

The ..... of cell **P** is removed and is discarded.

**4 (b) (iv)** Use the correct answer from the box to complete the sentence.

**[1 mark]**

| | | |
|---|---|---|
| **an electric shock** | **enzymes** | **hormones** |

To make cell **W** divide to form an embryo, the cell must be treated with

..... .

**4 (b) (v)** The embryo must be placed in an adult female to develop into a child.

Where, in the adult female, should the embryo be placed?

**[1 mark]**

.....

**4 (c)** Some children have kidney disease. Kidney disease cannot be cured.
In the future, scientists could make a healthy clone of a child with kidney disease.
One kidney could then be transplanted from the cloned child into the child with kidney disease. The cloned child would still live with only one remaining kidney.

Suggest **two** reasons why people might disagree with cloning a child to get a kidney for transplanting.

**[2 marks]**

1 .....

.....

2 .....

.....

8

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 40**

June 2015 | BL3FP | Original Q3 | Legacy

**3 (a)** Humans need to remove waste products from their bodies.

Which organ removes waste carbon dioxide from the body?

**[1 mark]**

Tick (✓) **one** box.

Liver ☐

Lung ☐

Skin ☐

**3 (b)** Kidneys make urine. Urine is stored in the bladder.

Which **one** of the following stages is involved in making urine in a healthy kidney?

**[1 mark]**

Tick (✓) **one** box.

Filtering the blood ☐

Reabsorbing **all** of the ions ☐

Reabsorbing **all** of the water ☐

**3 (c)** A healthy kidney keeps the correct amount of water in the blood.

If there is too much water in the blood, what might happen to the blood cells?

**[1 mark]**

Tick (✓) **one** box.

They will take in water and burst. ☐

There will be no change. ☐

They will lose water and shrink. ☐

**Question 3 continues on the next page**

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 40 · continued



**3 (d)** A child has kidney failure.

A doctor recommends dialysis to treat the kidney failure.

Before dialysis starts, the doctor measures the concentration of glucose and of urea in the child's blood.

The concentration of glucose in the dialysis fluid is 6 mmol per $dm^3$.

The results are shown in **Table 1**.

**Table 1**

| | **Concentration in the blood before dialysis starts in mmol per $dm^3$** |
|---|---|
| **Glucose** | 6 |
| **Urea** | 28 |

**3 (d) (i)** Suggest what the concentration of glucose in the blood will be **after** the dialysis treatment.

Draw a ring around the correct answer.

**[1 mark]**

**less than 6** **6** **more than 6**

**3 (d) (ii)** Suggest what the concentration of urea in the blood will be **after** the dialysis treatment.

Draw a ring around the correct answer.

**[1 mark]**

**less than 28** **28** **more than 28**

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

**[1 mark]**

.....

.....

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 40 · continued** June 2015 | BL3FP | Original Q3 | Legacy

**3 (e) (i)** Some patients have kidney transplants. Transplanted kidneys may be rejected by the body.

Use the correct answer from the box to complete the sentence.

**[1 mark]**

| | | |
|---|---|---|
| **antibodies** | **hormones** | **tissues** |

Transplanted kidneys have proteins on the surface of the cells. These proteins may be attacked by the patient's ..... .

**3 (e) (ii)** It is important to prevent rejection of a new kidney.

Which **one** of the following helps to prevent the kidney from being rejected?

**[1 mark]**

Tick (✓) **one** box.

Giving the patient antibodies ☐

Giving the patient painkillers ☐

Tissue typing the donor kidney ☐

8

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

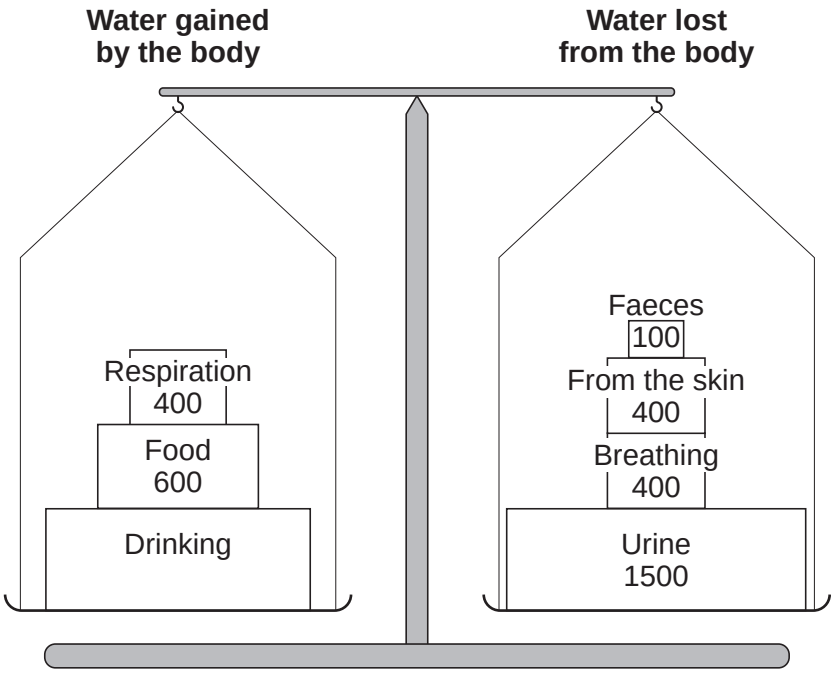
**Question 41**

June 2016 | BL1FP | Original Q1 | Legacy

**1** **Figure 1** shows the water balance for a person on a cold day.

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

**Figure 1**




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

**[1 mark]**

Draw a ring around the correct answer.

