

The Human Nervous System

These practice questions can be used by students and teachers and is suitable for GCSE AQA Biology topic Questions 8641

Level: GCSE AQA Biology 8641

Subject: Biology

Exam board: GCSE AQA

Topic: The Human Nervous System

Q1.

Many human actions are reflexes.

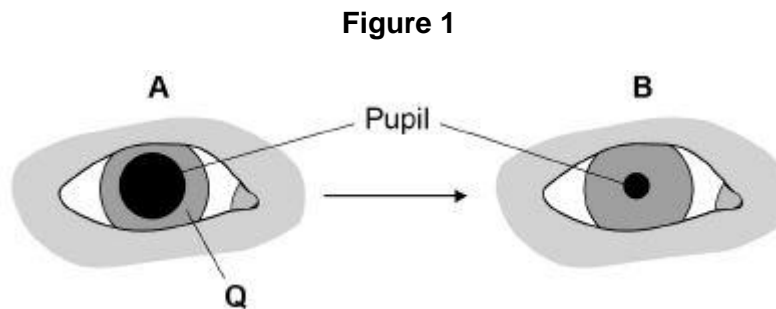
(a) Which **two** of the following are examples of reflex actions?

Tick **two** boxes.

- | | |
|--|--------------------------|
| Jumping in the air to catch a ball | <input type="checkbox"/> |
| Raising a hand to protect the eyes in bright light | <input type="checkbox"/> |
| Releasing saliva when food enters the mouth | <input type="checkbox"/> |
| Running away from danger | <input type="checkbox"/> |
| Withdrawing the hand from a sharp object | <input type="checkbox"/> |

(2)

Figure 1 shows how the size of the pupil of the human eye can change by reflex action.



(b) Name **one** stimulus that would cause the pupil to change in size from **A** to **B**, as shown in **Figure 1**.

(1)

(c) Structure **Q** causes the change in size of the pupil.

Name structure **Q**.

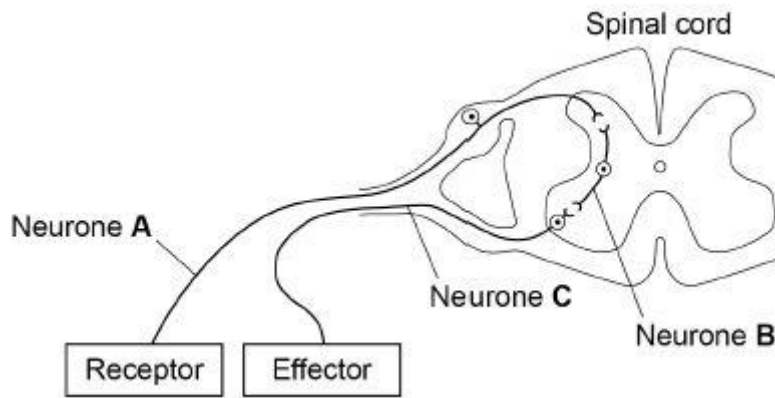
(1)

- (d) Describe how structure **Q** causes the change in the size of the pupil from **A** to **B**.

(1)

- (e) **Figure 2** shows some structures involved in the coordination of a reflex action.

Figure 2



Describe how the structures shown in **Figure 2** help to coordinate a reflex action.

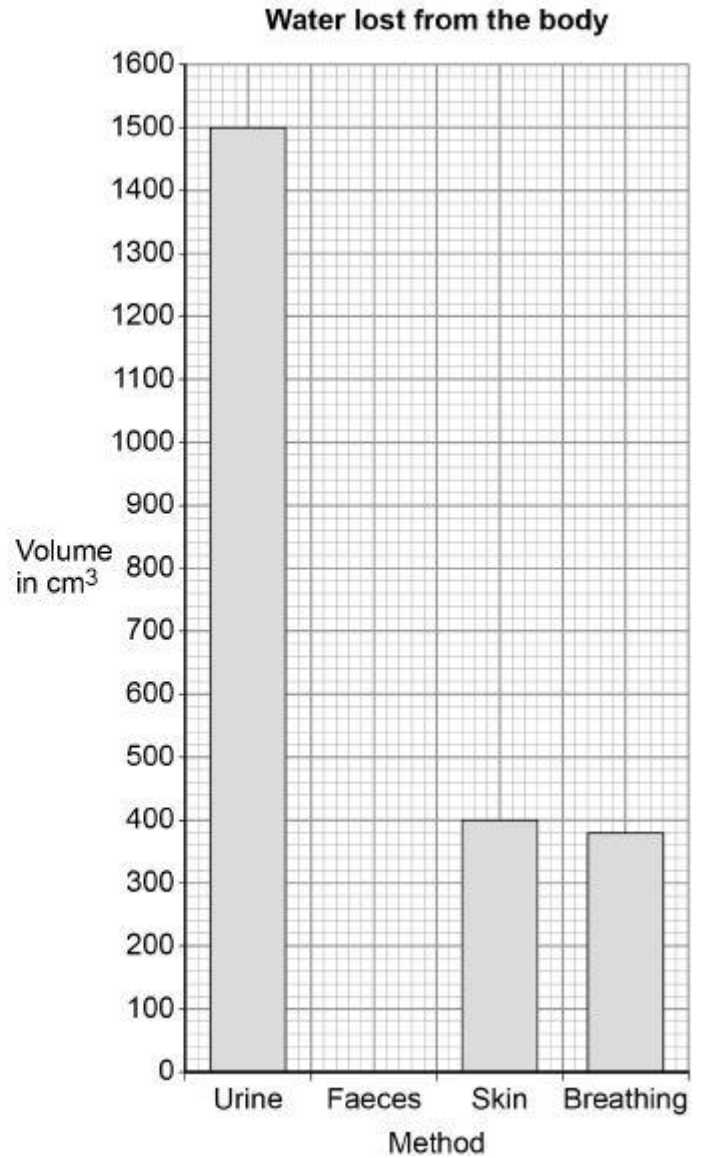
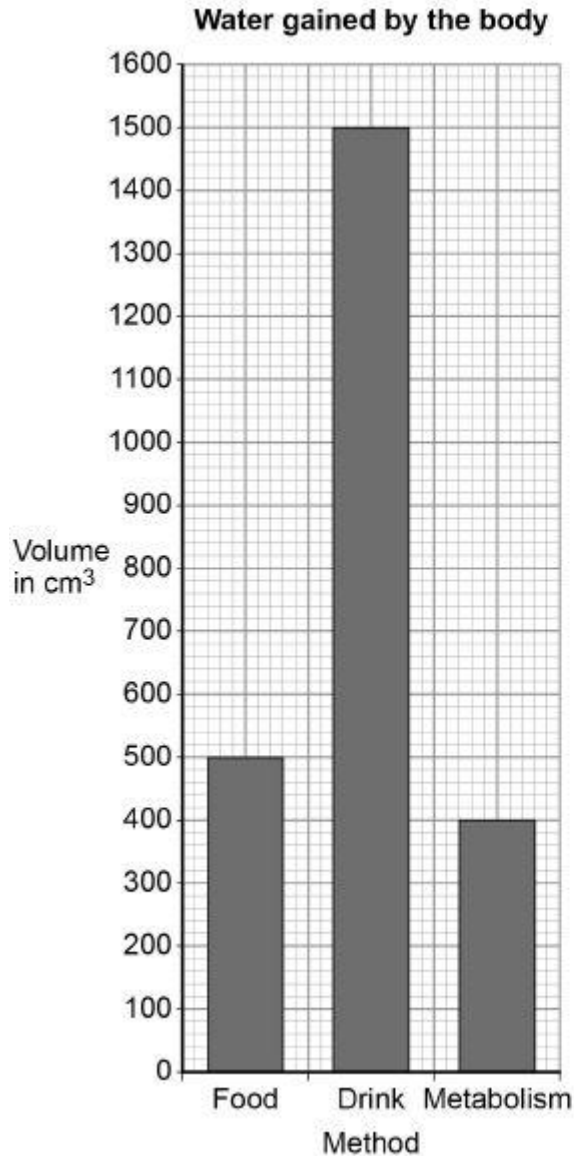
(6)

(Total 11 marks)

Q2.

It is important to maintain water balance in the body.

The graphs below show how much water a person gained and lost by different methods in one day.



When water is balanced, the volume of water taken in by the body is equal to the volume of water lost from the body.

- (a) Calculate the volume of water the person lost in one day in faeces.

Use information from the graphs above.

Volume lost in faeces = _____ cm³

(2)

(b) The graphs above show that one method of gaining water is by metabolism.

Which metabolic process produces water?

Tick **one** box.

Breakdown of protein to amino acids

Changing glycogen into glucose

Digestion of fat

Respiration of glucose

(1)

The next day, the person ran a 10-kilometre race.

The volume of water lost from the body through the skin and by breathing increased.

(c) Explain why more water was lost through the skin during the race.

(2)

(d) Explain why more water was lost by breathing during the race.

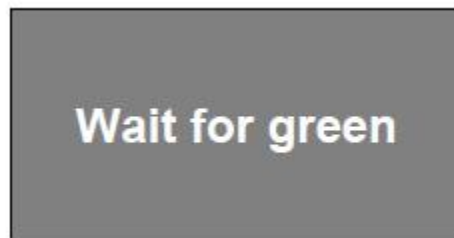
(3)
(Total 8 marks)

Q3.

Three students measured their reaction times.

The students used a computer program.

The image below shows the image displayed on the computer screen.



This is the method used:

1. Sit facing the computer screen.
2. Click the mouse button as quickly as possible when the computer screen turns green.
3. Record the time taken as shown on the computer screen.
4. Repeat steps 2 and 3 a further 9 times.

The table shows the students' results.

Attempt number	Time in milliseconds		
	Student A	Student B	Student C
1	275	260	272

2	259	268	268
3	251	251	275
4	261	256	266
5	260	244	270
6	263	280	283
7	259	468	274
8	256	258	278
9	255	255	286
10	248	277	275
Mean	259	282	275

(1 second = 1000 milliseconds)

- (a) Suggest why measuring reaction time with a computer is more accurate than measuring reaction time with a stopwatch.

(1)

- (b) The students measured 10 reaction times for each person rather than 3 reaction times.

Explain why.

(2)

- (c) Explain why the mean for student **B** has been calculated incorrectly.

Use information from the table.

(2)

- (d) Calculate the ratio of student **C**'s mean reaction time to student **A**'s mean reaction time.

Give your answer to 3 significant figures.

Ratio student **C** : student **A** = _____ : 1

(2)

- (e) Student **A** wanted to present his mean result in seconds, in standard form.

What is the correct way of doing this?

Tick **one** box.

259×10^{-3} seconds

0.259×10^{-3} seconds

2.59×10^{-1} seconds

0.259×10^{-4} seconds

(1)

- (f) Student **C** said the results from this investigation showed that he had the fastest reactions.

Give **two** reasons why student **C**'s statement is **not** correct.

1.

2.

(2)

- (g) The reaction the students investigated is **not** a reflex action.

Give the reason why.

(1)

(Total 11 marks)

Q4.

In humans, chromosome **X** and chromosome **Y** are the sex chromosomes.

- (a) Most cells in the human body contain two sex chromosomes.

Which type of cell does **not** have two sex chromosomes?

Tick **one** box.

Liver cell

Muscle cell

Nerve cell

Red blood cell

(1)

- (b) Apart from the sex chromosomes, how many **other** chromosomes are there in most human body cells?

Tick **one** box.

21 23 44 46

(1)

Stickler syndrome is an inherited disorder that causes damage to the eye.

One of the symptoms of Stickler syndrome is that black spaces can appear in the visual image.

- (c) Which part of the eye is affected by Stickler syndrome?

Tick **one** box.

Ciliary muscles

Iris

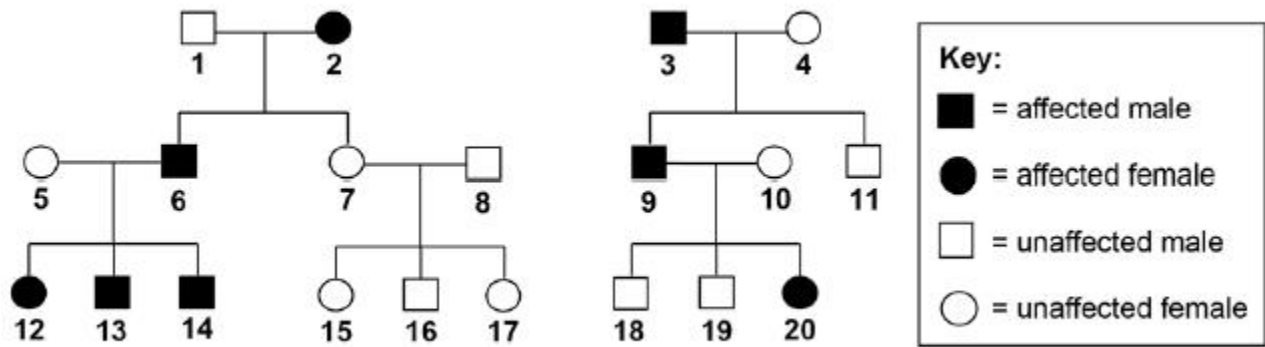
Retina

Suspensory ligaments

(1)

Stickler syndrome is caused by the inheritance of a dominant allele.

The diagram shows the inheritance of Stickler syndrome in two families.



Use the following symbols in your answers to (d) and (e):

A = the dominant allele for Stickler syndrome

a = the recessive allele for unaffected vision.

(d) Explain why none of the children of persons **7** and **8** have Stickler syndrome.

(2)

(e) Person **12** marries person **18**.

Use a Punnett square diagram to find the probability that their first child will be a female with Stickler syndrome.

Probability of a female child with Stickler syndrome =

(4)

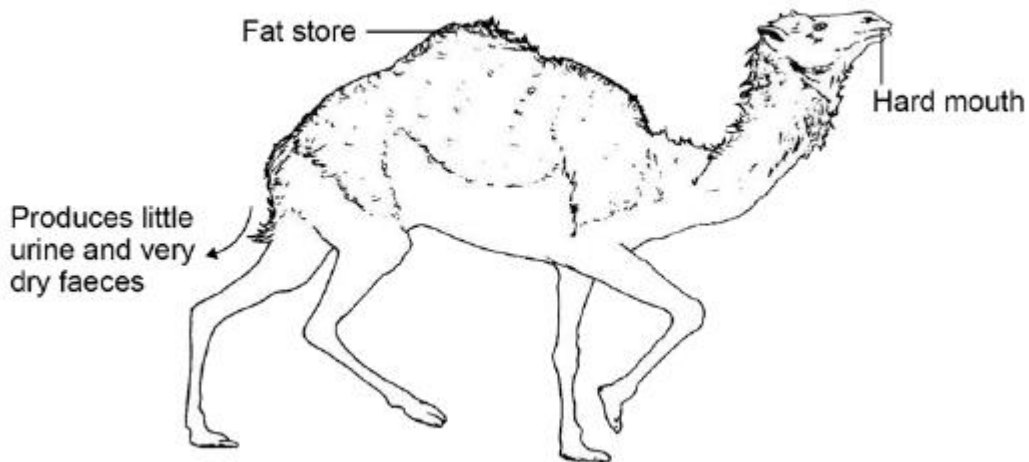
(Total 9 marks)

Q5.

Figure 1 shows a type of camel called a dromedary (*Camelus dromedarius*).

The dromedary lives in hot, dry deserts.

Figure 1



(a) One adaptation of the dromedary is 'temperature tolerance'.

This means that the animal's body temperature can rise by up to 6 °C before it starts to sweat.

Explain how temperature tolerance can help the dromedary to survive in the desert.

(2)

(b) Three more adaptations of the dromedary are given in **Figure 1**.

Give a reason why each adaptation helps the animal survive in the desert.

Fat store

Produces little urine and very dry faeces

Hard mouth

(3)

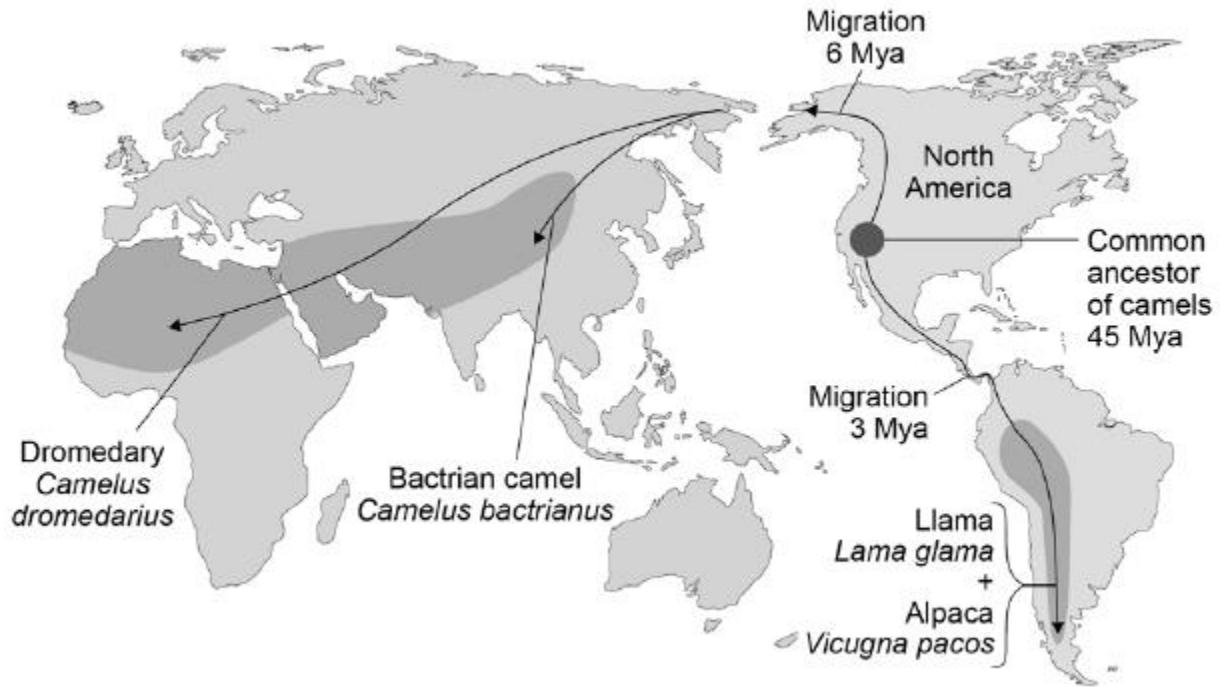
There are several species of the camel family alive today.

Scientists think these species evolved from a common ancestor that lived in North America about 45 million years ago (Mya).

Figure 2 shows:

- where four modern species of the camel family live today
- how the ancestors of these camels migrated from North America.

Figure 2



- (c) Which **two** of the four modern species of camel do scientists believe to be most closely related to each other?

Give the reason for your answer.

_____ and _____

Reason

(1)

- (d) Describe the type of evidence used for developing the theory of camel migration shown in **Figure 2**.

(2)

- (e) Explain how several different species of camel could have evolved from a common ancestor over 45 million years.
- (6)
- (Total 14 marks)**

Q6.

Two students investigated reflex action times.

This is the method used.

1. Student **A** sits with his elbow resting on the edge of a table.
2. Student **B** holds a ruler with the bottom of the ruler level with the thumb of Student **A**.
3. Student **B** drops the ruler.
4. Student **A** catches the ruler and records the distance.
5. Steps 1 to 4 are then repeated.

The same method was also used with Student **A** dropping the ruler and Student **B** catching the ruler.

- (a) Give **two** variables the students controlled in their investigation.

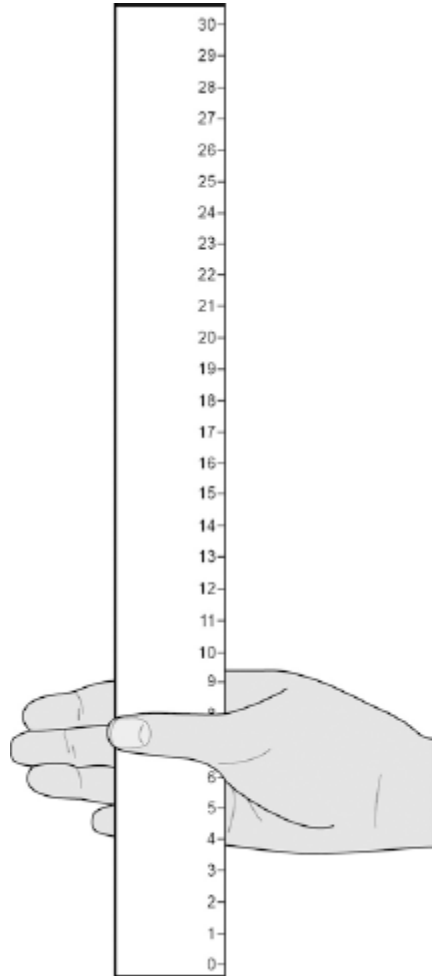
1.

2.

(2)

- (b) **Figure 1** shows one of the results for the Student **A**.

Figure 1



What is the reading shown in **Figure 1**?

Reading on ruler = _____ cm

(1)

(c) **Table 1** shows the students' results.

Table 1

Test number	Distance ruler dropped in cm	
	Student A	Student B
1	9	12
2	2	13

3	6	13
4	7	9
5	7	8
Mean	7	X

Circle the anomalous result in **Table 1** for Student **A**.

(1)

(d) What is the **median** result for Student **B**?

Tick **one** box.

8

11

12

13

(1)

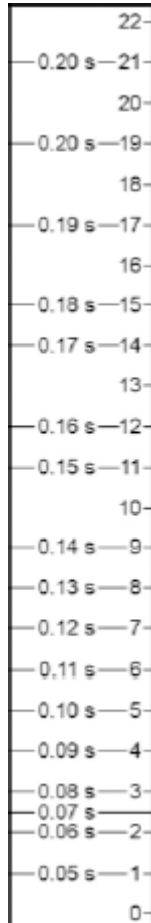
(e) Calculate the value of **X** in **Table 1**.

Mean distance ruler dropped = _____ cm

(1)

(f) **Figure 2** shows the scale used to convert distance of the ruler drop to reaction time.

Figure 2



Calculate how much faster the reaction time of Student **A** was compared to Student **B**.

Use **Figure 2** and **Table 1**.

Answer = _____ s

(2)

- (g) What improvement could the students make to the method so the results are more valid?

Tick **one** box.

Use alternate hands when catching the ruler

Carry out more repeats

Use a longer ruler for catching

Use more than two students to collect results

(1)

- (h) Student **A** carried out a second investigation to see the effect of caffeine on the reflex action.

Table 2 shows his results.

Table 2

Test number	Distance ruler dropped in cm	
	Without caffeine	With caffeine
1	9	5
2	6	5
3	9	4
4	6	7
5	10	4
Mean	8	5

Give **one** conclusion about the effect of caffeine on reflex actions.

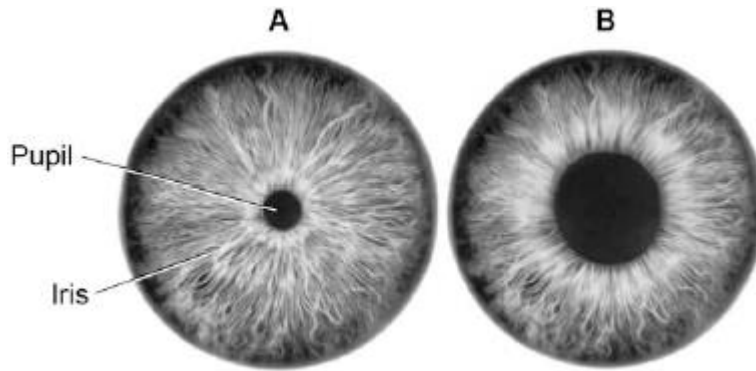
(1)

(Total 10 marks)

Q7.

Figure 1 shows a reflex in the iris of the human eye in response to changes in light levels.

Figure 1



@ Gandee Vasan/Stone/Getty Images

- (a) Describe the changes in the pupil and iris going from **A** to **B** in **Figure 1**.

Explain how these changes occur.

Refer to the changes in light level in your answer.

(4)

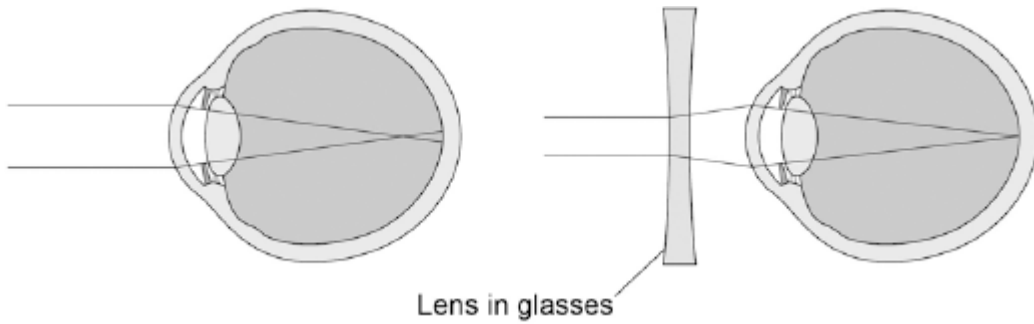
- (b) Some people wear glasses to improve their vision.

Figure 2 shows light entering the eye in a person with blurred vision.

Figure 3 shows how this condition is corrected with glasses.

Figure 2

Figure 3



Compare **Figure 2** and **Figure 3**.

Explain how the blurred vision is corrected.

(2)
(Total 6 marks)

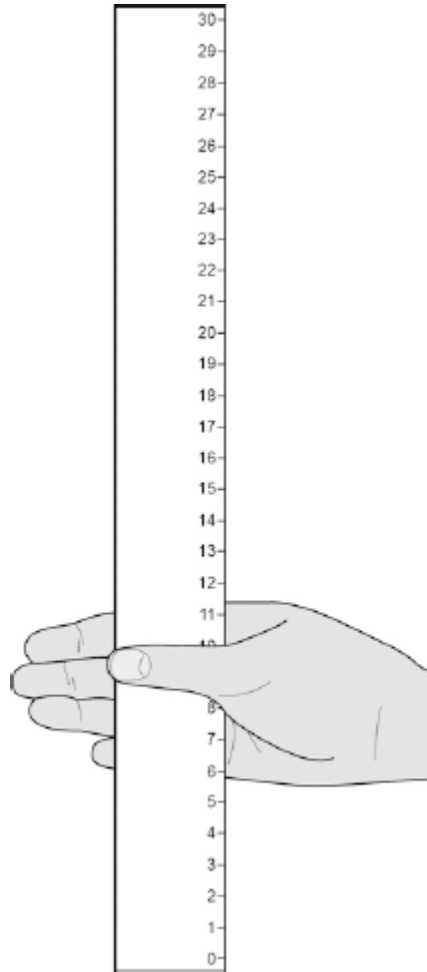
Q8.

Two students investigated reflex action times.

This is the method used.

1. Student **A** sits with her elbow resting on the edge of a table.
2. Student **B** holds a ruler with the bottom of the ruler level with the thumb of Student **A**.
3. Student **B** drops the ruler.
4. Student **A** catches the ruler and records the distance, as shown in the diagram below.

5. Steps 1 to 4 were then repeated.



(a) Suggest **two** ways the students could improve the method to make sure the test would give valid results.

1.

2.

(2)

(b) The table below shows Student **A**'s results.

Test Number	Distance ruler dropped in mm
1	117
2	120
3	115
4	106
5	123
6	125
7	106

What is the **median** result?

Tick **one** box.

- 106
- 115
- 116
- 117
- 123

(1)

- (c) The mean distance the ruler was dropped is 116 mm.

Calculate the mean reaction time.

Use the equation:

$$\text{reaction time in s} = \sqrt{\frac{\text{mean drop distance in cm}}{490}}$$

Give your answer to 3 significant figures

Mean reaction time = _____ s

(3)

- (d) The students then measured Student **A**'s reaction time using a computer program.

This is the method used.

1. The computer shows a red box at the start.
2. As soon as the box turns green the student has to press a key on the keyboard as fast as possible.
3. The test is repeated five times and a mean reaction time is displayed.

Student **A**'s mean reaction time was 110 ms.

Using a computer program to measure reaction times is likely to be more valid than the method using a dropped ruler.

Give **two** reasons why.

1.

2.

(2)

- (e) A woman has a head injury.

Her symptoms include:

- finding it difficult to name familiar objects

- not being able to remember recent events.

Suggest which part of her brain has been damaged.

(1)

- (f) A man has a head injury.

He staggers and sways as he walks.

Suggest which part of his brain has been damaged.

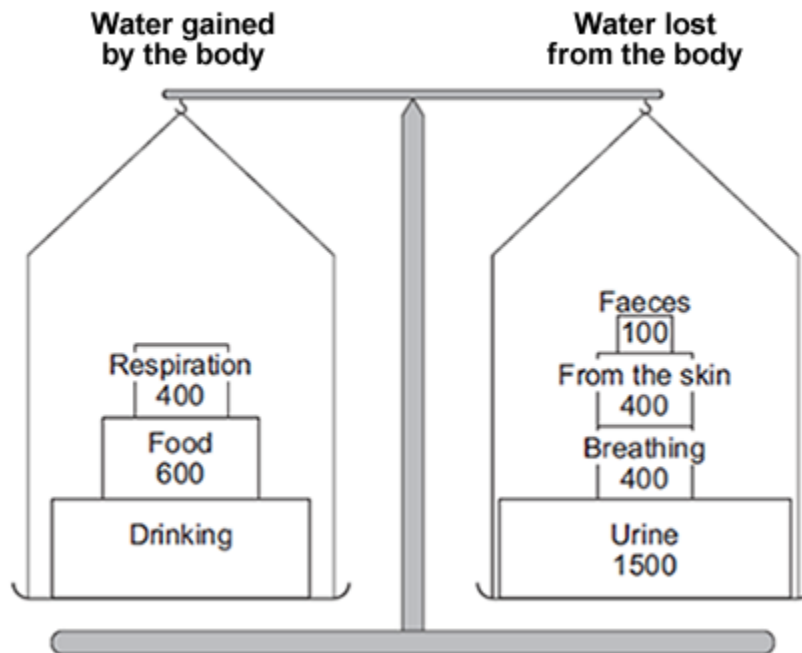
(1)

(Total 10 marks)

Q9.

The diagram below 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.



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

Draw a ring around the correct answer.

1800 cm³

2400 cm³

3300 cm³

(1)

- (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?

Volume of water = _____ cm³

(2)

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

(1)

- (ii) Why does the body need to lose water from the skin?

(1)

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

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

Tick (✓) **one** box.

Less water was lost through the skin.

More water was lost through the skin.

More water was lost in faeces.

(1)

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

Draw a ring around the correct answer.

decrease

increase

no change

(1)

(Total 7 marks)

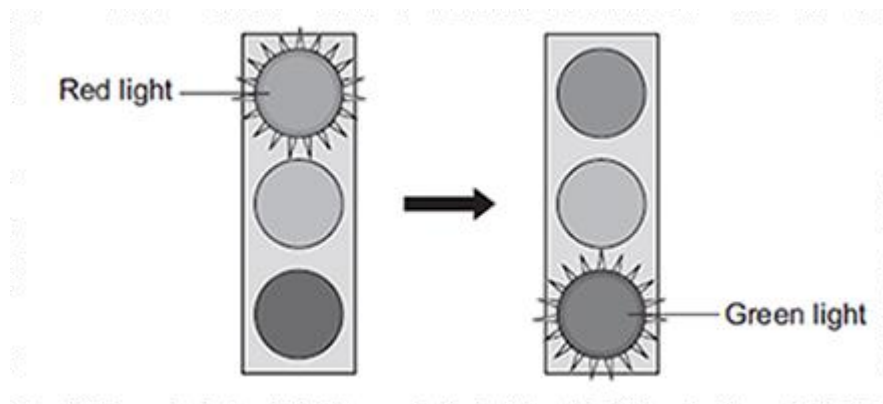
Q10.

