AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.5.2 THE HUMAN NERVOUS SYSTEM (PACK 1)

SCORE	PERCENTAGE
/307	%

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Q1.

Many human actions are reflexes.

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

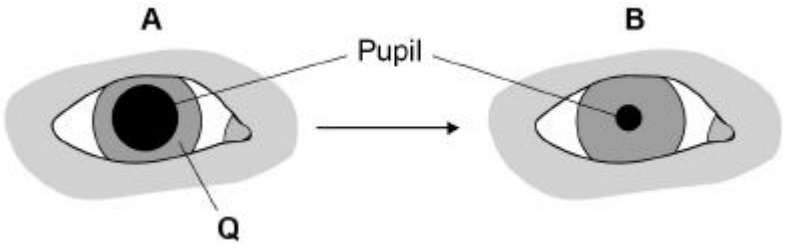
Tick **two** boxes.

Jumping in the air to catch a ball	☐
Raising a hand to protect the eyes in bright light	☐
Releasing saliva when food enters the mouth	☐
Running away from danger	☐
Withdrawing the hand from a sharp object	☐

(2)

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

Figure 1



(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**.

_____

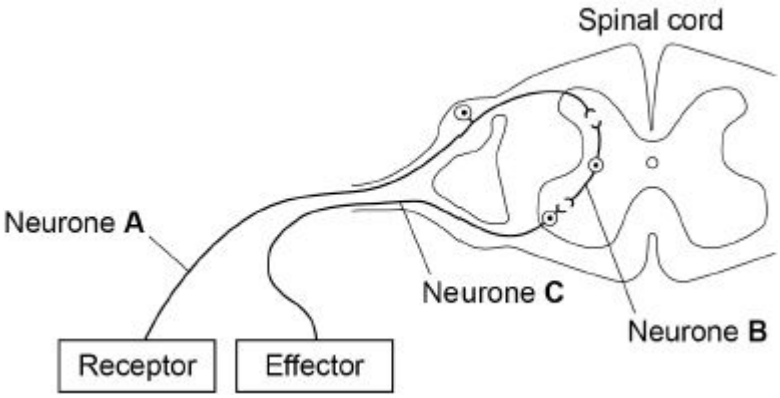
_____

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(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)

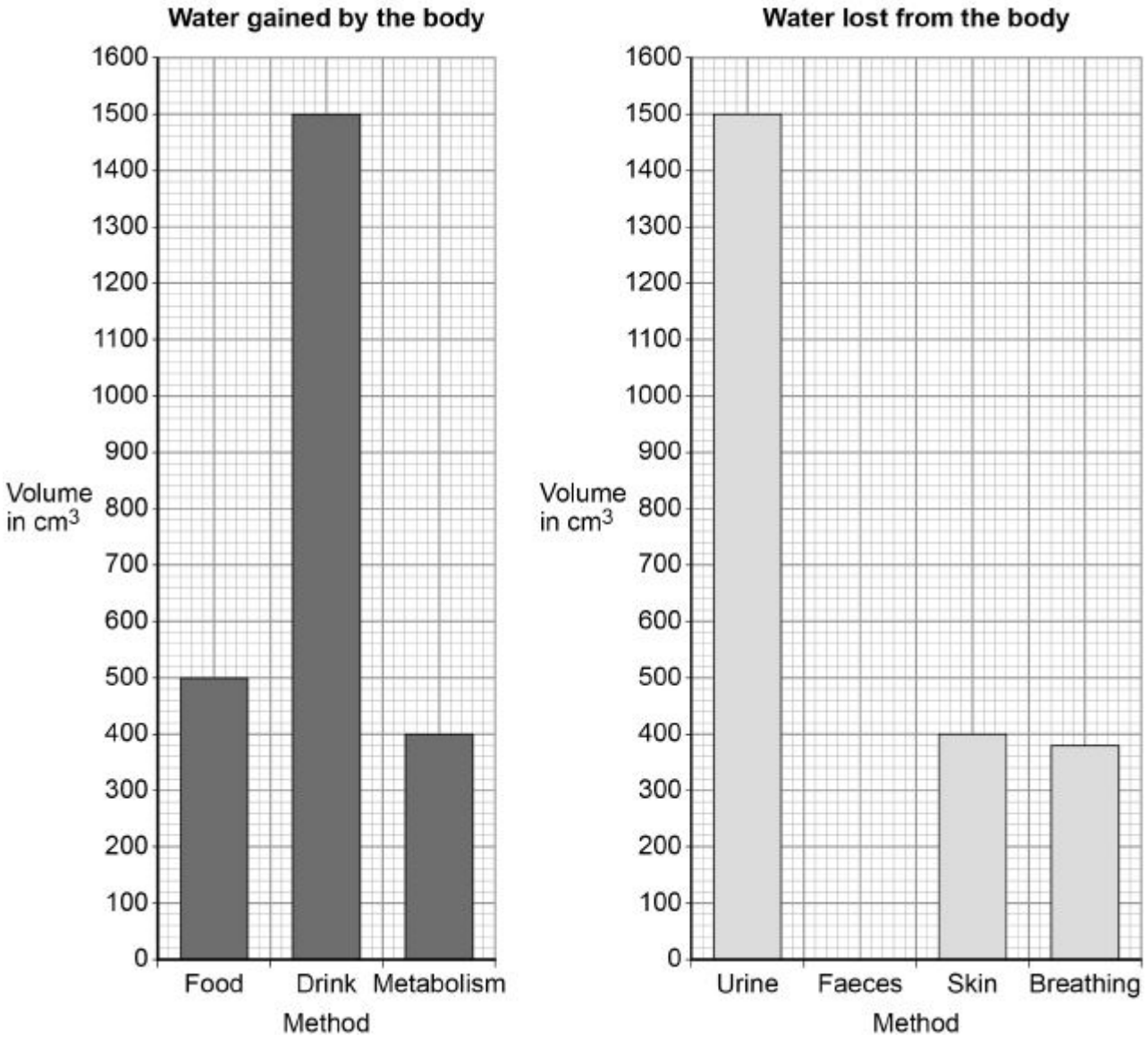
(Total 11 marks)

Q2.

It is important to maintain water balance in the body.

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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 = _____ cm^3

(2)

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

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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)

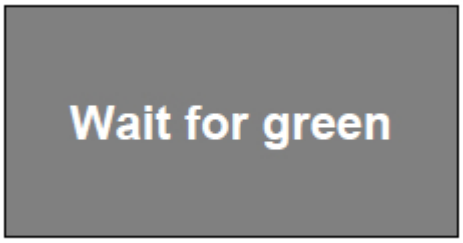
Q3.

Three students measured their reaction times.

The students used a computer program.

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

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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.

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_____

_____

_____

_____

(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)

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(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)

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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?