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

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

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

**[2 marks]**

_____

_____

Volume of water = _____ $cm^3$

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 41 · continued**



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

**[1 mark]**

_____

**1 (b) (ii)** Why does the body need to lose water from the skin?

**[1 mark]**

_____

_____

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

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

**[1 mark]**

Tick (✓) **one** box.

Less water was lost through the skin. ☐

More water was lost through the skin. ☐

More water was lost in faeces. ☐

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

**[1 mark]**

Draw a ring around the correct answer.

**decrease** **increase** **no change**

7

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

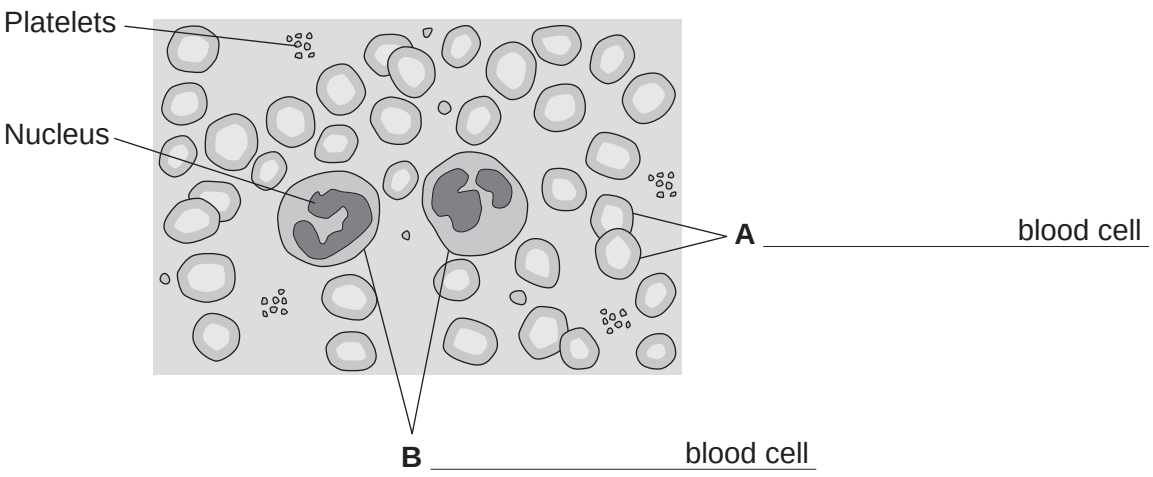
**Question 42**

June 2017 | BL3FP | Original Q3 | Legacy

**3** Blood is a tissue.

**Figure 4** is a diagram of the parts of the blood.

**Figure 4**




**3 (a)** **A** and **B** are different types of blood cell.

Label cells **A** and **B** in **Figure 4**.

**[2 marks]**

**3 (b)** A man has a bad cut on his arm that continues to bleed.

The man goes to hospital and has a blood test.

**Table 1** shows the results of the man's blood test.

**Table 1**

**Blood test results**

| Test | Normal range | Result | Healthy | Abnormal |
|---|---|---|---|---|
| Platelets | 140 – 400 | 98 | | ✓ |
| Cholesterol | 112 – 328 | 297 | ✓ | |
| Iron | 12 – 300 | 120 | ✓ | |

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 42 · continued**



**3 (b) (i)** Use information from **Table 1** and your own knowledge to explain why the man's cut does not stop bleeding.

**[2 marks]**

_____

_____

_____

_____

_____

**3 (b) (ii)** The doctor gives the man a blood transfusion.

Suggest why the blood needs to be the same blood group as the man.

**[1 mark]**

Tick (✓) **one** box.

So the donor is not harmed ☐

To prevent rejection of the new blood cells ☐

To reduce the number of blood cells ☐

To suppress the immune system ☐

**3 (c)** Blood plasma carries substances around the body.

Use the correct answers from the box to complete the sentences.

**[3 marks]**

| | | | |
|---|---|---|---|
| **bladder** | **carbon dioxide** | **kidneys** | **lungs** |
| **oxygen** | **small intestine** | **starch** | |

Blood plasma carries _____ from the organs to the lungs.

Blood plasma carries the soluble products of digestion from the _____ to other organs.

Blood plasma carries urea from the liver to the _____ to be removed.

8

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 43**

June 2018 | 8461/1F | Original Q4

**0 4** This question is about the circulatory system.

**0 4 . 1** Draw **one** line from each blood component to its function.

**[3 marks]**

| Blood component | Function |
|---|---|
| Platelet | Destroys microorganisms |
| Red blood cell | Helps the blood to clot |
| White blood cell | Transports glucose around the body |
| | Transports oxygen around the body |
| | Transports urea |