Car drivers need quick reactions to avoid accidents.

A student uses a computer program to measure reaction time.

The computer screen shows a traffic light on red. The traffic light then changes to green.

The diagram below shows the change the person sees on the computer screen.



When the traffic light changes to green the person has to click the computer mouse as quickly as possible.

The computer program works out the time taken to react to the light changing colour.

- (a) Special cells detect the change in colour.
- (i) What word is used to describe special cells that detect a change in the environment?

Draw a ring around the correct answer.

receptor cells

reflex cells

stimulus cells

(1)

- (ii) Where in the body are the special cells that detect the change in colour of the traffic lights?

(1)

- (b) The student used the computer program on one computer to measure the reaction times of people of different ages.

- (i) Give **one** variable the student should control so that a fair comparison can be made between the people of different ages.

(1)

- (ii) The student did each measurement three times to calculate a mean value.

The table shows the results.

Age in years	Mean reaction time in milliseconds
15	242
30	
45	221
60	258
75	364
90	526

The reaction times for the 30-year-old person were **192**, **174** and **180** milliseconds.

Calculate the mean reaction time of the 30-year-old person.

Mean reaction time = _____ milliseconds (1)

(iii) Which **one** of the following is an advantage of repeating each test three times and **not** doing the test just once?

Tick (✓) **one** box.

Any anomalies can be identified.

The results will be more precise.

There will be no errors.

(1)

(iv) Some people think that old people should **not** be allowed to drive a car.

Why is it more dangerous for old people to drive cars?

Use information from the table above to support your answer.

(2)

(Total 7 marks)

Q11.

This question is about the nervous system.

(a) Describe the difference between the function of a receptor and the function of an effector.

In your answer you should give **one** example of a receptor and **one** example of an effector.

(4)

(b) Synapses are important in the nervous system.

(i) What is a synapse?

(2)

(ii) Describe how information passes across a synapse.

(2)

(c) Reflexes may be co-ordinated by the brain or by the spinal cord.

(i) The reflexes from sense organs in the head are co-ordinated by the brain.

Name a sense organ involved in a reflex co-ordinated by the spinal cord.

(1)

(ii) The table shows information about reflexes co-ordinated by the brain and reflexes co-ordinated by the spinal cord.

Organ co-ordinating the reflex	Mean length of neurones involved in cm	Mean time taken for reflex in milliseconds	Mean speed of impulse in cm per millisecond
Brain	12	4	3
Spinal cord	80	50	

Calculate the mean speed of the impulse for the reflex co-ordinated by the spinal cord.

Mean speed = _____ cm per millisecond

(1)

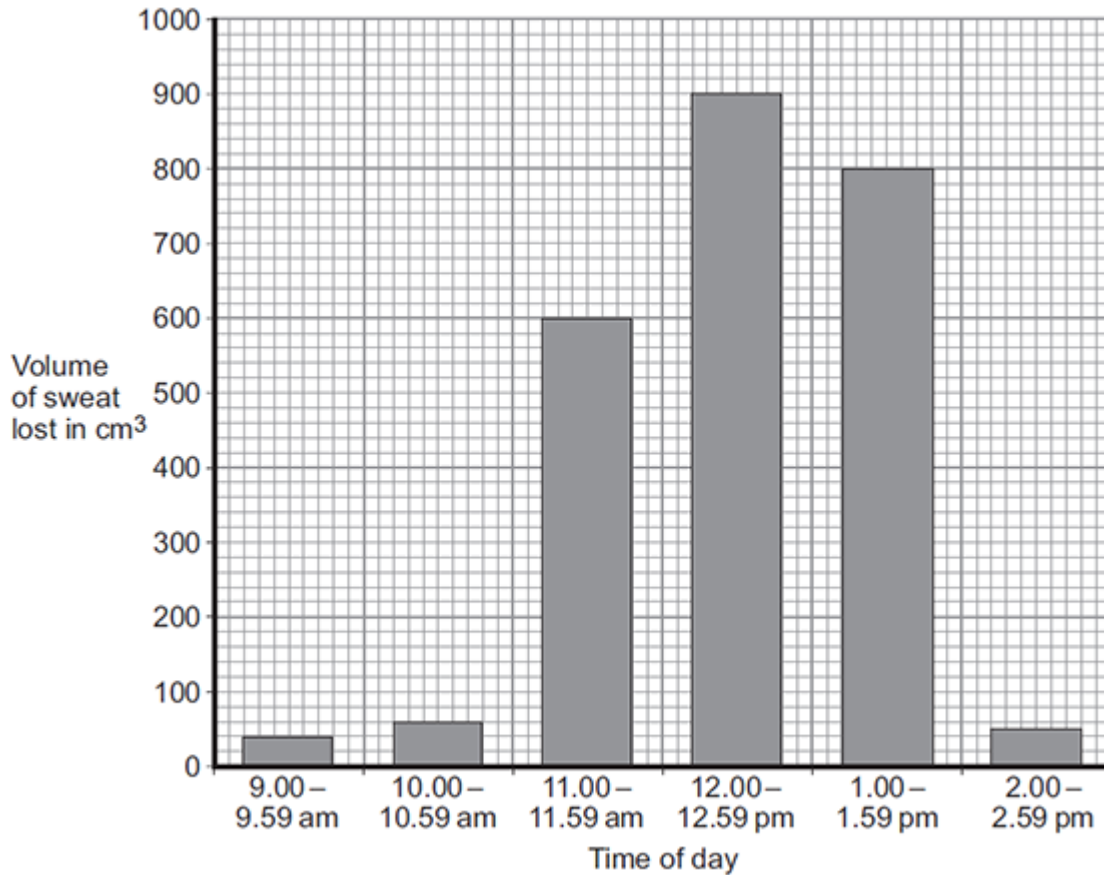
(iii) In reflexes co-ordinated by the brain there are **no** relay neurones.

Suggest why there is a difference in the mean speed of the impulse for the two reflexes.

(2)
(Total 12 marks)

Q12.

A scientist measured the volume of sweat lost between 9.00 am and 2.59 pm in one day by one person. The graph below shows the results.



(a) (i) Suggest what happened at 11.00 am.

Tick (✓) **one** box.

The person moved into a cold room.

The person removed their coat.

The person started running a race.

(1)

- (ii) Calculate the total volume of sweat lost between 11.00 am and 1.59 pm.

Total volume of sweat lost = _____ cm³

(1)

- (iii) Suggest **one** way the person could replace the water that was lost as sweat.

(1)

- (b) (i) Sweating helps keep our internal body temperature within a narrow range.

Which organ monitors body temperature?

Tick (✓) **one** box.

brain

kidney

pancreas

(1)

- (ii) The organ that monitors internal body temperature receives information about temperature from the skin.

Which structures in the skin send impulses with this information?

Tick (✓) **one** box.

capillaries

glands

receptors

(1)

(c) How does sweating help to control body temperature?

(1)

(Total 6 marks)

Q13.

Humans keep their internal conditions almost constant.

Body temperature is kept within a narrow range.

When the core body temperature is too low, this is detected by the thermoregulatory centre in the brain.

Describe how the body responds when a decrease in core body temperature is detected.

(Total 6 marks)

Q14.

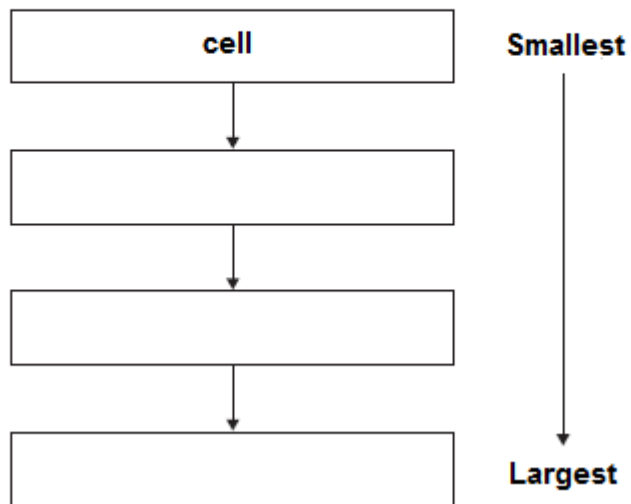
The human body is organised to carry out many different functions.

- (a) Use words from the box to complete **Figure 1** by putting the parts of the body in order of size from smallest to largest.

The smallest one has been done for you.

cell	organ system	organ	tissue
-------------	---------------------	--------------	---------------

Figure 1



(2)

(b) The stomach is made of different types of tissue.

Draw **one** line from each type of stomach tissue to the correct description.

Epithelial tissue	Allows food to be churned around the stomach
Glandular tissue	Covers the outside and the inside of the stomach
Muscular tissue	Produces digestive juices
	Coordinates nerve impulses

(3)

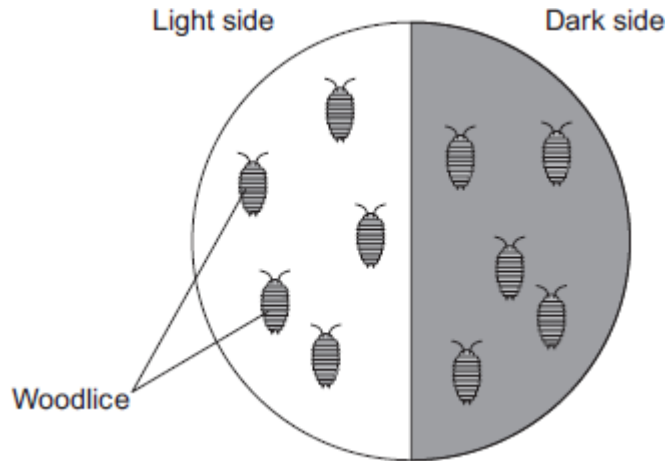
(c) Animals can react to their surroundings because they have nervous systems.

A student investigated the behaviour of small animals called woodlice.

The student set up the investigation as shown in **Figure 2**.

- The student covered one half of a Petri dish with black paper to make that side of the Petri dish dark.
- The other side had no cover.
- The student put five woodlice into each side of the dish and then put the clear Petri dish lid back on the dish.

Figure 2



After 30 minutes, all the woodlice had moved to the dark side of the Petri dish.

- (i) In this investigation, what is the **stimulus** that the woodlice responded to?

(1)

- (ii) In this investigation, what is the **response** that the woodlice made?

(1)

- (iii) The student concluded that woodlice prefer dark conditions.

Give **two** ways in which the student could improve the investigation to be sure that his conclusion was correct.

1.

2.

(2)

(Total 9 marks)

Q15.

Humans use the nervous system to react to changes in the environment.

- (a) (i) Which word means a change in the environment?

Draw a ring around the correct answer.

neurone

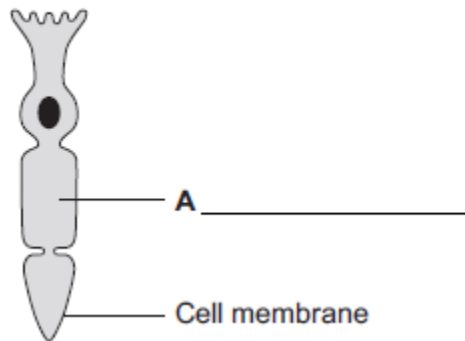
reflex

stimulus

(1)

- (ii) **Figure 1** shows a light receptor cell.

Figure 1



Use the correct answer from the box to label part **A** on **Figure 1**.

chloroplast

cytoplasm

vacuole

(1)

- (b) **Figure 2** shows a boy riding a bicycle on a sunny day.

Figure 2



© Stockbyte/Thinkstock

- (i) Receptors in the boy's body detect changes in the environment.

Complete the table to show which organ of the body contains the receptors for each change in the environment.

Change in the environment	Organ that contains the receptors
Sound of traffic from behind him	
Flashing blue lights of a police car	
Cooler air temperature in the shadows	

(3)

- (ii) The boy's response to danger is to pull on the bicycle brakes.

Which type of effector causes this response?

Tick (✓) **one** box.

A gland

A muscle

A synapse

(1)
(Total 6 marks)

Q16.

This question is about the nervous system.

(a) Describe the function of receptors in the skin.

(2)

(b) A response is caused when information in the nervous system reaches an effector.

(i) There are two different types of effector.

Complete the table to show:

- the two different types of effector
- the response each type of effector makes.

Type of effector	Response the effector makes
1 _____	_____ _____
2 _____	_____ _____

(4)

(ii) Some effectors help to control body temperature.

Give **one** reason why it is important to control body temperature.

(1)

(Total 7 marks)

Q17.

Many runners drink sports drinks to improve their performance in races.

A group of students investigated the effects of three brands of sports drink, **A**, **B** and **C**, on the performance of three runners on a running machine. One of the runners is shown in the image below.



© Keith Brofsky/Photodisc/Thinkstock

Table 1 gives information for each drink.

Table 1

Nutrient per dm^3	Brand of sports drink		
	A	B	C
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

- (a) (i) In the investigation, performance was measured as the time taken to reach the point of exhaustion.

Exhaustion is when the runners could not run anymore.

All three runners:

- ran on a running machine until the point of exhaustion
- each drank 500 cm^3 of a different brand of sports drink
- rested for 4 hours to recover
- ran on the running machine again and recorded how much time

they ran until the point of exhaustion.

The speed at which the runners ran was the same and all other variables were controlled.

The students predicted that the runner drinking brand **B** would run for the shortest time on the second run before reaching the point of exhaustion.

Use information from **Table 1** to suggest an explanation for the students' prediction.

(2)

- (ii) If the balance between ions and water in a runner's body is not correct, the runner's body cells will be affected.

Describe **one** possible effect on the cells if the balance between ions and water is **not** correct.

(1)

- (b) When running, a runner's body temperature increases.

Describe how the brain monitors body temperature.

(3)

- (c) (i) **Table 2** is repeated here to help you answer this question.

Table 2

Nutrient per dm ³	Brand of sports drink		
	A	B	C
Glucose in g	63	31	72
Fat in g	9	0	2
Ions in mg	312	332	495

People with diabetes need to be careful about drinking too much sports drink.

Use information from **Table 2** to explain why drinking too much sports drink could make people with diabetes ill.

(3)

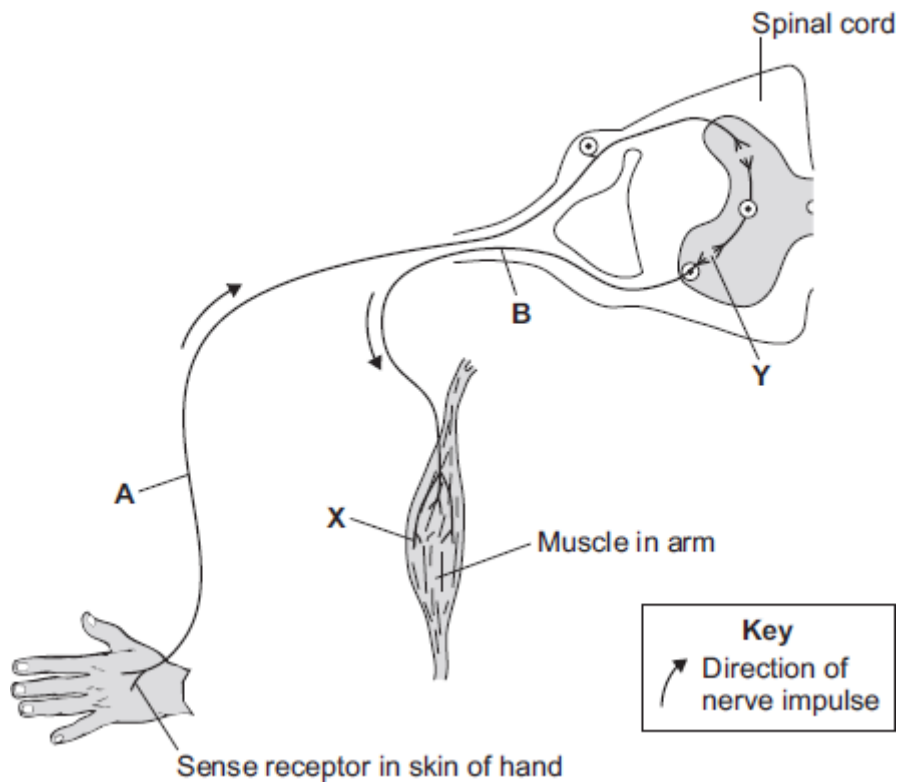
- (ii) Other than paying attention to diet, how do people with diabetes control their diabetes?

(1)
(Total 10 marks)

Q18.

- (a) **Diagram 1** shows the neurones and parts of the body involved in a response to touching a hot object.

Diagram 1



A neurone is a nerve cell. Neurones carry impulses around the body.

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

Neurone **A** is a
 motor neurone.
 relay neurone.

sensory neurone.

At point **Y** there is a tiny gap between two neurones called

an effector.
a receptor.
a synapse.

(2)

- (ii) The hand touches a hot object. An impulse travels through the nervous system to the muscle (point **X**). The muscle moves the hand away from the hot object.

What does the muscle do to move the hand away from the hot object?

Tick (✓) **one** box.

- contract
- relax
- stretch

(1)

- (iii) The action described in part **(a) (ii)** is a reflex action.

How can you tell that this action is **not** a conscious action?

Use information from the diagram.

(1)

- (iv) Reflex actions like this are useful.

Explain why.

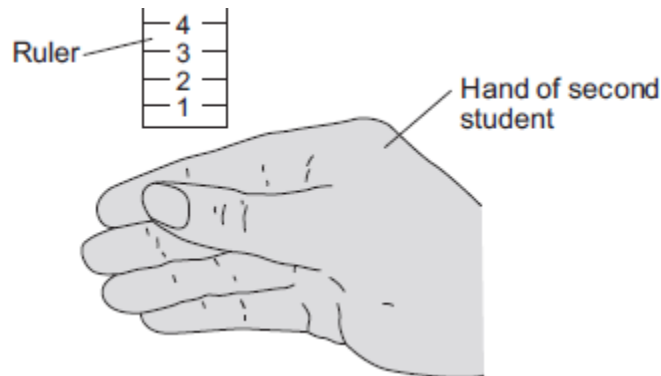
(2)

(b) Some students investigated the effect of caffeine on a person's reaction time.

The students used the following steps.

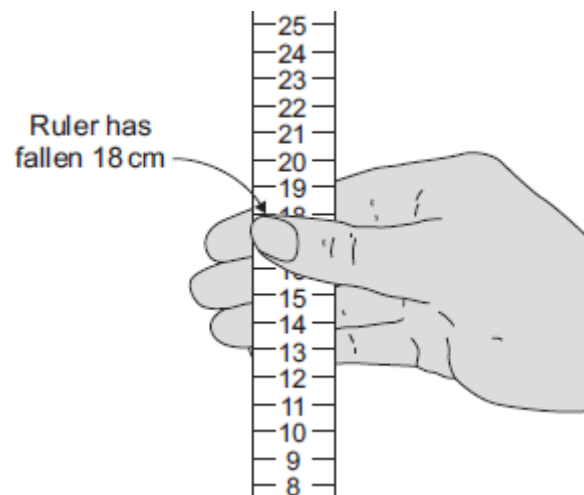
1. One student held a ruler just above a second student's hand, as shown in **Diagram 2**.

Diagram 2



2. The student let go of the ruler. The second student caught it as soon as possible, as shown in **Diagram 3**.

Diagram 3



3. The students repeated this experiment seven more times.

4. The student catching the ruler then drank a cup of strong coffee.

Coffee contains caffeine.

5. Fifteen minutes after drinking the coffee the students repeated steps 1 to 3.

Table 1 and **Table 2** show the students' results.

Distance ruler fell before it was caught in cm
Before drinking coffee
18
21
25
15
19
16
12
21
Mean = 18.4

Distance ruler fell before it was caught in cm
After drinking coffee
8
13
11
17
10
14
13
13
Mean = 12.4

(i) The students used the reading on the ruler as a measure of the reaction time.

What do the results show about the effect of caffeine on reaction time?

(1)

(ii) Look carefully at **all** the data in **Table 1** and **Table 2**.

Using the data in **Table 1** and **Table 2**, give **one** reason why a scientist may **not** accept your conclusion in part (b) (i).

(1)

(iii) How could the students improve their investigation?

Suggest **two** ways.

1.

2.

(2)

(Total 10 marks)

Q19.

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

The human body is kept at a constant internal temperature of about 37 °C.

Body temperature is monitored and controlled by the thermoregulatory centre in the brain.

Describe what happens in the body to keep the body temperature constant.

Extra space

(Total 6 marks)

Q20.

It is important that the amount of water in the body is controlled.

- (a) The table below shows the main ways that a person takes in and loses water in one day.

Water taken in		Water lost	
Method	Volume in cm ³	Method	Volume in cm ³
Drink	1450	Urine	1500
Food	800	Sweat	600
Metabolic water	350	Breath	
		Faeces	100
Total	2600	Total	2600

- (i) Calculate the volume of water lost from the body through breathing.

Use information from the table above.

Volume of water lost through breathing = _____
cm³

(2)

- (ii) Metabolic water is water produced by aerobic respiration.

Complete the equation for aerobic respiration.

_____ + oxygen \longrightarrow _____ + water (+ energy)

(2)

- (iii) If the water intake stays the same, what will happen to the volumes of sweat and urine lost from the body on a much hotter day?

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

The volume of sweat will

decrease.
increase.
stay the same.

The volume of urine will

decrease.

increase.
stay the same.

(2)

- (b) The kidneys help to control the water content of the body and the concentrations of substances dissolved in the body fluids. The kidneys do this by filtering the blood and then reabsorbing back into the blood the substances needed by the body.

The table above shows typical concentrations of some of the substances dissolved in a person's blood plasma, in the kidney filtrate, and in the urine.

Substance	Blood plasma in g per dm ³	Kidney filtrate in g per dm ³	Urine in g per dm ³
Protein	70	0	0
Glucose	1	1	0
Urea	0.3	0.3	20
Sodium ions	3	3	6

- (i) The table below shows that sodium ions are twice as concentrated in the urine as in the blood plasma.

Calculate how many times more concentrated **urea** is in the urine compared to the blood plasma.

Use information from the table.

Answer = _____ times more concentrated

(2)

- (ii) What is the main cause of this increase in concentration of urea between the blood plasma and the urine?

Tick (✓) **one** box.

Increased urea production by the kidney

Reabsorption of water by the kidney

Increased deamination of amino acids by the liver

(1)

- (iii) The table shows that both protein and glucose are found in the blood plasma but **not** in the urine.

Use your knowledge of kidney functioning to explain why.

Protein

Glucose

(4)

- (c) Some people have kidney failure.

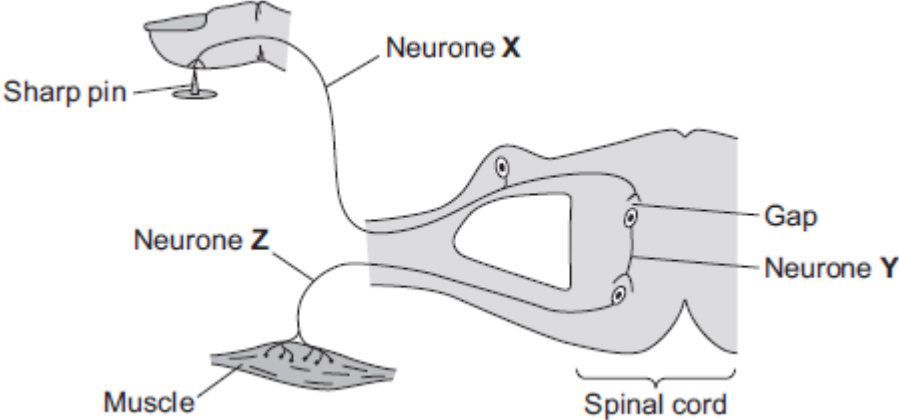
The two main types of treatment for kidney failure are dialysis and a kidney transplant operation.

Suggest reasons why most doctors think that a kidney transplant is better than dialysis treatment.

(4)
(Total 17 marks)

Q21.

The diagram below shows the pathway for a simple reflex action.



(a) What type of neurone is neurone X?

Draw a ring around the correct answer.

- motor neurone**
relay neurone
sensory neurone

(1)

(b) There is a gap between neurone **X** and neurone **Y**.

(i) What word is used to describe a gap between two neurones?

Draw a ring around the correct answer.

effector

receptor

synapse

(1)

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

Information passes across the gap as

a chemical.

an electrical impulse.

pressure.

(1)

(c) Describe what happens to the muscle when it receives an impulse from neurone **Z**. How does this reflex action help the body?

What happens to the muscle

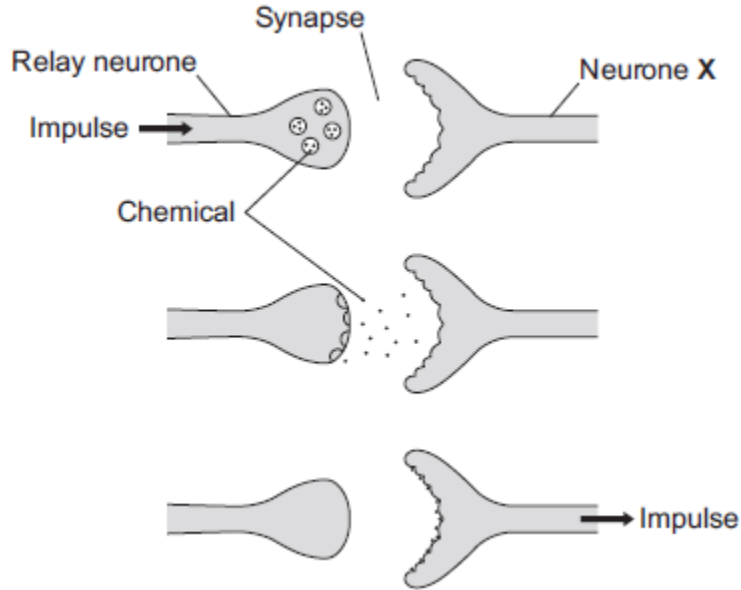
How this helps the body

(2)

(Total 5 marks)

Q22.

The diagram below shows how a nerve impulse passing along a relay neurone causes an impulse to be sent along another type of neurone, neurone **X**.



- (a) What type of neurone is neurone X?

(1)

- (b) Describe how information passes from the relay neurone to neurone X. Use the diagram to help you.

(3)

- (c) Scientists investigated the effect of two toxins on the way in which information passes across synapses. The table below shows the results.

Toxin	Effect at the synapse
Curare	Decreases the effect of the chemical on neurone X
Strychnine	Increases the amount of the chemical made in the relay neurone

Describe the effect of each of the toxins on the response by muscles.

Curare

Strychnine

(2)
(Total 6 marks)

Q23.

Human body temperature must be kept within narrow limits.

The image shows a cyclist in a race.



© Ljupco/iStock/Thinkstock

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

blood	brain	kidney	sweat	urine
--------------	--------------	---------------	--------------	--------------

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

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

If the cyclist's body temperature increases, his body increases the production of _____.

(3)

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

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

	Sports drink		
	A	B	C
Ratio of glucose (g per dm³) to ions (mg per dm³)	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)

(ii) Why should sports drinks contain ions?

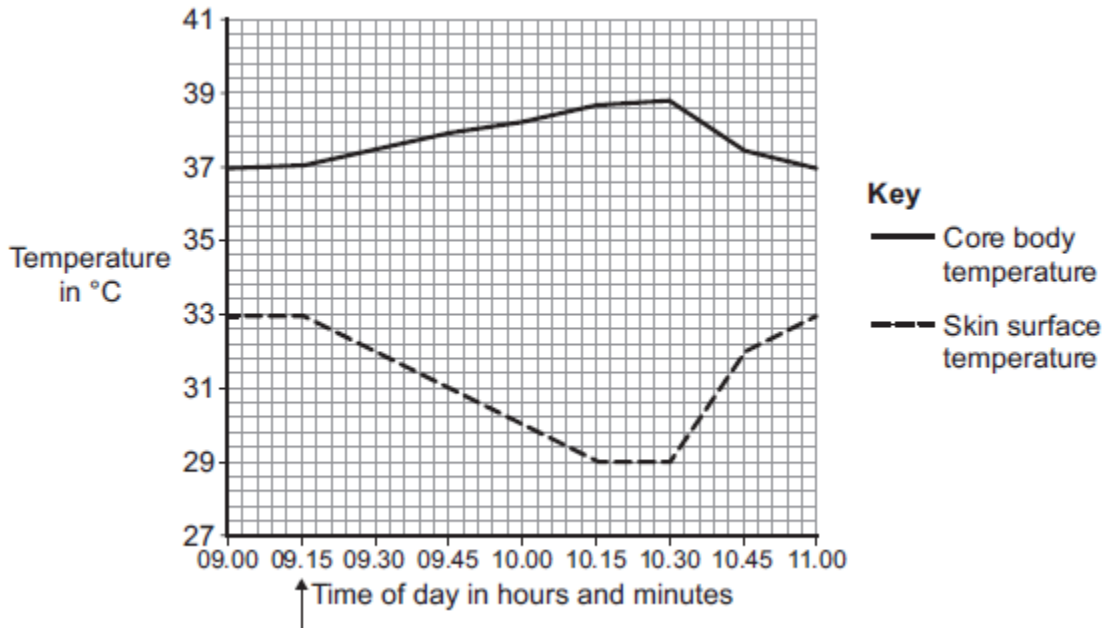
(1)

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

(1)
(Total 6 marks)

Q24.

The graph shows the core body temperature and the skin surface temperature of a cyclist before, during and after a race.



Start
of race

- (a) (i) When the cyclist finished the race, his core body temperature started to decrease.

How long did the race last?

(1)

- (ii) Describe and explain the different patterns shown in the core body temperature and skin surface temperature between 09.15 and 10.15.

(6)

- (iii) After 10.30, the core body temperature decreased.

Explain how changes in the blood vessels supplying the skin caused the skin surface temperature to increase.

(2)

- (b) During the race, the cyclist's blood glucose concentration began to decrease.

Describe how the body responds when the blood glucose concentration begins to decrease.

(3)

(Total 12 marks)

Q25.

The body controls internal conditions.

