

1 Conditions inside the body must be kept constant.

(a) Urea must be removed from the body.

(i) Name the organ which makes urea.

\_\_\_\_\_

(1)

(ii) Which organ removes urea from the body?

\_\_\_\_\_

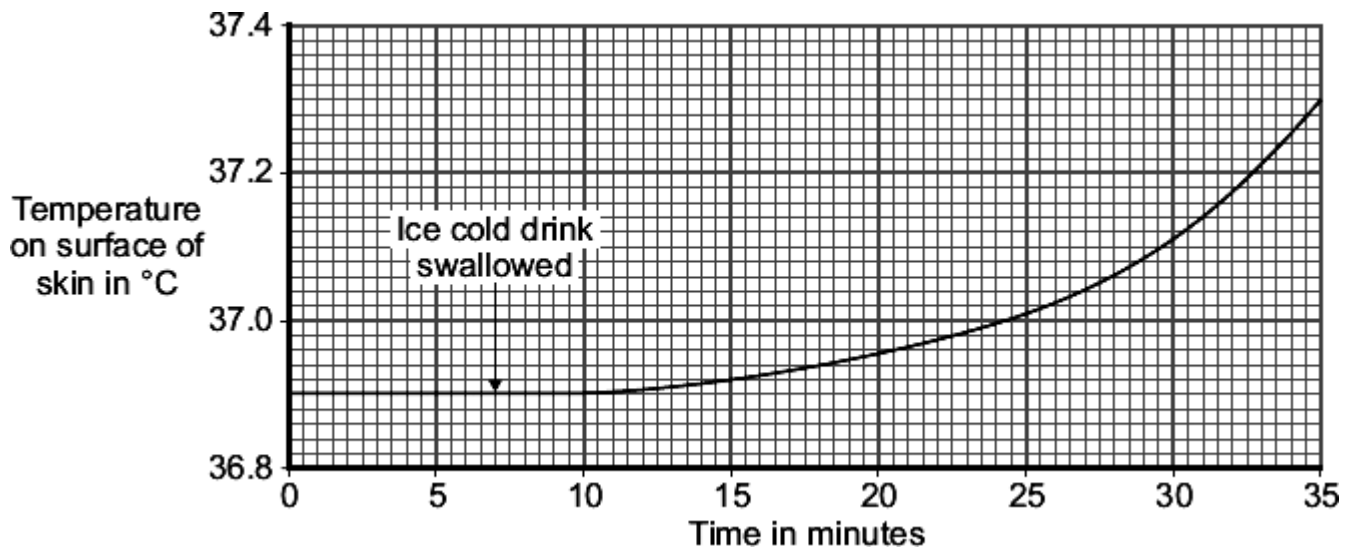
(1)

(iii) What is urea made from?

\_\_\_\_\_

(1)

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



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

Explain how.

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(2)

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

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

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(1)

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

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(1)

(Total 7 marks)

**2**

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

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

- (i) The brain

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(2)

(ii) The skin

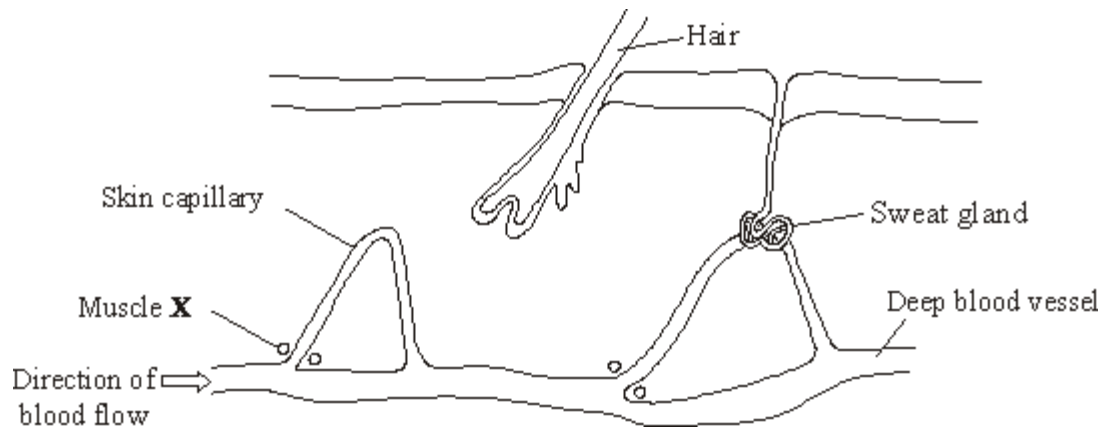
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(1)