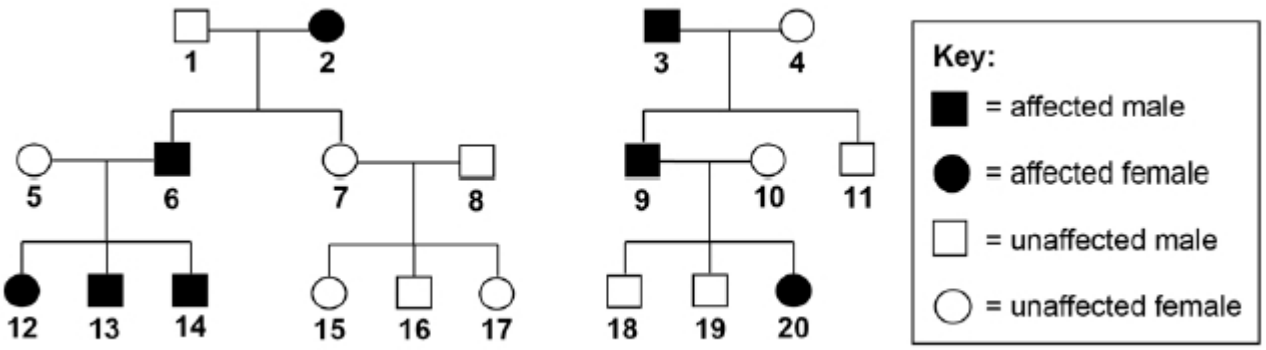
Tick **one** box.

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**.

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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)

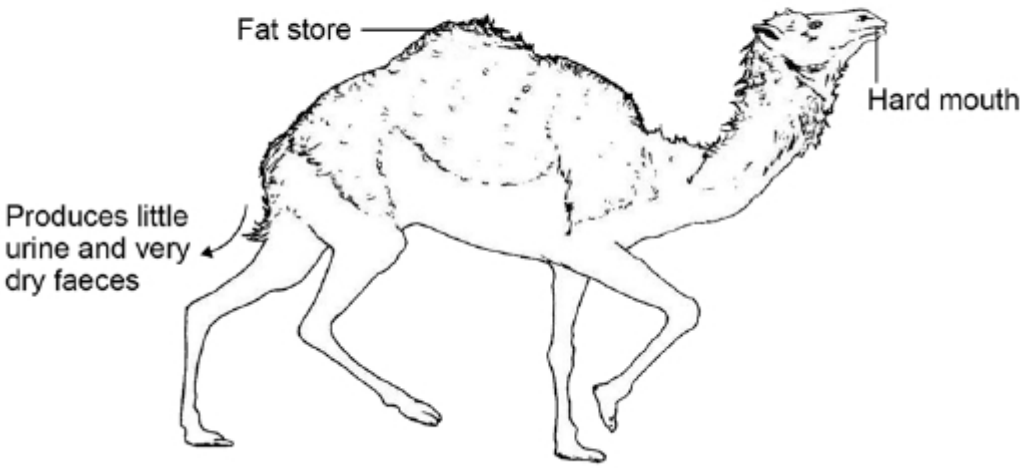
(Total 9 marks)

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.

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Fat store _____

_____

Produces little urine and very dry faeces _____

_____

Hard mouth _____

_____

(3)

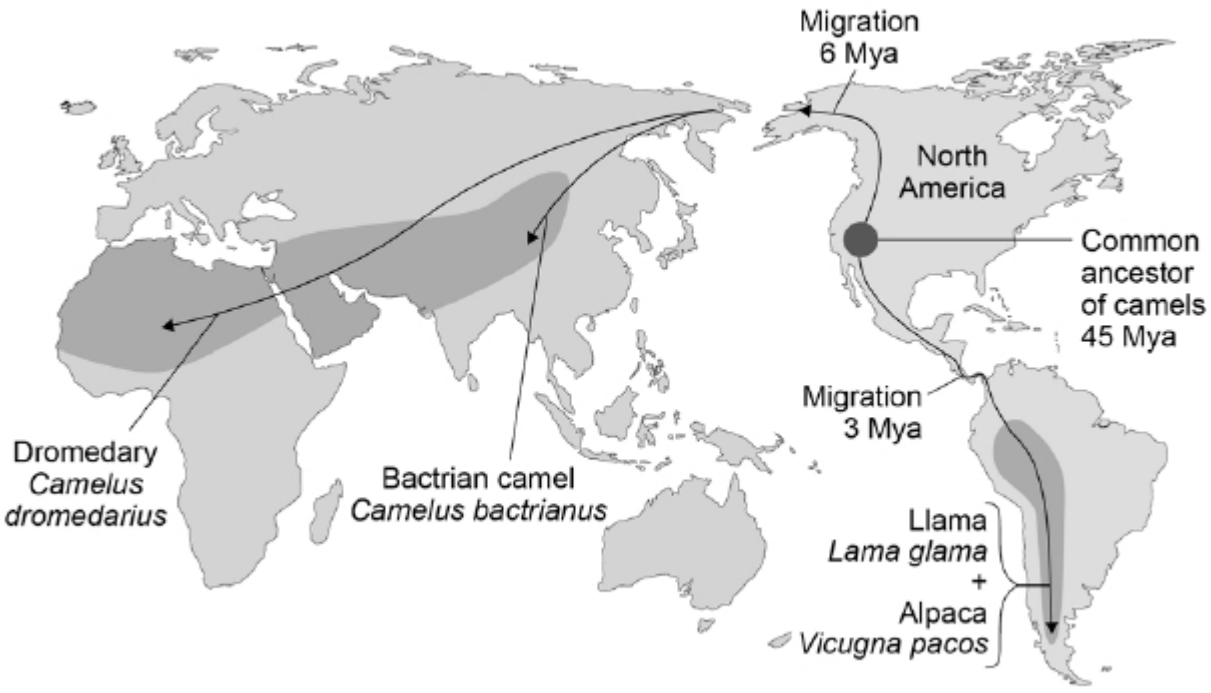
There are several species of the camel family alive today.

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 _____

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_____

(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. _____

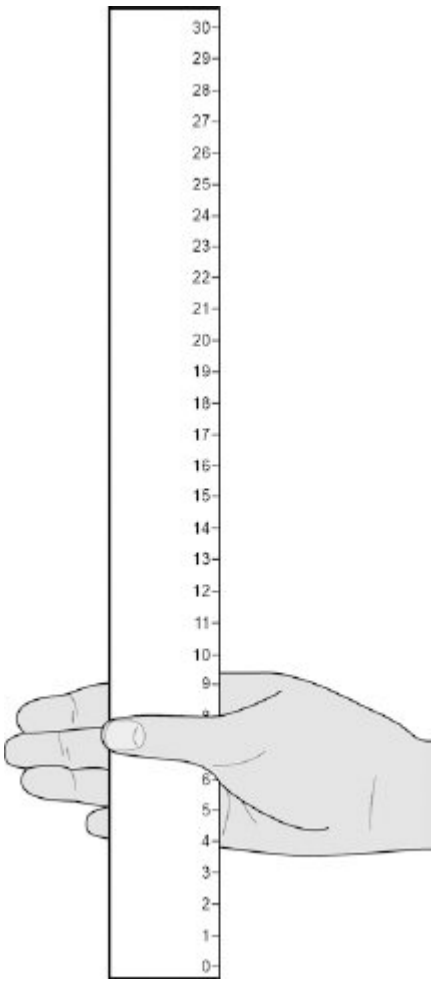
2. _____

(2)

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

Figure 1

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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**

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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**.

_____

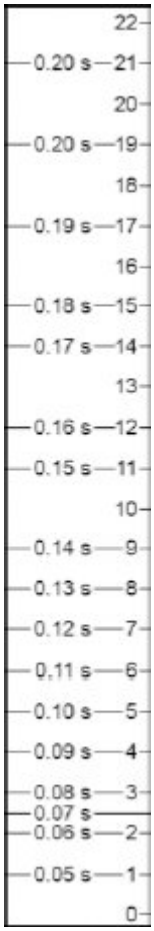
Mean distance ruler dropped = _____ cm

(1)

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

Figure 2

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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)

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(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.

