AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.5.2 THE HUMAN NERVOUS SYSTEM (PACK 4)

SCORE	PERCENTAGE
/127	%

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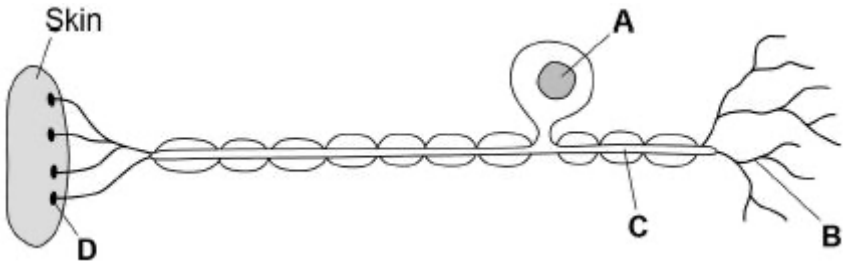
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Q1.

This question is about coordination in the human body.

Figure 1 shows a sensory neurone (nerve cell).

Figure 1



(a) Which label is the cell nucleus?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(b) Which label is the receptor?

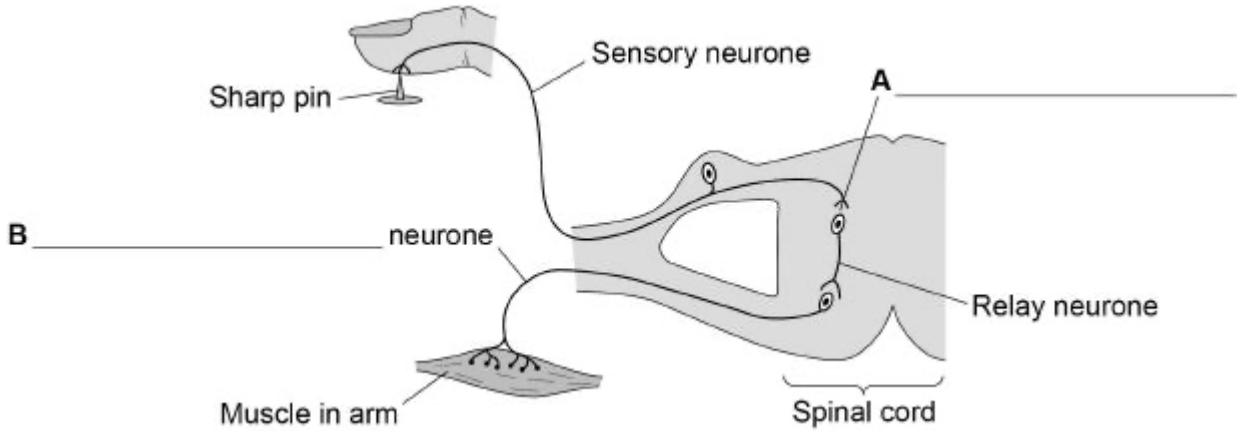
Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(c) **Figure 2** shows the nerve pathway when a person touches a sharp pin.

Figure 2



Name structures **A** and **B** on **Figure 2**

(2)

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(d) When the finger touches the sharp pin, the muscle in the arm contracts to pull the arm away.

What type of action is this?

Tick **two** boxes

A conscious action ☐

A delayed action ☐

A reflex action ☐

(1)

(e) Doctors tested people of different ages to time how long it took between touching a sharp pin and the arm muscle contracting.

At each age they tested five men and calculated a mean value for the time.

The table below shows the results.

Age in years	**Mean time for muscle to contract in milliseconds**
20	18
40	20
60	23
80	30

How much longer does it take for the muscle to contract at 80 years of age compared to at 20 years of age?

Give your answer in seconds.

_____

_____

_____

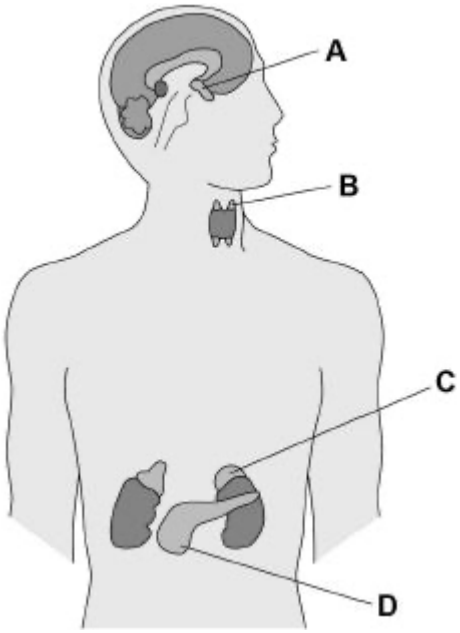
Time = _____ s

(2)

(f) **Figure 3** shows the position of some of the glands which release hormones.

Figure 3

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Which label on **Figure 3** shows the position of the pituitary gland?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(g) Luteinising hormone (LH) is a hormone released by the pituitary gland.

What is the function of LH?

Tick **one** box.

Controls blood glucose concentration ☐

Controls the formation of sperm ☐

Controls the growth of muscles ☐

Controls the release of an egg ☐

(1)

(h) How does LH travel from the pituitary gland to its target organ?