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

kidneys	liver	lungs	skin
----------------	--------------	--------------	-------------

- (i) Water is lost in sweat via the _____

(1)

- (ii) Water is lost in urine via the _____

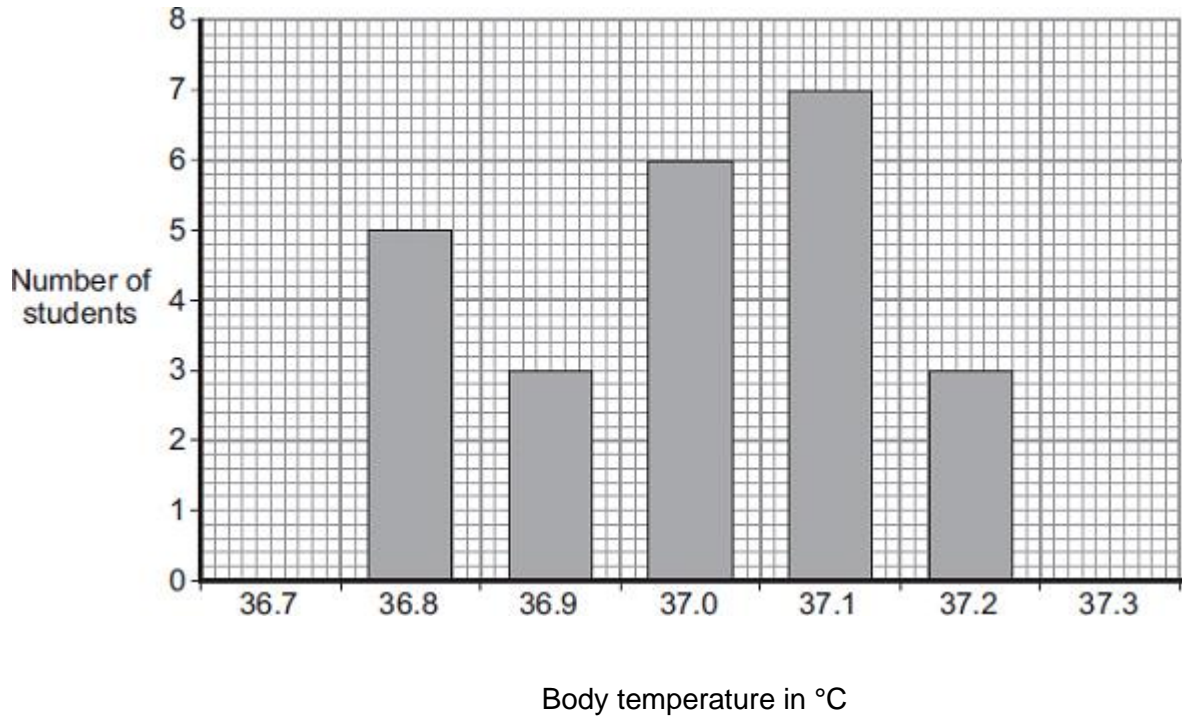
(1)

(iii) Water is lost in the breath via the _____

(1)

(b) Students investigated body temperature in the class.

The bar chart shows the results.



(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)

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

(1)

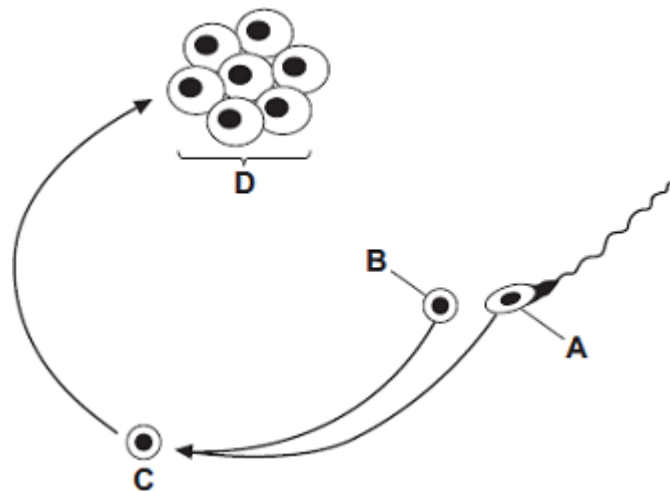
(iii) Body temperature must be kept within a narrow range.

Why?

(1)
(Total 7 marks)

Q26.

The diagram shows some of the stages in IVF (in vitro fertilisation).



(a) Use words from the box to name structures **A**, **B**, **C** and **D**.

egg	embryo	fertilised egg	ovary	sperm
-----	--------	----------------	-------	-------

Structure **A** _____

Structure **B** _____

Structure **C** _____

Structure **D** _____

(4)

(b) What do doctors do next with structure **D**?

(2)

(c) The table gives statistics for an IVF clinic.

	Age of women treated			
	Below 35 years	35 – 37 years	38 – 39 years	40 – 42 years
Number of women treated	414	207	106	53
Number of women who produced one baby	90	43	17	1
Number of women who produced twins	24	8	4	1
Number of women who produced triplets	1	0	0	0

(i) About what proportion of the treated women aged 35 – 37 years produced one or more babies?

Draw a ring around your answer.

one quarter one third half

(1)

(ii) This clinic does **not** give IVF treatment to women over 42 years of age.

Use data from the table to explain why.

(2)

- (iii) The committee which regulates IVF treatment now advises that only one embryo is used in each treatment.

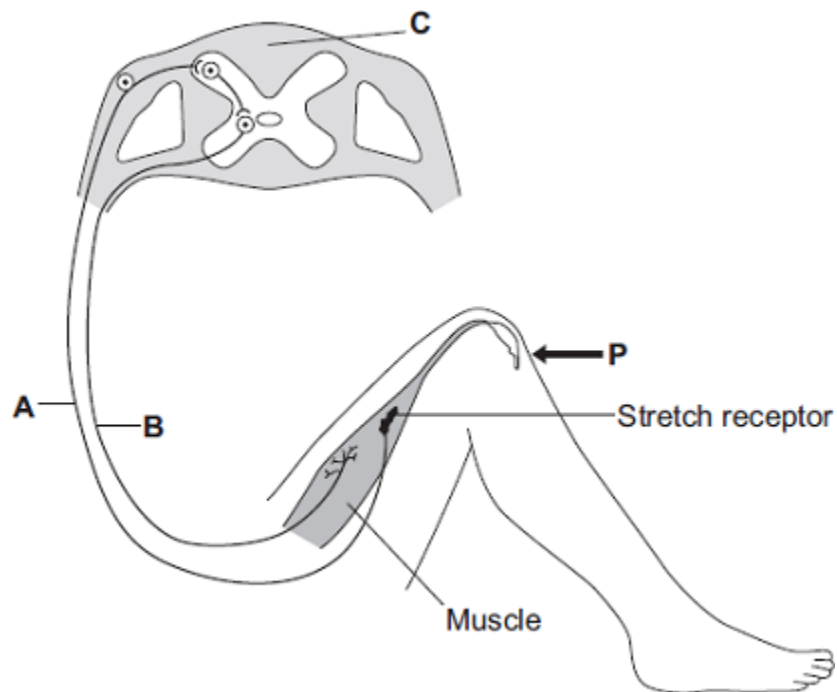
Suggest **one** reason for this.

(1)

(Total 10 marks)

Q27.

The diagram shows the structures involved in the knee-jerk reflex. When the person is hit at point **P**, the lower leg is suddenly raised.



- (a) Name the structures labelled **A**, **B** and **C**.

A _____

B _____

C _____

(3)

(b) How is information passed across a synapse?

(1)

(c) What is the effector in this response?

(1)

(Total 5 marks)

Q28.

A man hurt his head in an accident.

Doctors found that he could not remember anything that had happened on the day of the accident.

(a) (i) Name the part of the brain concerned with memory.

(1)

(ii) Name **one** method the doctors could use to find out how much the brain was damaged.

(1)

(b) The doctors were worried that the man might also have injured his spine. They touched different areas of his skin with a sharp point. They asked him to tell them each time if he could feel the sharp point.

(i) Explain how the information about the sharp point touching the skin reaches the man's brain.



(6)

- (ii) The doctors found that the man could feel the sharp point when the point touched his arms but not when the point touched his legs.

Suggest what this information could tell the doctors about the damage to the man's spinal cord. Explain your answer.

(2)
(Total 10 marks)

Q29.

Penguins live mainly in the Antarctic. Penguins eat mainly fish.
Photograph 1 shows a penguin swimming underwater.

Photograph 1



© raywoo/iStock

- (a) Use information from **Photograph 1** to suggest **three** ways the penguin is adapted for catching fish.

1.

2.

3.

(3)

- (b) The Antarctic winter is very cold. In the winter some species of penguin huddle together as shown in **Photograph 2**.

Photograph 2



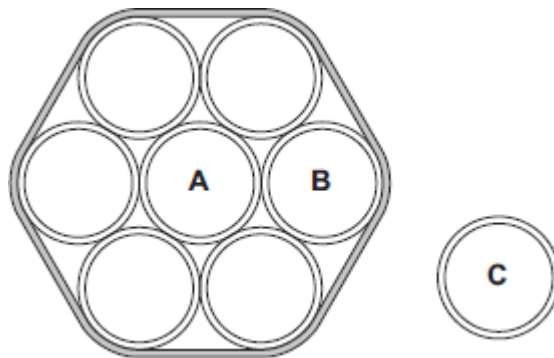
© Fuse

Suggest how the behaviour shown in **Photograph 2** helps the penguins to survive the Antarctic winter.

(3)

- (c) A student did an investigation to model the behaviour of the penguins shown in **Photograph 2**.

The diagram shows the apparatus the student used.



The student:

- held seven similar test tubes together with elastic bands as shown in the diagram
- stood a similar eighth tube in a test tube rack
- filled each of the eight tubes with hot water to the same level
- measured the temperature of the water in tubes **A**, **B** and **C** every 2 minutes for 20 minutes.

The table shows the student's results.

Time in Minutes	Temperature in °C		
	Tube A	Tube B	Tube C
0	65	65	65
2	65	65	64
4	65	64	63
6	64	64	62
8	64	63	61
10	64	63	60
12	63	62	59
14	63	62	58
16	63	61	57
18	62	61	56

20	62	60	55
----	----	----	----

(i) Give **two** variables that were controlled in the investigation.

1.

2.

(2)

(ii) Describe the patterns the data shows.

(2)

(iii) How far does the data from the model support the suggestion you made in part **(b)**?

(2)

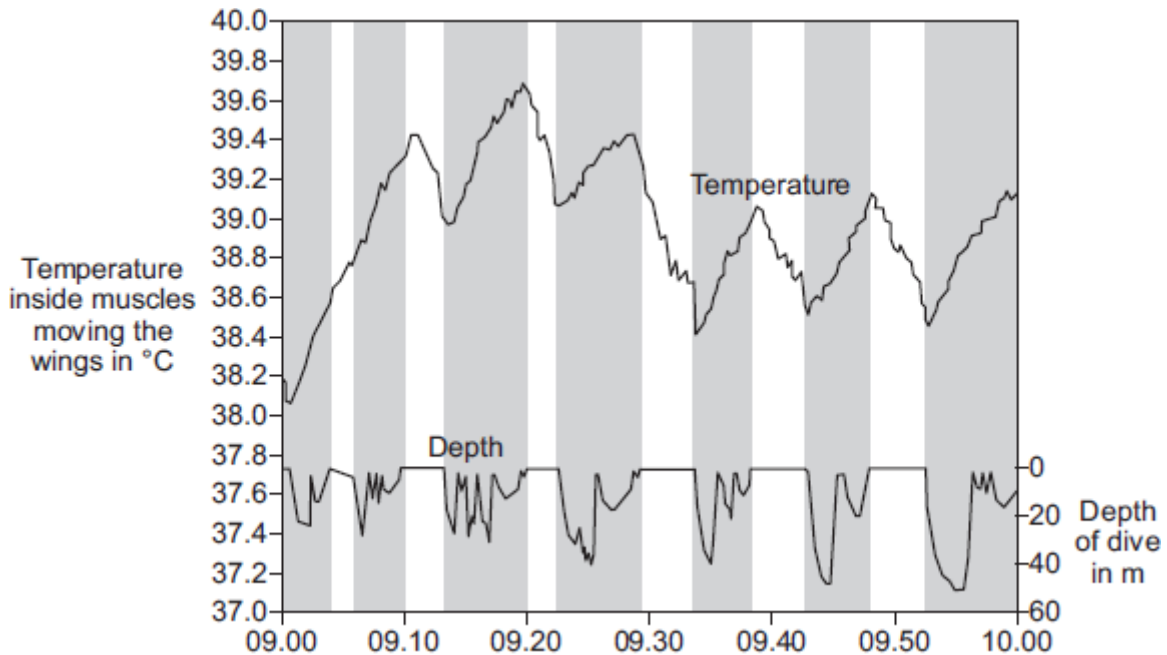
(d) Describe how blood vessels help control human body temperature.

(4)

- (e) Penguins control their body temperature in similar ways to humans. Scientists investigated changes in body temperature of penguins when the penguins were diving to catch fish.
- (i) **Graph 1** shows the relationship between the temperature of the muscles moving a penguin's wings and diving.

The shaded areas show when the penguin was diving.

Graph 1



Time

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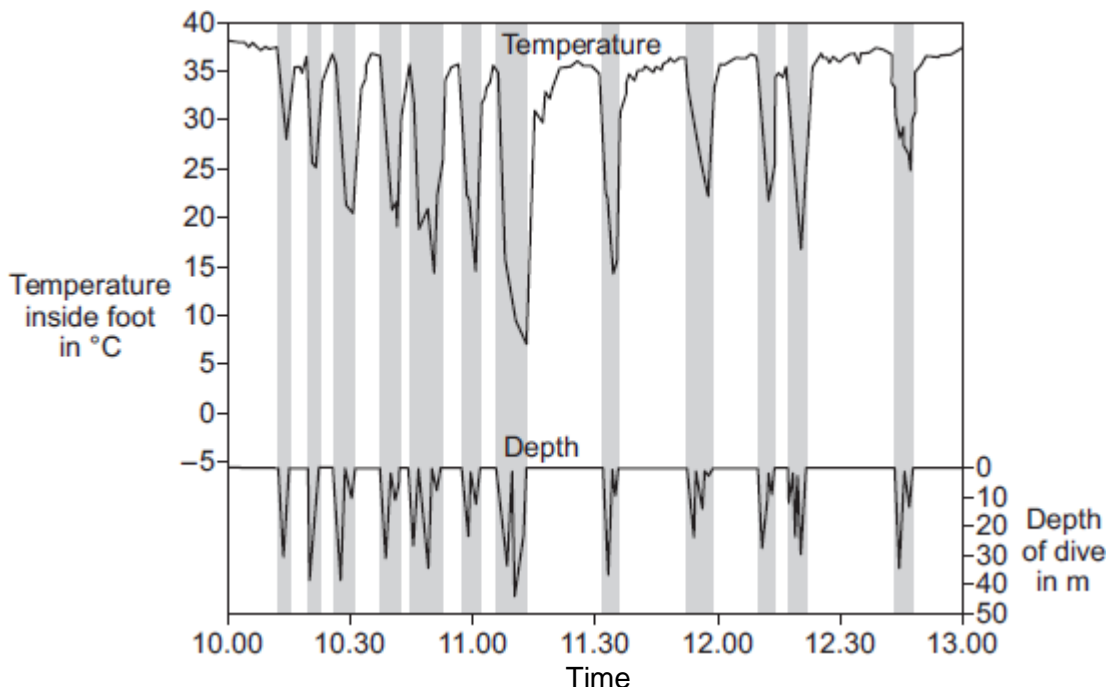
Suggest an explanation for the changes in temperature inside the muscles moving the penguin's wings.

(3)

- (ii) **Graph 2** shows the relationship between the temperature inside a penguin's foot and diving.

The shaded areas show when the penguin was diving.

Graph 2



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Suggest an explanation for the changes in temperature inside the penguin's foot as it dives.

(3)
(Total 22 marks)

Q30.

The photograph shows an athlete at the start of a race.



© Wavebreakmedia Ltd./Thinkstock

- (a) The athlete's sense organs contain special cells. These special cells detect changes in the environment.

- (i) **List A** shows changes in the environment.

List B shows some of the athlete's sense organs.

Draw **one** line from each change in the environment in **List A** to the sense organ detecting the change in **List B**.

List A Change in the environment	List B Sense organ
<input type="text" value="Sight of the finishing line"/>	<input type="text" value="Ear"/>
<input type="text" value="Sound of the starting gun"/>	<input type="text" value="Nose"/>
<input type="text" value="Pressure of the ground on the fingers"/>	<input type="text" value="Eye"/>
	<input type="text" value="Skin"/>

(3)

- (ii) Which cells detect changes in the environment?

Tick (✓) **one** box.

- Gland cells
- Muscle cells
- receptor cells

(1)

(b) During the race, the concentration of sugar in the athlete's blood decreases.

Why?

(1)

(c) Some athletes use anabolic steroids to improve performance.

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

Anabolic steroids increase

- breathing rate.
growth of muscles.
heart rate.

(1)

(ii) Sporting regulations ban the use of anabolic steroids.

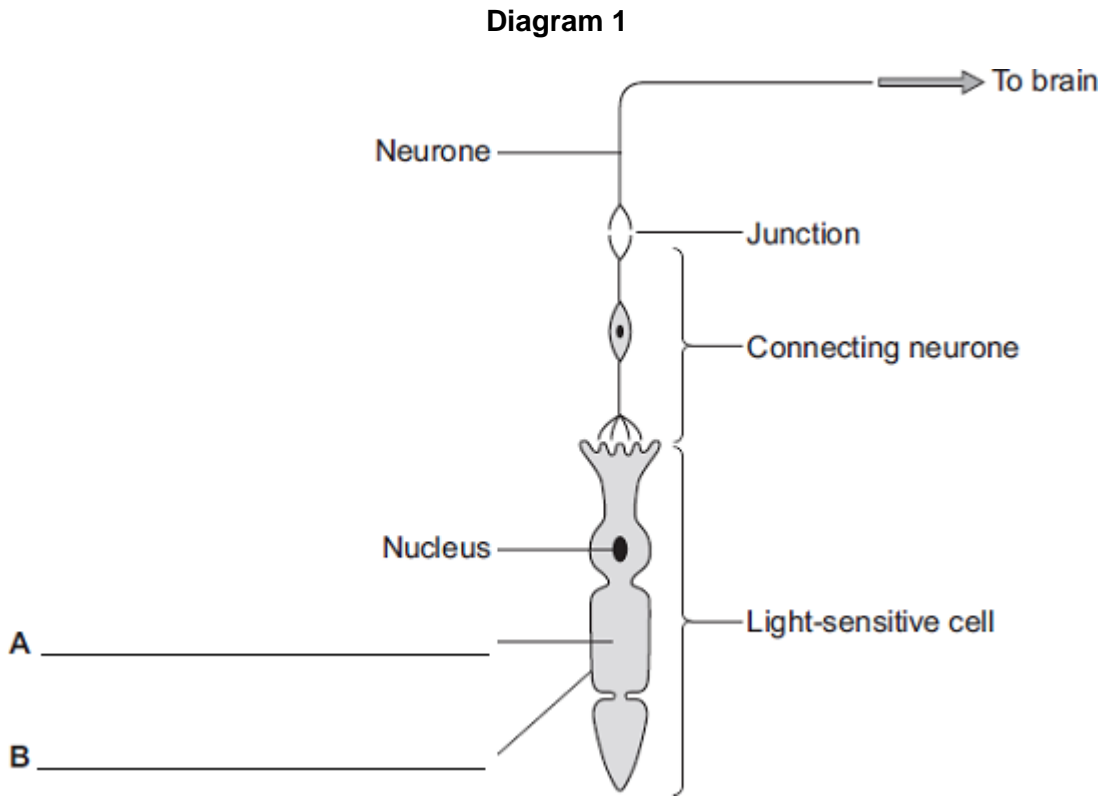
Suggest **one** reason why.

(1)

(Total 7 marks)

Q31.

Diagram 1 shows cells from the light-sensitive layer in the eye.



(a) On **Diagram 1**, add labels to name part **A** and part **B** of the light-sensitive cell.

(2)

(b) There is a junction between the connecting neurone and the neurone carrying the impulse to the brain.

(i) What name is given to the junction?

(1)

(ii) In what form is information passed across the junction?

(1)

(c) **Diagram 2** shows a bee flying towards a man's eye.

Q32.

Humans maintain an almost constant body temperature.

- (a) Describe the role of blood vessels in the control of body temperature.

(4)

- (b) An athlete can run a marathon in 2 hours 15 minutes on a dry day in outside temperatures up to 35 °C.

If the air is dry, his body will **not** overheat.

In humid conditions the same athlete can run the marathon in the same time. However, in humid conditions, if the outside temperature goes over 18 °C then his body **will** overheat.

Suggest an explanation for the athlete overheating in humid conditions.

(3)
(Total 7 marks)

Q33.

Nicotine is a drug in tobacco smoke. Smoking tobacco is harmful.

- (a) (i) Many smokers find it difficult to stop smoking.

Complete the sentence.

It is difficult to stop smoking because nicotine is very

_____.

(1)

- (ii) Nicotine affects synapses in the brain.

What is a synapse?

(1)

- (b) A drug company has developed a new drug, Drug **A**, to help people stop smoking.

Doctors tested the drug in a double-blind trial with over 2000 volunteers who were smokers.

The volunteers wanted to stop smoking.

The volunteers were divided into three groups. Each volunteer took a tablet once a day for 12 weeks:

- group 1 took Drug **A**

- group 2 took Drug **B** (a drug already in use to stop people smoking)
- group 3 took a placebo.

The smoking habits of each group were recorded for a year.

(i) What is a placebo?

(1)

(ii) Why is a placebo group used in drug trials?

(1)

(iii) Which people knew what was in each tablet, in this trial?

Tick (✓) **one** box.

Both doctors and volunteers

Doctors but not volunteers

Neither doctors nor volunteers

(1)

(iv) It is important that the three groups of volunteers should be similar.

Give **two** factors that should be similar in the groups of volunteers.

1.

2.

(2)

(c) The table shows the results of the trials.

Tablet	Percentage of volunteers who had stopped smoking	
	After 12 weeks	After 1 year
Drug A	44	23
Drug B	30	15
Placebo	18	10

A doctor looked at the results of the tests.

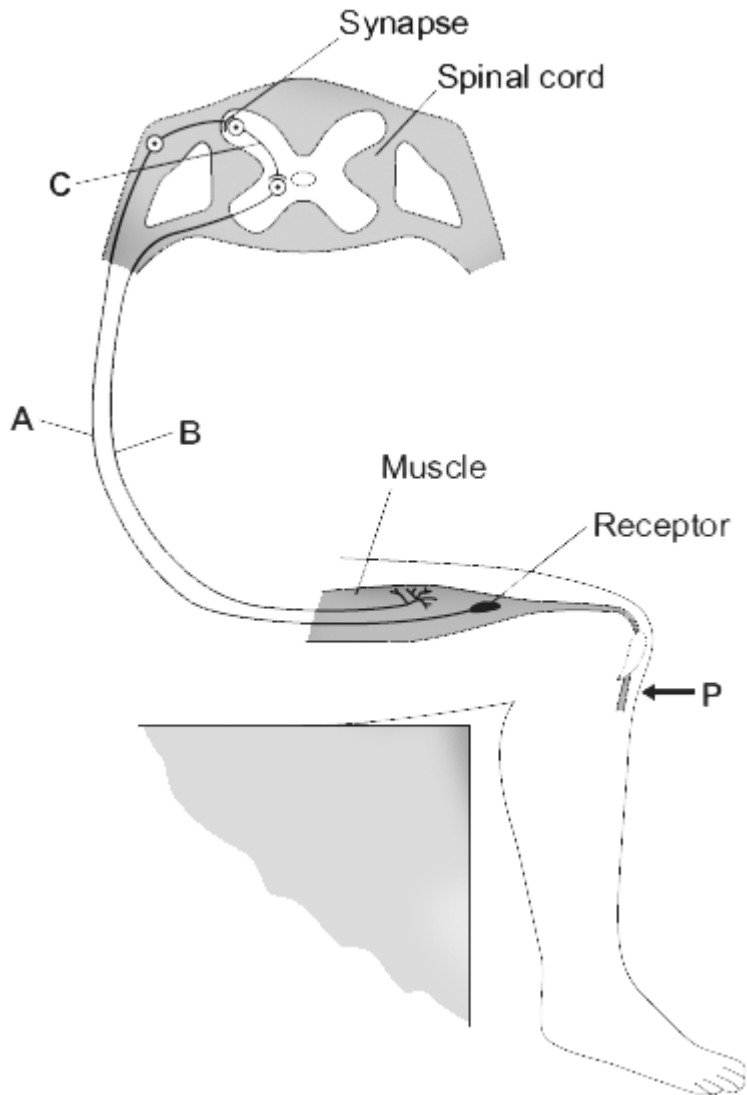
The doctor suggested that a smoker who wanted to give up smoking should use Drug A.

Why?

(1)
(Total 8 marks)

Q34.

The diagram shows the nervous pathway used to coordinate the knee-jerk reflex. When the person is hit at point P, the lower leg is suddenly raised.



(a) Name neurones **A**, **B** and **C**.

A

B

C

(3)

(b) The receptor in the muscle in the leg is sensitive to a stimulus.

Suggest the stimulus.

(1)

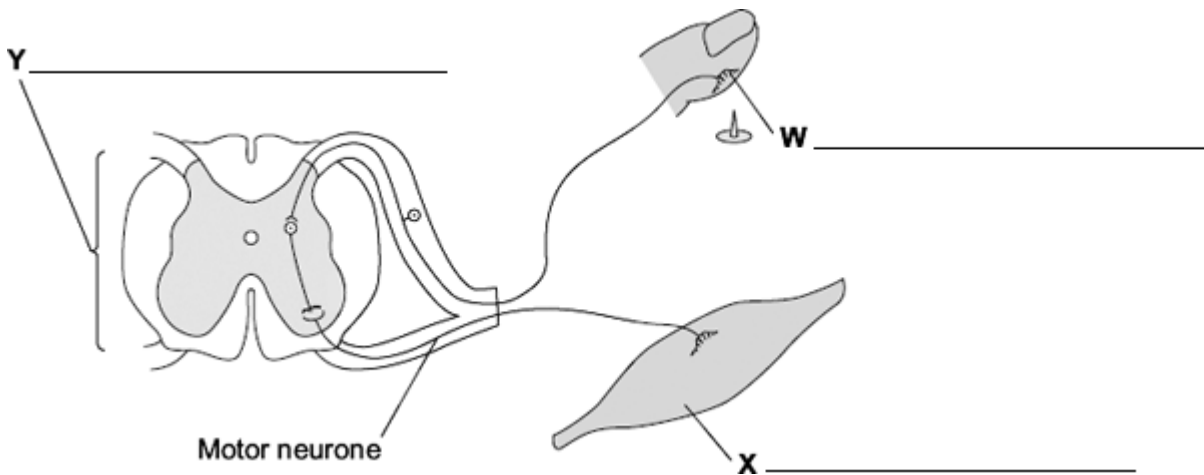
(c) Describe what happens at the synapse during this reflex.

(3)

(Total 7 marks)

Q35.

The diagram shows the structures involved in a reflex action.



(a) On the diagram, name the structures labelled **W**, **X** and **Y**.

(3)

(b) The control of blood sugar level is an example of an action controlled by

hormones.

Give **two** ways in which a reflex action is different from an action controlled by hormones.

1.

2.

(2)
(Total 5 marks)

Mark schemes

Q1.

- (a) releasing saliva when food enters the mouth 1
- withdrawing the hand from a sharp object 1
- (b) bright light 1
- allow described method of increasing light*
ignore light unqualified
allow correctly named drug e.g. morphine / heroin
- (c) iris 1
- (d) muscle contraction 1
- allow muscles shorten*
ignore radial / circular
ignore muscles relax / constrict
*do **not** accept muscles expand*
*do **not** accept ciliary muscle contracts*
- (e) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account. 4-6
- Level 1:** Facts, events or processes are identified and simply stated but their relevance is not clear. 1-3
- No relevant content** 0
- Indicative content**
- receptor detects stimulus
 - e.g. receptor detects pressure
 - receptor generates impulses / electrical signals
 - neurones conduct impulses / electrical signals
 - neurone A conducts impulses to spinal cord
 - neurone A = sensory neurone
 - synapse between neurones
 - chemical (/ neurotransmitter) crosses synapse
 - chemical stimulates impulse(s) in neurone B
 - neurone B = relay neurone
 - neurone C = motor neurone
 - effector carries out response

- e.g. muscles of the arm / leg contract
- muscles contract **or** gland secretes chemicals

to access **level 2**, candidates need to consider, in terms of the indicative content, the receptor, the neurones and the effector in the correct sequence

[11]

Q2.

- (a) 2400 **and** 2280
or
500 **and** 380

1

120

1

an answer of 120 scores 2 marks

- (b) respiration of glucose

1

- (c) (more) sweating

*ignore reference to vasodilation /
vasoconstriction*

1

(because) exercise releases heat

or

need to cool the body

or

need to lose heat

or

need to maintain body temperature

*do **not** accept energy being produced*

1

- (d) more energy needed

*do **not** accept energy production*

*do **not** accept energy needed for respiration*

1

(so) more (aerobic) respiration

1

(so) increased breathing (rate / depth) (to supply oxygen **or** remove carbon dioxide / water)

1

*'more' does not need to be stated a second time
to gain marking point 1 and marking point 2*

[8]

Q3.

- (a) times are very short / in milliseconds
or
milliseconds cannot be

- measured with a stopwatch 1
- (b) to increase validity / repeatability
or
 to get representative results
allow to give a more reliable mean value 1
- because of variation in results
allow to identify any anomalies 1
- (c) (they have included) 468 / the 7th result
allow identification of anomaly in the table 1
- (which) is anomalous / is a much higher value (than the others) 1
- (d) $\frac{275}{259}$
 1.06 (: 1)
an answer of 1.06 (: 1) scores 2 marks 1
allow max 1 mark if wrong number of sig. figs. 1
- (e) 2.59×10^{-1} seconds 1
- (f) any **two** from:
 • cannot compare mean to **B** as it has been incorrectly calculated
 • **C**'s mean reaction time is the longest, not the shortest
 • only measured one type of reaction
or
 • cannot generalise to all reaction types
 • other factors can influence reaction time
allow examples 2
- (g) involves (the conscious part of) the brain
allow voluntary (re)action 1
- [11]**

Q4.

- (a) red blood cell 1
- (b) 44 1
- (c) retina 1

(d) **7** and **8** / the parents
 do not have **A** (allele)
 or only have **a** (allele) or are **aa**
*allow converse – if parents had an **A** (allele) they would have Stickler syndrome*

1

so children cannot inherit **A**
 or can only inherit **a**

or

the parents show the recessive characteristic

so must be homozygous
 (recessive)

or must be **aa**
 or parents cannot have **A**

1

(e) parental genotypes:
12 = Aa and 18 = aa
 or parental gametes:
12 = A + a and 18 = a + a

1

derivation of offspring genotypes

allow ecf

1

identification of **Aa** offspring as Stickler

1

probability = $0.25 / \frac{1}{4} / 1 \text{ in } 4 / 25\% / 1:3$

*allow ecf – e.g. 0.5 if **12 = AA***

do not accept 3:1

do not accept 1:4

1

[9]

Q5.

(a) less sweating so less water loss

1

(as) no / little water available in desert

1

(b) (fat store) can be metabolised / respired to water

1

(little urine...) conserve water

1

(hard mouth) not damaged by spines on plants / on food

- or**
not damaged by hard / dry food 1
- (c) dromedary / *C.dromedarius*
and bactrian / *C. bactrianus*
no mark for the names, but must be identified
because
same genus
ignore 'both are Camelus' 1
- (d) any **two** from:
- the fossil record
 - oldest fossils in N. America
or
 - newer fossils in S. America / in Asia / in Africa
*allow numbers for ages (45 Mya **and** 3 Mya / 6 Mya)*
 - chemical / DNA analysis of living species
allow radioactive dating of fossils 2
- (e) isolation of separate camel populations by sea
or
by mountains 1
- habitat variation / described between populations
allow examples – biotic (e.g. food / predators) or abiotic 1
- genetic variation / mutation in each population 1
- 45 million years is sufficient time to accumulate enough mutations 1
- natural selection
or
better adapted survive to reproduce 1
- pass on favourable allele(s)
allow gene(s) 1

[14]

Q6.

