AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.5.2

The human nervous system

Past-paper questions

Tier	**Foundation**
Question groups	**6**
Available paper years	**2018–2024**

Using this booklet

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

Name: _____ **Date:** _____

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

4.5.2 The human nervous system

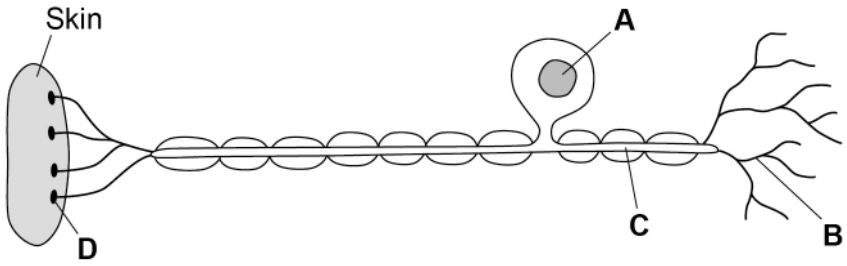
Question 01

June 2018 | 8464/B/2F | Original Q3

0 3 This question is about coordination in the human body.

Figure 2 shows a sensory neurone (nerve cell).

Figure 2



0 3 . 1 Which label is the cell nucleus?

[1 mark]

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 3 . 2 Which label is the receptor?

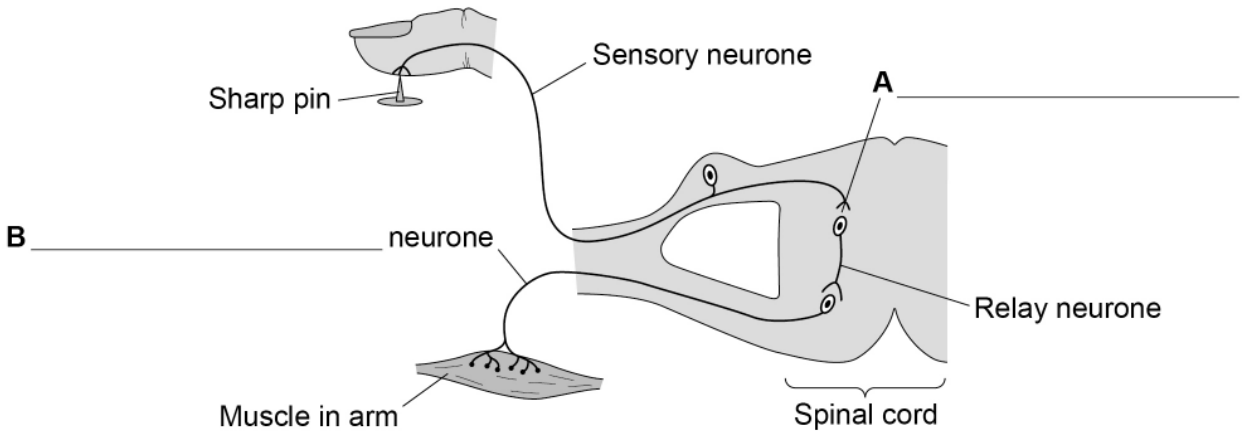
[1 mark]

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 3 . 3 **Figure 3** shows the nerve pathway when a person touches a sharp pin.

Figure 3



Name structures **A** and **B** on **Figure 3**

[2 marks]

Question 01 · continued

0 3 . 4 When the finger touches the sharp pin, the muscle in the arm contracts to pull the arm away.

What type of action is this?

[1 mark]

Tick **one** box.

A conscious action ☐

A delayed action ☐

A reflex action ☐

0 3 . 5 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.

Table 1 shows the results.

Table 1

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?