**Question 4 continues on the next page**

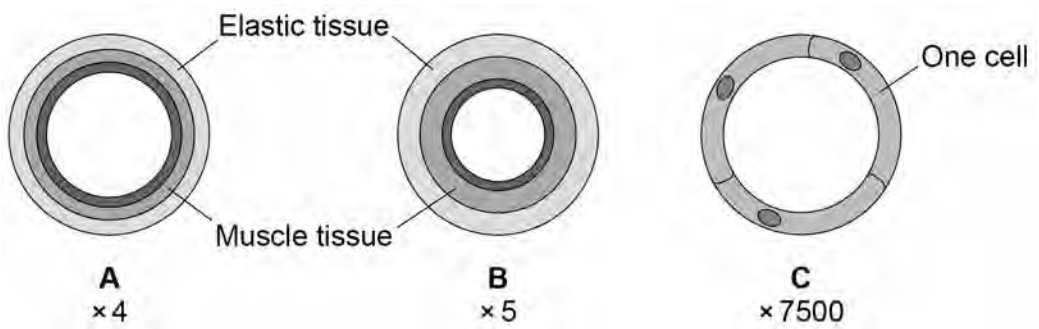
4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 43 · continued



**0 4 . 2** **Figure 6** shows cross sections of the three main types of blood vessel found in the human body. Each blood vessel is drawn to the scale shown.

**Figure 6**




Which blood vessel has the smallest diameter?

**[1 mark]**

Tick **one** box.

| A | | B | | C | |
|---|---|---|---|---|---|

**0 4 . 3** Which blood vessel in **Figure 6** is an artery?

Give **one** reason for your answer.

**[2 marks]**

Blood vessel: _____

Reason: _____

_____

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 43 · continued



**Table 1** gives information about the blood flow in two people.

**Table 1**

| Person | Blood flow through the coronary arteries in $cm^3$/minute |
|---|---|
| **A** - does **not** have coronary heart disease | 250 |
| **B** - has coronary heart disease | 155 |

**0 4 . 4** Calculate the difference in blood flow between person **A** and person **B**.

**[1 mark]**

Difference = _____ $cm^3$/minute

**0 4 . 5** Suggest why blood flow through the coronary arteries is lower in people with coronary heart disease.

**[1 mark]**

**0 4 . 6** Calculate the volume of blood flowing through the coronary arteries of person **A** in 1 hour.

Give your answer in $dm^3$.

**[2 marks]**

Volume of blood in 1 hour = _____ $dm^3$

Question 43 · continued



Coronary heart disease can be treated by:

- inserting a stent
- using a Coronary Artery Bypass Graft (CABG).

**Table 2** gives information about each method.

**Table 2**

| | Stent | CABG |
|---|---|---|
| **Procedure** | The patient is awake during the procedure.<br><br>A small cut is made in the skin.<br><br>A wire mesh is inserted into the coronary artery via a blood vessel in the arm or leg. | The patient is not awake during the procedure.<br><br>The chest is cut open.<br><br>A section of blood vessel from the arm or leg is removed. It is used to create a new channel for blood to bypass the blockage in the coronary artery. |
| **When procedure is recommended** | When only one blockage is present | When multiple blockages are present |
| **Time spent in hospital after procedure** | 2-3 hours | at least 7 days |
| **Recovery time after procedure** | 7 days | 12 weeks |
| **Risk of heart attack during procedure** | 1% | 2% |
| **Chance of failure within one year** | 40% | 5% |

**0 4 . 7** Give **two** advantages of using a stent instead of CABG.

**[2 marks]**

1 _____

_____

2 _____

_____

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 43 · continued



**0 4 . 8** Give **two** advantages of using CABG instead of a stent.

**[2 marks]**

1 _____

_____

2 _____

_____

14

**Turn over for the next question**

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 44**

June 2018 | 8461/2F | Original Q5

**0 5** A person with Type 1 diabetes cannot make enough insulin.

**0 5 . 1** Which organ makes insulin?

**[1 mark]**

Tick **one** box.

- Adrenal gland ☐
- Pancreas ☐
- Pituitary gland ☐
- Thyroid ☐

**0 5 . 2** A person with Type 1 diabetes can control the concentration of glucose in the blood by injecting insulin.

Complete the sentences.

**[2 marks]**

Choose answers from the box.

| | | |
|---|---|---|
| **DNA** | **glycogen** | **kidney** |
| **liver** | **protein** | **skin** |

Insulin acts on an organ called the _____.

This organ then takes in excess glucose from the blood and changes the glucose into _____.

**0 5 . 3** Insulin cannot be taken as a tablet. This is because insulin is a type of protein.

What would happen to the insulin in the tablet if it reached the stomach?