- (a) any **two** from:
- drop the ruler from the same height
 - use the same / dominant hand each time
 - thumb same distance from ruler at the start
 - use same type / weight of ruler
 - drop the ruler without any force each time

- keep arm resting on the edge of the table 2
 - (b) 8 1
allow 8.0
 - (c) 2 (in test number 2) 1
 - (d) 12 1
 - (e) $(12 + 13 + 13 + 9 + 8 / 5 =) 11$ 1
 - (f) $0.15 - 0.12$ (s) 1
 0.03 (s) 1
allow 0.03 (s) with no working shown for 2 marks
 - (g) carry out more repeats 1
 - (h) caffeine speeds up reflex actions 1
or
reduces reaction time 1
- [10]**

Q7.

- (a) pupils dilated (at **B**) 1
allow converse for A
 - in dim light / low light levels 1
 - because circular muscles (in iris) relax 1
 - (and) radial muscles contract 1
 - (b) figure 2 shows myopia where light does not focus on the retina 1
allow refraction
 - in figure 3 the lens bends the light so that light focuses on the retina 1
- [6]**

Q8.

- (a) any **two** from:
- drop the ruler from the same height each time
 - let the ruler drop without using any force
 - same type / weight of ruler
 - thumb should be same distance from the ruler each time at the start
 - use the same hand to catch the ruler each time
 - carry out the experiment with the lower arm resting in the same way on the table
- allow description of holding bottom edge of ruler opposite the catcher's thumb*
- 2
- (b) 117
- 1
- (c) $\sqrt{\frac{11.6}{490}}$
- 1
- 0.1539
- allow 01539 with no working shown for 2 marks*
- 1
- 0.154
- allow 0.154 with no working shown for 3 marks*
- 1
- allow ecf as appropriate*
- (d) no indication beforehand when the colour will change
- or**
- you might be able to tell when the person is about to drop the ruler
- 1
- measurement of time is more precise (than reading from a ruler)
- or**
- resolution (of computer timer) is higher
- 1
- (e) cerebral cortex
- allow cerebrum*
- 1
- ignore identified lobes*
- (f) cerebellum
- 1

[10]

Q9.

- (a) (i) 2400 cm³
- 1
- (ii) 1400 (cm³)
- allow 2 marks for ecf of correct answer to [answer given in (a)(i) – 1000]*

allow 1 mark for 2400 – (600 + 400) or equivalent with no or incorrect answer

allow 1 mark for ecf of answer given in (a)(i) – 1000 or equivalent with no or incorrect answer

- 2
- (b) (i) sweat(ing)
 allow evaporation
 allow perspiration
1
- (ii) any **one** from:
 • for cooling
 • to maintain body temperature
1
- (c) (i) More water was lost through the skin.
1
- (ii) decrease
1
- [7]

Q10.

- (a) (i) receptor cells
1
- (ii) eye(s)
 accept retina
1
- (b) (i) any **one** from:
 • gender / sex
 • quality of eyesight
 eg wearing glasses
 • eg of factor that might affect reaction times
 eg alcohol consumption / distractions / tiredness / health /
 time of day / amount of practice (at this test)
 do not allow time / age
1
- (ii) 182
 allow 182.0
1
- (iii) Any anomalies can be identified.
1
- (iv) reaction time (too) long **or** reactions (too) slow
1
 allow reaction time (too) slow
 allow examples of data quoted **or** derived from the table, eg
 (mean) reaction time for 90 year olds is 162 ms longer than
 for 75 year olds

(so) more likely to have / cause an accident

1

[7]

Q11.

- (a) receptors detect / sense stimuli / change in surroundings **or** convert stimulus into an impulse

ignore send impulses to brain / spinal cord

1

example of a receptor

allow any appropriate organ or part of an organ, eg eye / retina or named type of receptor eg light receptor

1

effectors allow / make response **or** convert an impulse to an action

ignore receive impulses from brain / spinal cord

1

(effector) muscle / gland

allow an example

ignore eg arm / leg

1

- (b) (i) junction

allow idea of a (small) gap / space

*do **not** allow if implication is that the neurones move*

1

between neuron(e)s

allow named types of neurones

1

- (ii) chemical

allow answers in terms of specific types of neurone

allow neurotransmitter / named neurotransmitter released

1

any **one** from:

- (chemical released) from one neurone
ignore produced
- (chemical) passes (across synapse) to next neurone to stimulate / cause (electrical) impulse
allow diffuses for passes (across)

1

- (c) (i) skin

ignore hand / leg

1

- (ii) 1.6 (cm per millisecond)

allow 2 if evidence of rounding up of 1.6

1

- (iii) any **two** from:
- *ignore length of neurones*
 - *synapses slow down transmission / impulse*
allow idea of movement of chemical being slower than electrical impulse
 - *fewer synapses (via brain)*
*allow one synapse compared to two **or** only one synapse*
(therefore) fewer delays
 - *allow impulse travels more slowly in relay neurones*

2

[12]

Q12.

- (a) (i) The person started running a race.

1

- (ii) 2300

1

- (iii) drinking (water / sports drink)
or
through eating

1

- (b) (i) brain

1

- (ii) receptors

1

- (c) cools us down

allow evaporates

1

[6]

Q13.

blood vessels supplying skin

1

constrict

allow vasoconstriction
*do **not** allow capillaries /veins constricting*
*do **not** allow moving blood vessel*

1

less blood flow (to / through capillaries / to skin)

allow blood flows further away from skin surface

1

so less energy is lost (to the surroundings)

allow less heat is lost

1

'shivering' by muscle (contraction)

allow muscles contract (and relax) rapidly

1

releasing energy **or** respiring (more)

allow 'heat produced'

*do **not** allow energy produced / made*

*do **not** allow energy **for** respiration*

allow sweating stops / reduces

ignore hair erection

1

[6]

Q14.

(a) tissue → organ → organ system

one right for 1 mark

three right for 2 marks

2

(b) **Epithelial tissue** → covers the outside and the inside of the stomach

more than one line from a tissue = no mark

1

Glandular tissue → produces digestive juices

1

Muscular tissue → allows food to be churned around the stomach

1

(c) (i) light

ignore dark

1

(ii) moving (to the dark)

1

(iii) any **two** from:

- use more woodlice
- repeat the experiment
- run for a longer time

2

[9]

Q15.

(a) (i) stimulus

1

(ii) cytoplasm

1

(b) (i) ear(s)

in this order only

eye(s)
accept retina

1

skin
ignore extra detail

1

(ii) A muscle

1

1

[6]

Q16.

(a) detect changes in surroundings **or** detect stimuli
allow any named stimulus for skin

1

convert information to impulse
allow send impulse to sensory neurones / brain

1

(b) (i)

muscle	contract(ion)
gland	release / secrete / produce chemical / hormone / enzyme

1 mark for each effector

1 mark for each response

response must match type of effector (if given)

ignore examples

ignore relax(ation) / movement for contraction

*do **not** allow expansion for muscles*

4

(ii) any **one** from:

- (maintain temperature at which) enzymes work best
 - so chemical reactions are fast(est)
 - prevent damage to cells / enzymes
- allow prevent enzymes being denatured (by temperature being too high)*

1

[7]

Q17.

(a) (i) has the least amount of glucose

- 1
- 1
- 1
- 1
- 3
- 1
- 1
- 1
- 1
- 1
- 1

Q18.

- (a) (i) sensory neurone 1
- a synapse 1
- (ii) contract 1
- (iii) not connected to brain / coordinated only by spinal cord 1
- (iv) automatic / rapid (response) 1
- allow no thinking / faster / less time*
- protects body from danger / from damage / from burning 1
- (b) (i) caffeine decreases reaction time 1
- accept caffeine speeds up / quicker reactions*
- (ii) the two sets of results overlap (considerably) 1
- allow use of appropriate numbers – eg 5 of the ‘after’ results overlap with the ‘before’ results*
- allow ‘wide spread of results’*
- allow ‘it was just one person’ or ‘it was a small sample’*
- accept use of one pair of results only – if meaning is clear*
- accept use of one pair of overlapping results*
- (iii) any **two** sensible suggestions: eg 1
- more repetitions
 - perform investigation on several other people
 - use other (measured) amounts of coffee
 - use different / more time intervals
 - other suggested measure of reaction time – eg computer-generated light flash + time measurement
 - use pure caffeine or caffeine tablets
- 2

[10]

Q19.

Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also apply a ‘best-fit’ approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

There is a description of thermoregulation **or** at least one correct mechanism (skin, sweat glands or muscles) but roles may be confused.

Level 2 (3 – 4 marks)

There is a description of thermoregulation **or** some correct mechanisms (sweating, shivering, blood flow in the skin).

Level 3 (5 – 6 marks)

There is a clear description of thermoregulation by TC or skin **and** some correct control mechanisms.

examples of biology points made in the response:

full marks may be awarded for detailed description of what happens if the core temperature is either too high or too low

- temperature receptors in TC
- the TC detects (core) body / blood temperature
- temperature receptors in the skin send impulses to the TC, giving information about skin temperature
- if the core body temperature is too high: blood vessels / arterioles supplying the skin capillaries dilate / vasodilation

***do not** accept refs to veins instead of arterioles or answers that imply blood vessels have moved up / down through the skin.*

- so that more blood flows (through the skin) and more heat is lost
- sweat glands release more sweat to cool the body
- by evaporation
- if the core body temperature is too low: blood vessels supplying the skin capillaries constrict
- to reduce the flow of blood (through the skin) and less heat is lost
- *allow idea of blood diverted to vital organs in extreme cold*
- muscles may shiver to release (heat) energy
- from respiration, some of which is lost as heat

[6]

Q20.

(a) (i) 400

correct answer = 2 marks with or without working

$$2600 - (1500 + 600 + 100)$$

or

$$2600 - 2200$$

for 1 mark

2

(ii) LHS: glucose

accept $C_6H_{12}O_6$ / $C6H12O6$ / sugar

1

RHS: carbon dioxide

accept CO_2 / $CO2$

*do **not** accept CO^2 / CO*

1

- (iii) (sweat) increase 1
- (urine) decrease 1
- (b) (i) $66.7 / 66.67 / 66\% / \overset{\cdot}{66.6} / 67$
accept answers in range
*correct answer = 2 marks with **or** without working*
or
 $\frac{20}{0.3}$ for 1 mark
- or $66 / 66.6 / 66.66 / 66.\overset{\cdot}{6} / 67.0$ for 1 mark*
(penalise excessive number of sig. figs. –1 mark) (eg no more than 2 decimal places) 2
- (ii) reabsorption of water by the kidney 1
- (iii) (protein) (too) big 1
- cannot pass through filter / stays in blood / cannot enter kidney tubule 1
- (glucose) small / can pass through filter 1
- all taken back into blood / all reabsorbed
allow the glucose is reabsorbed 1
- (c) any **four** from:
- transplant is permanent / dialysis is repetitive treatment / dialysis only short term
 - kidney works all the time / dialysis intermittent
 - concentrations in blood kept (\pm) constant / substances build up in blood between dialysis sessions
 - poisoning / damage to body by build-up of substances (with dialysis)
 - danger of infection / damage to blood vessels by needles (with dialysis)
 - risk of blood clots with dialysis or anticlotting drugs (can lead to blood loss)
 - long term expense of dialysis / excessive use of health service resources
 - social point – inconvenience of dialysis described – can eat or drink without constraint with transplant

4

[17]

Q21.

- (a) sensory neurone 1
- (b) (i) synapse 1
- (ii) a chemical 1
- (c) (What happens to the muscle)
mark both parts of the question together
- any **one** from:
- contraction / contracts
ignore relaxation / relaxes / tenses 1
 - gets shorter
- (How this helps the body)
- idea of protection for body (from damage / pain)
eg moves finger / arm away (from pin / stimulus / source of pain)

[5]

Q22.

- (a) motor
allow efferent / postsynaptic
*allow **another** relay (neurone)* 1
- (b) release of chemical (from relay neurone)
allow ecf for 'motor' neurone from (a)
allow release of neurotransmitter / named example 1
- chemical crosses gap / junction / synapse
allow diffuses across
allow chemical moves to X 1
- chemical attaches to X / motor / next neurone (causing impulse) 1
- (c) (curare) decrease / no contraction
accept (muscle) relaxes 1
- (strychnine) increase / more contraction
*if no other mark awarded allow 1 mark for (curare) decrease / no response **and** (strychnine) increase / more response* 1

[6]

Q23.

(a) brain

in correct order only

1

blood

1

sweat

1

(b) (i) A

1

(ii) to replace ions lost (in sweat)

accept salts

allow named examples, eg. prevent cramps

1

(iii) any **one** from:

- there is too much glucose / sugar in the sports drink
- they shouldn't have too much glucose / blood sugar
- it would cause their blood glucose / sugar to rise (too high)

1

[6]

Q24.

(a) (i) 1 hour 15 mins / 1.25 hours / 75 mins

allow 1:15

ignore 1.15 hours

1

(ii) increase in (core / body) temperature

ignore numbers

1

(due to an) increase in respiration **or** more muscle contraction

1

releasing energy (as a waste product)

allow produces 'heat'

*do **not** allow making energy*

1

skin temperature decreases

1

(because there is) sweating

1

(which) evaporates and cools the skin

	1
<p style="text-align: center;"><i>ignore references to vasodilation or vasoconstriction</i></p> <p>(iii) (there is) dilation of vessels (supplying skin capillaries)</p> <p style="padding-left: 40px;"><i>allow vasodilation</i></p> <p style="padding-left: 40px;"><i>allow blood vessels widen</i></p> <p style="padding-left: 40px;"><i>ignore expand</i></p> <p style="padding-left: 40px;"><i>do not accept dilating capillaries or moving vessels</i></p>	1
<p style="padding-left: 40px;">(so) more blood flows (near skin) (surface) or blood is closer (to the skin)</p> <p style="padding-left: 80px;"><i>ignore ref to heat</i></p>	1
<p>(c) pancreas detects (low) blood glucose</p>	1
<p>produces glucagon</p> <p style="padding-left: 40px;"><i>do not allow glucagon made in the liver</i></p>	1
<p>(so) glycogen is converted to glucose</p> <p style="padding-left: 40px;"><i>allow adrenaline released which increases conversion of glycogen to glucose</i></p> <p style="padding-left: 40px;">or</p> <p style="padding-left: 40px;"><i>reduced insulin production so less glucose into cells / less glucose converted to glycogen</i></p> <p style="padding-left: 40px;"><i>for 1 mark</i></p>	1
	[12]
 Q25.	
<p>(a) (i) skin</p>	1
<p style="padding-left: 40px;">(ii) kidneys</p> <p style="padding-left: 80px;"><i>accept kidney</i></p>	1
<p style="padding-left: 40px;">(iii) lungs</p> <p style="padding-left: 80px;"><i>accept lung</i></p>	1
<p>(b) (i) multiply temperature by number of students at that temperature and add them up</p> <p style="padding-left: 40px;"><i>allow (36.8 5) + (36.9 3) + (37.0 6) + (37.1 7) + (37.2 3)</i></p> <p style="padding-left: 40px;"><i>allow 888</i></p>	1
<p style="padding-left: 40px;">divide by number of students</p> <p style="padding-left: 80px;"><i>allow divide by 24</i></p>	1

(ii) 10 / ten 1

(iii) so enzymes work (well)
ignore death / overheating / hypothermia
allow body reactions work (well) 1

[7]

Q26.

(a) **A** sperm 1

B egg 1

C fertilised egg 1

D embryo 1

(b) insert into mother
ignore fertilise / check fertilisation / check viability 1

womb / uterus 1

(c) (i) one quarter 1

(ii) no / little chance of success over 42 1

reference to table of only two women in the age bracket 40-42 years became pregnant

the statement 'only 2 out of 53 40-42 year old women became pregnant / had babies' gains 2 marks

1

(iii) so fewer twins / multiple births
or
 multiple births more dangerous 1

[10]

Q27.

(a) **A** sensory (neurone)
ignore nerve 1

B motor (neurone)
ignore nerve

		1
	C spinal cord / central nervous system / white matter <i>accept grey matter</i>	1
	(b) by chemical / substance <i>allow transmitter</i>	1
	(c) muscle <i>allow extensor</i> <i>ignore muscle names</i>	1
		[5]
Q28.		
	(a) (i) cerebral cortex <i>accept cerebrum / cerebral hemisphere</i>	1
	(ii) MRI (scan) <i>allow CAT / CT scan</i> <i>do not accept MIR</i>	
	or	
	electrode stimulation <i>allow electrical stimulation</i>	1
	(b) (i) sharp point stimulates (pain) receptor (in the skin) <i>must be in correct order</i>	1
	to send (nerve) impulse <i>ignore information and messages</i>	1
	via sensory neurone	1
	to spinal cord <i>do not accept spine, ignore CNS</i>	1
	crosses synapse <i>allow synapse in any correct context</i>	1
	to other (relay) neurones / to brain <i>do not accept motor neurone</i> <i>allow explanation in a flow diagram</i>	1

- (ii) damage must be between arms and legs / below arms
accept below the waist

1

since information from nerves in arms still reaches the brain / information from the legs doesn't reach the brain

1

[10]

Q29.

- (a) any **three** from:

- streamlined shape enables it to swim quickly (to catch fish)
- wings (provide power) to move quickly (to catch fish)
allow 'flippers'
- wings used for steering
- white underside / dark top acts as camouflage (so prey less likely to see it)
- long / sharp beak to catch fish

3

- (b) any **three** from:

- reduces (total) surface area of penguins exposed to wind / cold atmosphere
- reduced number of penguins exposed (to wind / cold)
accept reference to movement in or out of the huddle
accept outer ones insulate / act as barrier
- reducing heat loss
allow reduced cooling
- 'share' body warmth / heat

3

- (c) (i) any **two** from:

- size of tubes
- volume of (hot) water
accept amount of (hot) water
- left for same length of time
allow measured at same time intervals
- starting temperature

2

- (ii) any **two** from:

- tube alone (**C**) lost heat most (rapidly)
- tube **B** intermediate
- tube **A** least (rapidly)
allow correct use of figures for all 3 tubes
ignore just quoting final temperature

2

- (iii) confirms suggestion

no mark awarded

accept correct answers referring to other suggestions in (b)

since (both outer and inner) tubes in bundle lost heat less rapidly (than 'stand – alone' tube)
comparison needed

1

penguins in a huddle lose less heat (than single ones)
accept 'it is the same for penguins'

1

(d) **if the core body temperature is too high**

blood vessels supplying the skin (capillaries) dilate / widen
*accept reference to arteries / arterioles but **not** veins / capillaries*
*do **not** accept references to movement of blood vessels*
ignore enlarge / expand
reference to skin / surface required only once

1

so that more blood flows through the (capillaries) in skin / near surface
reference to 'more' needed at least once to gain 2 marks

1

and more heat is lost
reference to 'more' needed at least once to gain 2 marks

1

if the core body temperature is too low

blood vessels supplying the skin (capillaries) constrict / narrow
allow full marks if 'too low' given first
if no other marks awarded, allow vasodilation when too warm
***and** vasoconstriction when too cold for 1 mark*

1

(e) (i) wings move to provide movement for diving
allow muscles contract / work

1

energy (for movement) comes from respiration
*do **not** allow produces / makes / creates energy*
allow energy comes from / is supplied by / is released by respiration

1

respiration / muscle contraction also releases heat
allow produces heat

1

(ii) any **three** from:

- feet not / less used **or** no muscle contraction in feet
allow little energy / heat released through respiration in feet
*do **not** allow veins / capillaries*

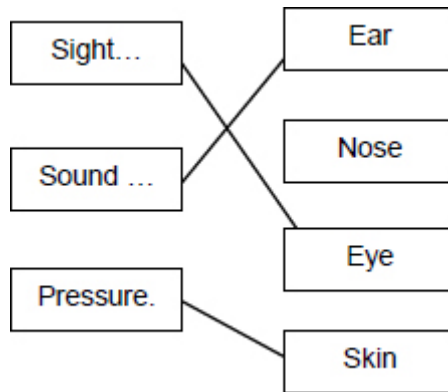
- vessels supplying feet constrict / less blood to feet
- so temperature in feet cools / decreases
- more heat loss from large surface area or rapid flow of cold water over foot

3

[22]

Q30.

(a) (i)



1 mark for each line

do **not** award a mark for a 'change' that has two lines

3

(ii) receptor cells

1

(b) used to provide (extra) energy

allow (more) used in respiration

allow suitable reference to muscles

do **not** accept used for sweat

1

(c) (i) growth of muscles

1

(ii) (these drugs have) possible side / harmful effects

or

answers that refer to 'fairness of competition' e.g. cheating

1

[7]

Q31.

(a) **A** cytoplasm

in this order only

1

B (cell) membrane

do **not** accept (cell) wall

1

(b) (i) synapse

- 1
- (ii) (as) chemical
accept neurotransmitter or named
ignore references to how the chemical is passed
*do **not** accept electrical*
- 1
- (c) (from light-sensitive cell to connecting neurone) to sensory neurone
ignore references to synapses accept 'nerve cell' for
neuron(e) throughout penalise 'nerve' for neurone once only
- 1
- (sensory neurone) to brain / CNS
allow (sensory neurone) to relay neurone / spinal cord
- 1
- (brain / CNS) to motor neurone
allow (relay neurone / spinal cord) to motor neurone
- 1
- (motor neurone) to (eyelid) muscle
ignore effector
- 1

[8]

Q32.

- (a) if body temperature too high blood vessels supplying skin (capillaries) dilate / widen
*do **not** accept capillaries / veins dilate/constrict*
- 1
- if body temperature is too low blood vessels supplying skin (capillaries)
 constrict / narrow
*do **not** accept idea of blood vessels moving (through skin)*
- 1
- ignore expand*
accept arteries / arterioles for 'blood vessels'
if no reference to skin allow blood vessels dilate and blood
vessels constrict for one mark
- so more / less blood flows through skin (capillaries) or nearerer the surface of
 the skin
must correctly relate to dilation or constriction
- 1
- so more / less heat is lost (from the skin by radiation)
must correctly relate to dilation or constriction
- 1
- (b) sweat released
- 1
- cannot evaporate because of high humidity / all the water vapour in the air

1

so less heat lost / less cooling

or

it is evaporation of sweat that cools the body

1

[7]

Q33.

(a) (i) addictive

allow addicting / addict / addicted / addiction or similar
allow phonetic spelling
*do **not** accept / additive / addition*

1

(ii) junction / gap / space between neurones

allow nerve cells / nerves for neurones
allow idea where neurones /
nerve cells / nerves meet / join

1

(b) (i) tablet with no drug

accept answers that convey this idea eg fake / dummy /
sugar pill
allow injection with no drug
ignore drugs that don't work.

1

(ii) for comparison

accept to see if drug / it works
*allow to see psychological effect **or** make sure, it is not all in*
the mind
allow as a control
ignore 'to make test fair / unbiased'

1

(iii) Neither doctors nor volunteers

1

(iv) any **two** from:

- age (range)
- sex / gender (mix)
- previous smoking habits **or** eg number smoked (before trial)
or length of time smoked
- number in the group
- other drugs being taken **or** general health **or** height / weight /

BMI / lifestyle / fitness

ignore factors already controlled

*ignore reference to all smokers **or** all want to give up*

2

- (c) higher percentage / number of smokers who had stopped smoking (than Drug B)

answers must refer to data and be comparative

allow best results / most effective

ignore best drug unqualified

ignore references to 12 weeks / 1 year

1

[8]

Q34.

- (a) *ignore nerve / neuron(e) throughout*

A sensory

accept afferent

1

B motor

accept efferent

1

C relay

accept intermediate

1

- (b) stretch

allow pressure / pull / tension (in muscle)

*allow a hit at (point) **P***

ignore pain

1

- (c) any **three** from:

- chemical (release)

accept neurotransmitter / acetylcholine

- diffuses (across the gap / synapse)

- transmits impulse / information (across synapse)

allow transmits signal / message

- between neurones / nerve cells / named

*if named, must be either sensory / A to relay / C **or** relay / C to motor / B*

allow 'to the next neurone'

3

[7]

Q35.

(a) Y - spinal cord / central nervous system / CNS

*do **not** accept spine*

ignore nerve / nervous system / coordinator

ignore grey / white matter

1

W - receptor / nerve ending

ignore sensory / neurone / stimulus

1

X - effector / muscle

allow gland

1

(b) any **two** from: eg

accept reverse argument for each marking point

- reflex action quicker
- effect of reflex action over shorter period
- hormone involves blood system and reflex involves neurones / nerve cells
ignore nervous system / nerves
- reflex involves impulses and hormone involves chemicals
- reflex action affects only one part of the body
ignore involves brain
ignore outside / inside stimuli

2

[5]

Q1.

A group of students is going on an outdoor expedition.
The students need to keep warm in windy conditions.

The table shows the effect of wind speed on how quickly someone gets frostbite at different air temperatures.

Wind speed in metres per second	Air temperature in °C				
	10	0	-10	-20	-30
0					
5					
10					
15					

20			
----	--	--	--

Key

Time taken to get frostbite:

- No frostbite
- 30 minutes
- 10 minutes
- 5 minutes

- (a) (i) Describe the effect of changing air temperature on the time taken to get frostbite.

(1)

- (ii) What is the longest time it is safe to stay outside when the air temperature is – 20 °C and the wind speed is 10 metres per second?

_____ minutes

(1)

- (b) When core body temperature begins to fall, changes may happen in the body.

Which **two** changes will happen when core body temperature begins to fall?

Tick (✓) **two** boxes.

More blood flows through skin capillaries

Muscles 'shiver'

Blood vessels supplying the skin capillaries constrict

Sweat glands release more sweat

(2)

(Total 4 marks)

Q2.

The nervous system allows humans to react to their surroundings.

- (a) Sense organs have receptors. Receptors detect *changes in the environment*.

Which word describes *a change in the environment*?

Draw a ring around **one** answer.

an effector a neurone a stimulus

(1)

- (b) The photograph shows a baby.
Labels **A**, **B**, **C**, **D** and **E** show some of the baby's sense organs.

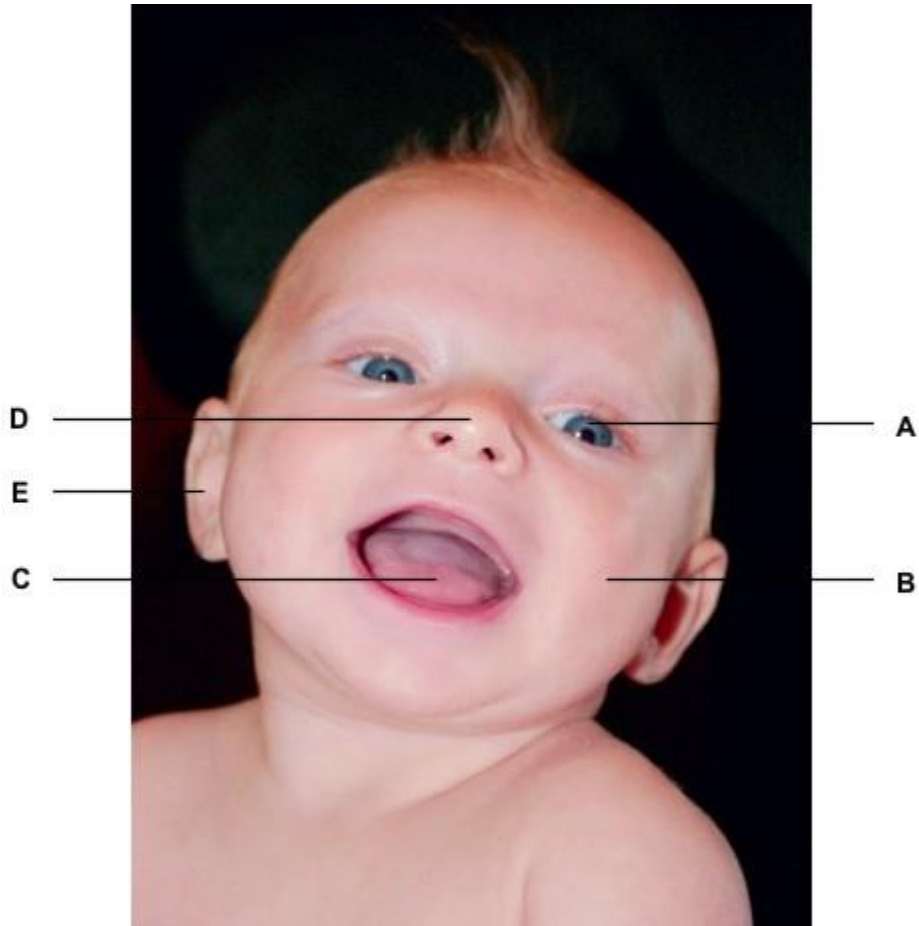


Photo by D. Sharon Pruitt [CC-BY-2.0], via Wikimedia Commons

Answer each question by writing **one** letter, **A**, **B**, **C**, **D** or **E**, in each box.

- (i) Which sense organ has receptors sensitive to light?

(1)

- (ii) Which **two** sense organs have receptors sensitive to chemicals?

 and

(2)

- (iii) Which sense organ has receptors sensitive to changes in the baby's position?



(1)

- (c) Information from sense organ **A** is passed along nerve cells. The information is coordinated to produce a response.

Which organ in the body coordinates the information?

(1)

(Total 6 marks)

Q3.

- (a) **List A** gives the names of three stages in trialling a new drug.

List B gives information about the three stages.

Draw a line from each stage in **List A** to the correct information in **List B**.

**List A
Stage**

**List B
Information**

Tests on humans including a placebo

Used to find if the drug is toxic

Tests on humans using very small quantities of the drug

The first stage in the clinical trials of the drug

Tests on animals

Used to find the optimum dose of the drug

Used to prove that the drug is effective on humans

(3)

- (b) Read the passage.

Daily coffee dose delays development of Alzheimer's in humans.

Alzheimer's is a brain disease that causes memory loss in elderly people. Scientists studied 56 mice that had been genetically engineered to develop Alzheimer's.

Before treatment all the mice did badly in memory tests.

Half the mice were given a daily dose of caffeine in their drinking water. The dose was equivalent to the amount of caffeine in six cups of coffee for a human.

The other mice were given ordinary water.

After two months, the caffeine-drinking mice did better in memory tests than the mice drinking ordinary water.

The headline for the passage is not justified.

Explain why as fully as possible.

(3)

(Total 6 marks)

Q4.

One group of scientists is working in a hot desert and another group is working in a tropical rainforest.

The table shows information about the scientists and the conditions in the desert and the rainforest.

Information	Hot desert	Rainforest
Mean core body temperature of scientists in °C	37.3	38.9

Air temperature in °C	36.0	35.5
Mean percentage concentration of moisture in the air	9.0	92.0
Mean wind speed at ground level in metres per second	12.0	3.0

- (a) Both groups of scientists are doing similar jobs. The jobs cause the scientists to sweat a lot.

Use information from the table to explain the difference in the mean core body temperature of the two groups of scientists.

(2)

- (b) Changes to blood vessels in the skin help to decrease body temperature.

Explain how.

(2)

(Total 4 marks)

Q5.

The temperature in a sauna is much hotter than core body temperature.

A woman sits in a sauna.

The high temperature of the sauna causes the woman's core body temperature to rise.

- (a) When the woman's core body temperature rises, the woman's rate of sweating increases.

Explain why.

(2)

- (b) The woman comes out of the sauna.
The woman's skin looks redder than when she went into the sauna.

Describe what happened to the blood circulation in her skin to cause this change in colour.

(2)

- (c) After coming out of the sauna the woman gets into a bath of icy water.
This makes the woman shiver.

- (i) What process brings about shivering?

(1)

- (ii) Shivering increases body temperature.

Explain how.

(2)

(Total 7 marks)

Q6.