_____

_____

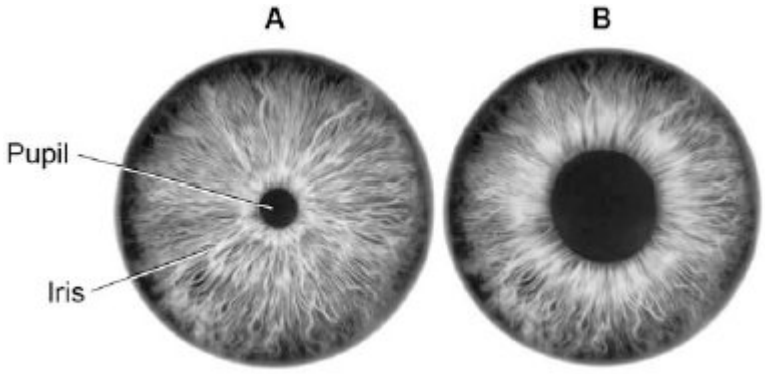
(1)

(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.

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_____

_____

_____

_____

_____

_____

_____

_____

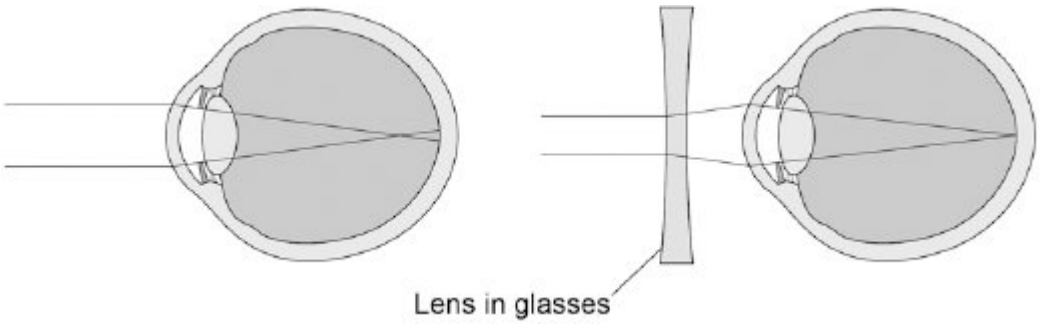
(4)

(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.

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This is the method used.

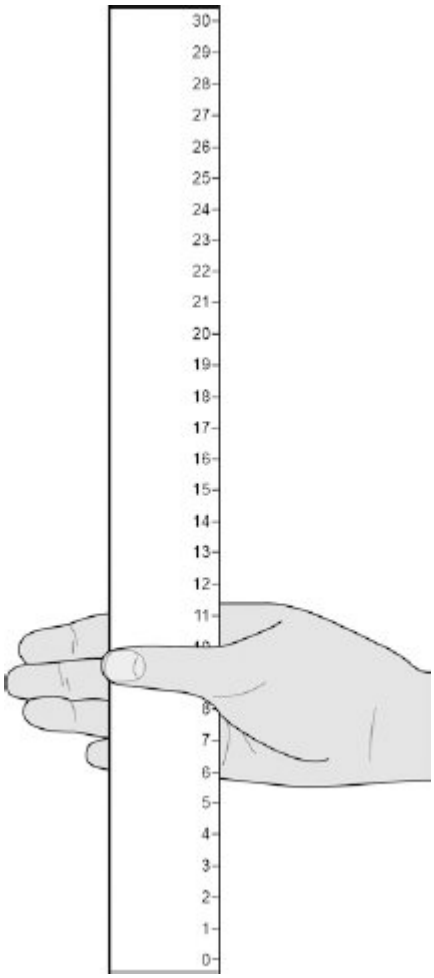
1. Student **A** sits with her elbow resting on the edge of a table.

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.

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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:

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)

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(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)

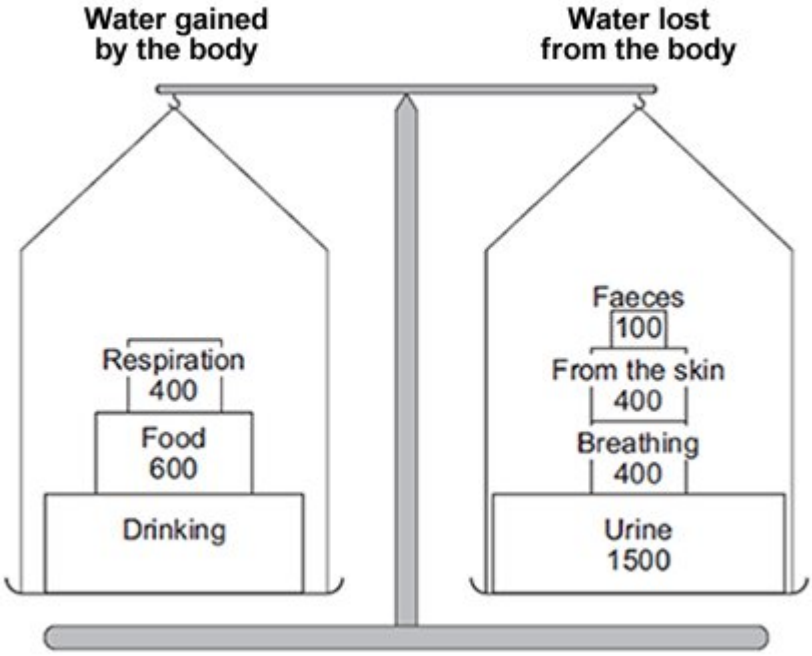
(Total 10 marks)

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.

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

Draw a ring around the correct answer.

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

(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 = _____ cm^3

(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.

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(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)

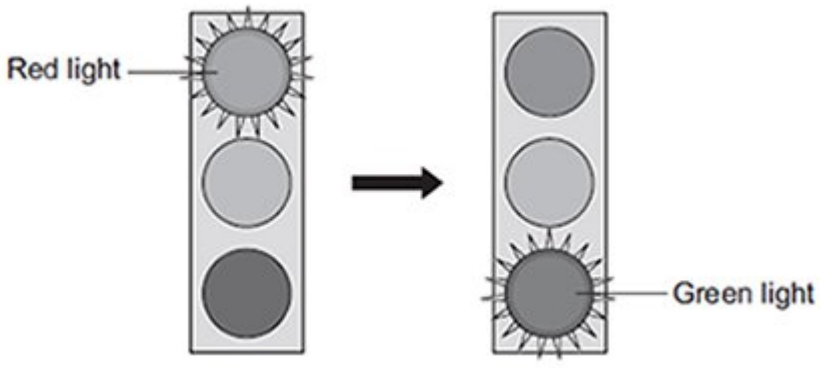
Q10.

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.

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(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)

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(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)

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(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.