**[1 mark]**

_____

_____

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 44 · continued



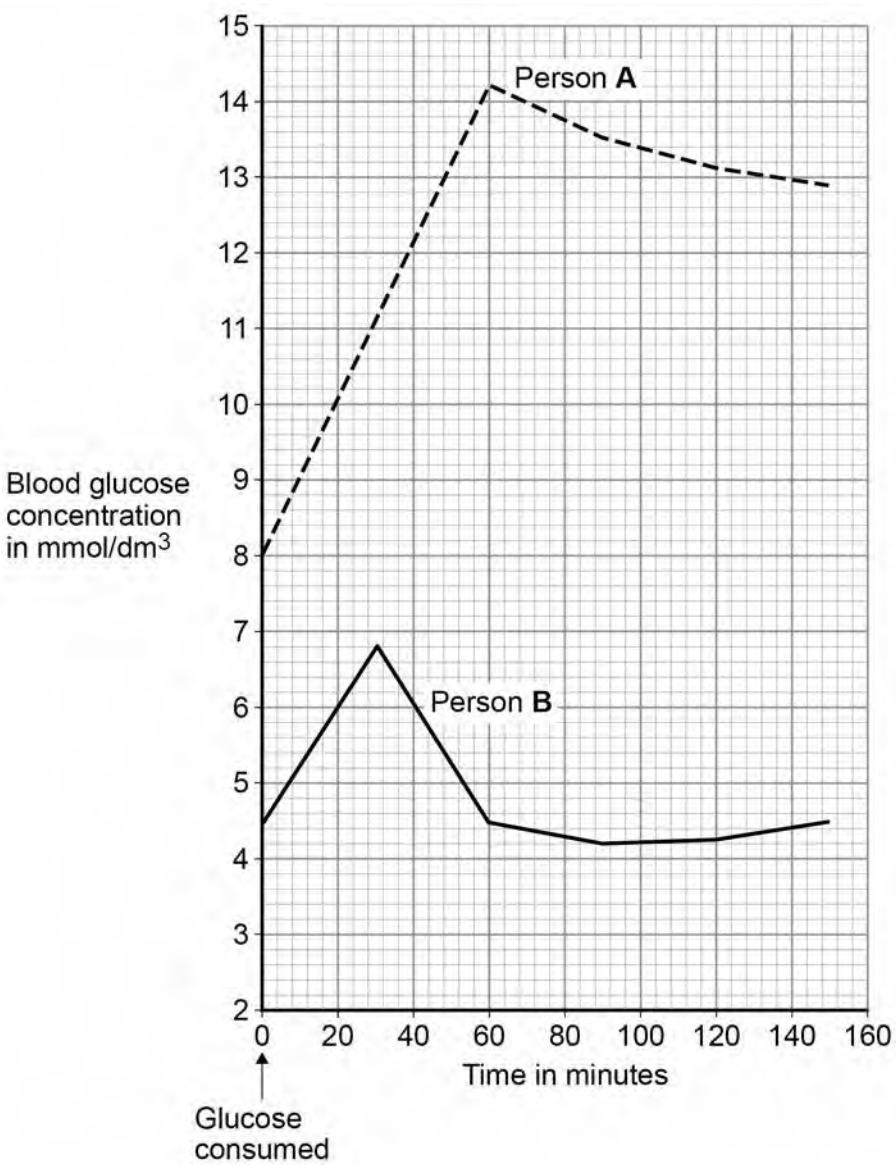
Two people each drank the same volume of a glucose drink.

Person **A** has Type 1 diabetes.

Person **B** does **not** have diabetes.

**Figure 6** shows how the concentration of glucose in their blood changed.

**Figure 6**



4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 44 · continued



**0 5 . 4** How much higher was the **highest** concentration of glucose in the blood of person **A** than the **highest** concentration in person **B**?

Use information from **Figure 6**.

**[2 marks]**

Answer = _____ mmol/dm$^3$

**0 5 . 5** Describe **one** other way that the results for person **A** were different from the results for person **B**.

Use information from **Figure 6**.

**[1 mark]**

**Question 5 continues on the next page**

Question 44 · continued

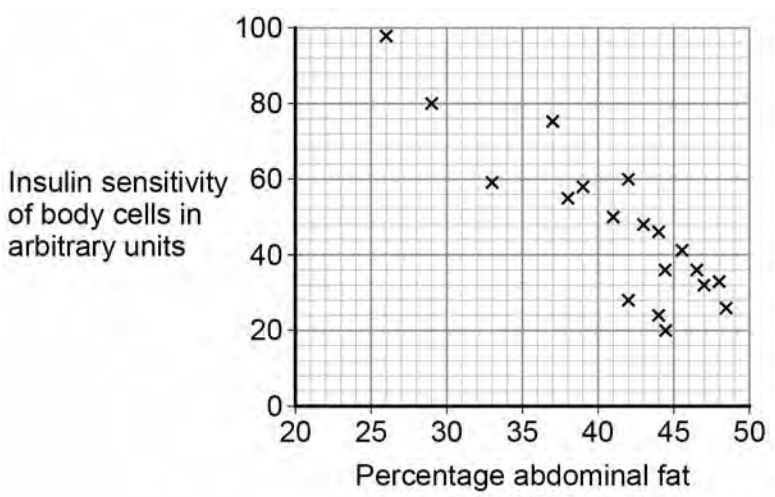


Type 2 diabetes is another form of diabetes. Type 2 diabetes is common in obese people.

People with Type 2 diabetes make enough insulin, but still cannot control their blood glucose concentration. This is because the body cells are not sensitive to the insulin.

**Figure 7** shows information about abdominal fat and insulin sensitivity in body cells.

**Figure 7**




**0 5 . 6** What type of relationship is shown in **Figure 7**?

**[1 mark]**

Tick **one** box.

A negative correlation ☐

No correlation ☐

A positive correlation ☐

**0 5 . 7** A person is at risk of developing Type 2 diabetes.

Suggest **two** ways the person could lower the chance of developing Type 2 diabetes.

**[2 marks]**

1 _____

_____

2 _____

_____

**10**

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 45**

June 2019 | 8461/2F | Original Q6

**0 6** Two of the substances the body excretes are urea and carbon dioxide.

**0 6 . 1** Complete the sentence.

**[1 mark]**

Choose the answer from the box.

| | | | |
|---|---|---|---|
| **carbohydrate** | **lipid** | **protein** | **salt** |

A person makes a lot of urea if the person's diet contains

a lot of _____.