_____

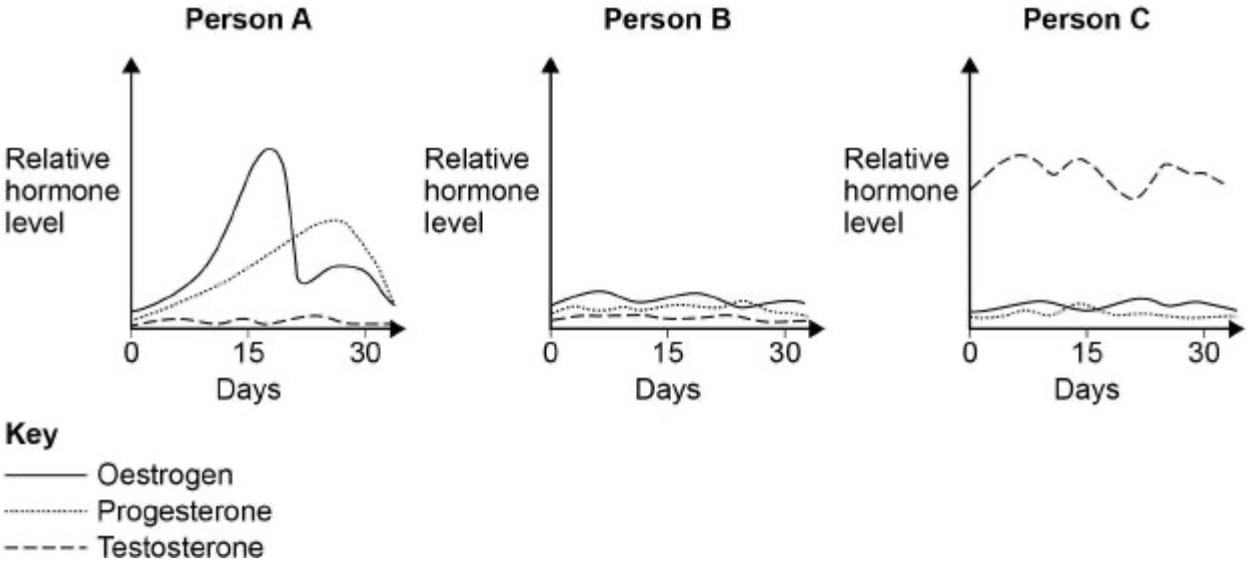
(1)

(i) **Figure 4** shows the relative levels of sex hormones of three young people over 30 days.

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One person is an 8-year-old girl, one is an 18-year-old boy and the other is an 18-year-old girl.

Figure 4



Which person is the 18-year-old boy?

Give **one** reason for your answer.

Person _____

Reason _____

_____

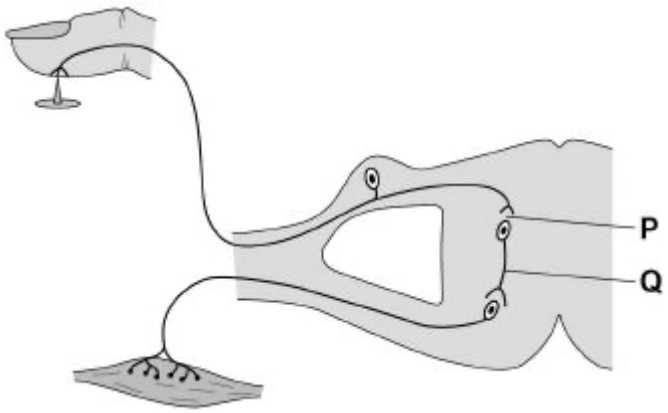
(2)

(Total 12 marks)

Q2.

This question is about the nervous system.

The diagram below shows a reflex arc.



(a) Name parts **P** and **Q** shown on the diagram above.

P _____

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Q _____

(2)

(b) Compare how information is transferred along a neurone with how information is transferred across gap **P**.

_____

_____

_____

_____

(2)

(c) Why does a conscious action take longer than a reflex action?

_____

_____

(1)

(d) Information travels at 120 metres per second in neurones.

Calculate the time it would take for the information to travel 1.6 m along a neurone.

Give your answer in milliseconds.

_____

_____

_____

Time = _____ ms

(3)

(e) Doctors tested people of different ages to time how long it took between touching a sharp pin and the arm muscle contracting.

The table below shows the results.

Age in years	**Time for muscle to contract in milliseconds**
30	18.9
40	20.2
50	23.1
60	26.7
70	31.3
80	37.0

Describe the relationship between age in years and time for the muscle to contract.

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_____

_____

_____

_____

(2)

(Total 10 marks)

Q3.

Students investigated the effect of lack of sleep on reaction time.

This is the method used.

1. Each student sleeps for a different amount of time.
2. Each student then completes a reaction time test on the computer five times.

The computer program asks the students to press a key on the keyboard when they hear a sound played at random.

The table below shows the results of the investigation.

Student	Number of hours of sleep	Reaction time in milliseconds			
		Test 1	Test 2	Test 3	Mean
A	**8**	229.6	253.3	233.4	238.8
B	**6**	298.3	308.7	269.1	292.0
C	**4**	211.2	218.9	206.5	212.2
D	**2**	449.3	445.2	441.9	445.5
E	**1**	712.0	717.9	715.3	715.1

(a) Calculate the percentage decrease in mean reaction time when the number of hours of sleep increases from 1 hour to 8 hours.

_____

_____

_____

_____

Percentage decrease in reaction time = _____

(2)

(b) Apart from using a computer program, describe one other method of measuring reaction time.

_____

_____

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_____

_____

_____

_____

_____

_____

(4)

(c) A computer program measures reaction time accurately.

Suggest **one** other reason why the students used a computer program to measure reaction time.

_____

_____

(1)

(d) A student concluded that lack of sleep increases reaction time.

Suggest **two** reasons why the data generated from the students' method may not allow a valid conclusion to be made.

1. _____

_____

_____

2. _____

_____

_____

(2)

Scientists investigated the effect of lack of sleep and the effect of alcohol consumption on the human nervous system.

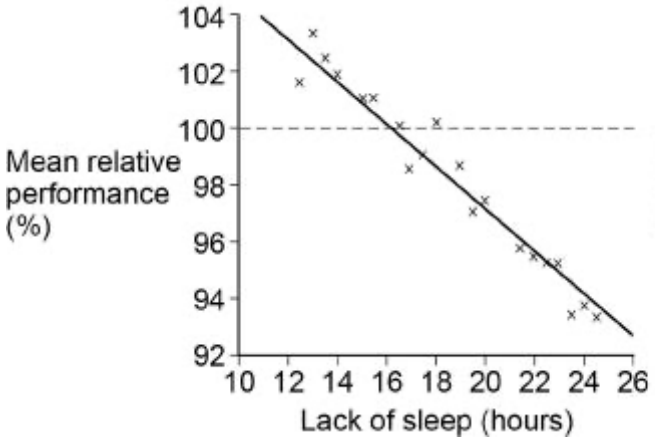
This is the method used.