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

_____

_____

_____

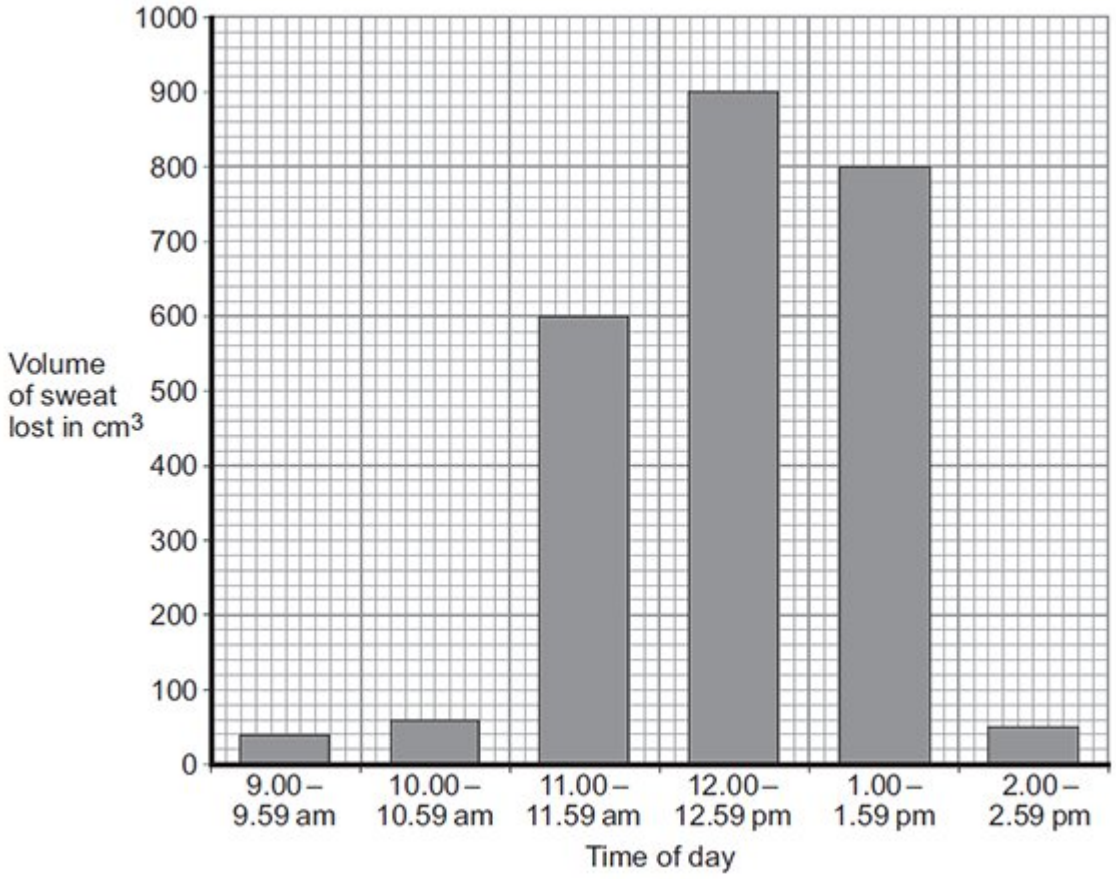
_____

(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. ☐

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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 = _____ cm^3

(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?

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_____

_____

(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.

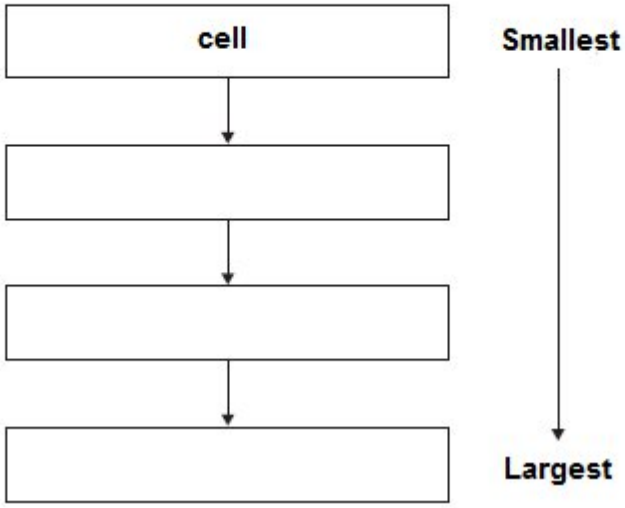
(a) Use words from the box to complete **Figure 1** by putting the parts of the body in order of size from smallest to largest.

The smallest one has been done for you.

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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.

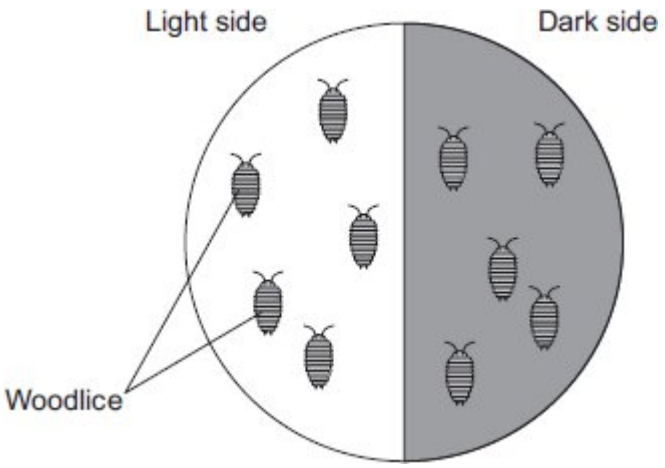
The student set up the investigation as shown in **Figure 2.**

- 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.

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- 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.

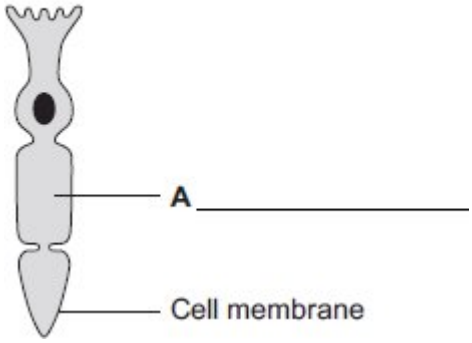
neurone **reflex** **stimulus**

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(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	

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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.

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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.

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© Keith Brofsky/Photodisc/Thinkstock

Table 1 gives information for each drink.

Table 1

	Brand of sports drink		
Nutrient per dm^3	**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.

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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

	Brand of sports drink		
Nutrient per dm^3	**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.

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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?

_____

_____

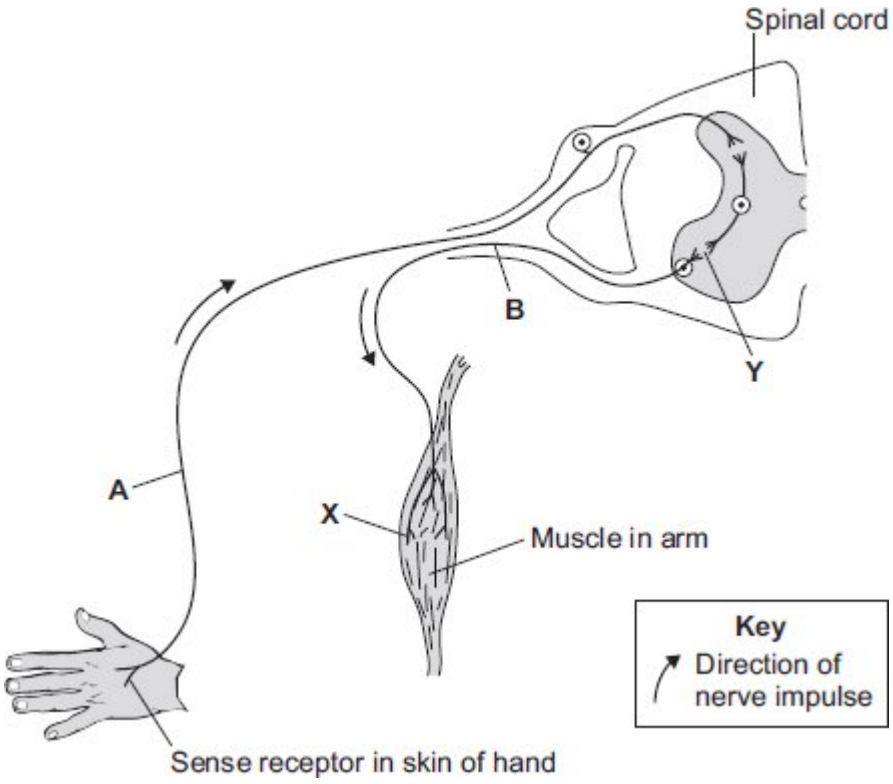
(1)

(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.