**0 6 . 2** Why must urea be excreted from the body?

**[1 mark]**

_____

_____

**0 6 . 3** A person produces more carbon dioxide during exercise than when resting.

Complete the sentences.

**[2 marks]**

Choose answers from the box.

| | | |
|---|---|---|
| **breathing** | **digestion** | **egestion** |
| **osmosis** | **respiration** | |

The process that makes carbon dioxide is _____.

During exercise, extra carbon dioxide can be removed from the body by increasing the rate of _____.

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 45 · continued



**0 6 . 4** Excess water must also be removed from the body.

If a person sweats a lot, less water will be excreted in the urine.

A healthy person did the same amount of exercise on each of 3 days.

**Table 2** shows information for the 3 days.

**Table 2**

| Day | Air temperature in °C | Volume of water consumed in $cm^3$ | Relative amount of urine produced by the kidneys |
|---|---|---|---|
| 1 | 30 | 1500 | |
| 2 | 20 | 1500 | |
| 3 | 15 | 2000 | |

Complete **Table 2**.

**[2 marks]**

Choose answers from the box.

| least | medium | most |
|---|---|---|

**Question 6 continues on the next page**

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 45 · continued



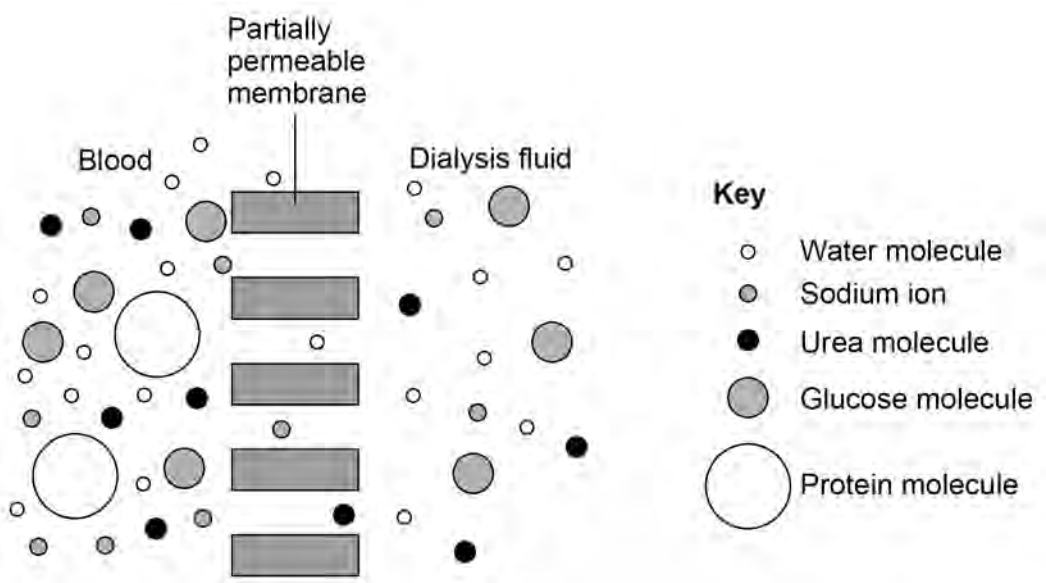
Some people have kidney disease.

Kidney disease may be treated by dialysis or by having a kidney transplant operation.

- During dialysis, a person is connected to a machine that filters the blood.
- Each dialysis session lasts about 6 hours.
- The person has several dialysis sessions each week.

**Figure 12** shows how dialysis works.

**Figure 12**




**0 6 . 5** How does urea move out of the blood during dialysis?

**[1 mark]**

Tick (✓) **one** box.

Diffusion ☐

Digestion ☐

Osmosis ☐

Respiration ☐

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 45 · continued

June 2019 | 8461/2F | Original Q6

**0 6 . 6** Which substance in **Figure 12** does **not** pass from the blood into the dialysis fluid?

Give the reason for your answer.

**[2 marks]**

Substance _____

Reason _____

_____

**Question 6 continues on the next page**

Question 45 · continued



Two people have kidney disease.

- Person **A** is treated by dialysis.
- Person **B** has had a kidney transplant.