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

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



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

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(3)

(Total 6 marks)

3

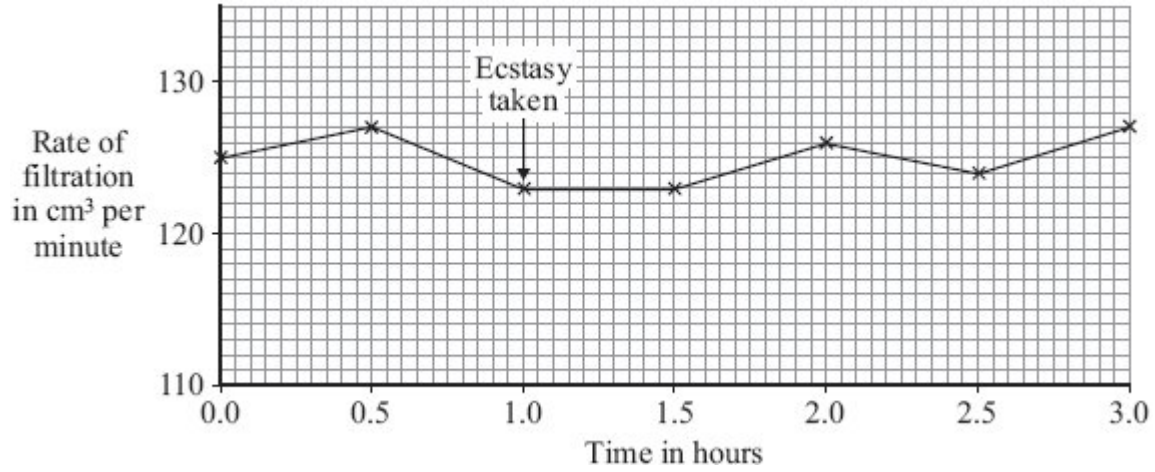
Taking the drug ecstasy affects the rate of urine flow from the kidneys.

**Graph 1** shows the rate of filtration by the kidneys of a healthy person.

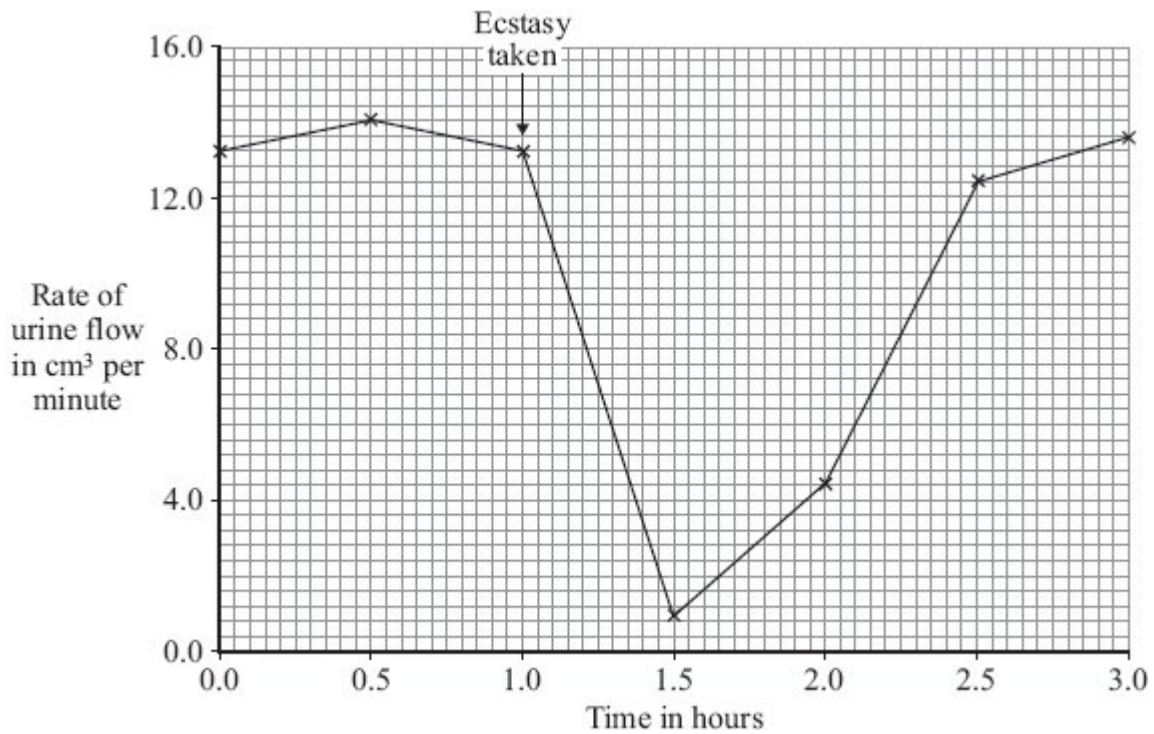
**Graph 2** shows the rate of urine flow from the kidneys of the same person.