The photograph shows a new-born baby.



By SCA Svenska Cellulosa Aktiebolaget [CC-BY-2.0], via Wikimedia Commons

- (a) New-born babies have reflex actions. The reflex actions help new-born babies to survive.

Draw a line from each reflex action to the way in which it helps the baby to survive.

Reflex action	How the reflex action helps the baby
If milk goes down the baby's windpipe the baby coughs	Helps the baby to hold on to the mother
If the mother touches the palm of the baby's hand, the baby clenches its fist.	Prevents the baby from choking
If the mother strokes the baby's mouth, the baby begins to suck.	Helps to protect some of the baby's receptors
If a bright light shines on the baby, the baby's eyes shut.	Helps the baby to crawl
	Helps the baby to feed

(4)

- (b) Which **two** of the following may be effectors in reflex actions?

Tick (✓) **two** boxes.

Brain

Glands

Motor neurones

Muscles

Sensory neurones

(2)
(Total 6 marks)

Q7.

Caffeine is a *recreational* drug found in drinks such as coffee and cola.

(a) What is meant by a *recreational drug*?

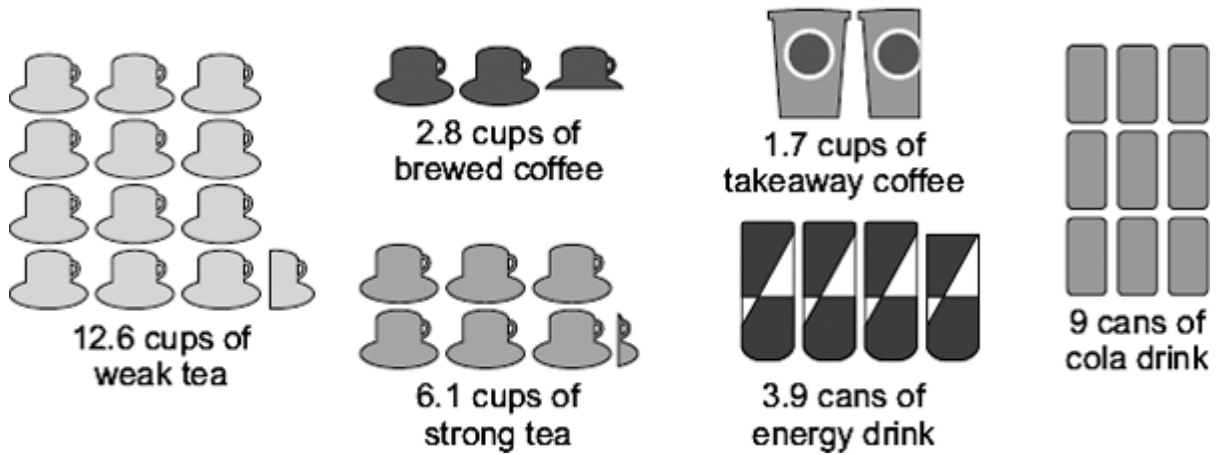
(1)

(b) Scientists investigated the effect on the brain of drinking large amounts of caffeine.

They chose students whose drinks contained caffeine equal to at least seven cups of instant coffee each day.

The diagram compares the amount of caffeine in different drinks.

Seven cups of instant coffee a day equals:



- (i) Seven cups of instant coffee contain 315 mg of caffeine.
 How much caffeine is there in **one** cup of instant coffee?

_____ mg

(1)

- (ii) Which drink in the diagram contains the highest amount of caffeine?
 Tick (✓) **one** box.

A cup of weak tea	<input type="checkbox"/>
A cup of takeaway coffee	<input type="checkbox"/>
A can of cola	<input type="checkbox"/>

(1)

- (c) Caffeine may cause hallucinations.

One example of a hallucination is hearing voices that are not there.

The scientists found that students who drank more than seven cups of instant coffee per day were three times more likely to have hallucinations than students who drank one cup or less.

Which is the best conclusion?

Tick (✓) **one** box.

Drinking caffeine causes hallucinations.

It is dangerous to drink caffeine.

There is a link between drinking caffeine and hallucinations.

(1)
(Total 4 marks)

Q8.

A walker falls through thin ice into very cold water.



The walker's core body temperature falls. He may die of hypothermia (when core body temperature falls too low).

(a) (i) Which part of the brain monitors the fall in core body temperature?

(1)

(ii) How does this part of the brain detect the fall in core body temperature?

(2)

(b) While in the water the walker begins to shiver.

Shivering helps to stop the core body temperature falling too quickly.

Explain how.

(2)

- (c) The walker had been drinking alcohol.

Alcohol causes changes to the blood vessels supplying the skin capillaries, making the skin look red.

- (i) Describe the change to the blood vessels.

(1)

- (ii) The walker is much more likely to die of hypothermia than someone who has not been drinking alcohol.

Explain why.

(2)

(Total 8 marks)

Q9.

Conditions inside the body must be kept constant.

- (a) Urea must be removed from the body.

- (i) Name the organ which makes urea.

(1)

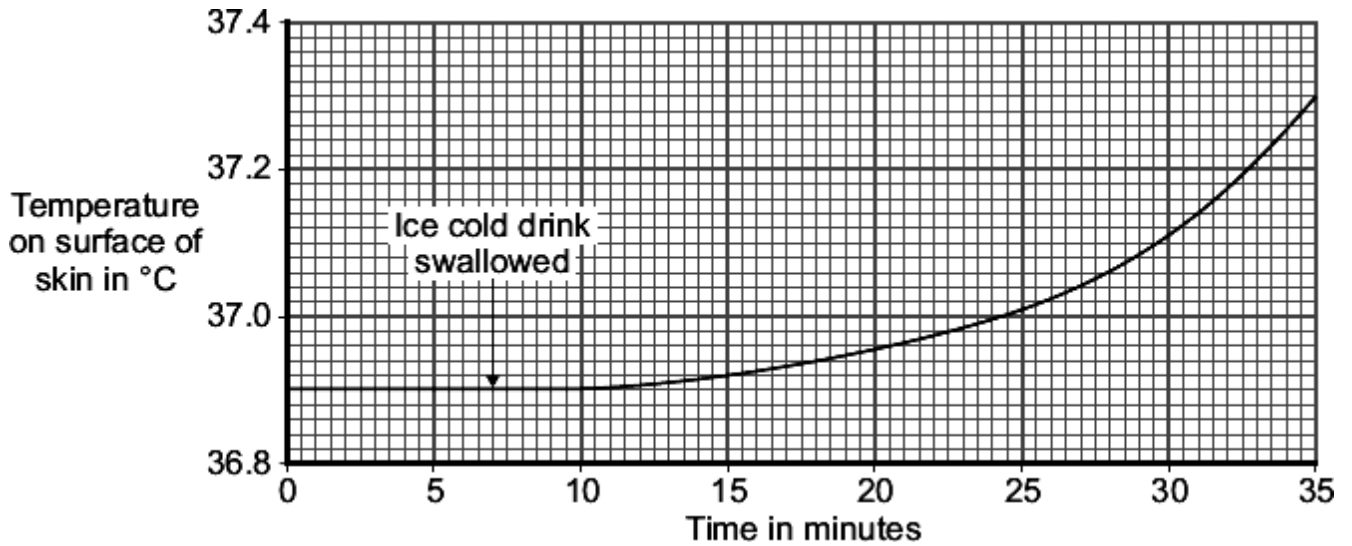
- (ii) Which organ removes urea from the body?

(1)

- (iii) What is urea made from?

(1)

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



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

Explain how.

(2)

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

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

(1)

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

(1)
(Total 7 marks)

Q10.

The photograph shows a girl waiting to cross a road.



© Lionel Lassman

- (a) Name **two** different sense organs she would use to detect when it is safe to cross the road.

1. _____

2. _____

(2)

- (b) Which sense organ contains receptors that help the girl to keep her balance?

(1)

- (c) (i) Complete the sentence.

A car driver automatically brakes if a child dashes out into the road.

This is called a _____ action.

(1)

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

In the nervous system, information passes along cells called

effectors
neurones
synapses

(1)

Q11.

Reflex actions are rapid and automatic.

(a) Name the following structures in a reflex action.

(i) The structure that detects the stimulus.

_____ (1)

(ii) The neurone that carries impulses to the central nervous system.

_____ (1)

(iii) The neurone that carries impulses away from the central nervous system.

_____ (1)

(iv) The structure that brings about the response.

_____ (1)

(b) Describe what happens at a synapse when an impulse arrives.

_____ (2)

(c) Some people have a condition in which information from the skin does not reach the brain.

Explain why this is dangerous for the person.

(2)
(Total 8 marks)

Q12.

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

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

(1)

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

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

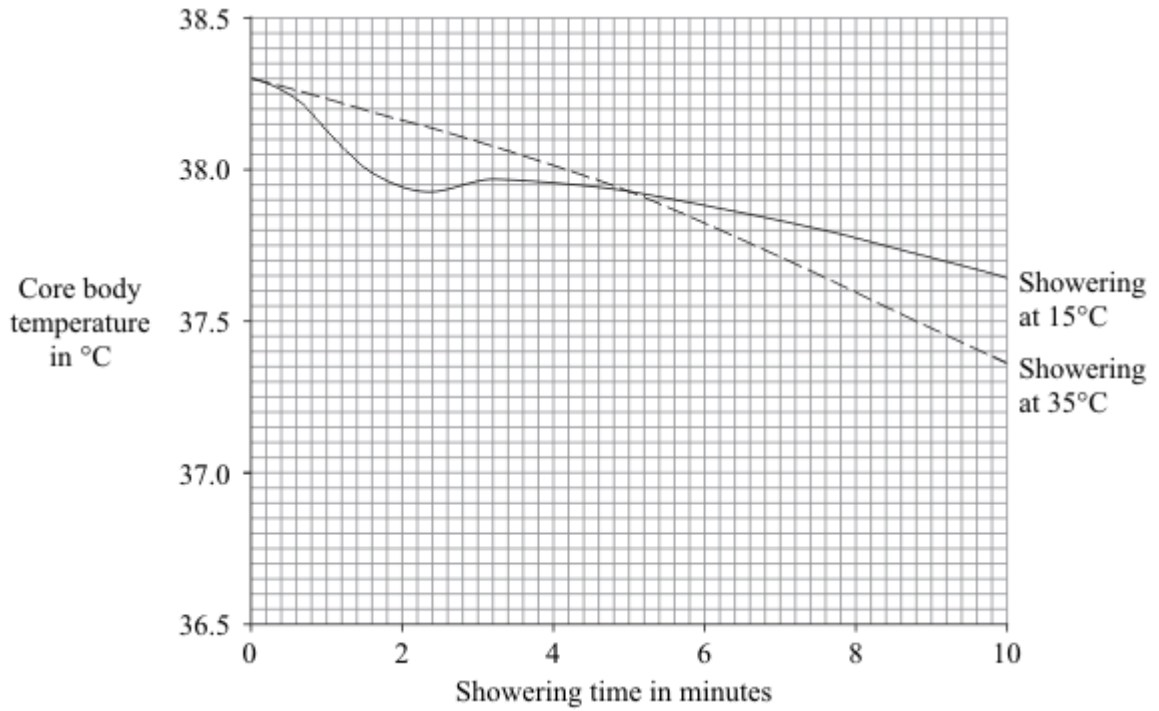
Explain why.

(2)

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

(2)

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



Suggest an explanation for the differences in core body temperature:

- (i) between 0 and 2 minutes

(1)

- (ii) between 4 and 10 minutes.

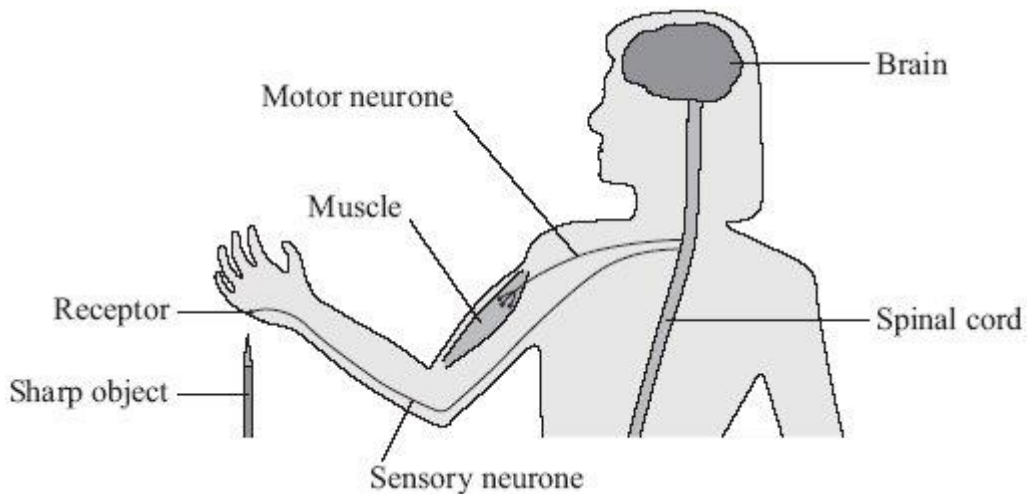
(2)

(Total 8 marks)

Q13.

A student accidentally touches a sharp object.
Her hand is immediately pulled away from the object.

The diagram shows the structures involved in this response.



(a) Use the correct word or phrase **from the diagram** to complete each sentence.

- (i) The stimulus is detected by the _____ (1)
- (ii) Impulses travel to the central nervous system along a cell called a _____ (1)
- (iii) Impulses travel from the central nervous system to the effector along a cell called a _____ (1)
- (iv) The hand is pulled away from the sharp object by the _____ (1)

(b) Where in the body are there cells sensitive to:

- (i) light _____ (1)
- (ii) sound _____ (1)
- (iii) changes in position? _____ (1)

(Total 7 marks)

Q14.

(a) Use words from the box to complete the sentences about controlling conditions in our bodies.

kidneys	liver	lungs	skin
----------------	--------------	--------------	-------------

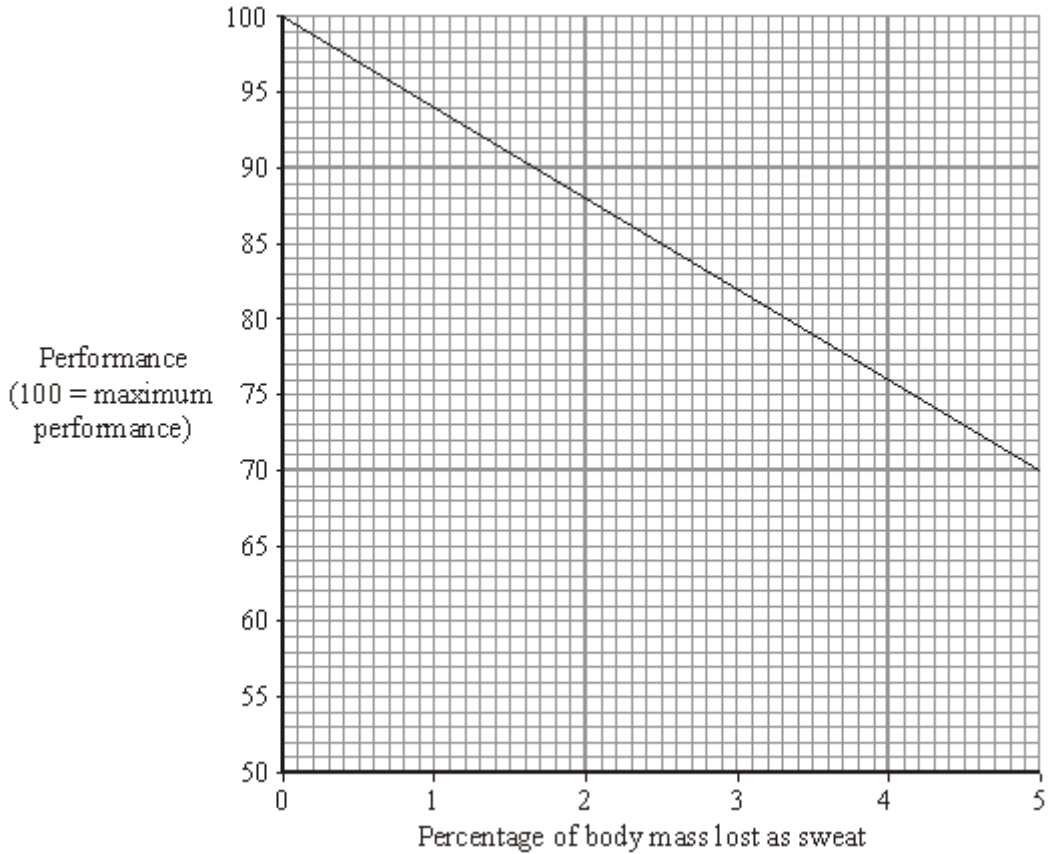
(i) When we breathe out, water leaves the _____ (1)

(ii) When we sweat, water leaves the body through the _____ (1)

(iii) Excess water leaves the body in a liquid called urine.
 Urine is produced by the _____ (1)

(b) We lose a lot of sweat during exercise. When this happens, we cannot perform as well as we could at the start of the exercise.

The graph shows the effect of losing sweat on the performance of an athlete.



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

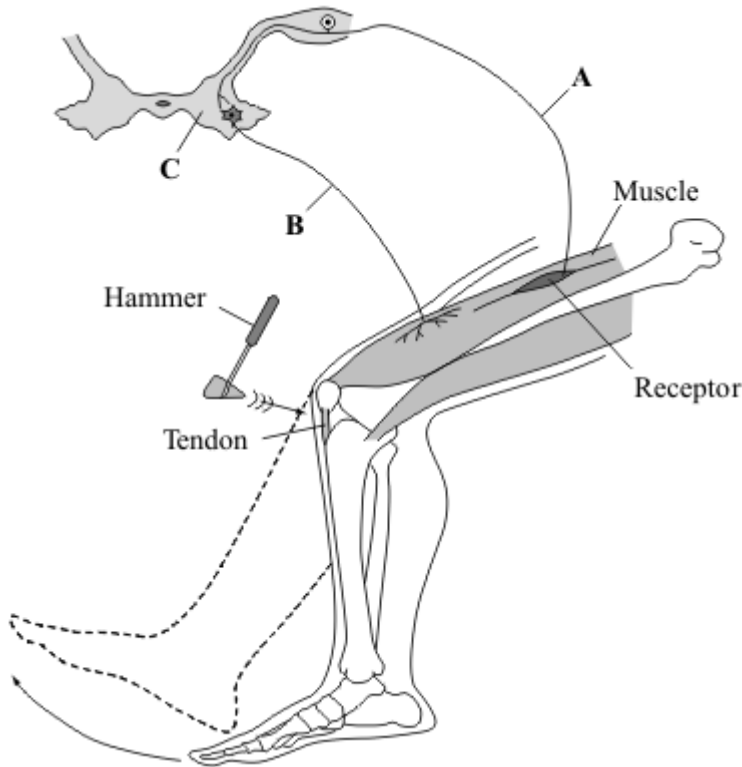
(1)

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

(1)
(Total 5 marks)

Q15.

The diagram shows the structures involved in the knee-jerk reflex. When the tendon is struck with the hammer, the receptor is stimulated and the lower leg moves forward.



(a) Name the structures labelled **A**, **B** and **C**.

A _____

B _____

C _____

(3)

(b) How is information passed from structure **A** to structure **B**?

(1)

(c) What is the effector in this response?

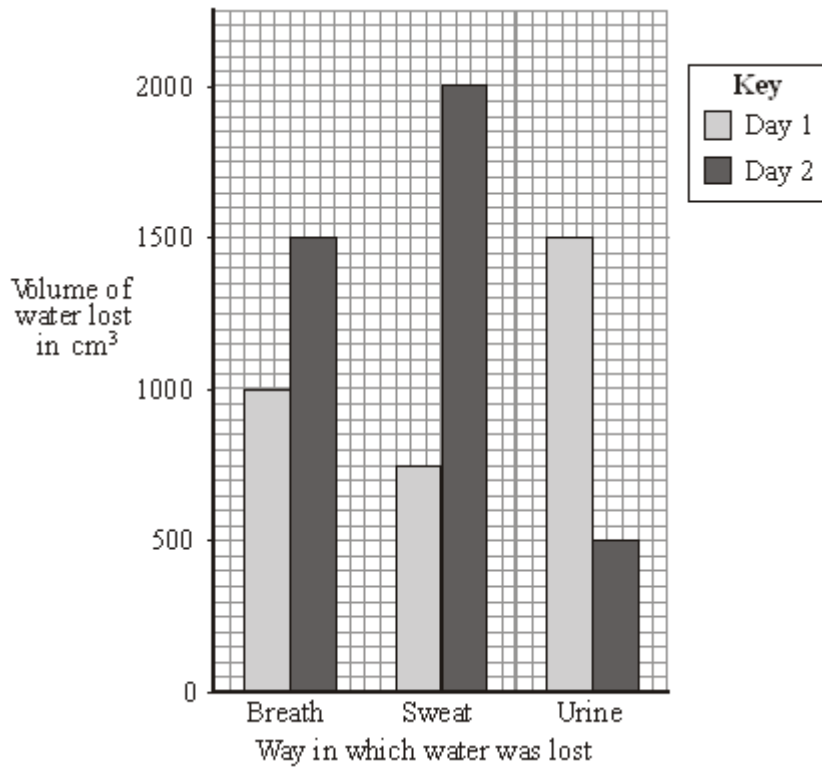
(1)

(Total 5 marks)

Q16.

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 cm³.

How much water was lost on day 2? Show all your working.

_____ cm³

(2)

(b) The student did much more exercise on one of the days than on the other.

On which day did he do more exercise? Day _____

Give **two** reasons for your answer.

1. _____

2. _____

(2)

- (c) (i) Which **one** of these is a chemical reaction that produces water in the body?

Put a tick (✓) in the box next to your choice.

Breathing

Osmosis

Respiration

Sweating

(1)

- (ii) How does sweating help the body?

(1)

- (iii) If the body loses more water than it gains, it becomes dehydrated. The concentration of the solution surrounding the body cells increases. This causes the cells to lose water.

By which process do cells lose water?

Put a tick (✓) in the box next to your choice.

Breathing

Osmosis

Respiration

Sweating

(1)

(Total 7 marks)

Q17.

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

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

- (i) The brain

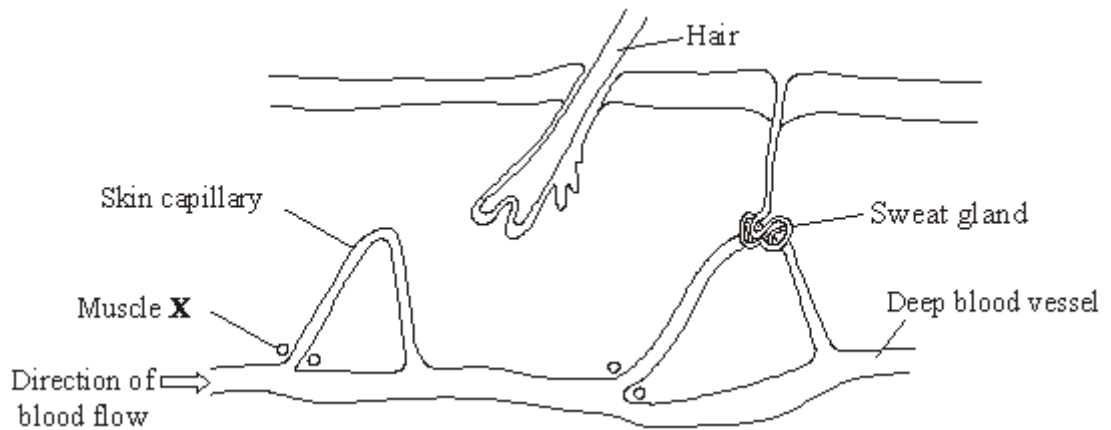
(2)

(ii) The skin

(1)

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

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



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

(3)

(Total 6 marks)

Q18.

The drawing shows a group of people in a café.



(a) Use words from the box to answer the questions.

brain eye nose skin tongue

Which organ contains receptors that allow a person to:

- (i) read the newspaper _____ (1)
- (ii) smell the coffee _____ (1)
- (iii) feel how hot the cup is _____ (1)
- (iv) taste the coffee? _____ (1)

(b) A cigarette manufacturer increased the amount of nicotine in cigarettes by 11% between 1997 and 2006. The manufacturer did not tell the public about this change.

- (i) Suggest **one** reason why the manufacturer increased the amount of nicotine in the cigarettes.

 _____ (1)
- (ii) Suggest **one** reason why the manufacturer did not tell the public about the change.

 _____ (1)

(1)
(Total 6 marks)

Q19.

The volume of water that the body loses must balance the volume of water that it gains.

Tables 1 and **2** show losses and gains of water by the body in one day.

Table 1
Losses of water by the body

Method	Volume in cm ³
breathing	300
sweating	600
faeces	
urine	100
Total	2400

Table 2
Gains of water by the body

Method	Volume in cm ³
drinking	1300
food	800
chemical reactions	300
Total	2400

- (a) (i) Calculate the volume of urine lost by the body.

Show clearly how you work out your answer.

Volume of urine lost by the body = _____ cm³

(2)

- (ii) What proportion of water gained by the body comes from food?

Put a tick (✓) in the box next to your choice.

$\frac{1}{4}$

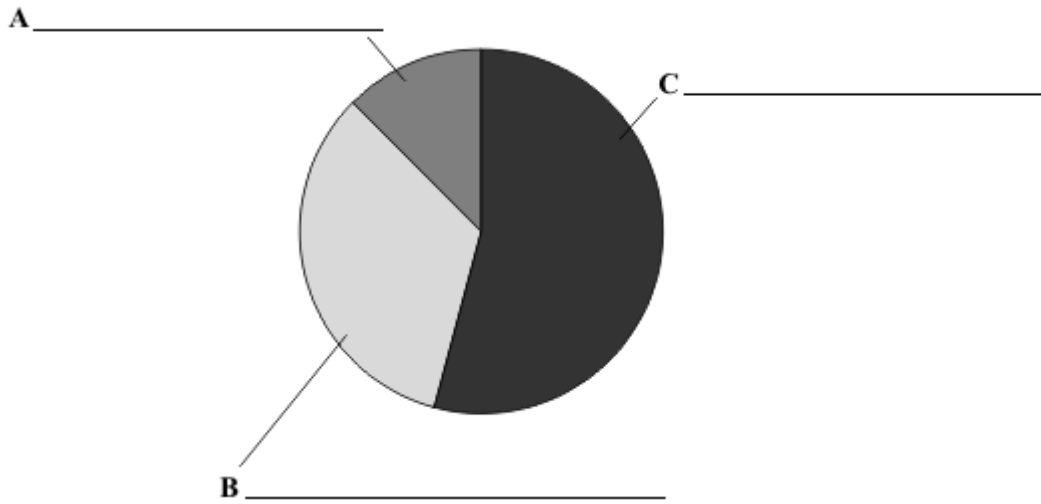
$\frac{1}{3}$

$\frac{1}{2}$

(1)

- (b) One pupil decided to show the figures from **Table 2** as a pie chart.

Label sections **A**, **B** and **C** of the pie chart.



(1)

(c) How does sweating help the body?

(1)

(d) On a hotter day, the volumes of water lost and gained will be different.

What differences will there be?

Tick (✓) **two** answers from the list.

- More sweat produced
- More faeces produced
- More food eaten
- Less urine produced
- Less liquid drunk

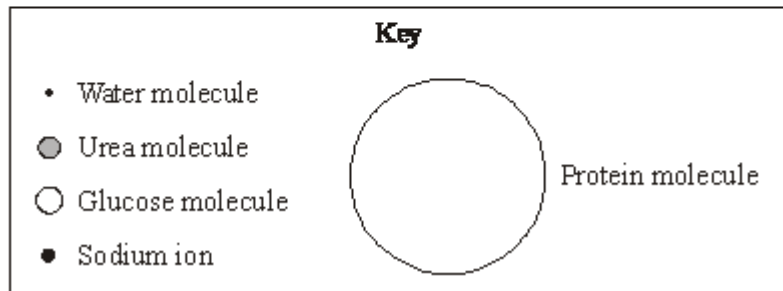
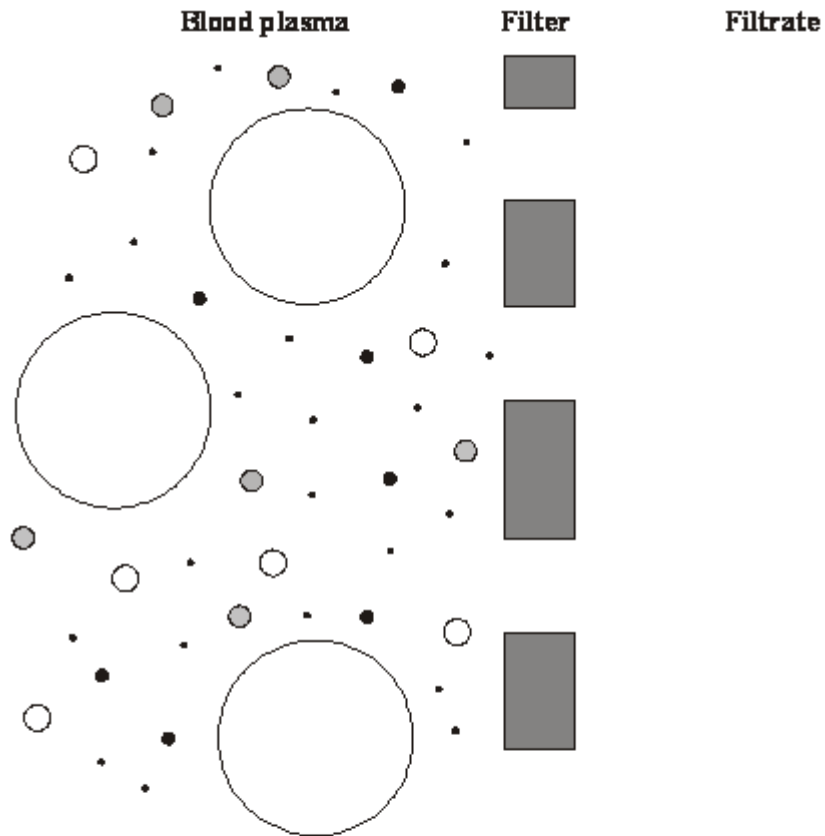
(2)

(Total 7 marks)

Q20.

The kidneys filter the blood.

The diagram shows the site of filtration in the kidney.



(a) Use information from the diagram to answer this question.

Put a tick (✓) in the box next to every substance that will pass through the filter from the blood plasma into the filtrate.

One has been done for you.

- | | |
|-------------|---|
| glucose | ✓ |
| urea | |
| water | |
| sodium ions | |

protein

(2)

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

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

(1)

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

After filtration, all the glucose is

reabsorbed
released
respired

(1)

(c) An athlete trained on a hot day and on a cold day. On each day, he did the same amount of exercise and drank the same volume of water.

Complete the sentences by drawing a ring around the correct answer.

(i) On the hot day, the athlete would produce

less
more
the same amount of

urine.

(1)

(ii) This is because he would produce

less
more
the same amount of

sweat.