**Figure 13** shows changes in the urea concentration in the blood of each person over 2 weeks.

**Figure 13**




**0 6 . 7** How many dialysis sessions did person **A** have **each week**?

**[1 mark]**

_____

**0 6 . 8** What happens to the concentration of urea in the blood between dialysis sessions?

**[1 mark]**

_____

**0 6 . 9** Give **two** reasons why a kidney transplant is a better method for treating kidney disease than dialysis.

**[2 marks]**

1 _____

_____

2 _____

_____

13

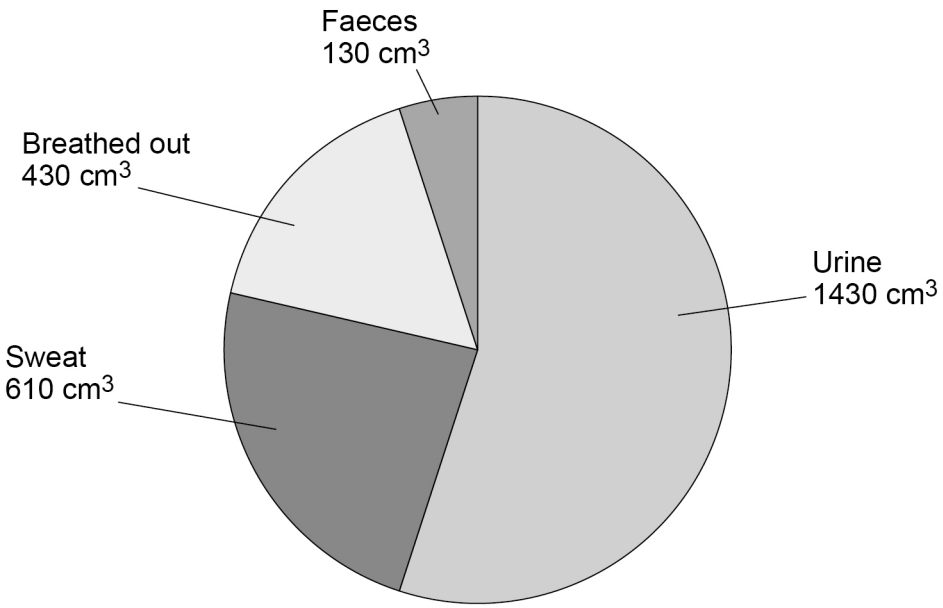
### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 46**

November 2020 | 8461/2F | Original Q4

**0 4** **Figure 5** shows the water loss from a person on one day.

**Figure 5**




**0 4 . 1** The total water loss was 2600 $cm^3$.

Calculate the percentage of the total water loss that was lost as urine.

**[2 marks]**

Percentage lost as urine = _____ %

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 46 · continued



A marathon race is 42 km long.

**0 4 . 2** What happens to the volume of water lost as sweat when a person runs a marathon?

**[1 mark]**

**0 4 . 3** What must marathon runners do to prevent themselves becoming dehydrated?

**[1 mark]**

**0 4 . 4** Complete the sentences.

**[3 marks]**

Choose answers from the box.

| | | | | |
|---|---|---|---|---|
| **digestion** | **excretion** | **fertilisation** | **filtration** | **reabsorption** |

Blood entering the kidneys goes through the process of

_____ .

Glucose is **not** found in urine because of _____.

Urine is removed from the body in the process of _____.

**Question 4 continues on the next page**

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 46 · continued**



**0 4 . 5** People with kidney failure can have dialysis or a kidney transplant.

Dialysis is often needed 3 times each week and can take over 4 hours each time.

Dialysis usually happens in a hospital.

Kidney transplants require a donor and major surgery.

Describe the advantages **and** disadvantages of having a kidney transplant instead of having dialysis.

**[4 marks]**

11

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 47**

June 2022 | 8461/2F | Original Q1

**0 1** Maple syrup urine disease (MSUD) is a rare inherited human condition.

The allele for MSUD is recessive.

**0 1 . 1** What is a recessive allele?

**[1 mark]**

Tick (✓) **one** box.

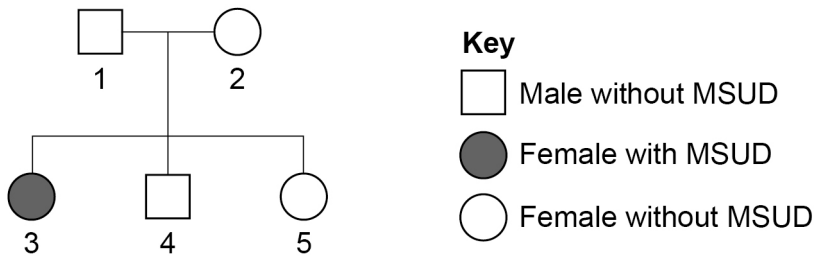
An allele expressed only if a person has two copies of the allele ☐

An allele expressed only if it is inherited from the male parent ☐

An allele expressed when it is found on only one of the chromosomes ☐

**Figure 1** shows the inheritance of MSUD in one family.

**Figure 1**




**0 1 . 2** The symbol ■ is **not** in the key for **Figure 1**.

What would this symbol represent?

**[1 mark]**

_____

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 47 · continued



Persons **1** and **2** in **Figure 1** have a child with MSUD and some children without MSUD.

**0 1 . 3** Complete **Figure 2** to show the possible genotypes of the children.

Use the following symbols:

**N** = allele for **not** having MSUD
**n** = allele for MSUD

**[2 marks]**

**Figure 2**

| | | **Person 2** | |
|---|---|---|---|
| | | **N** | **n** |
| **Person 1** | **N** | | **Nn** |
| | **n** | | |

**0 1 . 4** What is the phenotype of a person with the genotype **Nn**?

**[1 mark]**

**0 1 . 5** What percentage of the offspring in **Figure 2** will have MSUD?

**[1 mark]**

Tick (✓) **one** box.

25% ☐ 50% ☐ 75% ☐ 100% ☐

**Question 1 continues on the next page**

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 47 · continued



**0 1 . 6** Which scientific term describes the allele **N**?

**[1 mark]**

Tick (✓) **one** box.

- Dominant ☐
- Genetic ☐
- Heterozygous ☐

**0 1 . 7** Alleles are found in the nucleus of a cell.

What chemical substance are alleles made from?