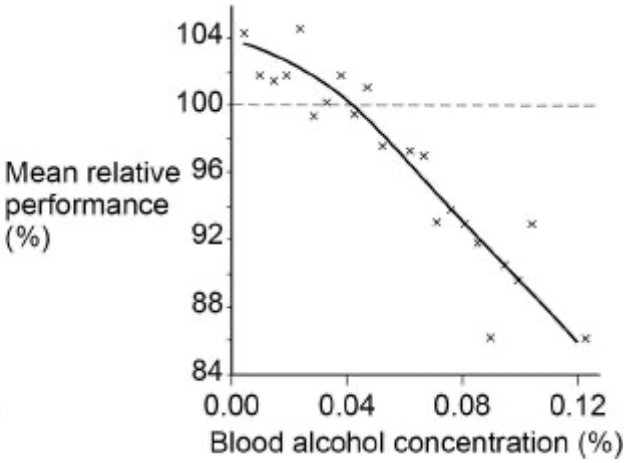
1. Each person completes an accuracy test using a computer.
2. Their average score is taken as 100%.
3. Half of the group are kept awake for 24 hours.
4. The other half of the group drink alcohol until their blood alcohol level reaches 0.12%.
5. Each person repeats the accuracy test at regular intervals using a computer.

Figure 1 and **Figure 2** show the results of the investigation.

Figure 1 **Figure 2**

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(e) Mean relative performance is a comparison with the person's original score. For example, 50% means their accuracy on the test was half of their original score.

If your blood alcohol concentration is above 0.08% it is against the law to drive in the UK.

A newspaper states the following:

Driving whilst tired is as dangerous as driving after drinking alcohol.

Evaluate the newspaper's statement.

Use information from **Figure 1** and **Figure 2**.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 13 marks)

Q4.

This question is about the human nervous system.

(a) A ball is thrown towards a boy.

As the ball is thrown, information passes along a pathway to allow the boy to catch the ball.

Draw **one** line from each action to the correct part of the pathway.

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Action	Part of the pathway
Retina cells in the eye detect the light from the ball	Coordinator
The impulse reaches the brain which 'sees' the ball and sends an impulse to the arm muscle	Effector
The muscle in the arm contracts	Response
The arm stretches to catch the ball	Receptor
	Stimulus

(3)

Students in a college made this hypothesis:

'reaction time will increase as the time you have been awake increases.'

The students set up an investigation to test their hypothesis.

This is the method used.

1. Find 5 volunteers willing to stay awake for 24 hours.
2. Keep the volunteers in a room where they can study, use an exercise bike or watch TV as they wish.
3. Provide food, water, coffee and tea as requested.
4. Measure the volunteers' reaction time every 4 hours using a computer program.

(b) What was the independent variable in this investigation?

_____

(1)

The students used a computer program to test reaction time.

(c) Describe one **other** method that can be used to measure reaction time.

_____

_____

_____

_____

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_____

_____

(3)

(d) Which method would you choose to use at your school?

Tick **one** box.

Computer program	☐
Method described in part (c)	☐

Give **one** reason for your choice.

_____

_____

(1)

The table shows the students' results.

Time awake in hours	**Reaction time in seconds**					
	Volunteer					
	A	**B**	**C**	**D**	**E**	**Mean**
0	0.25	0.33	0.35	0.21	0.27	0.28
4	0.20	0.30	0.31	0.19	0.26	0.25
8	0.21	0.28	0.33	0.20	0.27	0.26
12	0.26	0.40	0.58	0.22	0.30	0.35
16	0.44	0.49	0.83	0.27	0.75	**X**
20	0.64	0.55	1.11	0.39	1.40	0.82
24	0.92	0.61	1.15	0.45	1.35	0.90

(e) Calculate value **X** in the table.

Give your answer to 2 significant figures.

_____

_____

X = _____ seconds

(2)

(f) Describe the pattern of results for mean reaction time as the time awake increases.

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_____

_____

_____

_____

(2)

(g) Do these results support the students' hypothesis: 'reaction time will increase as the time you have been awake increases'?

Give **one** reason for your answer.

_____

_____

(1)

(g) Give **two** ways the students could improve their investigation to make it more valid.

1. _____

_____

2. _____

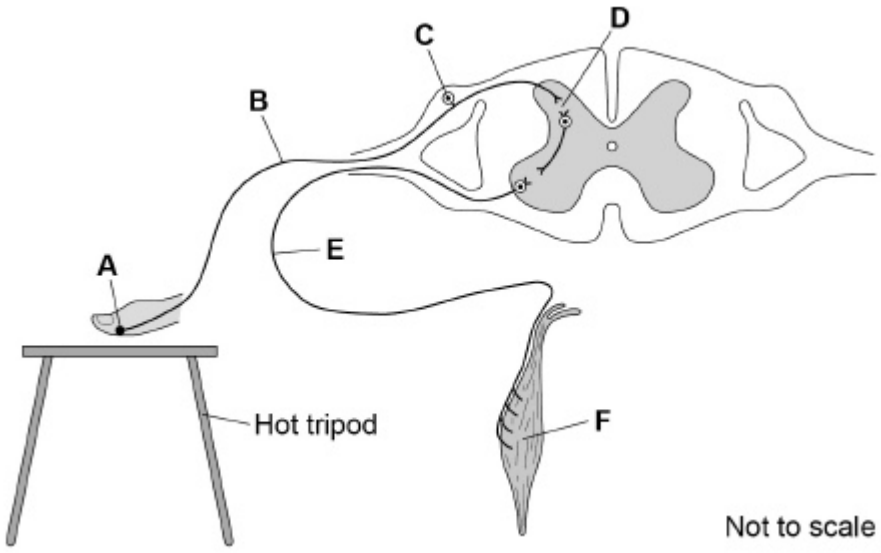
_____

(2)

(Total 15 marks)

Q5.

The diagram shows a reflex arc that moves the arm if the hand touches something hot.



(a) Which part is the receptor?

Tick **one** box.

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A ☐ B ☐ D ☐ F ☐

(1)

(b) Which part is the effector of the reflex action?

Tick **one** box.

A ☐ B ☐ D ☐ F ☐

(1)

(c) Which part shows a sensory neurone?

Tick **one** box.

B ☐ D ☐ E ☐ F ☐

(1)

(d) Which part shows a synapse?

Tick **one** box.

A ☐ B ☐ D ☐ E ☐

(1)

(e) Part **C** contains DNA.

Which part of the nerve cell is **C**?

Tick **one** box.

Cell membrane ☐

Cytoplasm ☐

Mitochondrion ☐

Nucleus ☐

(1)

(f) Reflex actions are automatic and do not involve thinking.

Why is this an advantage?

_____

_____

(1)

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(g) Which two factors can make you slower to react to a stimulus?