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

**Graph 1**



**Graph 2**



(a) Describe the effect of taking ecstasy on

(i) the rate of filtration

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(1)

(ii) the rate of urine flow.

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(1)

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

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

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(2)

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

Suggest an explanation for this.

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(2)

**(Total 6 marks)**

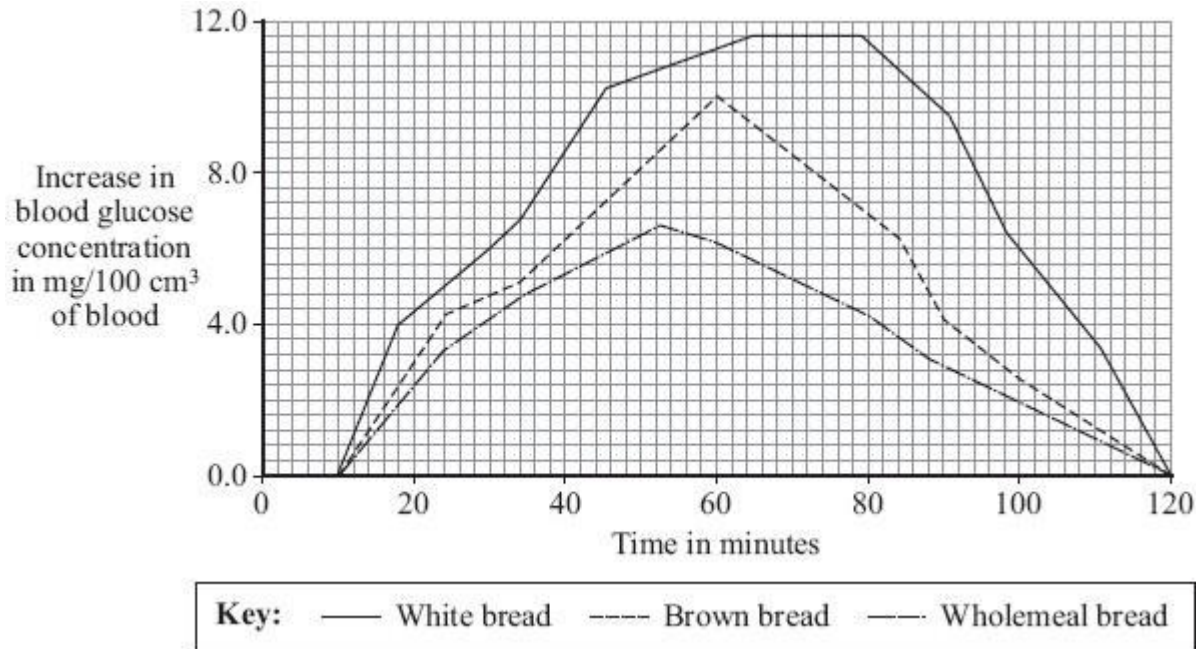
4

Insulin controls blood glucose concentration.

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

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

The graph shows the results of the three experiments.



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

Type of bread \_\_\_\_\_

Give **two** reasons for your answer.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

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(2)

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

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**(4)**

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

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

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

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**(3)**

**(Total 9 marks)**

5

Urine consists of water, ions and other substances such as urea.

Urine is formed in the kidney by filtering the blood.

The diameter of the pores in the filter is about 6 nanometres.

The table shows the diameters of the molecules of some of the substances in the blood.

Substance	Diameter of molecule in nanometres
A	10 to 20
B	1.0
C	0.6
D	0.5
E	0.2

Use information from the table and your own knowledge to answer the questions.

(a) (i) Which substance, **A**, **B**, **C**, **D** or **E**, is protein?

(1)

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

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(2)

(b) Substance **B** is **not** found in the urine of a healthy person.

Suggest an explanation for this.

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(2)



(c) Haemolytic anaemia is a disease in which some of the red blood cells burst open.