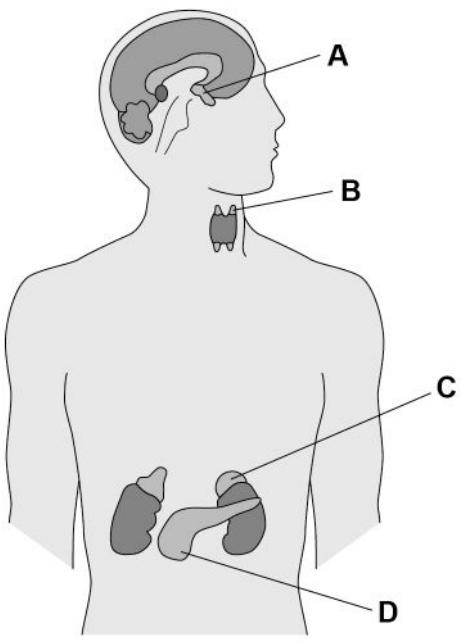
Give your answer in seconds.

[2 marks]

Time = _____ s

0 3 . 6 **Figure 4** shows the position of some of the glands which release hormones.

Figure 4



Which label on **Figure 4** shows the position of the pituitary gland?

[1 mark]

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 3 . 7 Luteinising hormone (LH) is a hormone released by the pituitary gland.

What is the function of LH?

[1 mark]

Tick **one** box.

Controls blood glucose concentration ☐

Controls the formation of sperm ☐

Controls the growth of muscles ☐

Controls the release of an egg ☐

4.5.2 The human nervous system

Question 01 · continued

0 3 . 8 How does LH travel from the pituitary gland to its target organ?

[1 mark]

_____

0 3 . 9 **Figure 5** shows the relative levels of sex hormones of three young people over 30 days.

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 5



Which person is the 18-year-old boy?

Give **one** reason for your answer.

[2 marks]

Person _____

Reason _____

_____

12

4.5.2 The human nervous system

Question 02

June 2019 | 8464/B/2F | Original Q6

0 6 Some students investigated the effect of drinking caffeine on reaction time.

They used a drink containing 32.25 mg of caffeine per 100 cm^3

This is the method used.

1. Divide the students into four groups, **A**, **B**, **C** and **D**.
2. Measure and record the reaction time of each student using the ruler-drop test.
3. Students in:
   - group **A** drink 200 cm^3 of water
   - group **B** drink 200 cm^3 of the caffeine drink
   - group **C** drink 400 cm^3 of the caffeine drink
   - group **D** drink 600 cm^3 of the caffeine drink.
4. Repeat step 2 after 15 minutes.

0 6 . 1 Describe how to do the ruler-drop test.

[3 marks]

Question 6 continues on the next page

Question 02 · continued

0 6 . 2 **Table 3** shows the mass of caffeine taken in by each student.

Table 3

Group	Mass of caffeine in mg
A	0
B	64.5
C	129.0
D	**X**

Calculate value **X**.

[1 mark]

X = _____ mg

0 6 . 3 Why did group **A** drink water instead of the caffeine drink?

[1 mark]

4.5.2 The human nervous system

Question 02 · continued

Table 4 was used to convert the results of the ruler-drop test into reaction times.

Table 4

Distance in cm	Reaction time in s	Distance in cm	Reaction time in s
2	0.064	28	0.239
4	0.090	30	0.247
6	0.111	32	0.256
8	0.128	34	0.263
10	0.143	36	0.271
12	0.156	38	0.278
14	0.169	40	0.286
16	0.181	42	0.293
18	0.192	44	0.300
20	0.202	46	0.306
22	0.212	48	0.313
24	0.221	50	0.319
26	0.230	52	0.326

0 6 . 4 Estimate the reaction time for a student who recorded a distance of 23 cm

[1 mark]