Tick **two** boxes.

Alcohol	☐
Caffeine	☐
Daylight	☐
Practice	☐
Tiredness	☐

(2)

(Total 8 marks)

Q6.

Neurones pass information around the body.

(a) Why are reflex reactions important?

_____

(1)

(b) Caffeine is a drug found in coffee.

After a person drinks coffee information passes through neurones in the nervous system more quickly.

Suggest a hypothesis for the effect of caffeine concentration on reaction time.

_____

_____

(1)

(c) Two students investigated the effect of caffeine concentration on reaction time.

This is the method used.

1. Student **A** drinks a cup of coffee.
2. Student **B** holds a ruler above Student **A**'s hand.
3. Student **B** drops the ruler.
4. Student **A** catches the ruler as quickly as she can.
5. The distance the ruler falls is recorded.

Suggest how this method could be improved to produce valid results.

_____

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(6)

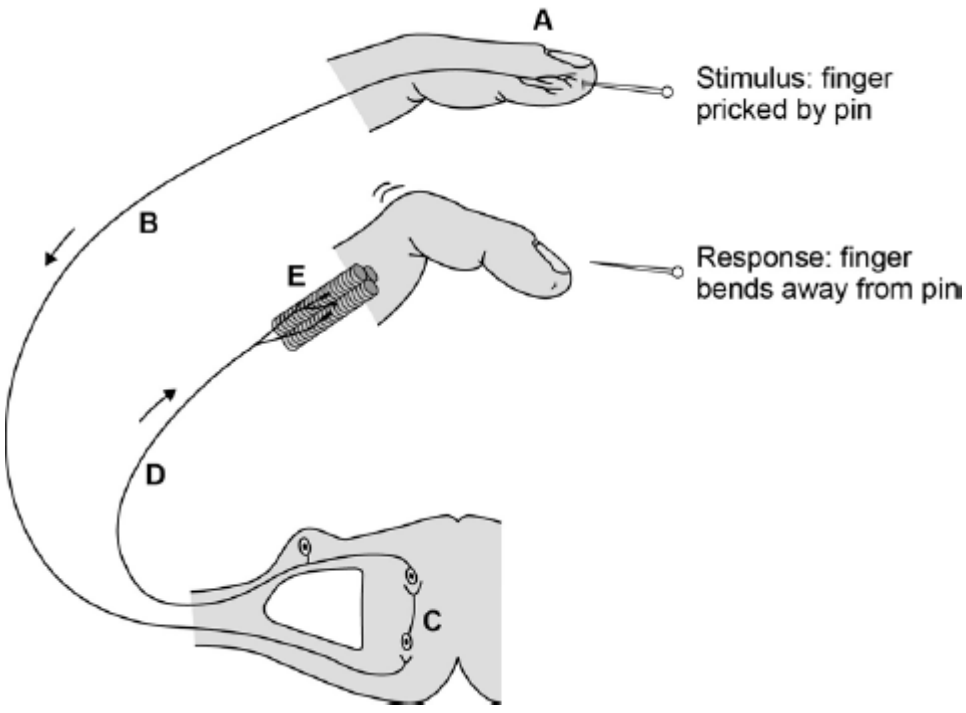
(Total 8 marks)

Q7.

Our nervous system controls our reactions.

Figure 1 shows the part of the nervous system involved in the rapid response to a stimulus.

Figure 1



(a) What is this type of rapid response called?

Tick **one** box.

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Circular action ☐

Fast action ☐

Forced action ☐

Reflex action ☐

(1)

(b) Features of the nervous system are labelled **A**, **B**, **C**, **D** and **E** on **Figure 1**.

Draw **one** line from each feature to the correct label from **Figure 1**.

Feature	**Label**
	A
Effector	**B**
Relay neurone	**C**
Sensory neurone	**D**
	E

(3)

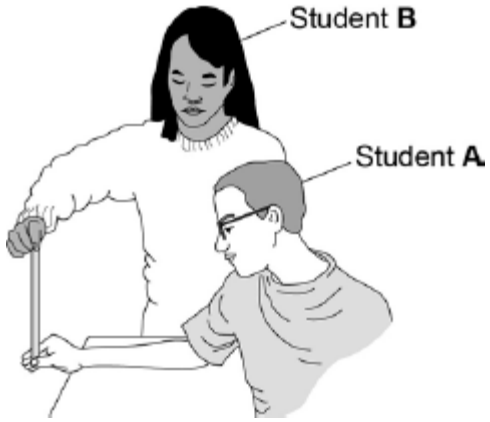
(c) Two students compare their reactions using a ruler.

This is the method used.

1. Student **A** sits with his elbow on a table top.
2. Student **B** holds the ruler so the bottom of the ruler is level with the top of student **A**'s thumb.
3. Student **B** drops the ruler.
4. Student **A** catches the ruler.
5. Record the drop distance.
6. Repeat steps 1 to 5 four more times.
7. Repeat the whole experiment with student **A** dropping the ruler and student

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B catching it.



Both students are right-handed.

The students are testing the hypothesis:

the drop distance of the ruler is smaller when a right-handed person uses their right hand to catch the ruler.

Student **A** uses his right hand to catch the ruler.

Student **B** uses her left hand to catch the ruler.

Complete the sentence.

Use an answer from the box.

control	**dependent**	**independent**

The drop distance was the _____ variable.

(1)

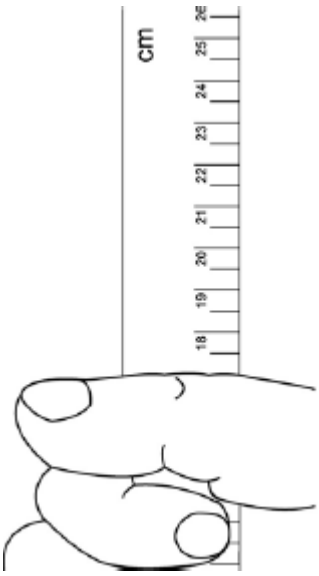
(d) The table below shows the students' results.

Student	**Drop distance in cm**				
	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Student **A**	17.5	15.5	15.0	23.5	17.0
Student **B**	20.5		19.5	21.0	19.0

Figure 2 shows student **B**'s Test 2 result.

Figure 2

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Use **Figure 2** to complete the missing result for Test 2.

Write the answer in the table above.

(1)

(e) What was the resolution of the ruler the students used?