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(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)

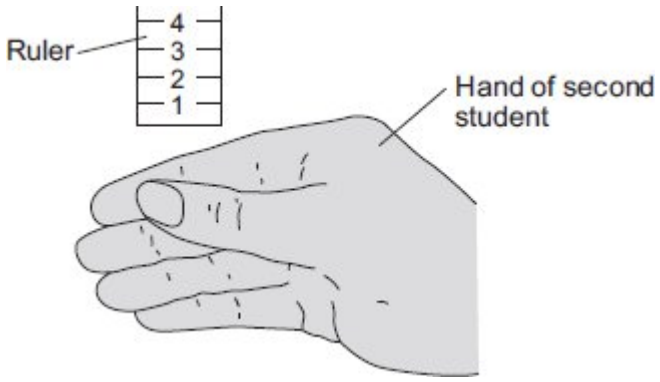
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(b) Some students investigated the effect of caffeine on a person's reaction time.

The students used the following steps.

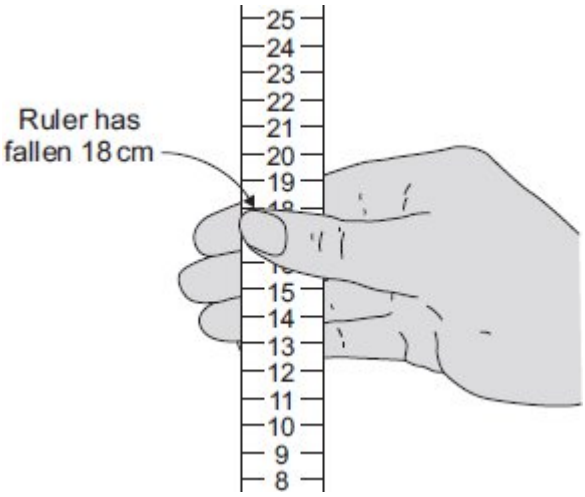
1. One student held a ruler just above a second student's hand, as shown in **Diagram 2**.

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.

Table 1

Distance ruler fell before it was caught in cm

Table 2

Distance ruler fell before it was caught in cm

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Before drinking coffee	After drinking coffee
18	8
21	13
25	11
15	17
19	10
16	14
12	13
21	13
Mean = 18.4	**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.

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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.

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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 = _____ cm^3

(2)

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

Complete the equation for aerobic respiration.

_____ + oxygen ⟶ _____ + 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	Kidney	Urine

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	plasma in g per dm^3	filtrate in g per dm^3	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 _____

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_____

_____

_____

(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.

_____

_____

_____

_____

_____

_____

_____

_____

_____

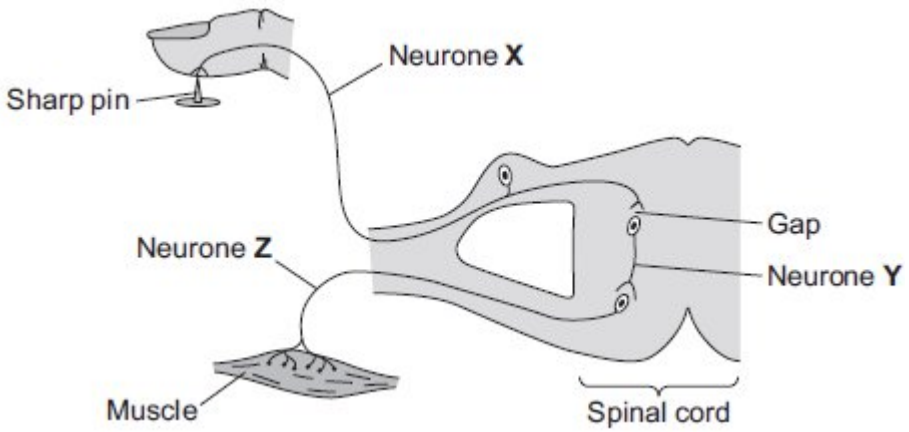
_____

(4)

(Total 17 marks)

Q21.

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



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

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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 _____

_____

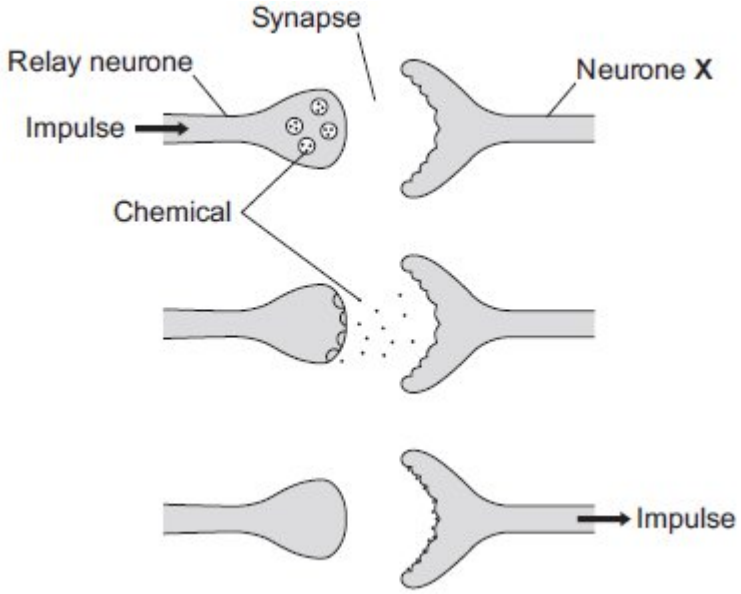
(2)

(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**.

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(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 _____

_____

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_____

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 dm^3)	15:14	12:1	2:7

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

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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?