**[1 mark]**

_____

**0 1 . 8** People with MSUD must eat a special diet to reduce their intake of some types of amino acid.

Which component of the diet is made of amino acids?

**[1 mark]**

Tick (✓) **one** box.

- Carbohydrates ☐
- Minerals ☐
- Proteins ☐

9

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

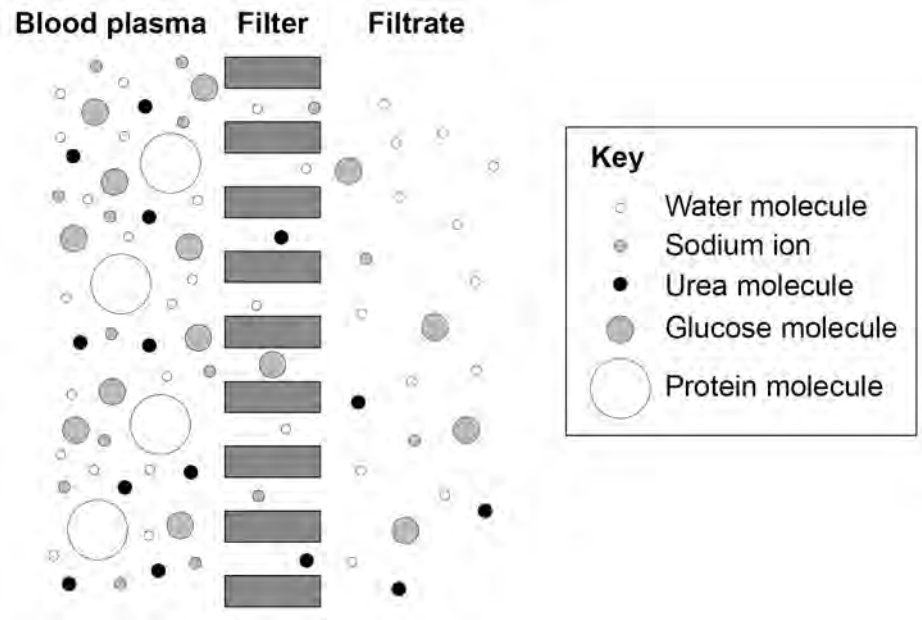
Question 48

June 2023 | 8461/2F | Original Q6

**0 6** The kidneys filter the blood.

**Figure 10** shows filtration in the kidney.

**Figure 10**




**0 6 . 1** Glucose molecules are found in the blood plasma **and** in the filtrate.

Protein molecules are **only** found in the blood plasma.

Draw **one** line from each substance to the reason for where the substance is found.

**[2 marks]**

| Substance | Reason |
|---|---|
| Glucose | The molecules are too large to pass through the filter |
| | The molecules are small enough to pass through the filter |
| Protein | |
| | The molecules are too small to pass through the filter |

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 48 · continued



**0 6 . 2** The kidneys control the volume of water in the body.

**Table 4** shows information about a person on one day.

**Table 4**

| | Volume in $dm^3$ |
|---|---|
| Water filtered from blood | 160.0 |
| Water lost in urine | 1.9 |

Calculate the volume of water reabsorbed into the blood.

**[1 mark]**

Volume = _____ $dm^3$

**Question 6 continues on the next page**

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 48 · continued



**0 6 . 3** A person with kidney disease may be treated by dialysis or by having a kidney transplant.

**Figure 11** gives information about dialysis and kidney transplants.

**Figure 11**

**Dialysis**

- A person needs 3 dialysis sessions a week, with each session lasting about 8 hours.
- Most patients have dialysis in hospital.
- Protein and salt levels in food must be kept low.
- Dialysis costs £35 000 per year for each patient.

**Kidney transplant**

- In a surgical operation the use of a general anaesthetic can occasionally cause damage to other organs.
- After a transplant the patient must take drugs for the rest of their life to suppress the immune system.
- A transplant costs £17 000 in the first year and then £5 000 in each of the following years for drugs.
- The transplanted kidney will work well for about 10 years.

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 48 · continued** June 2023 | 8461/2F | Original Q6

A doctor states:

‘It is better to treat a person with kidney disease by using a kidney transplant rather than by dialysis.’

Evaluate the doctor’s statement.

Use information from **Figure 11**.

**[6 marks]**

**Question 6 continues on the next page**

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 48 · continued**



**0 6 . 4** A kidney transplant costs £17 000 in the first year and then £5 000 in each of the following years for drugs.

Calculate the total cost of treatment by kidney transplant over the first 5 years.

**[3 marks]**

Total cost = £ _____

**12**

### 4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

**Question 49**

June 2025 | 8461/2F | Original Q4

**0 4** It is important to maintain the water balance of the body.

The volume of water a person gained and lost was measured on a day the person did no exercise.