Tick **one** box.

0.1 cm ☐

0.5 cm ☐

1 cm ☐

10 cm ☐

(1)

(f) One of the results in the table above is anomalous.

Identify the anomalous result.

Give the reason why you chose your answer.

_____

_____

_____

(2)

(g) The students are testing the hypothesis:

the drop distance of the ruler is smaller when a right-handed person uses

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their right hand to catch the ruler.

The results in the table above are not a good test of the hypothesis.

What is one reason why?

Tick **one** box.

The drop distances are very variable	☐
The drop distance for Student **A** is sometimes bigger than the drop distance for Student **B**	☐
The results are for the left and right hands of different people	☐
The drop distances are not measured accurately enough	☐

(1)

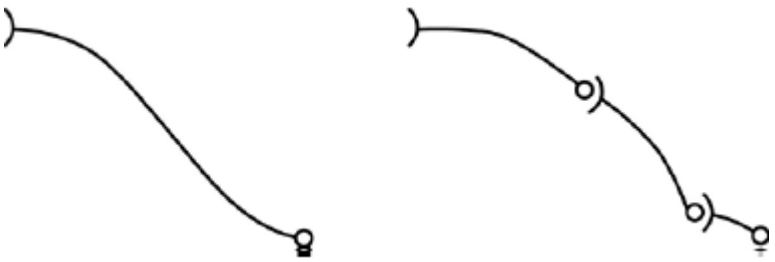
(Total 10 marks)

Q8.

The nervous system allows humans to respond to their surroundings.

The figure below shows two nerve pathways.

Nerve pathway A **Nerve pathway B**



(a) Nerve pathway **A** is 92 cm long.

A nerve impulse travels along pathway **A** at 76.2 m / s.

Calculate how long it takes for the nerve impulse to travel the length of the pathway.

Use the equation:

distance = speed × time

_____

_____

_____

_____

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Time = _____ s

(3)

(b) Nerve pathways **A** and **B** are the same length.

The nerve impulse takes longer to travel along pathway **A** than along pathway **B**.

Use the figure above to explain why.

_____

_____

_____

_____

_____

_____

(3)

(c) Two students compare their reactions using a ruler.

This is the method used.

1. Student **A** sits with his elbow on a table top.

2. Student **B** holds the ruler so the bottom of the ruler is level with the top of student **A**'s thumb.

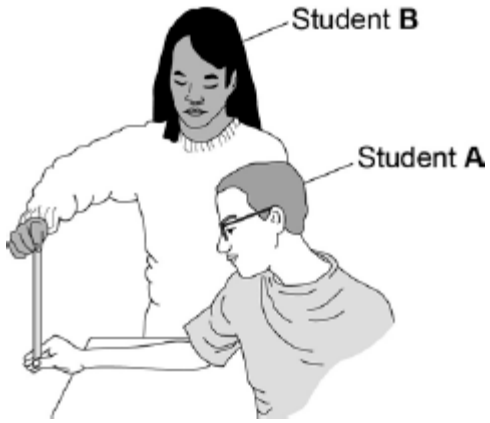
3. Student **B** drops the ruler.

4. Student **A** catches the ruler.

5. Record the drop distance.

6. Repeat steps 1 to 5 four more times.

7. Repeat the whole experiment with student **A** dropping the ruler and student **B** catching it.



Both students are right-handed.

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Student **A** uses his right hand to catch the ruler.

Student **B** uses her left hand to catch the ruler.

The table below shows the students' results.

Student	**Drop distance in mm**				
	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Student **A** – right hand	203	167	140	156	163
Student **B** – left hand	230	211	279	215	264

What is the range of student **A**'s results?

_____

(1)

(d) The students are testing the hypothesis:

The drop distance of the ruler is smaller when a right-handed person uses their right hand to catch the ruler.

The students' results in the table above are not a good test of the hypothesis.

Suggest what the students should have done to test the hypothesis.

_____

_____

_____

_____

_____

_____

(3)

(e) Student **A**'s mean reaction time was 0.19 s.

Mean reaction time can be calculated using the equation:

$$\text{Mean reaction time} = \sqrt{\frac{2 \times \text{mean drop distance in m}}{9.8\ \text{m/s}^2}}$$

Calculate the mean reaction time for Student **B**.

Give your answer to two significant figures.

Student **B**'s results are repeated here to help you answer the question.

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	Drop distance in mm				
	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Student **B** – left hand	230	211	279	215	264

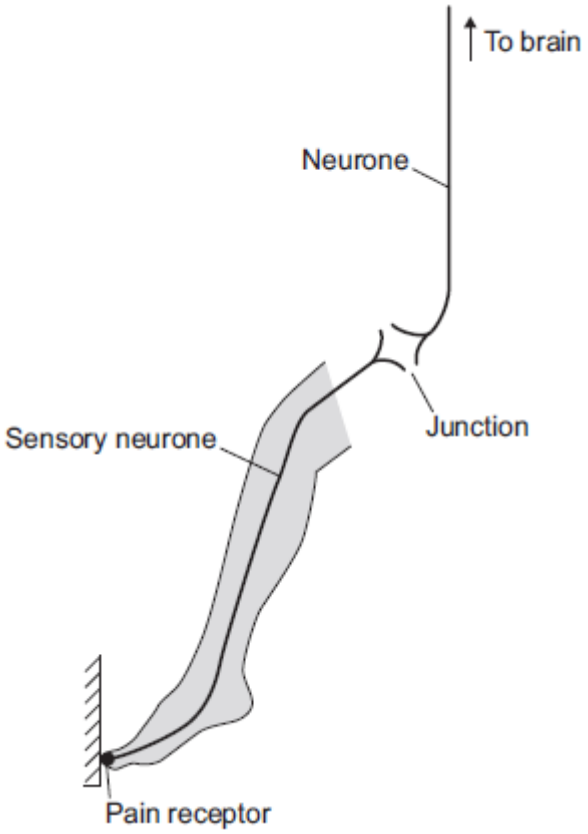
Mean reaction time = _____ s

(4)

(Total 14 marks)

Q50.

The diagram shows the pathway of an impulse from a pain receptor when someone bangs their toe on a hard surface.



(a) (i) What is the junction between neurones called?

_____

(1)

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(ii) How does information cross the junction between neurones?