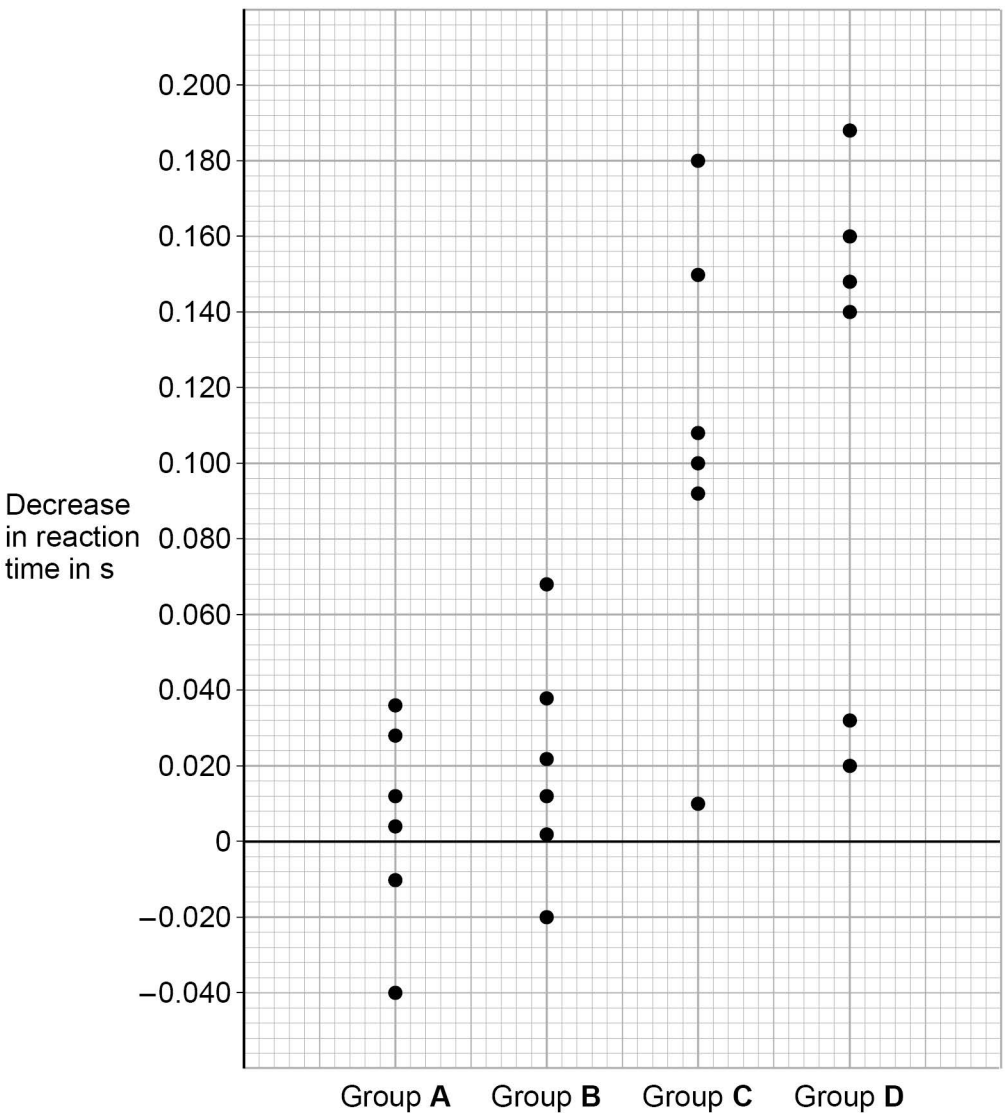
Reaction time = _____ s

Question 6 continues on the next page

Students calculated the decrease in their reaction time after the drink compared with before the drink.

Figure 6 shows the results for each student.

Figure 6



0 6 . 5 Describe the effect of the mass of caffeine taken in on the decrease in reaction time.

[1 mark]

4.5.2 The human nervous system

Question 02 · continued

0 6 . 6 For three students the decrease in reaction time was negative.

Give the reason why the value was negative.

[1 mark]

0 6 . 7 What is the range of results for group **C**?

[1 mark]

0 6 . 8 Suggest **two** variables that should have been controlled in this investigation.

[2 marks]

1

2

0 6 . 9 Explain why the ruler-drop test does **not** involve a reflex action.