_____

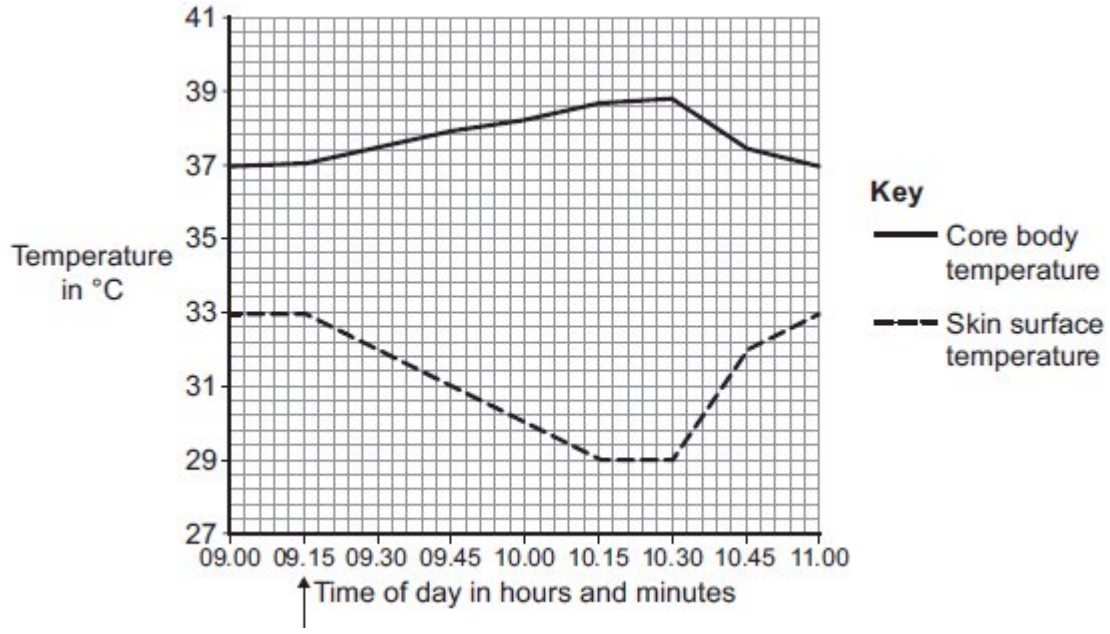
_____

(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.



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

How long did the race last?

_____

(1)

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(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.

_____

_____

_____

_____

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_____

_____

_____

_____

(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 _____

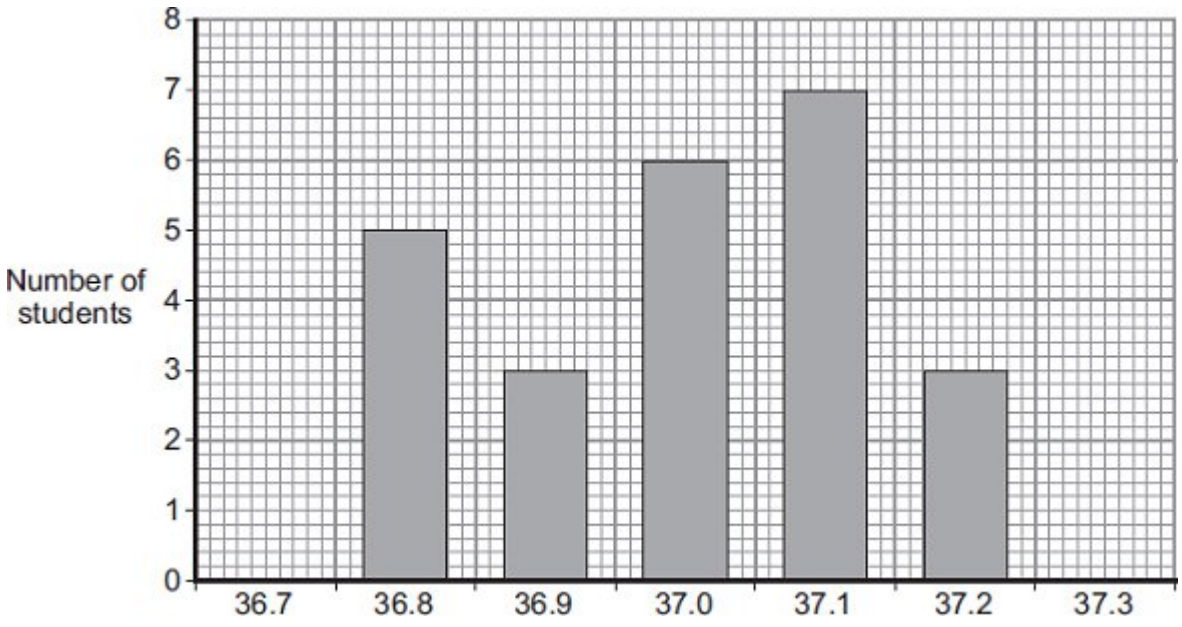
(1)

(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.

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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?

_____

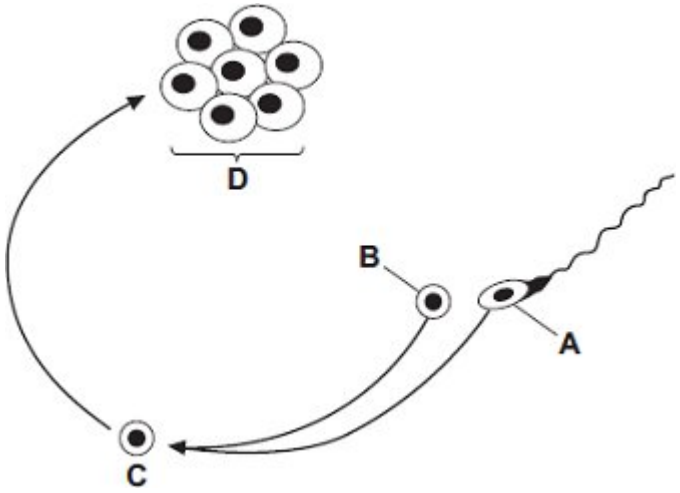
_____

(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** _____

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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)

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

Suggest **one** reason for this.

_____

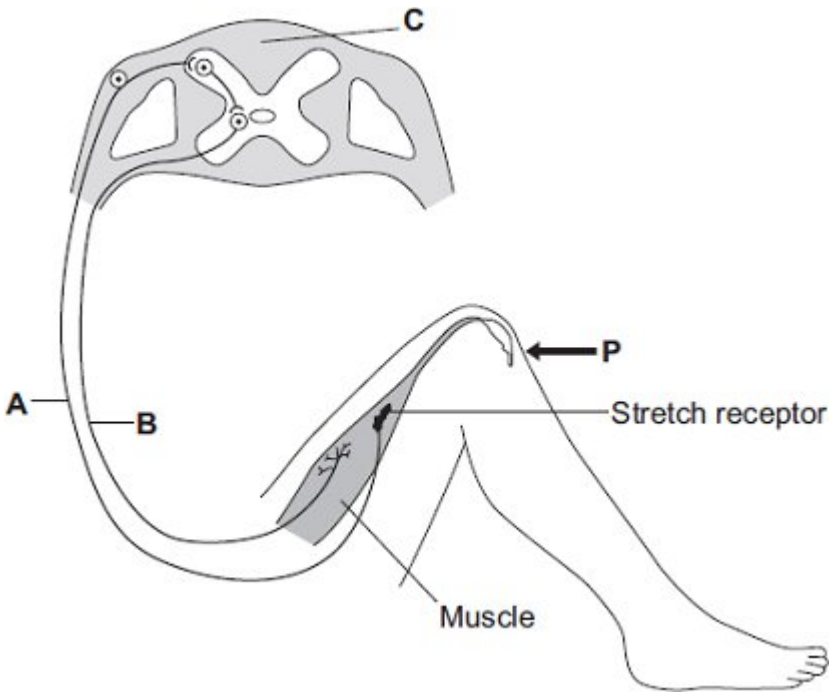
_____

(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?

_____

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(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.