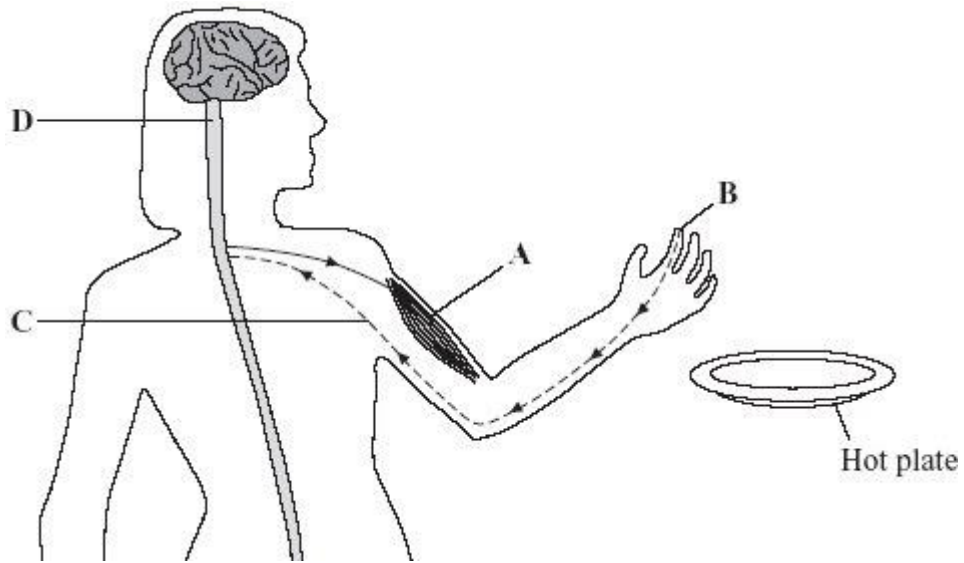
(1)

(Total 6 marks)

Q21.

A girl picks up a hot plate. A reflex action causes her to drop it.

The diagram shows some of the structures involved in this reflex action.



Use words from the box to name the structures labelled **A**, **B**, **C** and **D**.

brain	gland	muscle	neurone	receptor	spinal cord
-------	-------	--------	---------	----------	-------------

- A _____
- B _____
- C _____
- D _____

(Total 4 marks)

Q22.

A runner might drink a special 'sports drink' at intervals during a marathon race. The table shows the substances present in a sports drink.

Substance	Percentage
Water	
Sugar	5.0
Ions	0.2

- (a) Complete the table to show the percentage of water in the sports drink. (1)
- (b) The runner sweats and also breathes heavily during the race.
- (i) Why does the runner need to sweat?

(1)

(ii) Which **two** substances in the table are lost from the body in sweat?

(1)

(iii) Which substance in the table is lost from the body during breathing?

(1)

(c) How does the sugar in the sports drink help the athlete during the marathon?

(2)

(Total 6 marks)

Q23.

Each week, an athlete trains on 5 days (training days) but does not train on the other 2 days (rest days).

The table shows how water losses from the athlete's body are different on a rest day from those on a training day.

Method	Volume of water lost in cm ³	
	Rest day	Training day
Urine	1500	900
Sweating	625	2400
Breathing	450	1500
Faeces	125	120
Total	2700	

(a) Complete the table to show the total volume of water lost by the athlete on a training day.

(1)

(b) Explain why the athlete sweats more on a training day.

(2)

- (c) On a training day, the athlete needs to take in more water.

Explain why the athlete needs to take in more water on a training day.

(2)

(Total 5 marks)

Q24.

- (a) Each day, a boy ate food containing 12 000 kilojoules of energy. The boy's body used 80 per cent of this energy to maintain his core temperature.

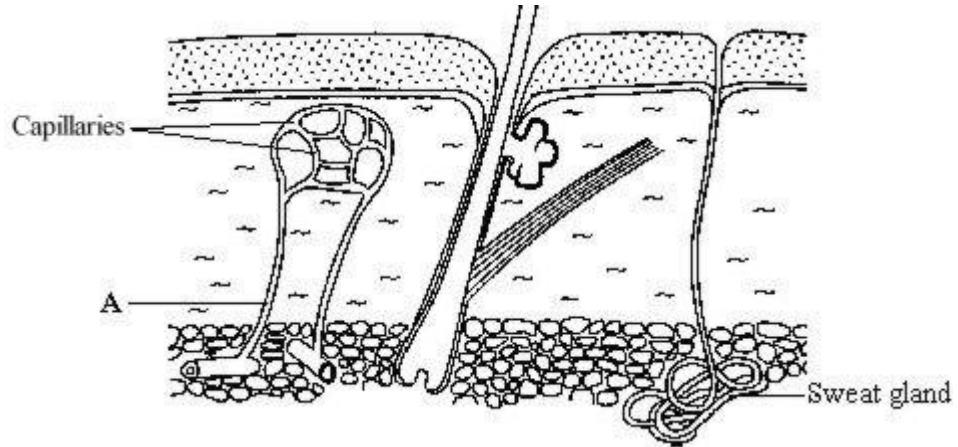
- (i) Name the process which releases energy from food.

(1)

- (ii) Calculate the amount of energy that the boy would use each day to maintain his core body temperature. Show clearly how you work out your final answer.

Amount of energy used each day = _____ kJ
(2)

- (b) The diagram shows a section through human skin.



Explain how structure **A** helps to cool the body on a hot day.

(3)

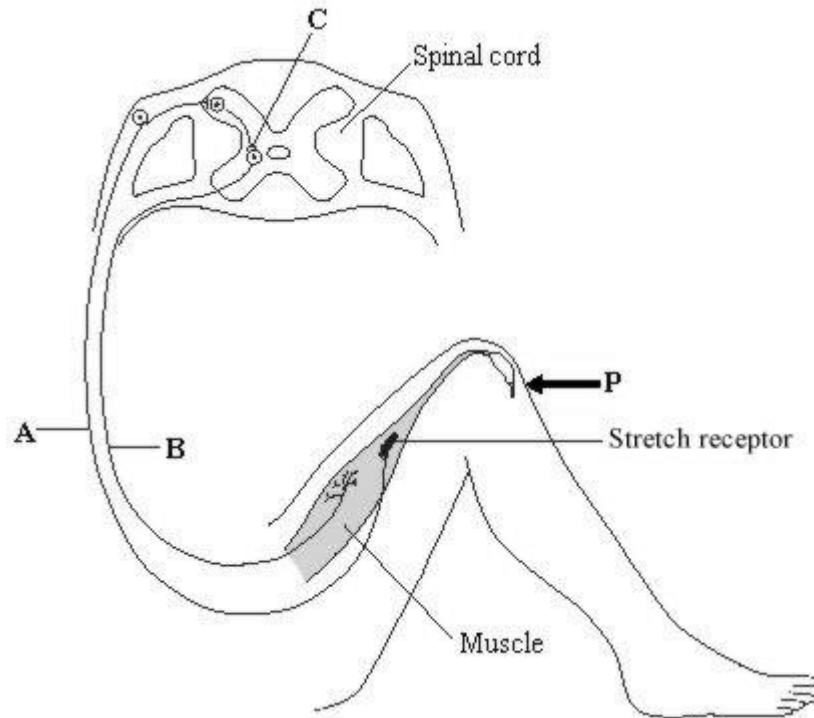
- (c) Body temperature is monitored and controlled by the thermoregulatory centre. Where in the body is the thermoregulatory centre?

(1)

(Total 7 marks)

Q25.

The diagram shows the nervous pathway which is used to coordinate the knee-jerk reflex. When the person is hit at point **P**, the lower leg is suddenly raised.



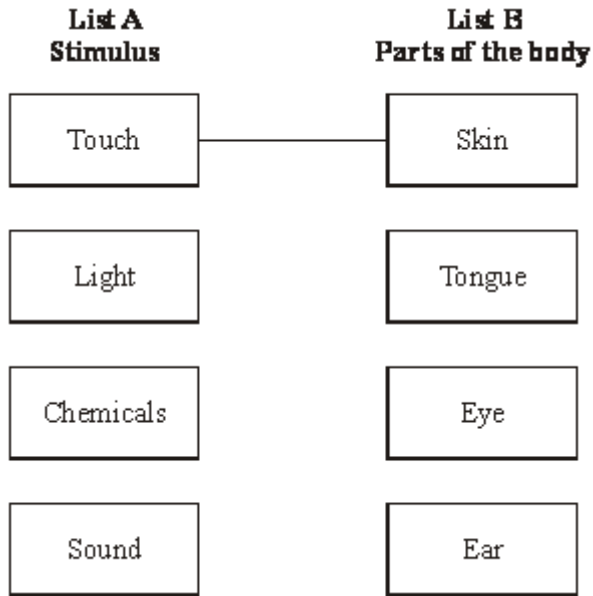
- (a) (i) Name the type of neurone labelled **A**. _____ (1)
- (ii) **On the diagram**, draw arrows next to the neurones labelled **A** and **B** to show the direction in which an impulse moves in each neurone. (1)
- (b) How is information passed across the synapse at **C**?
 _____ (1)
- (c) **On the diagram**, label the effector with the letter **X**. (1)
- (Total 4 marks)**

Q26.

- (a) List **A** gives the names of four stimuli. List **B** gives four parts of the human body.

Draw a straight line from each stimulus in List **A** to the part of the body in List **B** which has receptors for that stimulus.

(One has been done for you.)



(3)

(b) Complete the following sentence by choosing the correct words from the box.

brain glands motor sensory

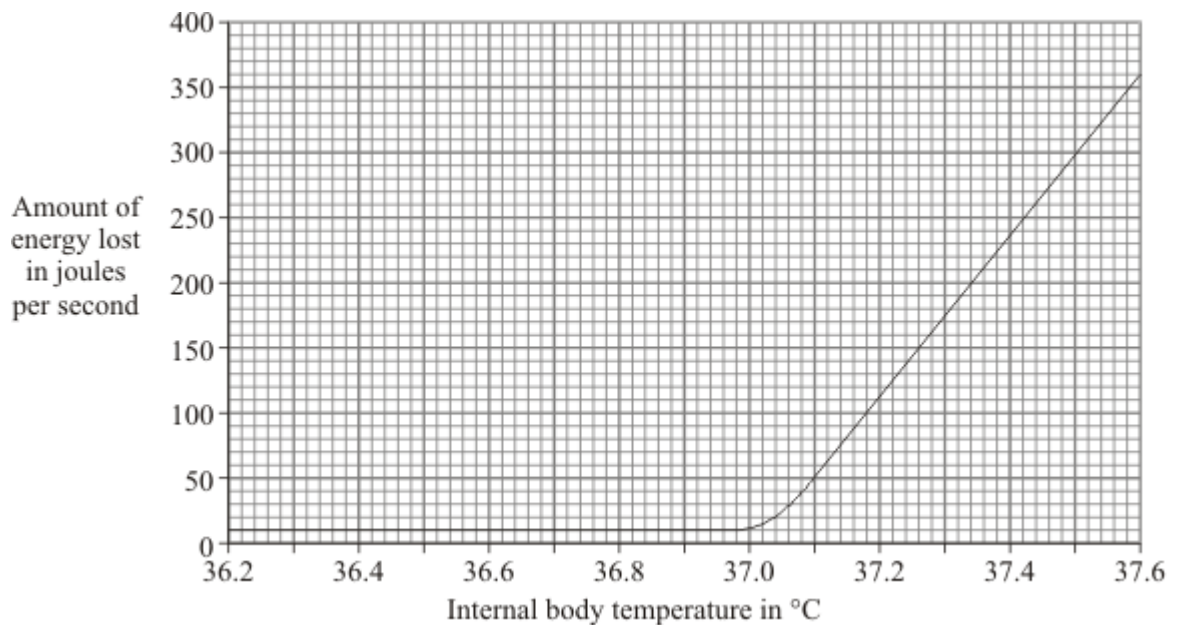
To make us aware of a stimulus, impulses are sent along a _____
 neurone to the _____

(2)

(Total 5 marks)

Q27.

The internal body temperature determines how much a person sweats. The graph shows the effect of different internal body temperatures on a person's rate of energy loss by sweating.



- (a) How much more energy was lost from the body each second by sweating when the body temperature was 37.6 °C than when it was 36.6 °C? Show clearly how you work out your final answer.

Amount of energy = _____ joules per second

(2)

- (b) Explain why a person would feel more thirsty when the body temperature was 37.6 °C than when it was 36.6 °C.

(2)

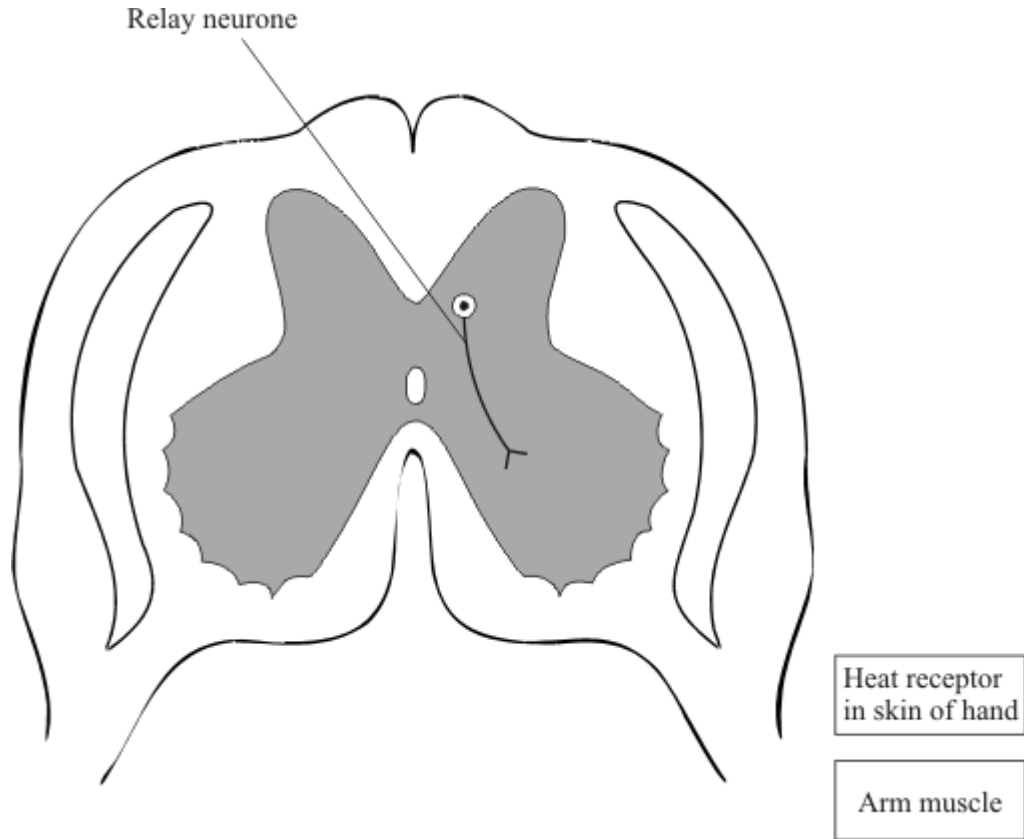
- (c) Explain how sweating helps to control body temperature.

(3)

(Total 7 marks)

Q28.

The diagram shows a section through the spinal cord.



(a) Coordination of a reflex movement of the arm, in response to the hand touching a hot object, involves three neurones. One of these, the relay neurone, is shown in the diagram. Complete the nerve pathway between the receptor and the muscle on the diagram by drawing and labelling:

- (i) the sensory neurone;
- (ii) the motor neurone.

(2)

(b) The nerve pathway linking the heat receptor in the hand with the arm muscle is about 1.5 metres in length. It would take the nervous impulse 0.02 seconds to travel this distance along a neurone. However, it takes about 0.5 seconds for the arm to start moving during the reflex response to the heat stimulus.

Explain the difference.

(2)

(Total 4 marks)

Q29.

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

Hamster



36.8 °C

Horse



38.0 °C

Sheep



39.2 °C

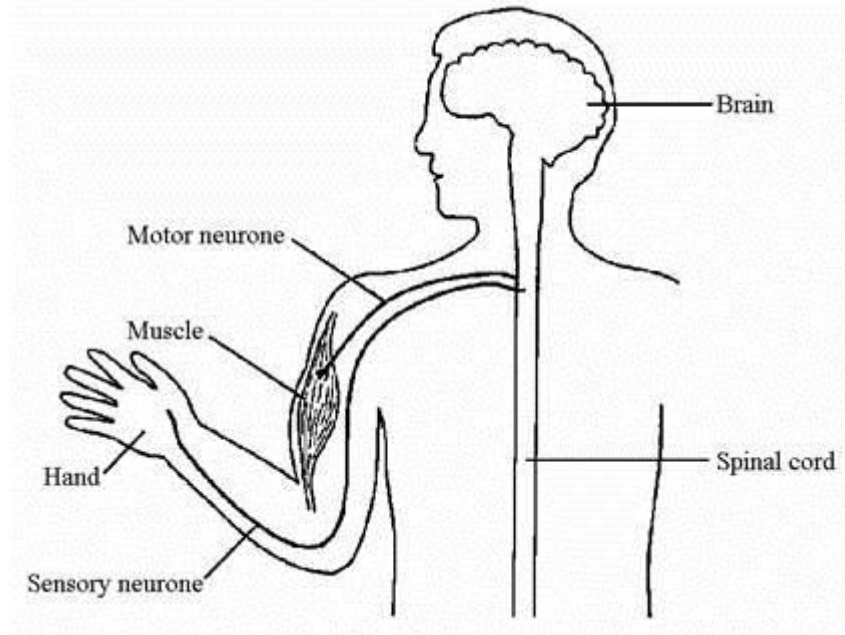
NOT TO SCALE

Describe **three** different ways by which most mammals are able to maintain a constant body temperature when the temperature of the environment falls.

(Total 6 marks)

Q30.

The diagram shows a reflex pathway in a human.

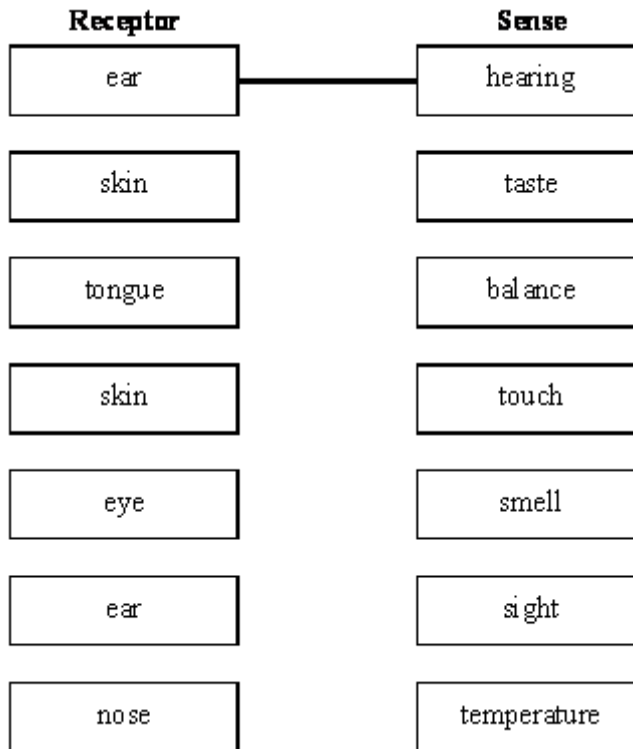


- (a) Label the *receptor* on the diagram. (1)
- (b) Label the *effector* on the diagram. (1)
- (c) (i) Suggest a stimulus to the hand that could start a reflex response.
 _____ (1)
- (ii) Describe the response that this stimulus would cause. _____

 _____ (1)
- (d) Put arrows on the diagram to show the direction of the path taken by the nerve impulses. (1)
- (Total 5 marks)**

Q31.

Humans use receptors to help them to respond to stimuli in the environment. Match up each receptor with the correct sense. One has been done for you.



(Total 5 marks)

Q32.

- (a) During respiration, sugar is oxidised to release energy. Complete the equation for respiration.

Sugar + _____ = _____ + _____ + energy

(3)

- (b) The photograph below shows an athlete using an exercise machine. The machine can be adjusted to vary the rate at which the athlete is required to work.



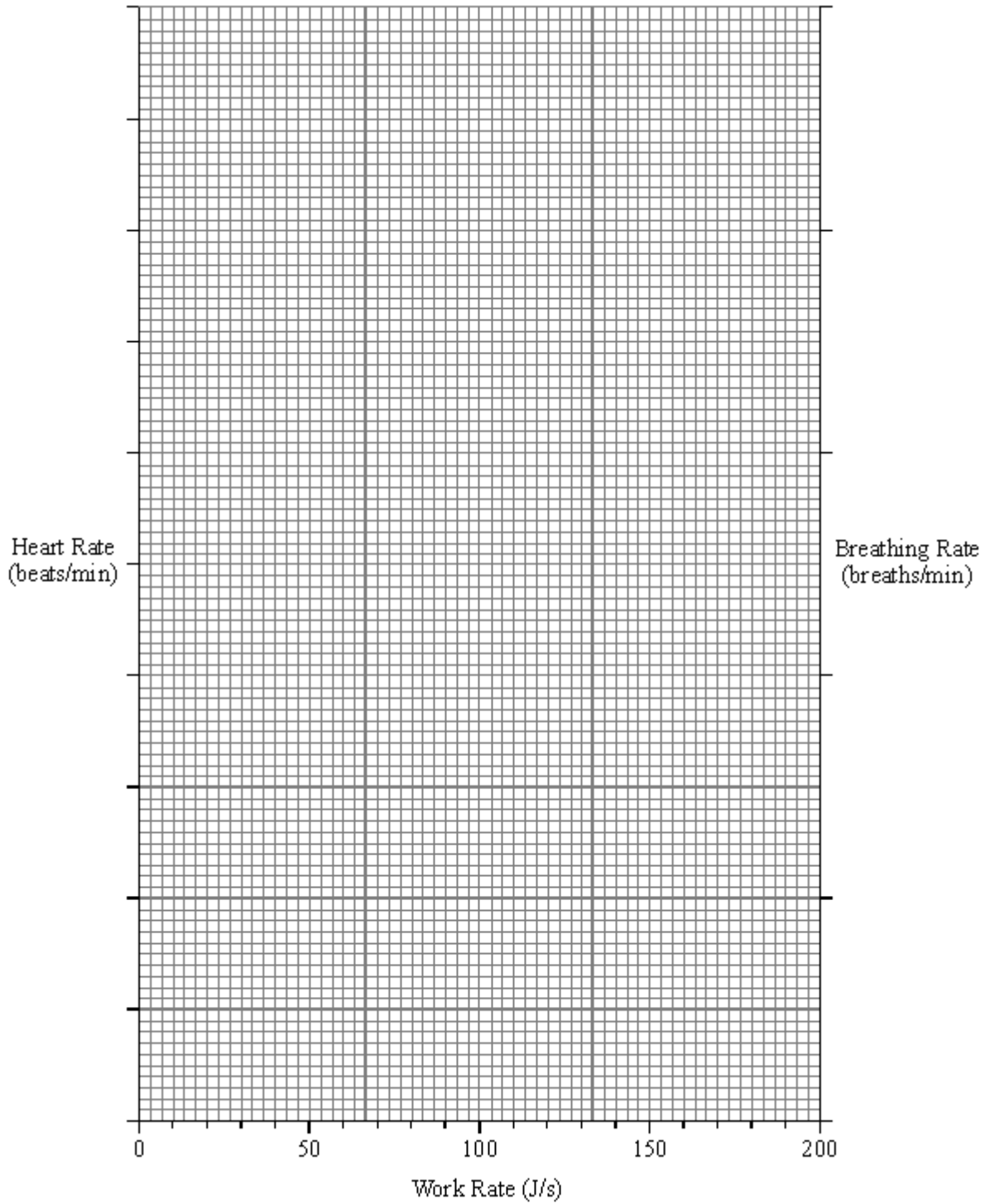
The athlete's heart rate and breathing rate were measured at different work rates.

The table below shows the results which were obtained.

WORK RATE	HEART RATE	BREATHING RATE
-----------	------------	----------------

(J/s)	(beats/min.)	(breaths/min.)
0	86	9.6
60	106	10.0
80	112	10.4
100	122	10.4
120	135	11.4
140	143	14.5
160	156	15.8
200	174	30.5

Plot the data on the graph paper below.



(3)

- (c) Explain, as fully as you can, the advantages to the body in the change in breathing and heart rates.

(6)

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

(i) the stimulus; _____

(ii) the co-ordinator; _____

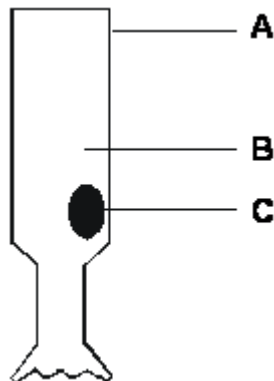
(iii) the effector. _____

(3)

(Total 15 marks)

Q33.

The drawing below shows a light-sensitive (receptor) cell from the eye. The structures labelled A, B and C, can be found in most animal cells.



(a) Name the structures labelled A, B and C.

A _____

B _____

C _____

(3)

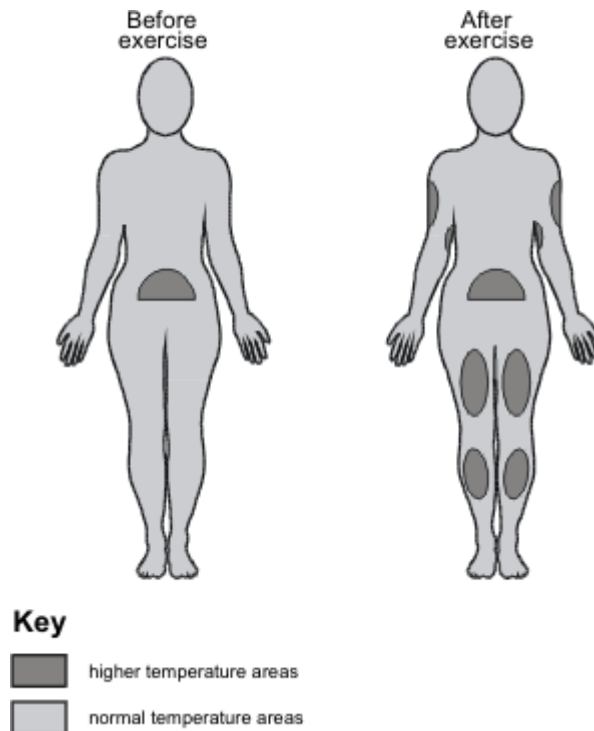
(b) Describe, as fully as you can, what happens in the nervous system when this receptor cell is stimulated by light.

(3)

(Total 6 marks)

Q34.

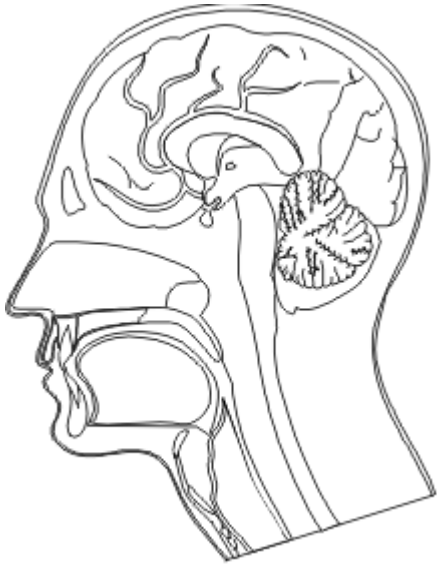
The temperature at the surface of the skin can be measured by using a technique called thermography. Areas with higher temperature appear as a light shade on the thermographs. The drawings below show the results of an investigation in which thermographs were taken before and after exercise.



Explain, as fully as you can, the body mechanisms which affected the skin temperature to give the results shown in the drawings.

(Total 8 marks)

Q35.



(a) **On the diagram**, use guidelines to label:

1 the brain;

2 the spinal cord.

(2)

(b) Some students are investigating the behaviour of a mouse. They use a large empty box. The box has squares marked on the floor, as shown in the diagram.

(C = corner square, S = side square, I = inside square)

C ₁	S ₁	S ₂	S ₃	C ₂
S ₁₀	I ₁	I ₂	I ₃	S ₄
S ₉	I ₆	I ₅	I ₄	S ₅
C ₄	S ₈	S ₇	S ₆	C ₃

They put a mouse in the empty box. They record which square the mouse is in every minute for 15 minutes. They get these results.

Time (minutes)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Position of mouse	C ₁	C ₁	S ₂	C ₃	C ₃	S ₉	I ₃	C ₁	C ₁	C ₁	S ₈	C ₄	C ₄	C ₁	S ₂

- (i) Fill in the table below to show how much time the mouse spends in the corner squares (C), the side squares (S) and the inside squares (I).

POSITION	TIME (minutes)
Corner (C)	
Side (S)	
Inside (I)	

(3)

- (ii) What pattern is shown by the results?

(1)

- (iii) Suggest how the behaviour of the mouse might help its survival.

(2)

(Total 8 marks)

Mark schemes

Q1.

- (a) (i) the lower the temperature the shorter the time
a trend is required
accept reverse

or

the lower the temperature the more chance of frostbite
accept the lower the temperature the faster you get frostbite
*accept positive correlation but **not** directly proportional*
ignore wind speed

1

- (ii) any value from 5 to below 10
*do **not** accept 10*
*allow less than 10 **or** < 10*

1

- (b) Muscles 'shiver'
if more than two boxes ticked deduct 1 mark for each additional tick

1

Blood vessels supplying the skin capillaries constrict

1

[4]

Q2.

- (a) a stimulus

1

- (b) (i) **A**

1

- (ii) **C**

either order

1

D

1

- (iii) **E**

1

- (c) brain

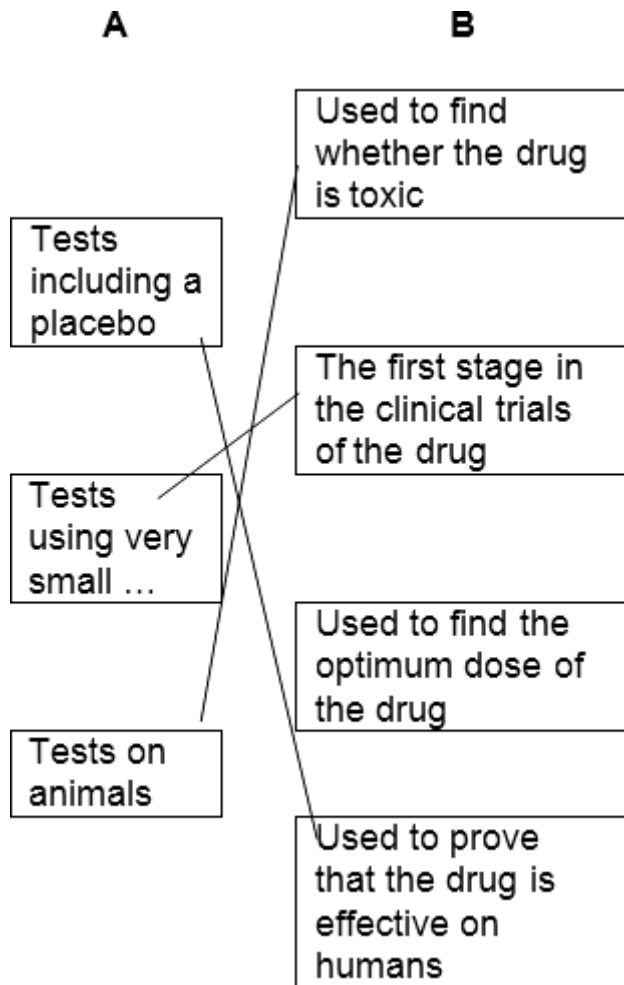
allow spinal cord / CNS / central nervous system
*do **not** allow spine*

1

[6]

Q3.