[2 marks]

13

4.5.2 The human nervous system

Question 03

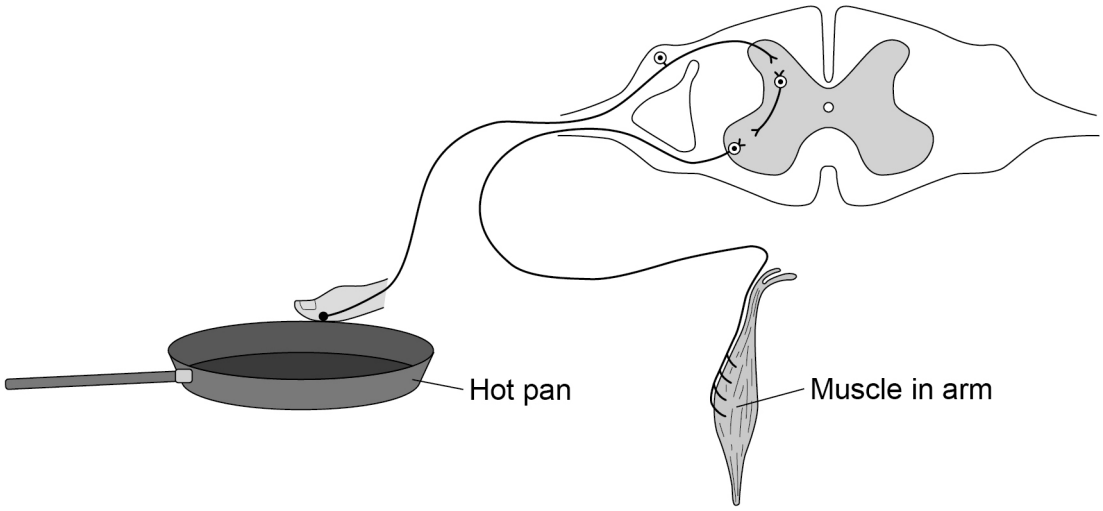
November 2020 | 8464/B/2F | Original Q7

0 7 Human reactions are a response to an external change.

0 7 . 1 Reflex actions help to protect the body against damage.

Figure 8 shows the nervous pathway for a reflex action.

Figure 8



A stimulus from the hot pan will cause the muscle in the arm to contract and move the finger away.

Describe how the stimulus from the hot pan reaches the muscle in the arm.

[4 marks]

4.5.2 The human nervous system

Question 03 · continued

0 7 . 2 A student investigated whether using the right hand or the left hand had an effect on reaction time.

The student only tested right-handed people.

Describe a method for the student's investigation.

Include details of the test you would use for reaction time.

[4 marks]

Question 7 continues on the next page

Question 03 · continued

A different student carried out an investigation to see if playing tennis improved reaction time.

The student used two groups of six people.

Table 2 shows the results.

Table 2

Person	Reaction time in seconds	
	People who play tennis	People who do not play tennis
1	0.2	0.3
2	0.4	0.4
3	0.3	0.6
4	0.4	0.5
5	0.2	0.3
6	0.3	0.2
Mean	**X**	0.4

0 7 . 3 Calculate mean value **X** in **Table 2**.

[2 marks]

X = _____ seconds

0 7 . 4 What is the dependent variable in the student's investigation?

[1 mark]

_____

4.5.2 The human nervous system

Question 03 · continued

The student concluded:

'Playing tennis improves reaction time.'

0 7 . 5 Give **one** piece of evidence which supports the conclusion.

[1 mark]

0 7 . 6 Give **one** piece of evidence which does **not** support the conclusion.

[1 mark]

13

4.5.2 The human nervous system

Question 04

November 2021 | 8464/B/2F | Original Q2

0 2 Caffeine is a drug that affects reaction time.

Coffee is a drink that contains caffeine.

Five students investigated the effect of drinking coffee on their reaction time.

Each student sat in front of a computer screen showing a reaction timer.

This is the method used.

1. Press any key on the keyboard when the colour of the screen changes to green.
2. Record the reaction time shown on the computer screen.
3. Drink coffee containing caffeine.
4. Wait 15 minutes then repeat steps 1 and 2.