_____

_____

(1)

(b) If you bang your toe you feel the pressure of the impact before you feel the pain. This is because the impulse from a touch receptor travels faster than the impulse from a pain receptor.

The speed of transmission of the impulse from a touch receptor is 76.2 m / s.

The speed of transmission of the impulse from a pain receptor is 0.60 m / s.

The following equation can be used to calculate how long it takes for each impulse to reach the brain:

$$\text{Speed of transmission} = \frac{\text{distance}}{\text{time}}$$

If the distance each impulse has to travel from the toe to the brain is 1.920 metres, it will take 0.025 seconds for the impulse from the touch receptor to reach the brain.

Calculate how much **longer** it will take the impulse from the pain receptor to reach the brain.

You must show your working.

_____

_____

_____

_____

_____

_____

_____ seconds

(3)

(Total 5 marks)

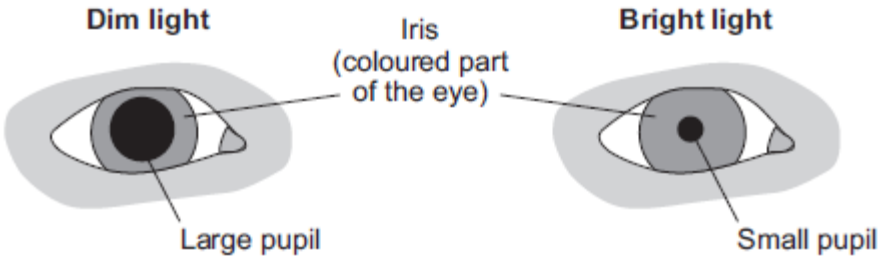
Q51.

The pupil is the black part of the eye.
It is the opening for light to enter the eye and reach the receptor cells.
If bright light is shone into the eye, the pupil decreases in size.

This is an example of a reflex action.

The figure below shows two eyes, one reacting to dim light, the other reacting to bright light.

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(a) Suggest how the reflex action of the eye to bright light is useful to the body.

_____

_____

_____

_____

(2)

(b) Picking up a book is a voluntary action.

Describe **two** differences between a reflex action and a voluntary action.

_____

_____

_____

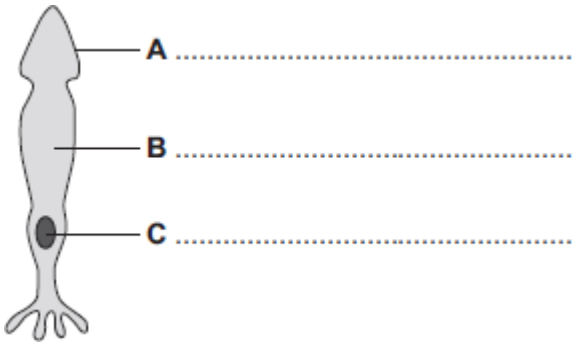
_____

(2)

(Total 4 marks)

Q52.

(a) The diagram shows a light receptor cell.



Label structures **A**, **B** and **C** on the diagram.

(3)

(b) It is important that the nervous system can detect stimuli.

Give **two** reasons why.

_____

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_____

_____

_____

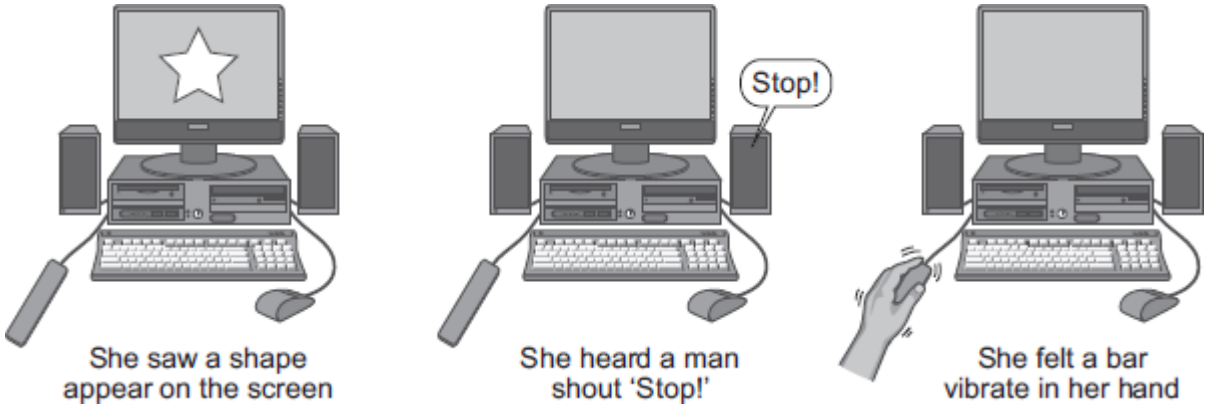
(2)

(Total 5 marks)

Q53.

A student investigated her reaction time.

A computer measured how quickly she clicked the mouse when she detected each of three different stimuli as shown in the diagrams.



(a) Give the stimulus each sense organ detected in this investigation.

Complete each sentence using the correct word from the box.

chemicals	**light**	**sound**	**touch**

Receptors in her eyes detected _____ .

Receptors in her ears detected _____ .

Receptors in her skin detected _____ .

(3)

(b) Each sense organ was tested 4 times and the mean reaction times were calculated.

The table shows the results.

	Reaction time for each sense organ in seconds		
	Eyes	**Ears**	**Skin**
Test 1	0.23	0.17	0.18
Test 2	0.27	0.14	0.16
Test 3	0.24	0.15	0.35

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Test 4	0.26	0.14	0.17
Mean reaction time		0.15	0.17

(i) There is one anomalous result in the table.

Draw a ring around the anomalous result.

(1)

(ii) Calculate the mean reaction time for the eyes.

_____

_____

Mean reaction time for the eyes = _____ seconds

(2)

(iii) Give **one** conclusion you can make from these results.

_____

_____

(1)

(Total 7 marks)

Q54.

A student did an investigation to see if reaction time was affected by the sense organ stimulated.

A computer measured how quickly she clicked the mouse when she:

- saw a shape appear on the screen

or

- heard a man shout 'Stop!'