**Table 2** shows how much water the person gained and lost by different methods on the day.

**Table 2**

| Water gained | |
|---|---|
| **Method** | **Volume in $cm^3$** |
| Food | 550 |
| Drink | 1540 |
| Metabolism | 410 |
| **Total** | 2500 |

| Water lost | |
|---|---|
| **Method** | **Volume in $cm^3$** |
| Urine | 1600 |
| Faeces | 140 |
| Sweat | 420 |
| Breathing | 340 |
| **Total** | 2500 |

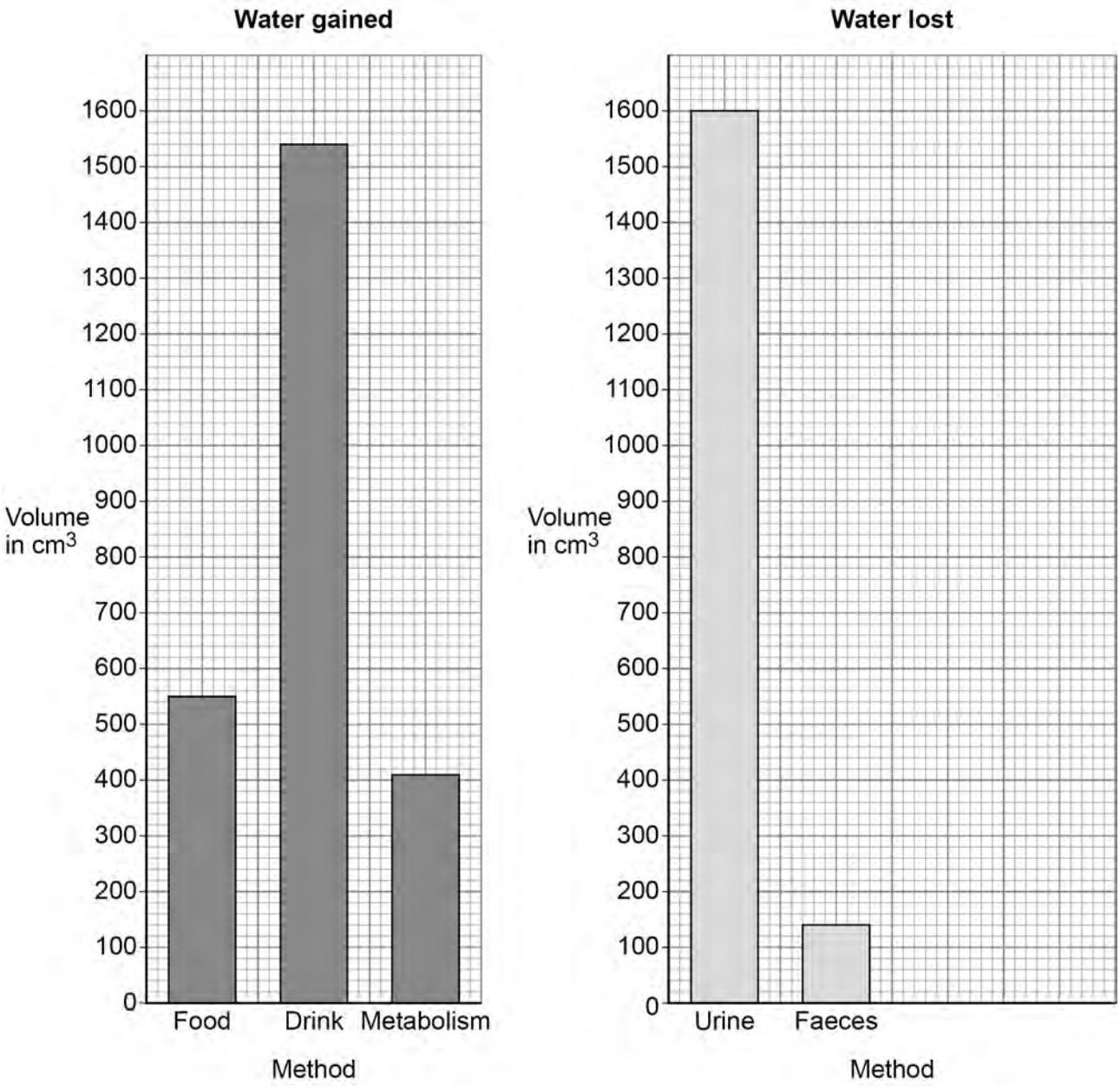
4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 49 · continued



**Figure 7** shows some of the data from **Table 2**.

**Figure 7**




**0 4 . 1** Complete **Figure 7**.

**[2 marks]**

You should:

- plot the data for sweat and for breathing from **Table 2**
- label each bar.

**Question 4 continues on the next page**

**4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)**

**Question 49 · continued**



**0 4 . 2** On another day, the person ran in a long-distance race.

What would happen to the volume of water lost by sweating on the day of the race?

**[1 mark]**

Tick (✓) **one** box.

Decrease ☐

No change ☐

Increase ☐

**0 4 . 3** The kidneys control the amount of water in the body.

Draw **one** line from each process in the kidneys to the name of that process.

**[3 marks]**

| Process in the kidneys | Name of process |
|---|---|
| Removes water from the blood | Coordination |
| Takes excess water out of the body | Excretion |
| Takes water back into the blood | Filtration |
| | Reabsorption |

4.5.3.3 Maintaining water and nitrogen balance in the body (biology only)

Question 49 · continued



**0 4 . 4** A person with kidney failure can be treated by dialysis or by a kidney transplant.

**For dialysis:**

- a person needs 3 dialysis sessions each week
- each session can last 6 to 8 hours
- each session has to happen in a hospital.

**For a kidney transplant:**

- a suitable donor is needed
- a surgical operation is needed.

Evaluate the use of a kidney transplant instead of dialysis for treating kidney failure.

Include your own knowledge in your answer.

**[4 marks]**

Extra space

10