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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

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© Fuse

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

_____

_____

_____

_____

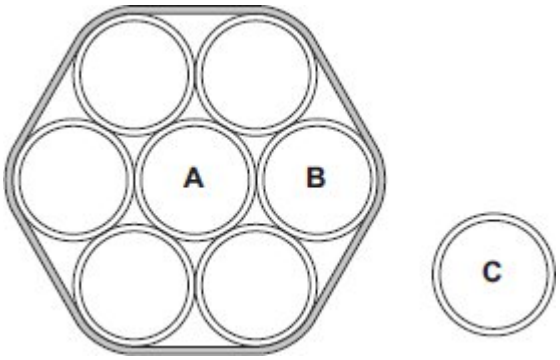
_____

_____

(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.

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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)**?

_____

_____

_____

_____

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(2)

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

_____

_____

_____

_____

_____

_____

_____

_____

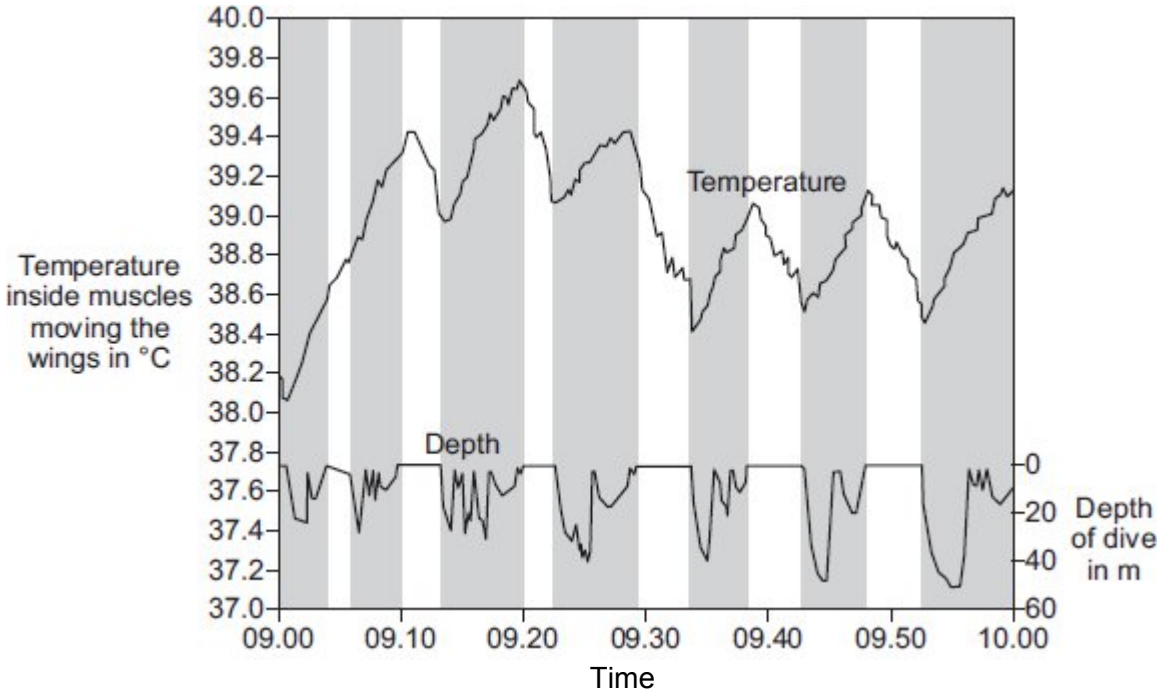
(4)

(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



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

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_____

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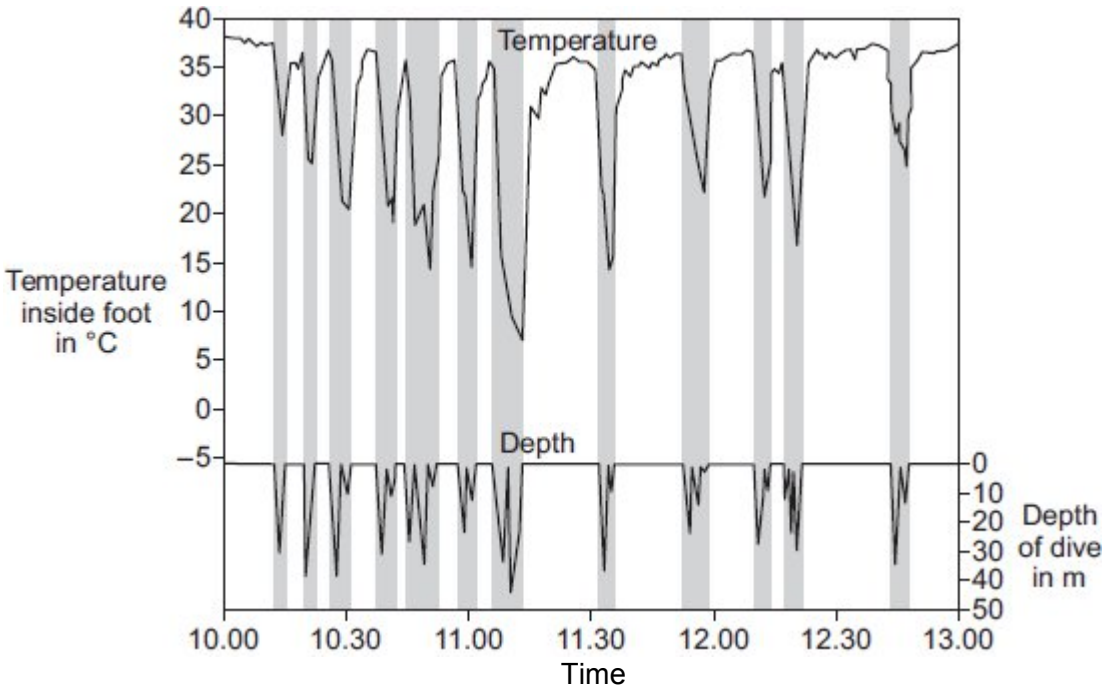
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(3)

(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.

_____

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(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**
Sight of the finishing line	Ear
Sound of the starting gun	Nose
Pressure of the ground on the fingers	Eye
	Skin

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(3)

(ii) Which cells detect changes in the environment?

Tick (✓) **one** box.

Gland cells ☐

Muscle cells ☐

eceptor 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)

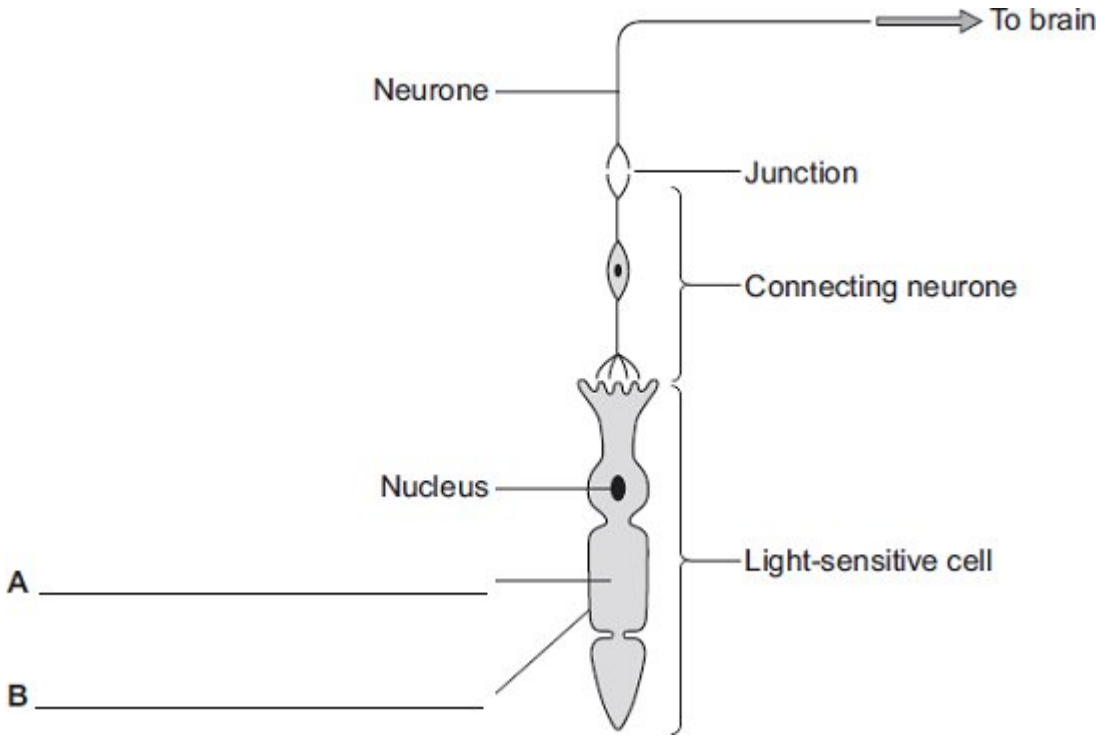
(Total 7 marks)