0 2 . 1 What is the dependent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

- The coffee containing caffeine ☐
- The number of students ☐
- The reaction time ☐

0 2 . 2 Give **two** control variables the students should have used.

[2 marks]

1 _____

_____

2 _____

_____

Question 04 · continued

0 2 . 3 Why did the students wait 15 minutes after drinking the coffee before repeating the test?

[1 mark]

0 2 . 4 Responding to the colour change of the screen involves a receptor in the student.

Where is the receptor in the student?

[1 mark]

Tick (✓) **one** box.

- Ear ☐
- Eye ☐
- Skin ☐

0 2 . 5 Responding to the colour change of the screen involves an effector in the student.

What is the effector in the student?

[1 mark]

Tick (✓) **one** box.

- Brain ☐
- Gland ☐
- Muscle ☐
- Spinal cord ☐

Question 04 · continued

Table 1 shows the results.

Table 1

Student	Reaction time in milliseconds	
	Before drinking coffee	After drinking coffee
1	385	255
2	420	291
3	285	265
4	871	259
5	463	247

0 2 . 6 What is the effect of drinking coffee on reaction time?

Use **Table 1**.

[1 mark]

Question 04 · continued

0 2 . 7 Which student had the smallest change in reaction time after drinking coffee?

[1 mark]

Tick (✓) **one** box.

Student 1 ☐

Student 2 ☐

Student 3 ☐

Student 4 ☐

Student 5 ☐

0 2 . 8 The students decided that one of the results was anomalous.

What should the students do with the anomalous result when calculating the mean change in reaction time?

[1 mark]

_____

_____

9

4.5.2 The human nervous system

Question 05

0 2 A student investigated the effect of either **seeing** a stimulus or **hearing** a stimulus on reaction time.

First, the student measured their reaction time to **seeing** a colour change.

This is the method used.

1. Sit in front of a computer with a reaction timer program open.
2. Press a key on the keyboard as quickly as possible when the computer screen changes colour.
3. Record the reaction time.
4. Repeat steps 1 to 3 four more times and calculate the mean reaction time.

Next, the student measured their reaction time to **hearing** a sound.

This is the method used.

5. Sit in front of a computer with a reaction timer program open.
6. Press a key on the keyboard as quickly as possible when the computer produces a sound.
7. Record the reaction time.
8. Repeat steps 5 to 7 four more times and calculate the mean reaction time.

0 2 . 1 **Table 1** shows some variables in this investigation.

Table 1

Variable	Independent variable	Dependent variable	Control variable
Distractions from background sounds			
Reaction time			
Type of stimulus			

Identify each variable as an independent variable, a dependent variable or a control variable.

Tick (✓) **one** box in each row on **Table 1**.

[3 marks]

0 2 . 2 How could the method be improved?

[1 mark]

Tick (✓) **one** box.

Measure the reaction time with a stopwatch. ☐

Only test reaction time to seeing a colour change. ☐

Repeat both methods 10 times. ☐

Question 2 continues on the next page

0 2 . 3 A shorter reaction time means the student reacted faster.

The student reacted faster as each test was repeated.

Suggest **one** reason why the student's reactions got faster.

[1 mark]

Table 2 shows the results.

Table 2

Method	Mean reaction time in milliseconds
Seeing the stimulus	350
Hearing the stimulus	220