(a)



1 mark for each correct line

mark each line from left hand box

two lines from left hand box cancels mark for that box

3

(b) any **three** from:

Students have been informed that the headline is not justified

- reference to reliability, eg only a small number of mice tested
or trial too short
or investigation not repeated
- reference to control, eg mice given caffeine not coffee
or 6 cups (equivalence) is more than 1 dose
- (and) the effect on mice might not be same as on humans
allow only tested on mice
- (also) text suggests that the treatment improves memory loss (rather than delays it)
accept text suggests disease cured

or mice already have memory loss or experiment only showed improvement in memory
or does not show **delays** Alzheimer's
or experiment not done on old mice
allow reference to the fact that mice engineered to have it

3

[6]

Q4.

(a) in rainforest:

accept converse

(water from) sweat does not evaporate (as much)

max 1 if not clear whether desert or rainforest

1

any **one** from:

- (due to) less wind / higher moisture / humidity
- less cooling effect

ignore references to temperature

1

(b) blood vessels supplying capillaries dilate / widen **or** vasodilation

*do **not** award mark if candidate refers only to blood vessels dilating **or** to capillaries dilating.*

*accept 'arteries' or 'arterioles' for 'blood vessels supplying, capillaries' but do **not** accept 'veins'.*

ignore expand / get bigger / relax / open

*do **not** accept idea of blood vessels moving*

1

more blood (through skin / surface capillaries) leads to greater heat loss

1

[4]

Q5.

(a) any **two** from

- reference to role of thermoregulatory centre detecting rise in temperature (of blood or skin) **or** / causing increase in sweating

- more evaporation

*need to refer to more at least once to gain **both** marks*

- more cooling / heat loss

without reference to more only award max 1 mark if both ideas given, eg cooling alone gets no marks

2

(b) blood vessels supplying (skin) capillaries

do **not** accept capillaries / veins

1

or

arteries

or

arterioles

1

dilate / widen

allow vasodilation

do not accept idea of blood vessels moving

note: marks are awarded independently

accept shunt vessels close for 2 marks

1

(c) (i) muscle contraction

ignore relaxing

*do **not** allow vasoconstriction*

1

(ii) respiration

(respiration) releases / produces heat

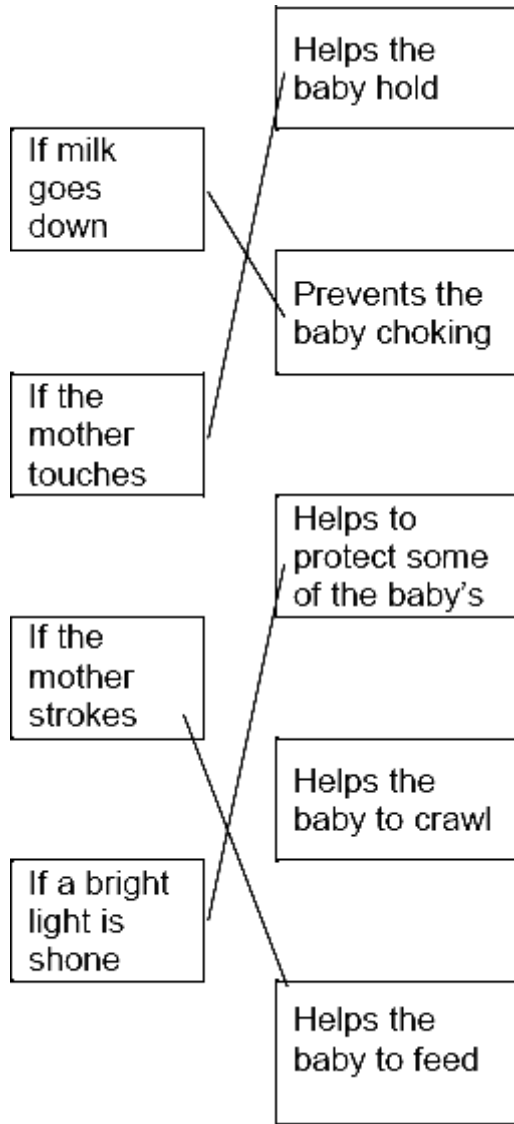
reference to respiration is required for this mark

1

[7]

Q6.

(a)



all four correct = 4 marks
three correct = 3 marks
two correct = 2 marks
one correct = 1 mark
extra line from a statement cancels the mark

4

(b) glands

1

muscles

1 mark for each correct tick
each extra box ticked cancels 1 mark

1

[6]

Q7.

(a) a drug taken for pleasure / fun

allow not taken as medicine

ignore recreational / legal / harmless / specific effects on body

- | | | | |
|-----|---|--------------------------|---|
| | | | 1 |
| (b) | (i) | 45 | 1 |
| | (ii) | a cup of takeaway coffee | 1 |
| (c) | There is a link between drinking caffeine and hallucinations.
<i>extra boxes ticked cancels the mark</i> | | 1 |

[4]

Q8.

- | | | | |
|-----|------|---|---|
| | | | |
| (a) | (i) | thermoregulatory centre
<i>allow thermoregulation centre
allow hypothalamus</i> | 1 |
| | (ii) | it has receptors
<i>ignore receptors in skin</i> | 1 |
| | | reference to temperature of <u>blood</u>
<i>allow plasma for blood</i> | 1 |
| (b) | | muscles <u>contract</u>
<i>ignore relax / expand</i> | 1 |
| | | increased respiration or more heat released
<i>allow more heat produced
if more not given allow respiration releases / produces heat</i> | 1 |
| (c) | (i) | (blood vessels / arteries / arterioles) dilate / widen
<i>do not accept capillaries dilate
ignore blood vessels get bigger / expand
do not accept idea of blood vessels moving</i> | 1 |
| | (ii) | more blood close to / near surface
<i>allow blood is closer to the surface
do not accept idea of blood vessels moving</i> | 1 |
| | | more heat lost or heat lost faster or cools faster
<i>do not allow for idea of evaporation</i> | 1 |

[8]

Q9.

- (a) (i) liver 1
- (ii) kidney 1
allow urethra / bladder
ignore ureter
- (iii) (excess) protein / named / amino acids 1
accept amino / ammonia
- (b) less / no sweating 1
allow ideas of how sweat glands change in order to reduce sweating
- less heat lost / evaporation 1
- (c) (i) become narrower / constrict 1
allow contract / get smaller etc
allow less blood flows through vessels
*do **not** allow capillaries become narrower **or** reference to movement of vessels*
- (ii) reduced / no heat loss 1
allow heat gained from room

[7]

Q10.

- (a) eye / sight / eyesight 1
either order
- ear / hearing 1
ignore light
- (b) ear 1
- (c) (i) reflex 1
- (ii) neurons 1

[5]

Q11.

- (a) (i) receptor
allow named receptor eg light receptor
ignore sensory neurone
allow sense organ / named sensory organ eg skin / eye 1
- (ii) sensory (neurone)
allow afferent 1
- (iii) motor (neurone)
allow efferent 1
- (iv) effector / muscle / gland / named 1
- (b) any **two** from:
- impulse / information passes from one neurone to another
or impulse / information passes across gap
 - chemical / transmitter involved
 - diffusion (across gap) 2
- (c) brain / person not aware of pain / stimulus / can't feel
allow brain/ person doesn't know / realise / unable to coordinate
ignore reflex
ignore information 1
- possibility of (permanent / serious) damage / eg burning
ignore danger 1

[8]

Q12.

- (a) respiration
*allow muscle contraction **or** muscle movement **or** exercise of muscles*
allow metabolism / chemical reactions 1
- (b) (i) any **two** from:
- 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**

blood vessels supplying the skin **or**
blood vessels in skin

*do **not** allow first mark if implied that
skin capillaries dilate*

1

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]

Q13.

(a) (i) receptor

1

(ii) sensory neurone

1

- (iii) motor neurone 1
- (iv) muscle 1
- (b) (i) eye(s)
 - allow retina*
 - ignore sight* 1
- (ii) ear(s)
 - ignore hearing*
 - do **not** allow ear drum* 1
- (iii) ear(s)
 - ignore balance* 1

[7]

Q14.

- (a) (i) lungs 1
- (ii) skin 1
- (iii) kidneys 1
- (b) (i) (as sweat lost,) performance falls 1
- (ii) drink water / sports drink
 - ignore antiperspirant* 1

[5]

Q15.

- (a) **A** sensory (neurone)
 - ignore nerve* 1
- B** motor (neurone)
 - ignore nerve* 1
- C** spinal cord / central nervous system / grey matter 1
- (b) by chemical / substance
 - allow transmitter* 1

(c) muscle

allow extensor
ignore muscle names

1

[5]

Q16.

(a) 4000

*award **both** marks for correct answer, irrespective of working*
1500 + 2000 + 500 gains 1 mark

2

(b) day 2 (no mark)

any **two** from:

max 1 mark if correct day not identified or if no day given

- more (water in) breath / breathing
- more (water in) sweat / sweating
accept a lot of sweating
- less (water in) urine
if no other marks awarded allow 1 mark for more water lost on day 2

2

(c) (i) respiration

1

(ii) cools / removes heat owtte

ignore 'maintains body temperature' unqualified

1

(iii) osmosis

1

[7]

Q17.

(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

(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]

Q18.

(a) (i) eye

1

(ii) nose

1

(iii) skin

1

(iv) tongue

1

(b) (i) eg to ensure more people addicted to cigarettes / make cigarettes more addictive

1

(ii) eg people might not buy the brand 1

[6]

Q19.

(a) (i) 1400
award 2 marks for correct answer if no working shown
2400 – (300 + 600 + 100) or equivalent for 1 mark 2

(ii) $\frac{1}{3}$ 1

(b) **A:** chemical reactions
B: food
C: drinking
all three required for 1 mark 1

(c) cools / reduces temperature
allow 'maintaining body temperature' owtte
*do **not** allow regulate unqualified*
ignore reference to urea
numerical references to temperature should be correct 1

(d) more sweat produced 1
 less urine produced 1

[7]

Q20.

(a)

glucose

urea

water

sodium ions

protein

all 3 correct = 2 marks
2 correct = 1 mark
0 or 1 correct = 0 marks

max 2

- (b) (i) protein cannot pass through filter
or
 protein (too) large
or
 protein stays in the blood

1

- (ii) reabsorbed

1

- (c) (i) less

1

- (ii) more

1

[6]

Q21.

- A** – muscle

1

- B** – receptor

1

- C** – neurone

1

- D** – spinal cord

1

[4]

Q22.

- (a) 94.8

1

- (b) (i) to cool (the body) / maintain (body) temperature
*do **not** accept let out heat*

1

- (ii) water **and** ions

1

- (iii) water ignore CO₂, and vapour

1

- (c) any **two** from:
 used in respiration
 provides energy
 (energy) needed for movement / running / muscle action

2

[6]

Q23.

- (a) (in table) 4920
- (b) exercise produces heat **or** causes rise in body temperature / makes athlete hot
named activity produces heat
- needs to cool **or** needs to maintain temperature **or** sweat helps to cool the body
- (c) more / a lot of water lost in sweating / breathing
- replace water / prevent dehydration

1

1

1

1

1

[5]

Q24.

- (a) (i) respiration
- (ii) 9600
if correct answer, ignore working / lack of working

$$\frac{80 \times 12000}{100}$$
for 1 mark
- (b) any **three** from:
- dilates / widens **or** muscle in wall relaxes **or** sphincter opens
*do **not** accept expands or just gets bigger*
 - more blood flows near skin surface **or** more blood through capillaries
 - heat lost by radiation / convection / conduction
ignore evaporation
 - heat loss from blood / cools blood
- (c) hypothalamus / brain

1

2

3

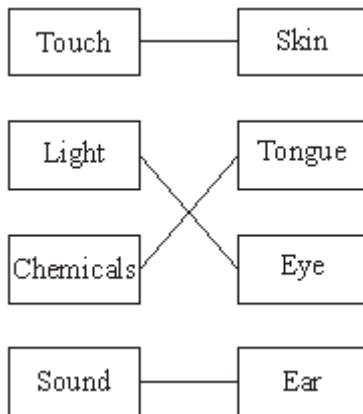
1

Q25.

- (a) (i) sensory / afferent 1
- (ii) on diagram:
 arrow (next to neurone **A**) pointing towards spinal cord
and
 arrow (next to neurone **B**) pointing towards muscle 1
- (b) chemical (released) **or** neurotransmitter
or by diffusion 1
accept correct named example of a neurotransmitter
- (c) on diagram:
X labelling muscle **or** motor end plate
*do **not** accept on stretch receptor* 1

Q26.

- (a) **Stimulus** **Part of the body**



*1 mark for each correct line
 if 2 lines to **one** box, CANCEL mark*

max 3

- (b) in correct sequence:
- sensory 1
- brain 1

Q27.

- (a) 345 to 350

*ignore working or lack of working
use of 355 to 360 **and** 10 for **1** mark*

2

- (b) any **two** from:

more sweating (at 37.6 °C)

'more' at least once in the first 2 points

more water loss **or** dehydration occurs

*do **not** accept prevents dehydration only*

blood becomes (more) concentrated / (more) salty **or** need to replace water

stimulation of the hypothalamus

2

- (c) any **three** from:

evaporation

of water

*do **not** accept just water loss unqualified*

cools skin **or** uses heat from skin

cools blood / heat from blood (passing through skin)

related to sweating

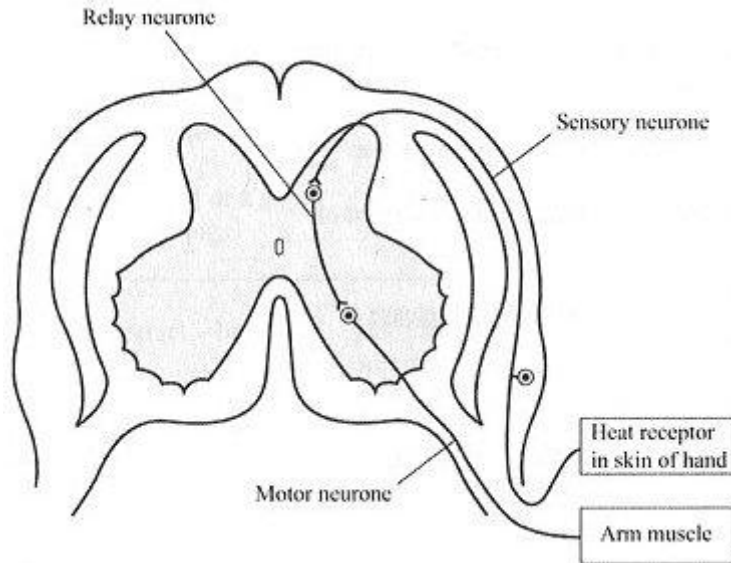
cooling the blood

ignore vasodilation

3

Q28.

- (a)



sensory neurone correctly drawn **and** labelled
from receptor + via dorsal root + cell body in ganglion + synapse to relay neurone

1

motor neurone correctly drawn **and** labelled
to muscle + via ventral root + same shape as relay neurone + synapse with relay neurone
OR correct pathways for both neurones given
*(ie without synapse or cell bodies) **and** labelled,*
***or** correctly drawn but unlabelled = 1 mark for this part)*

1

(b) any **two** from:

reference to synapses / gaps between neurones

extra time for release / movement of chemical

extra time for development of muscle 'tone' / tension

2

[4]

Q29.

vasoconstriction/blood vessels near surface get narrower/decreased blood supply near surface of the skin **or** closing sweat pores

any three pairs. 2 marks for each pair of features and explanations up to a maximum of 6 marks

(which) prevents the heat being lost from the blood/prevents heat lost due to evaporation

explanation must match feature to score the second mark

hair/fur stands on end **or** goosepimples

(this) increases the insulation effect

shivering/increased muscular activity/movement/increased metabolism

(this) generates heat

*do **not** accept raise body temperature*

behavioural changes/find somewhere warm/put on clothes / huddling / hibernate / grow **extra** fat / fur

(this) prevents/reduces heat loss

*do **not** accept keep warm*

[6]

Q30.

(a) label drawn to the hand

may be labelled as 'a'

accept the receptor identified as the hand

1

(b) label drawn to the muscle

may be labelled as 'b'

accept the effector identified as the muscle

1

(c) (i) sharp point **or** heat

accept specific examples such as pain, bee sting, cut, burning

*do **not** accept touch by itself*

1

(ii) move the hand (or arm) away from stimulus

or

muscle in the arm contracts

*do **not** credit reference to impulse reaching brain unless it is clear that this is in addition to the reflex act*

*do **not** credit 'reflex action' already given*

1

(d) an arrow on the sensory fibre from hand to spine

*award **one** mark for both arrows in the correct direction*

and

- *note the arrows may be drawn separately from the printed neurone*

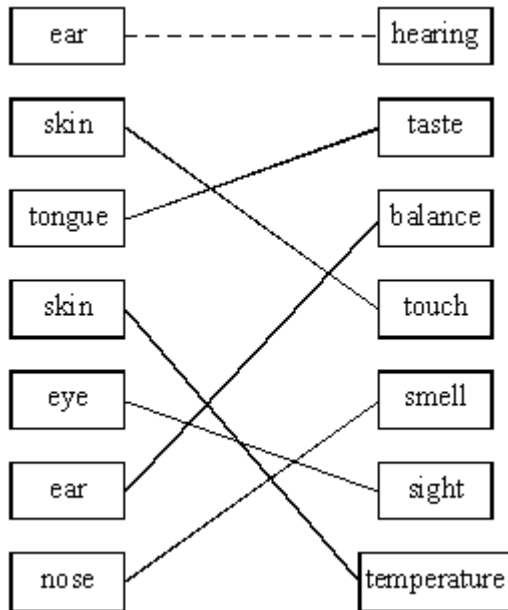
an arrow on the motor fibre from spine to muscle

- do **not** credit if the impulse travels to the muscle via the brain **but** a 'one way' journey to the brain will be neutral

1

[5]

Q31.



one correct **1** mark
 two correct **2** marks
 three correct **3** marks
 four correct **4** marks
 five or six correct **5** marks
 (• for 6th correct mark)

both skin boxes can be connected to either touch or temperature

do **not** credit where more than one link goes to or from any box (except for skin, touch and temperature)

[5]

Q32.

- (a) oxygen;)
 carbon dioxide;) allow symbols
 water)

each for 1 mark

3

- (b) graph with reasonable vertical scales;
 accurate plotting of all points (ignore lines) and labelling lines
 histogram – must be coded

gains 3 marks

3

- (c) 6 of:
 during exercise the level of CO₂ (in the blood) rises;
 increased breathing to remove excess CO₂;
 increased oxygen supply to muscles;
or increased breathing takes in more O₂
or increased heart rate takes more O₂ to muscles;
 increased supply of sugar to muscles;
 increased respiration rate;
 enable faster rate of energy release;
 reference to lactic acid (allow even though not on syllabus)/O₂ debt;
 to avoid cramp;
 anaerobic reference;
 reference to removal of 'heat';
- 6
- (d) high carbon dioxide concentration;
 brain/central nervous system;
 heart muscles (both)
- 3

[15]

Q33.

- (a) A – cell membrane
 B – cytoplasm
 C – nucleus
- each for 1 mark*
- 3
- (b) (nerve) impulse sent along nerve fibre to brain
- each for 1 mark*
- 3

[6]

Q34.

- 8 of e.g.:
 muscles release energy as heat
 blood flowing through muscles heated increased blood temperature sensed by
 centre in brain
 impulses to skin blood vessels
 particularly overlying muscles used in exercise to dilate
 increased surface flow in these regions
 gives pattern shown on thermographs
- each for 1 mark*
- 8

[8]

Q35.

- (a) brain correctly labelled spine correctly labelled
- for 1 mark each*
- 2
- (b) (i) 10

4
1

for 1 mark each

3

mouse spends most time in corners

for 1 mark

1

- (ii) 2 of:
idea that it is trying to make itself less conspicuous to predators
idea of looking for food

any 2 for 1 mark each

2

[8]

Q1.

- (a) Give **three** receptors which a mouse might use to detect food under natural conditions.

1. _____

2. _____

3. _____

(3)

- (b) Whilst observing mouse behaviour, a student drops a pen near the mouse's cage. The mouse jumps at the noise.

Describe, as fully as you can, the processes by which the mouse responds to the stimulus of the dropped pen.

(6)
(Total 9 marks)

Q2.

The doctor is testing the child's nervous system by tapping the tendon just below the knee.

This pulls cells which are sensitive to stretching.



- (a) What are cells which are sensitive to stimuli called?

(1)

- (b) These cells send information to the spinal cord.
In what form is this information sent?

(2)

- (c) The healthy response to the stimulus is the straightening of the leg.
What is the effector in this response?

(1)

- (d) This response is one example of a reflex action.

Describe **one other** example of a reflex action in terms of:

stimulus → *receptor* → *coordinator* → *effector* → *response*

(5)
(Total 9 marks)

Q3.

A dog runs across the road in front of a car. The driver slams her foot on the brakes.

- (i) Explain how the nervous system brings about this response.

(4)

- (ii) Explain why alcohol consumption would affect the driver's response.

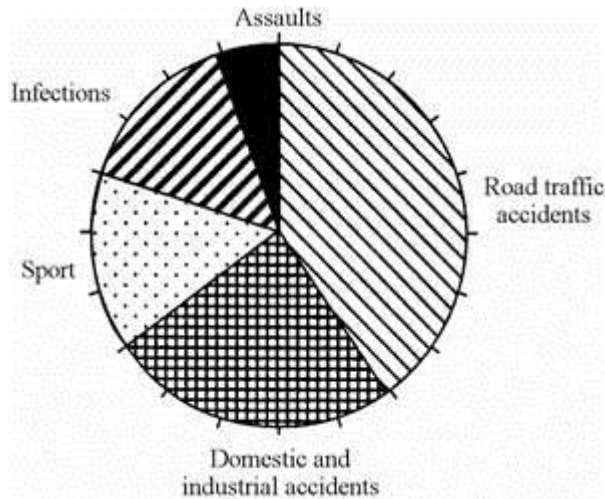
(1)
(Total 5 marks)

Q4.

Every year at least 700 people in Britain break their back or their neck. This damages the spinal cord and may result in permanent paralysis.



(a) The pie chart shows the causes of damage to the spinal cord.



(i) Which is the commonest cause of damage to the spinal cord?

_____ (1)

(ii) Calculate the proportion of injuries to the spinal cord caused by sport.

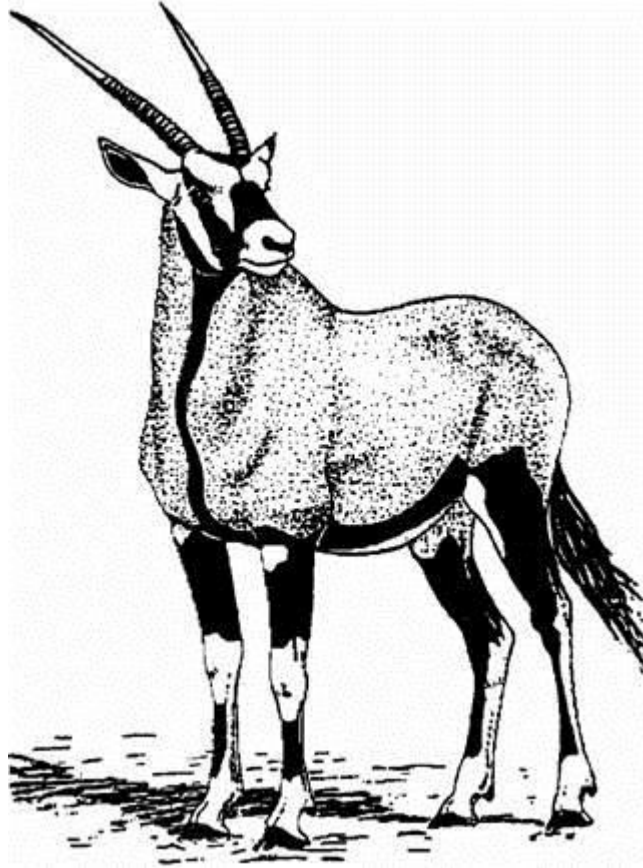
Proportion _____ (1)

(b) Explain why a man with a damaged spinal cord cannot feel a pin stuck in his toe.

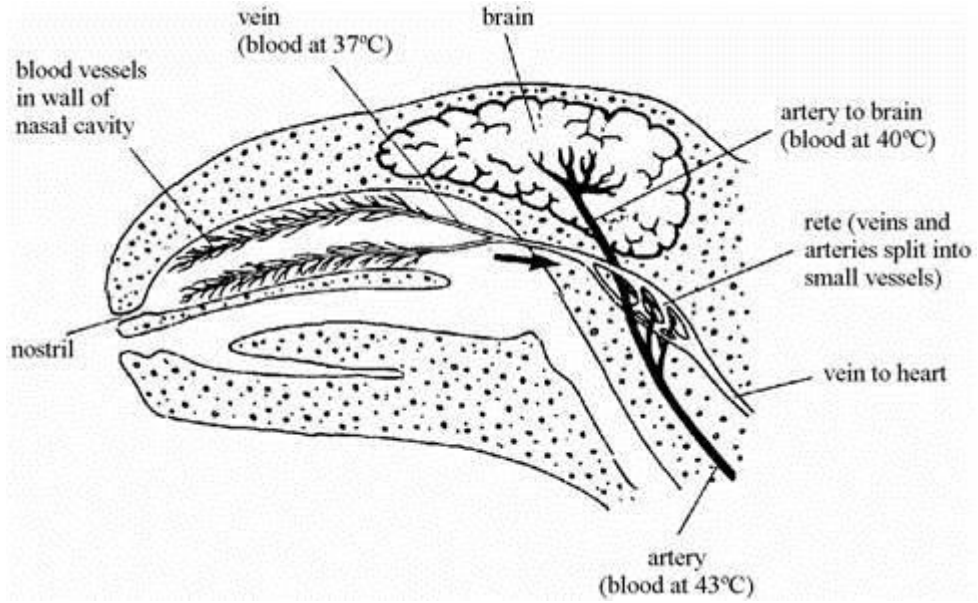
(3)
(Total 5 marks)

Q5.

The gemsbok is a large herbivore that lives in herds in desert areas of South Africa. Gemsboks feed on plants that are adapted to living in dry conditions. There are not many rivers, lakes or ponds that can provide drinking water for the animals. The desert areas are hot during the day but cool at night. As the air cools at night it becomes moist, and the plants absorb the moisture.



Although the gemsbok lives in hot conditions, it does not sweat. During the day its body temperature can rise, but it is important that blood reaching the brain does not rise above 40°C. The drawing shows how the blood system is adapted to cool the blood which flows to the brain.



(i) Suggest an advantage to the gembok of **not** sweating.

(1)

(ii) Explain how the blood is cooled in the cavities of the nose.

(2)

(iii) How does the structure of the rete help in keeping the brain cool?

(2)

(Total 5 marks)

Q6.

The table shows four ways in which water leaves the body, and the amounts lost on a cool day.

	WATER LOSS (cm ³)	
	COLD DAY	HOT DAY
Breath	400	the same
Skin	500	
Urine	1500	
Faeces	150	

- (a) (i) Fill in the table to show whether on a hot day the amount of water lost would be

less more the same

The first answer has been done for you.

(3)

- (ii) Name the process by which we lose water from the skin.

(1)

- (b) On a cool day the body gained 2550 cm³ of water.
 1500 cm³ came directly from drinking.
 Give **two** other ways in which the body may gain water.

1. _____

2. _____

(2)

(Total 6 marks)

Q7.

- (a) Fill in the table about receptors. The first answer has been done for you.

RECEPTORS IN THE	SENSITIVE TO
Eyes	Light
Skin	
	Sound
Tongue	

(3)

- (b) Describe, in as much detail as you can, how information is transmitted from light receptors in the retina to the brain.

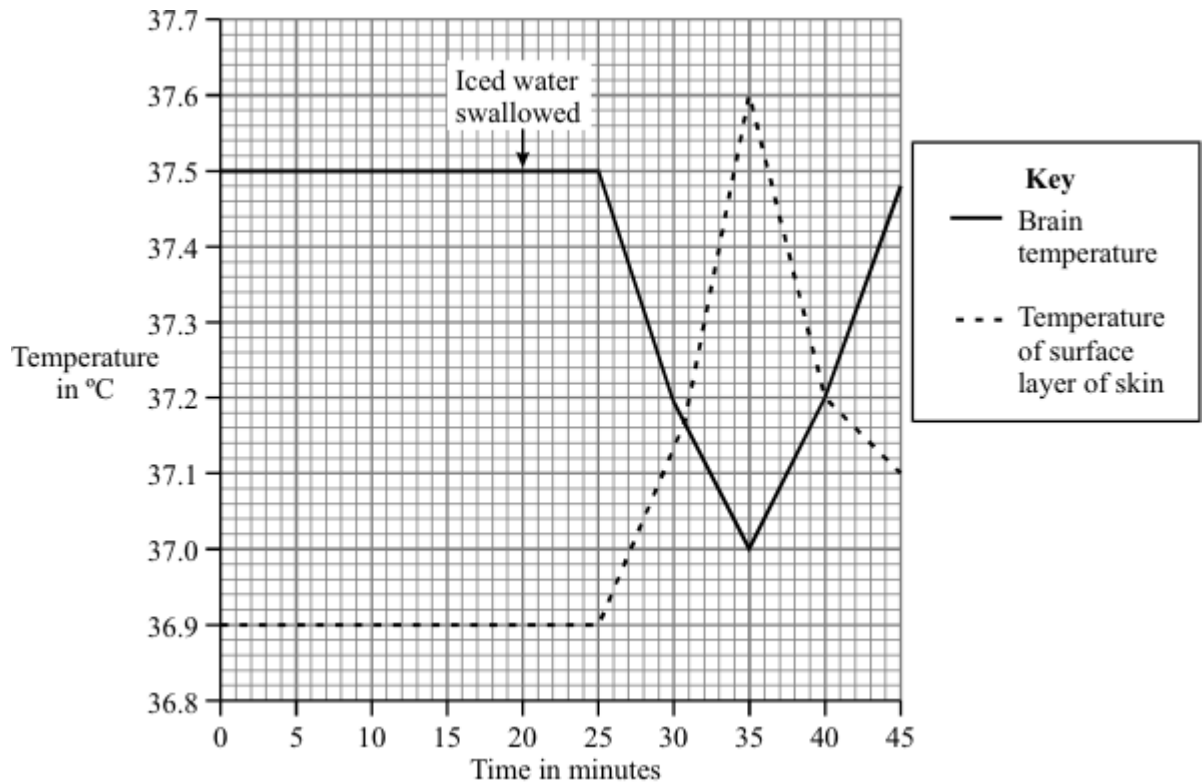
(3)
(Total 6 marks)

Q8.

- (a) Explain how sweating helps to keep our body temperature relatively constant.

(2)

- (b) In an experiment, a student swallowed some iced water. The graph shows how this affected the student's skin temperature and brain temperature.



- (i) Explain why the temperature of the brain changed after the student swallowed the iced water.

(2)

- (ii) This change in brain temperature led to a change in the temperature of the surface layer of the skin.

Explain how this happened.

(3)

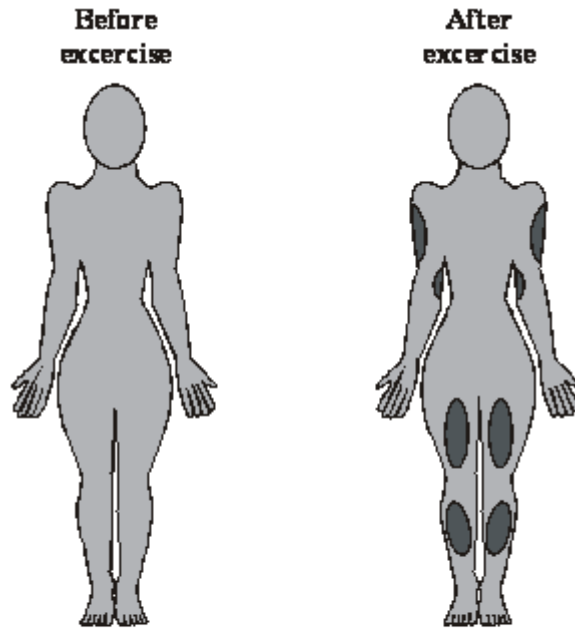
(Total 7 marks)

Q9.