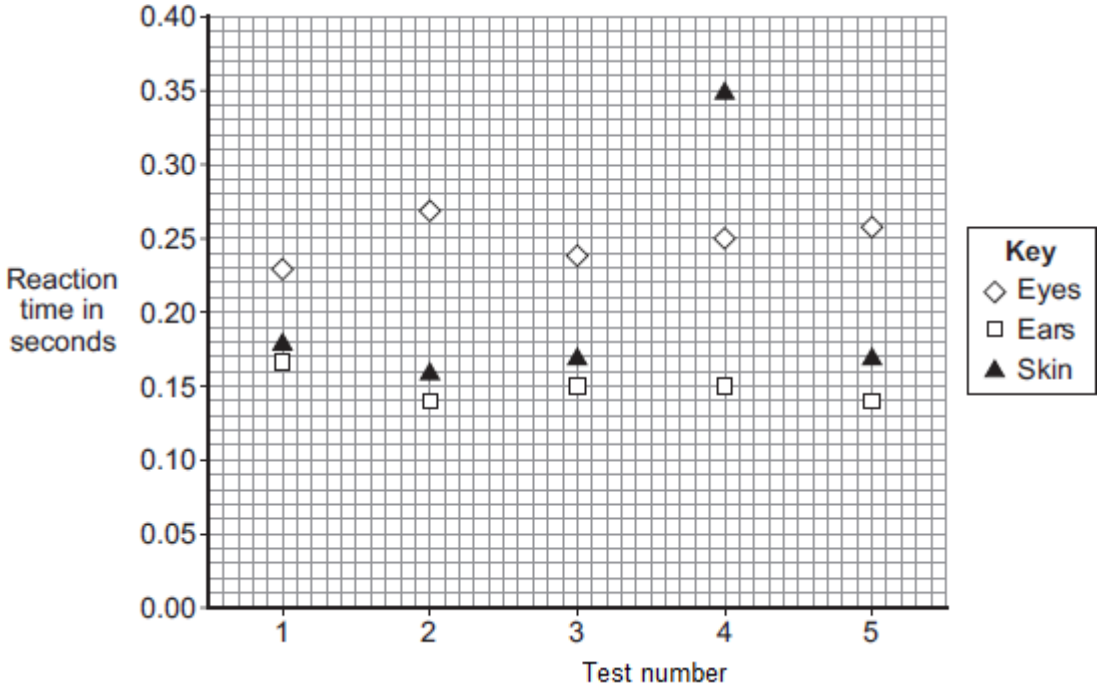
or

- felt a bar vibrate in her hand.

Each sense organ was tested 5 times.

The scatter graph shows her results.

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(a) (i) The data is shown as a scatter graph rather than a line graph.

Suggest why.

_____

_____

(1)

(ii) The results shown in the scatter graph might be easier to understand if they were drawn as a bar chart.

Describe what would have to be done with these results before they could be shown in a bar chart.

_____

_____

_____

_____

(2)

(b) Give **one** conclusion that can be made from these results.

_____

_____

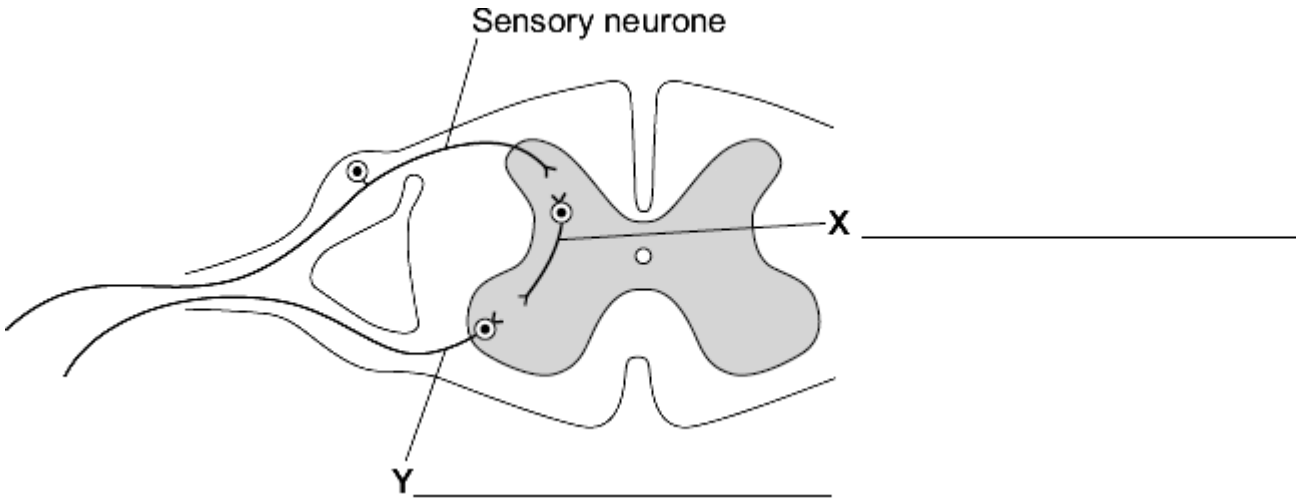
(1)

(Total 4 marks)

Q55.

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

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

(1)

(b) Describe how information is transmitted from neurone **X** to neurone **Y**.

_____

_____

_____

_____

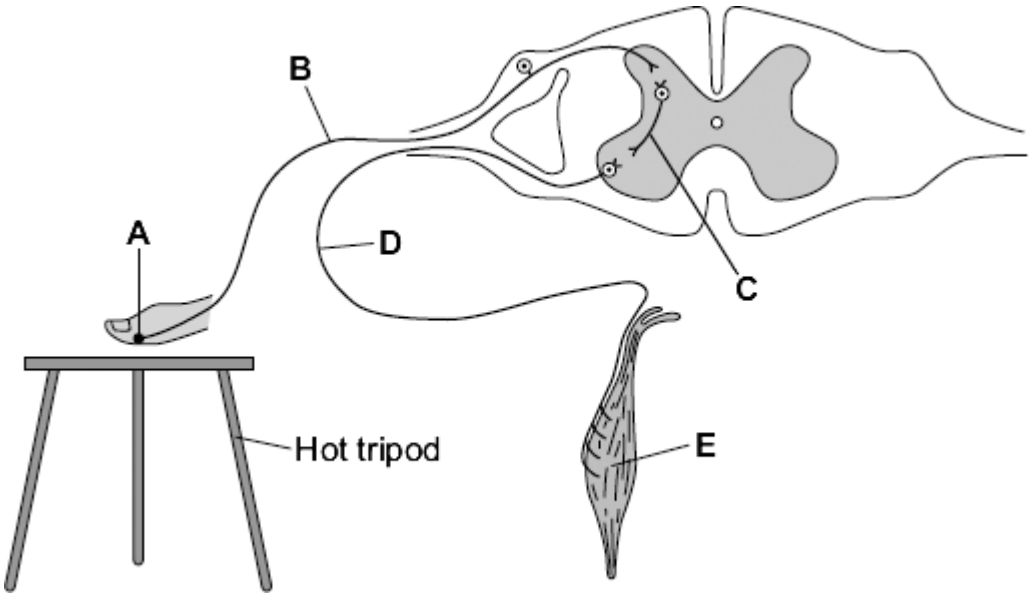
(2)

(Total 3 marks)

Q56.