Question 05 · continued

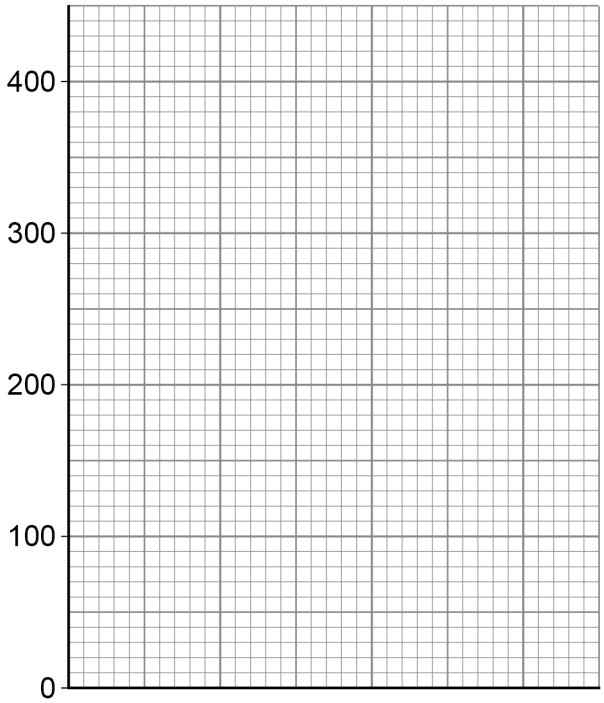
0 2 . 4 Complete **Figure 2**.

You should:

- plot the data from **Table 2** as a bar chart
- label each bar
- label the y-axis.

[2 marks]

Figure 2



Method

0 2 . 5 Compare the reaction time when seeing the stimulus with the reaction time when hearing the stimulus.

[1 mark]

8

4.5.2 The human nervous system

Question 06

June 2024 | 8464/B/2F | Original Q3

0 3 Students used a reaction test card in an investigation.

The reaction test card can be used to test the reactions of car drivers.

Figure 4 shows the reaction test card.

Figure 4

Reaction score	How fast are your reactions?
5	Too slow
4	A bit slow
3	OK
2	Good
1	Super

0 3 . 1 Suggest why fast reactions are important for car drivers.

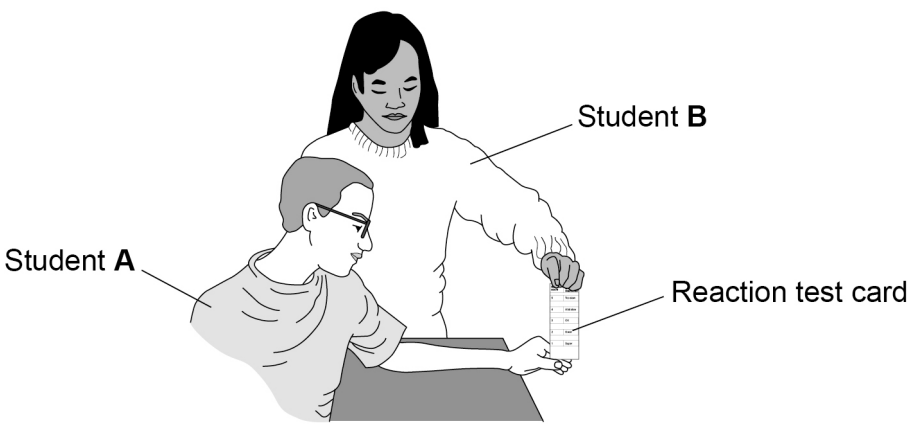
[1 mark]

Students investigated the effect of number of hours of sleep on reaction time.

The students used the reaction test card shown in **Figure 4** on page 11.

Figure 5 shows the method used.

Figure 5



This is the method used.

1. Record the number of hours of sleep student **A** had the night before the test.
2. Student **B** holds the lower edge of the card level with the top of student **A**'s thumb.
3. Student **A** holds their thumb and forefinger slightly apart, with space for the card to drop.
4. Student **B** drops the card.
5. Student **A** catches the card as quickly as possible.
6. Record the number shown at the top of student **A**'s thumb.
7. Repeat steps 1 to 6 with seven other students.

4.5.2 The human nervous system

Question 06 · continued

0 3 . 2 Draw **one** line from each type of variable to the example of that variable in the investigation.

[3 marks]

Type of variable	Example
Control variable	Number nearest top of thumb when student catches card
Dependent variable	Number of hours of sleep
Independent variable	Number of students tested
	Start with lower edge of card level with top of thumb

Question 3 continues on the next page

Figure 4 is repeated below.