Small amounts of haemoglobin may be found in the urine of a person suffering from haemolytic anaemia.

The diameter of a haemoglobin molecule is 5.5 nanometres.

Haemoglobin is **not** found in the urine of a healthy person, but can be found in the urine of a person with haemolytic anaemia.

Explain why.

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(3)

(Total 8 marks)

**6**

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

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

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(1)

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

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

Explain why.

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(2)

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

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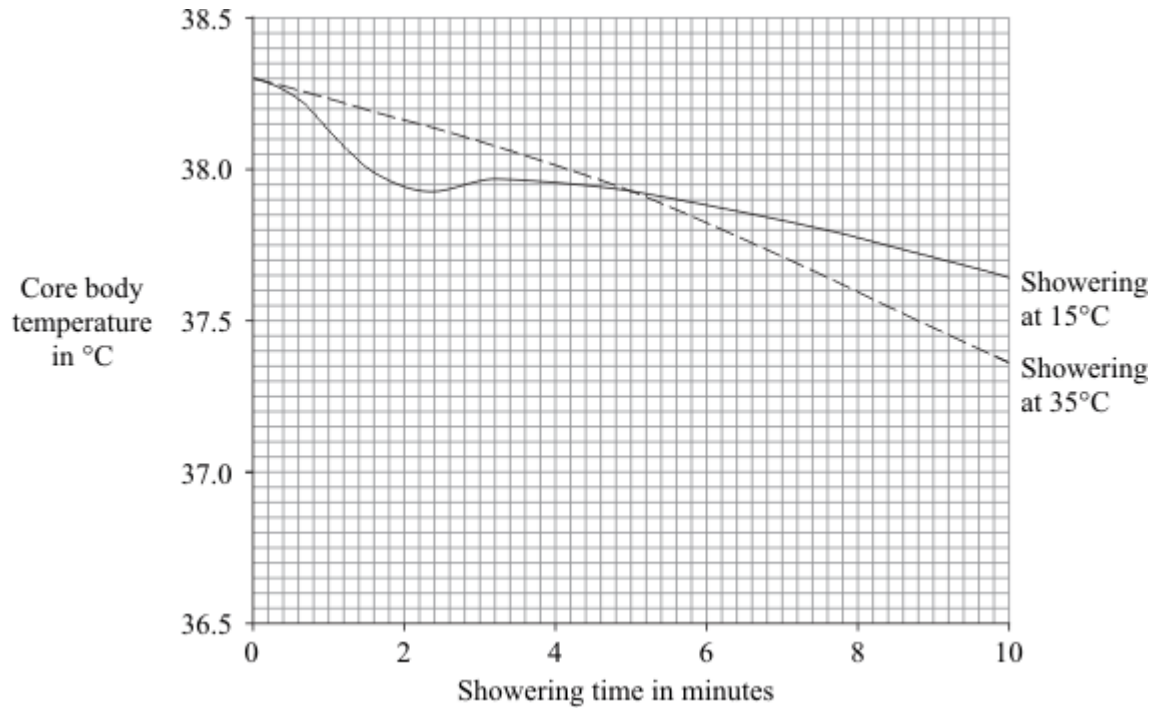
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(2)

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



Suggest an explanation for the differences in core body temperature:

- (i) between 0 and 2 minutes

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(1)

- (ii) between 4 and 10 minutes.

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(2)

(Total 8 marks)



8

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

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

A newspaper reported the investigation.

The headline was



The newspaper headline was **not** justified.

Explain why.

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(Total 3 marks)

## Mark schemes

- 1** (a) (i) liver 1
- (ii) kidney  
*allow urethra / bladder*  
*ignore ureter* 1
- (iii) (excess) protein / named / amino acids  
*accept amino / ammonia* 1
- (b) less / no sweating  
*allow ideas of how sweat glands change in order to reduce sweating* 1
- less heat lost / evaporation 1
- (c) (i) become narrower / constrict  
*allow contract / get smaller etc*  
*allow less blood flows through vessels*  
*do **not** allow capillaries become narrower **or** reference to movement of vessels* 1
- (ii) reduced / no heat loss  
*allow heat gained from room* 1
- 2** (a) (i) thermoregulatory centre (in brain)  
*accept hypothalamus* 1
- (receptors sensitive to/measures) temperature of blood 1
- (ii) any **one** from:
- receptors (in skin)
  - (skin) sends information / signals / impulses / messages to brain / thermoregulatory centre 1

[7]

(b) any **three** from:

(cold conditions)

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

conditions)

- muscle (X) relaxes/does not contract when hot  
*NB X contracts when cold and relaxes when hot = 2 marks*
- (more) blood through capillaries
- more heat lost / radiated
- more sweat produced  
*all other points must be clearly identified by correct conditions  
max 2 if idea of capillaries moving but ignore capillaries dilate*

3

[6]

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3

(a) (i) no effect / little effect

1

(ii) reduced

*ignore reference to later increase*

1

(b) (i) more (re)absorption

*do not allow if extra incorrect reference to filtration made*

1

**or** more (material) taken into blood

of water

*allow **only** if linked to reabsorption*

*do **not** accept water if in a list of substances*

1

(ii) ions in blood diluted 1

**or** concentration of ions decreases

increased water reabsorption

*do not allow if extra incorrect reference to filtration made*

**or** more water present in blood

*accept sensible alternative suggestion*

*eg reabsorption of ions disrupted*

1

[6]

4

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

lower maximum / peak / less change

1

slower rise / change

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

need to take less insulin / less likely to hyper

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

1

(ii) any **four** from:

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

4



(b) any **three** from:

advantages (compared to insulin injections):

- (may be) permanent / cure
- no / less need for self monitoring
- no / less need for insulin / injections  
*ignore reference to cost*
- no / less need for dietary control

disadvantages (compared to insulin injections):

- low success rate
- (may) still need insulin / dietary control
- operation hazards
- risk of infection from donor
- rejection / need for drugs to prevent rejection  
*max 2 if only advantages **or** only disadvantages discussed  
can give converse if clear that it relates to insulin injections*

3

[9]

5

(a) (i) **A**

1

(ii) (protein) molecule is large  
*ignore letters*

1

cannot pass through filter

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

1

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

1

reabsorbed completely  
**or** reabsorbed after filtration

1

- (c) RBC is too big to pass through filter 1
- Haemoglobin is inside red blood cells  
**or** haemoglobin released when red blood cell bursts 1
- Haemoglobin is small enough to pass through filter  
**or** haemoglobin diameter < pore diameter 1

[8]

- 6** (a) respiration 1
- allow muscle contraction **or** muscle movement **or** exercise of muscles*
- allow metabolism / chemical reactions*

- (b) (i) any **two** from: 1
- less / no water (available) for sweat  
*allow dehydrated so less sweat*  
*allow converse if evident that response refers to athletes who have drunk liquid*
  - less / no heat lost / less / no cooling  
*only need to refer to less / no once*
  - less / no evaporation (of sweat) 2

- (ii) **either** 1
- blood vessels supplying the skin **or**  
 blood vessels in skin  
*do **not** allow first mark if implied that skin capillaries dilate*
- dilate / widen / muscles relax  
*ignore enlarge / open*  
*vasodilation in skin = 2 marks*  
*allow hairs lie flat for 1 mark*  
*allow less insulation for 1 mark if linked to hairs*  
*allow more blood in skin for 1 mark if no other marks awarded* 1

(c) (i) cold / 15°C cools the body / blood (more)  
*or reverse argument*  
*ignore reference to values for body temperature derived from graph* 1

(ii) any **two** from:

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

2

[8]

7

(a) (i) movement of atoms / molecules / ions  
*accept particles*  
*allow dissolved substances*  
*ignore reference to membranes* 1

(substance) moves from high to low concentration  
*allow down the gradient ignore*  
*across / along / with a gradient*

1

(ii) any **two** from:

- movement of molecules / ions  
*accept particles*  
*allow dissolved substances this point once only in (a)(i) and (a)(ii)*
- from low to high concentration  
*allow up / against the gradient*  
*ignore across / along / with a gradient*
- requires energy / respiration  
*accept requires ATP*

2

(b) • **filtration** of blood **or**  
described re small (molecules) through / large not  
*ignore diffusion* 1

max **four** from:

- **reabsorption** / substances taken back into blood
- (reabsorption) of all of the sugar / glucose
- (reabsorption) of some of ions / of ions as needed by body
- (reabsorption) of some of water / of water as needed by the body
- urea present in urine  
*accept urea not reabsorbed*

•reabsorption of water by osmosis / diffusion **or** reabsorption of sugar / ions by active transport

4

[9]

**8**

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

1

students could drink as much water as they wanted

**or**

some students drank more water than others

**or**

some students drank water and beer

1

differences only slight

*ignore effects of beer or promotion of beer drinking*

1

[3]