If you touch a hot object you automatically pull your hand away.
This is called a reflex action.
The reflex action happens quickly and protects the body from harm.

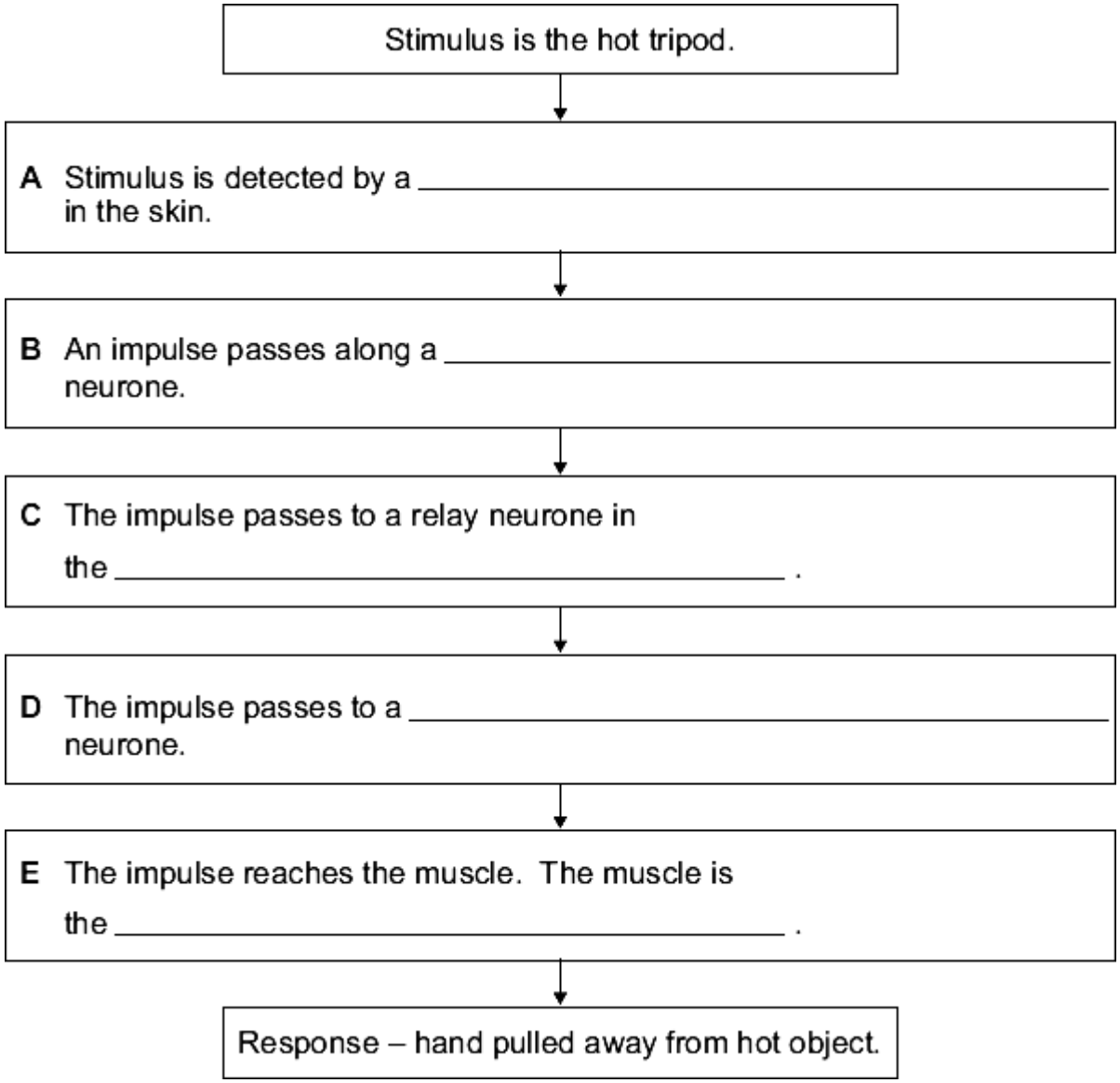
The diagram shows the structures involved in this reflex action.



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The flow diagram shows the pathway of a nerve impulse in a reflex action.

Use information from the diagram to complete the flow diagram.



(Total 5 marks)

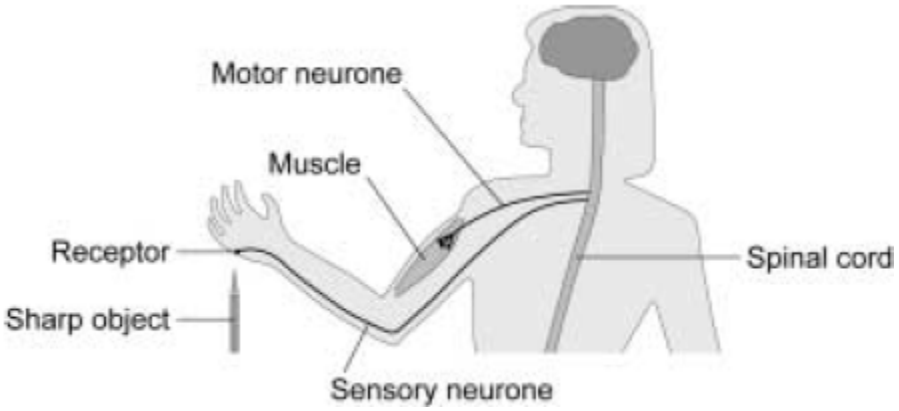
Q57.

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.

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Describe how the structures labelled on the diagram are involved in this reflex action.

(Total 4 marks)

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