The temperature at the surface of the skin can be measured by using a technique called thermography.

In this technique, areas with higher temperature appear as a different colour on the thermographs.

The drawings below show the results of an investigation in which thermographs were taken from a person before and after exercise.



Key
Higher temperature areas
Normal temperature areas

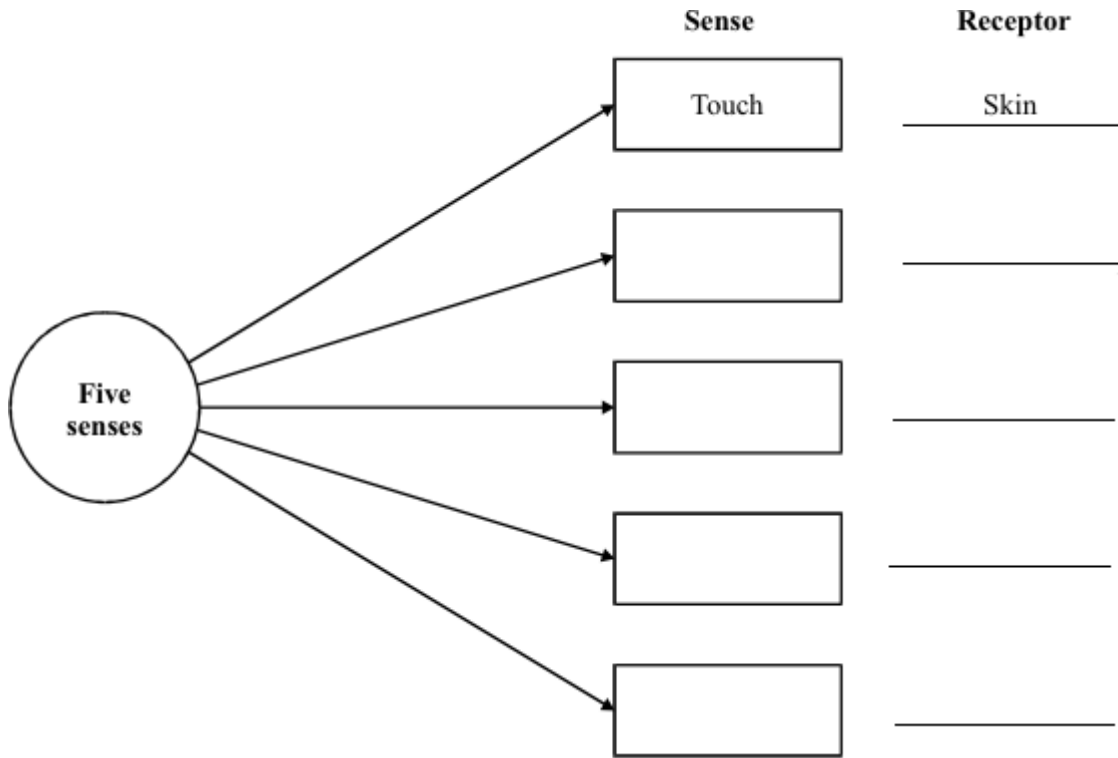
Describe and explain, as fully as you can, the effects of exercise on skin temperature.

(Total 3 marks)

Q10.

- (a) Humans have a number of senses, for example touch. Senses are detected by receptors, for example skin detects touch.

In the boxes write the names of **four** other senses. By each box write the name of the receptor.



(8)

(b) When your hand is touched, the information is passed to your brain. Describe how the information gets from your skin to your brain.

(2)

(Total 10 marks)

Q11.

Describe how the brain is informed of the image detected by the retina.

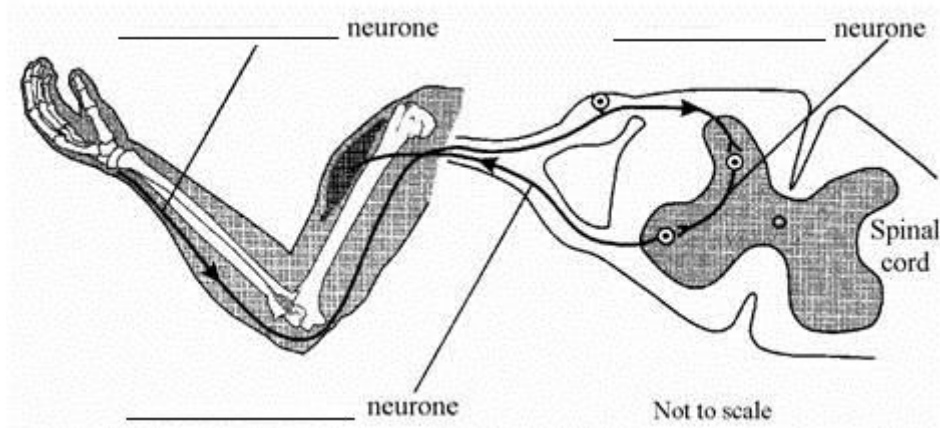
(Total 3 marks)

Q12.

- (a) What is the name of the organ which controls the nervous system?

_____ (1)

- (b) The diagram shows a reflex arc. Label the **three** neurones.



(3)

- (c) Snatching your hand from a hot object is an example of a reflex action. Give **one** other example of a reflex action.

_____ (1)

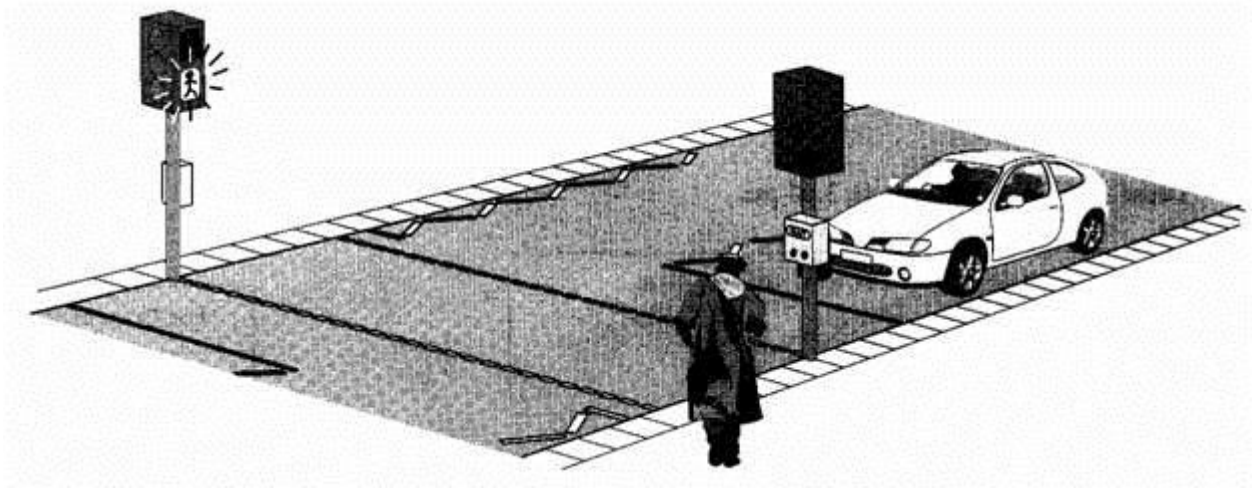
- (d) Describe the stages that happen in a reflex action.

(3)

(Total 8 marks)

Q13.

A man is walking along a street. He plans to cross the road at the pelican crossing. Pelican crossings show a flashing green person and bleep when it is safe to cross.



(a) State **two** different ways the man uses:

(i) his eyes, to help him cross the road safely;

1. _____

2. _____

(2)

(ii) his ears, to help him cross the road safely.

1. _____

2. _____

(2)

(b) (i) Eyes, ears and skin contain sense receptors.

State the names of **two** other parts of the body which contain sense receptors.

_____ and _____

(2)

(ii) What type of sense receptor is in the skin of his feet?

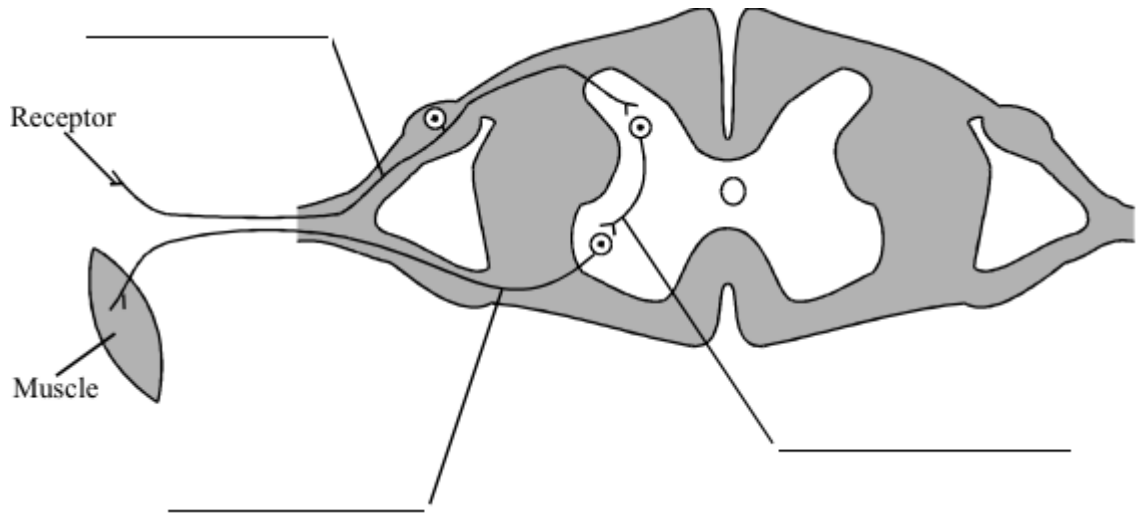
(1)

(Total 7 marks)

Q14.

Information is also passed by impulses in the nervous system. Neurones carry impulses very rapidly. The diagram shows a reflex arc.

Label the diagram by adding the names of the neurones.

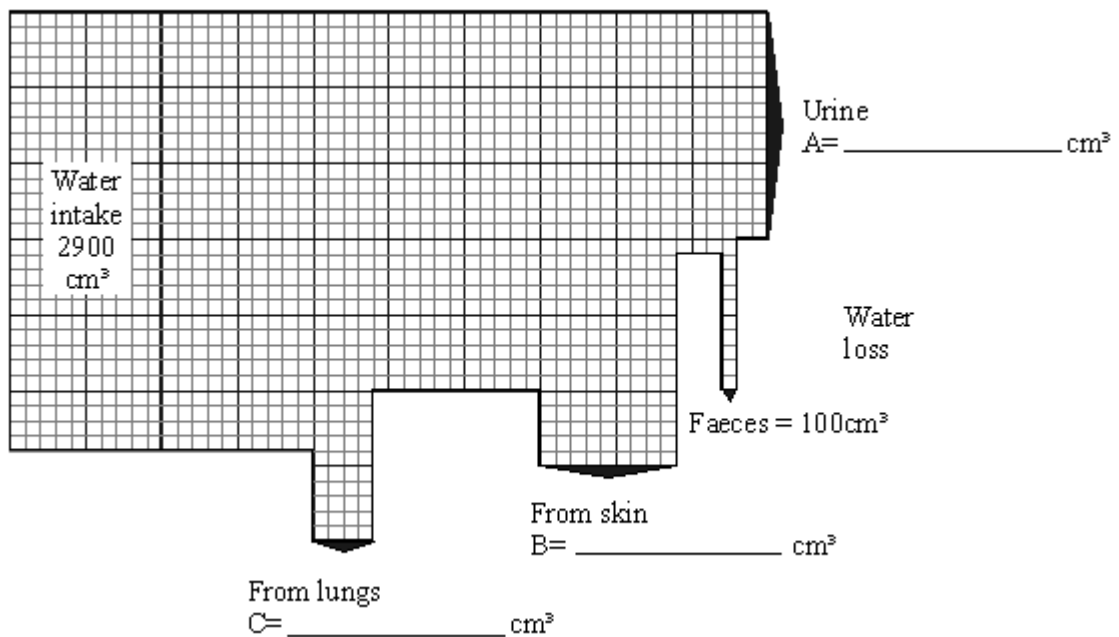


(Total 3 marks)

Q15.

The diagram shows the amount of water lost by an adult in one day.

The width of the arrows shows how much water is lost in each way.



- (a) Work out from the diagram the water loss for urine, skin and lungs and write the correct figures in the spaces on the diagram.

(4)

- (b) When it is hot, much more water is lost from the skin. Which other method of water loss would also change significantly?

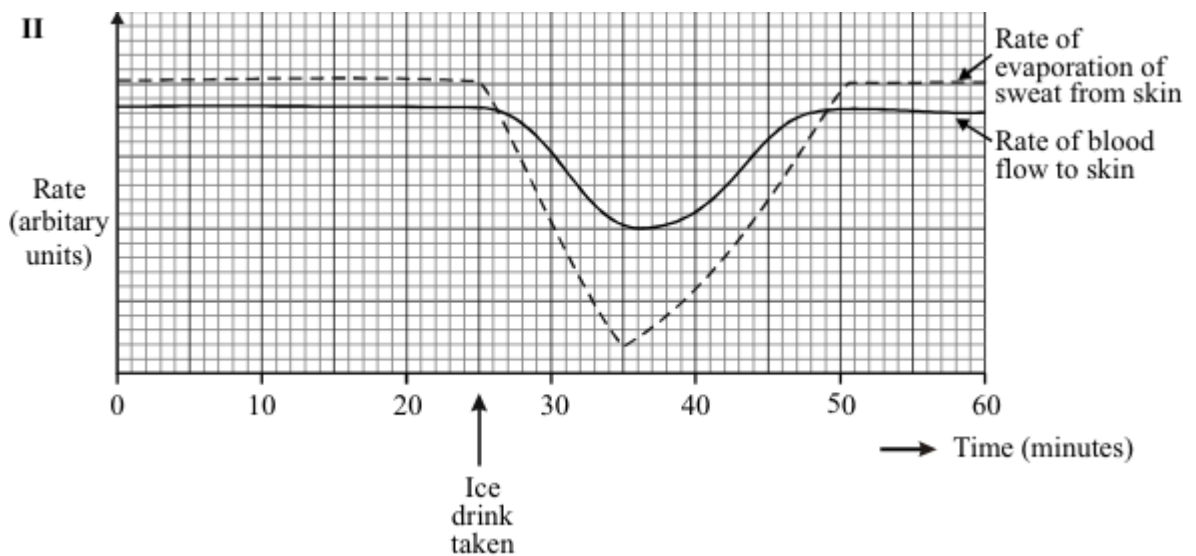
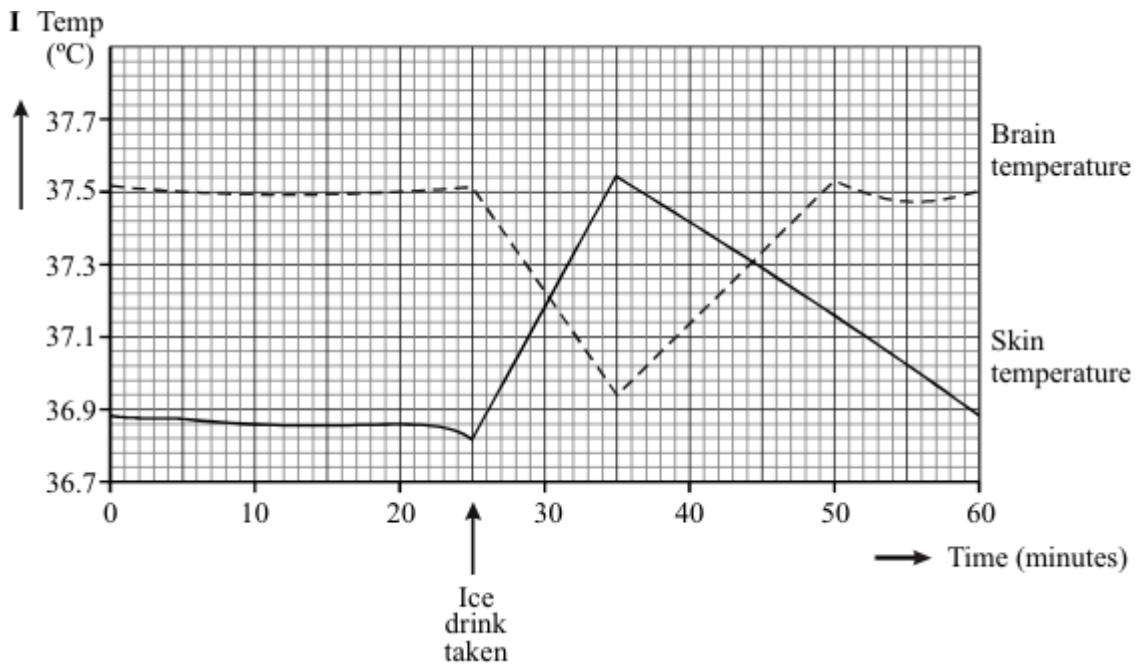
Explain your answer.

(3)
(Total 7 marks)

Q16.

On a hot day, a student has an iced drink.

Graphs I and II show some of the changes to the student's body produced by the iced drink.



Use the information from the graphs to explain, as fully as you can, why the temperature of the student's skin rises after she has taken the iced drink.

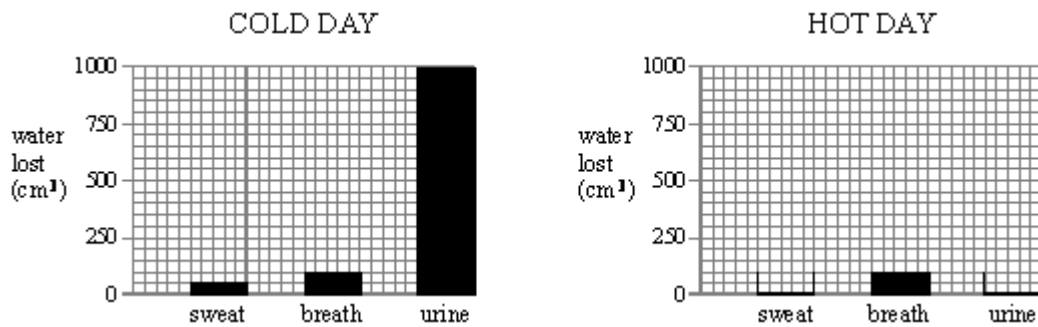
(Total 4 marks)

Q17.

The table shows how much water is lost from a boy's body on a cold day and on a hot day.

WATER LOST (cm ³)	COLD DAY	HOT DAY
in sweat	50	300
in breath	100	100
in urine	1000	750

(a) Use the figures in the table to complete the bar-chart for a hot day.



(2)

(b) How do the figures for the hot day compare with those for the cold day?
Answer in as much detail as you can.

(4)

- (c) The boy does the same things for the same amount of time on both days. Explain why the amounts of water lost in sweat and urine change.

Sweat _____

Urine _____

(2)
(Total 8 marks)

Q18.

The table shows how much water is lost from a boy's body on a cold day and on a hot day.

WATER LOST (cm ³)	COLD DAY	HOT DAY
in sweat	50	300
in breath	100	100
in urine	1000	750

- (a) How do the figures for the hot day compare with those for the cold day? Answer in as much detail as you can.

(2)

- (b) The boy does the same things for the same amount of time on both days. Explain why the amounts of water lost in sweat and urine change.

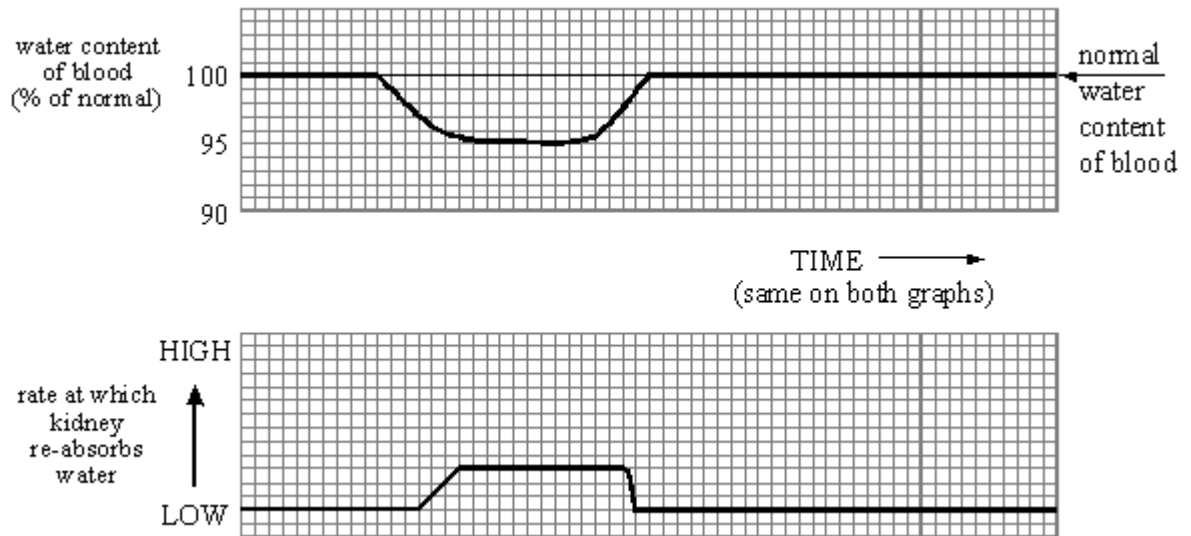
Sweat _____

Urine _____

(2)

- (c) The rate at which the kidney re-absorbs water depends on the percentage of water

in the blood.



Describe, as fully as you can, what the graphs tell you.

(4)

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

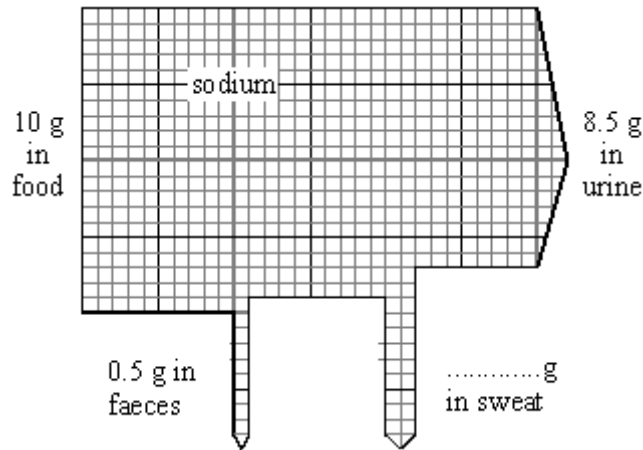
(2)

(Total 10 marks)

Q19.

To stay healthy, the amount of sodium in your body must not change very much.

On average, a girl takes in 10 grams of sodium a day in the food she eats.
The diagram shows what happens to this sodium.



(a) Add the missing figure to the diagram. (1)

(b) Choose words from this list to complete the sentences below.

bladder kidneys lungs skin

Sweat is produced by the girl's _____

Urine is produced by the girl's _____

(2)

(c) The girl goes on holiday to a very hot place.
Her diet stays the same but she now loses 12 g of sodium each day in sweat.

(i) How will this affect the amount of sodium she loses each day in her urine?

(1)

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

(1)

(Total 5 marks)

Mark schemes

Q1.

- (a) light/eye
smell/nose
taste/chemical/tongue
for 1 mark each 3

- (b) 6 of e.g.
receptors in ear detect sound waves/vibrations
impulses/electrical signals to brain
brain co-ordinates response
impulses sent along nerves
to muscles/effectors which contract to bring about response
any 6 for 1 mark each 6

[9]

Q2.

- (a) receptors
for 1 mark 1

- (b) electrical/nerve
signals/impulses
for 1 mark each 2

- (c) muscle
for 1 mark 1

- (d) correct description of:
stimulus
receptor
co-ordinator
effector
response
for 1 mark each 5

[9]

Q3.

- (i) eyes as sense organs/detector/receptors in eye,
electrical signals (impulses),
to co-ordinator,
then to leg muscles/effector
for 1 mark each 4

- (ii) affects the nervous system and slows down the reactions
for 1 mark

1

[5]

Q4.

- (a) (i) road traffic accidents
for one mark

1

- (ii) 15% / 0.15 / $\frac{3}{20}$ / 3:17
for one mark

1

- (b) *ideas that*
receptors (detect pain) involved initially
information (or impulses / messages / signals)
unable to pass along (nerves) cord idea
(to brain where pain is felt) brain involved at the end

each for 1 mark

3

[5]

Q5.

- (i) *idea that* reduce water loss (in dry area) / conserve water
for 1 mark

1

- (ii) ideas of evaporation (of moisture) uses energy / heat
or
large surface area of blood vessels / dilation of blood vessels
for evaporation / radiation
each for 1 mark

2

- (iii) ideas of large surface area of (small) vessels / intertwining results in close
contact of vessels idea that cool venous blood cools arterial blood
each for 1 mark

2

[5]

Q6.

- (a) (i) more
less
the same
(accept appropriate numbers)
for 1 mark each

3

- (ii) sweating / evaporation / perspiration

for 1 mark

1

- (b) in food / named solid food / eating from respiration

for 1 mark each

2

[6]

Q7.

- (a) pressure / temperature / hot / cold / touch / pain ear / cochlea
chemicals / taste / named taste e.g. salt
(reject skin receptors e.g. hot, cold)

for 1 mark each

3

- (b) impulses / electrical pulse / electrical signal
(reject information, message, pulse, signal)
via sensory neurones (ignore relay neurone, synapse)
(in) optic nerve

(allow 1 mark for via nerves or neurone if neither second nor third mark scored, reference to spinal cord disqualified route mark)

for 1 mark each

3

[6]

Q8.

- (a) evaporation of sweat

do not credit sweating cools body if no reference to evaporation

1

cools body

allow cools body if attempt at description of evaporation (e.g. sweat dries) for 1 mark

1

- (b) (i) idea blood (passing through gut) cooled (by ice)

1

(this) cooled blood cools brain

do not credit ice cools brain

1

- (ii) **impulses** from brain / thermoregulatory centre to skin

do not accept messages / signals

accept hypothalamus

accept electrical signals

1

vessels supplying skin surface
 capillaries constrict / sweat glands less
 active or hairs become erect
do not credit capillaries constrict / move down
accept reduced supply of blood to skin surface
shivering (unqualified) is neutral
 therefore less heat lost by skin

2

[7]

Q9.

any **three** from:

heat produced by muscles

during exercise

accept when working

by respiration

(skin) temperature over muscles rises / more blood to skin over muscles

*allow vasodilation **or** arterioles dilate over muscles*

reject capillaries dilate

sweating neutral

[3]

Q10.

(a)

the senses may be in any box.

do not credit list of receptors

the appropriate organ must be adjacent

2

Mark first

Look for
suitable

Sense

Receptor

taste

tongue **or**
taste buds

do not credit mouth

2

smell

nose

hearing

ear
cochlea

2

vision **or** sight **or**

eye **or** retina

effector **or** motor **or** efferent

- (c) any **one** from
blink (of eye)

*accept a violent movement of a limb from pain **or** sharp object*

knee jerk

*do not credit snatch from cold object **or** any temperature reference e.g. boiling water*

*accept sneezing, coughing, choking, vomiting, pupil closing **or** reflex*

1

- (d) danger **or** a signal detected (by nerve)
or impulse sent

1

goes to **or** through spine

*accept impulse by-passes the brain
do not award mark if brain mentioned
do not credit message to spine*

1

a very rapid response occurs **or** then to
effector **or** muscle **or** motor

accept no thinking time is needed

1

[8]

Q13.

- (a) (i) any **two** from

see the (green) light **or** sign **or** man
for seeing where to go to avoid
objects
see cars (that are stopped)

answer must show that the person sees something

2

- (ii) any **two** from

hear the bleeps **or** noise
to listen for traffic or danger
for balance

answer must show that the person hears something

2

- (b) (i) nose

credit smell

1

tongue

credit taste but not mouth

credit temperature sensor

1

(ii) any **one** from

do not accept sensory receptors or neurone

touch

pain

credit nerves

pressure

temperature

credit heat

do not accept cold

1

[7]

Q14.

top left label sensory

credit afferent

do not accept receptor

1

bottom right label connector **or** relay

credit intermediate

1

bottom left label motor **or** effector

credit efferent

1

[3]

Q15.

(a) $A > B > C$;

$A + B + C = 2\ 800$;

one number correct

two numbers correct

each for 1 mark

4

(b) urine;

less produced;

kidneys absorb more water

or

to maintain (water) balance

each for 1 mark

3

[7]

Q16.

ideas that

internal cooling/cooling of brain causes reduction in sweating and of blood flow to skin

less sweating = less loss of heat from skin (= X)

less blood flow = less heat supplied to skin (= Y)

X > Y (so temperature rises)

each for 1 mark

[4]

Q17.

(a) sweat – 6 squares high

urine – 15 squares high

each to < half a square for 1 mark each

2

(b) for *hot day* (assumed unless otherwise stated)

- same in breath
- same total
- more in sweat* / sweats more
- less in urine* / urinates less
- correct quantification of either * eg $x\text{cm}^3$ more / less or n times more / less

250 cm³ more sweat 6 × more sweat

250 cm³ less urine ¼ / 25% less urine

any four • for 1 mark each

[Do not allow just figures quoted from the table]

4

(c) *ideas that*

- you sweat more **to keep cool** on a hot day
- urine adjusted (by kidneys) to keep balance / to keep same total loss

each for 1 mark

[Accept "more sweat therefore less urine"]

[Credit ideas from (c) if given in (b)]

2

[8]

Q18.

(a) breath same + sweat more* + urine less* (All three needed)

or

total same but split differently

for 1 mark

**either change correctly quantified eg*

x cm³ more/less or n times more/less

for 1 further mark

sweat 250 more 6 x more
 urine 250 less ¼/25%less

2

(b) *ideas that*

- you sweat (more) to keep cool on a hot day
- urine adjusted (by kidneys) to keep balance / to keep same total loss
each for 1 mark

(NB credit these answers if in (a) candidates have answered more fully than expected)

2

(c) *ideas that*

- when blood water normal/100% / steady kidney re-absorbs water at low/steady rate
- when blood water percentage falls, the rate at which kidney re-absorbs water rises
- when blood water percentage rises again, is high/normal the rate at which kidney re-absorbs water falls
- 97 / 97.5% / 98% (of normal) blood water is the point at which the kidney's reabsorption rate starts to increase / decrease
each for 1 mark

[allow idea that there is delay between blood water percentage changing and rate of re-absorption changing]

4

(d) *any reference to hormone(s) / pituitary (gland)*
gains 1 mark

but
 ADH or hormone(s) from pituitary (gland)
gains 2 marks
(do not allow 'brain)

2

[10]

Q19.

(a) 1

for 1 mark

1

(b) skin
 kidneys

for 1 mark each

2

- (c) (i) *idea that*
there will be less / no sodium (per day) (in her urine)
for 1 mark

1

- (ii) *idea that*
she should take in more sodium (chloride) / salt
(*allow* stay indoors / in shade **or** be less active)
for 1 mark

1

[5]