Q31.

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

Diagram 1

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(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?

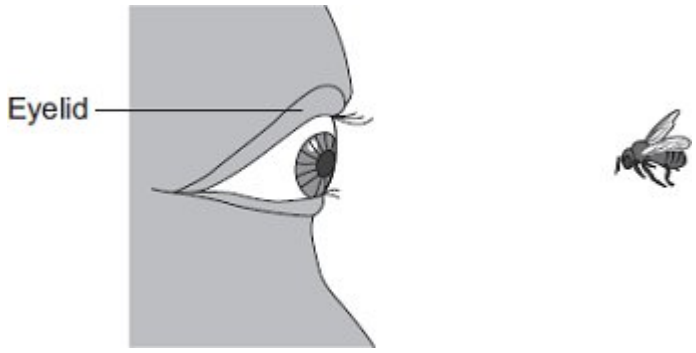
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(1)

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

Diagram 2



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In the *blink reflex* , light from the bee reaches the light-sensitive cell in the eye. The muscles in the eyelid shut the man's eye before the bee hits the eye.

Describe the pathway taken by the nerve impulse in the *blink reflex*.

(4)

(Total 8 marks)

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.

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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.

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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**.

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Why?

_____

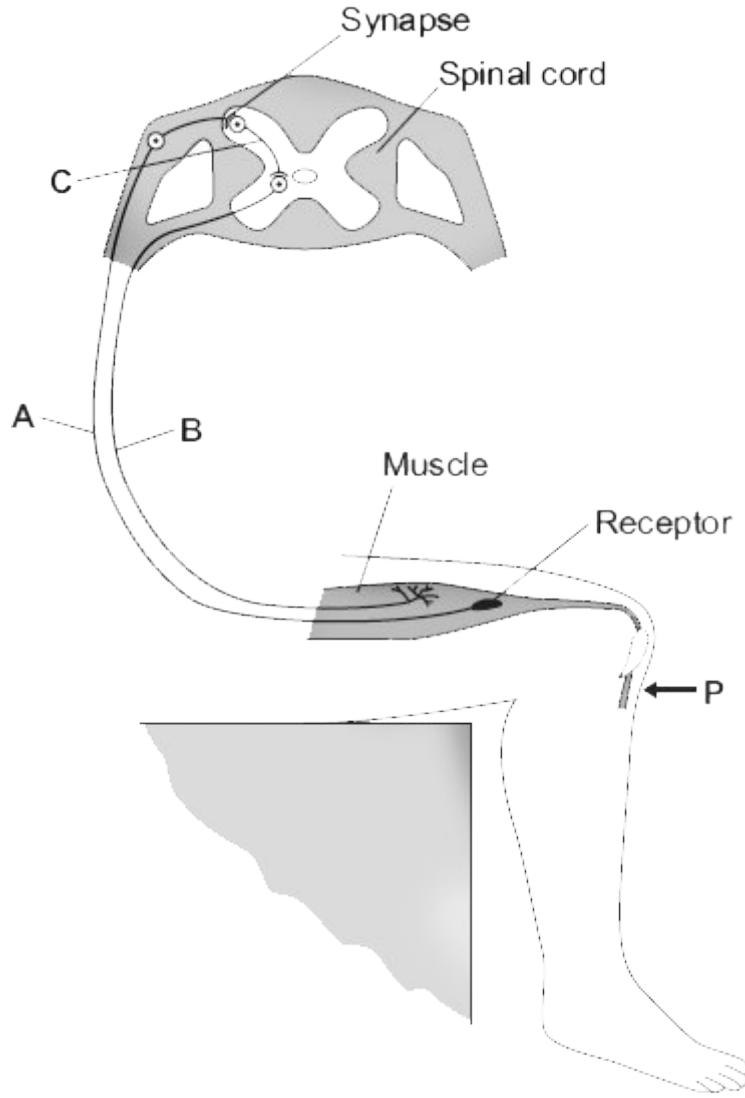
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(1)

(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.

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Suggest the stimulus.

_____

(1)

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

_____

_____

_____

_____

_____

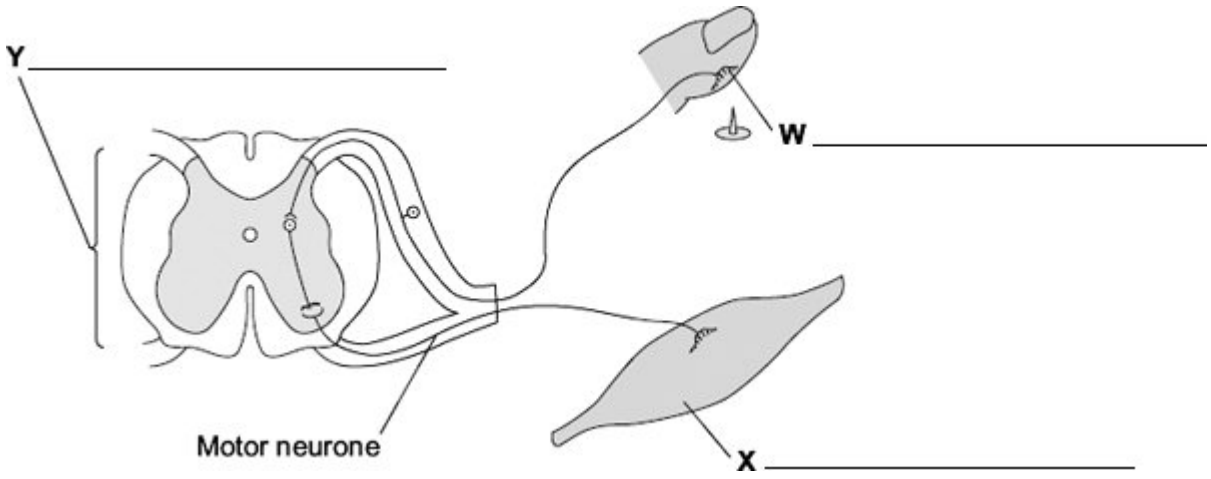
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(3)

(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. _____

_____

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(2)
(Total 5 marks)

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