Figure 4

Reaction score	How fast are your reactions?
5	Too slow
4	A bit slow
3	OK
2	Good
1	Super

0 3 . 3 A student said:

'It would be better to use a ruler showing millimetres instead of the card in **Figure 4**.'

Why is the student correct?

[1 mark]

Tick (✓) **one** box.

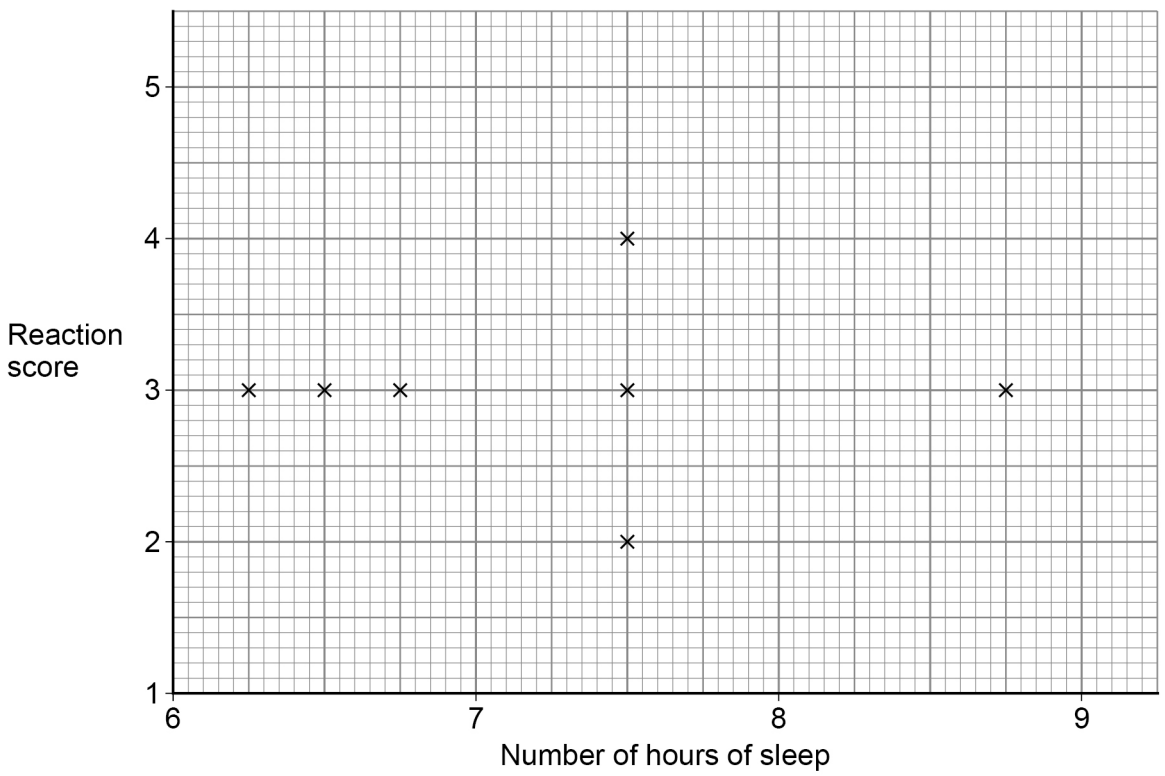
Students are familiar with a ruler but the card is new. ☐

Students have very fast reactions. ☐

Students may catch the card between scores. ☐

Figure 6 shows the results for the seven other students.

Figure 6



0 3 . 4 Student **A** had 8 hours and 30 minutes of sleep and a reaction score of 3

Plot the result for student **A** on **Figure 6**.

[1 mark]

0 3 . 5 The mean number of hours of sleep for all students was 7.4

What was the **mode** for the number of hours of sleep?

[1 mark]

Mode = _____ hours

0 3 . 6 A lower reaction score means a faster reaction.

What was the effect of increasing the number of hours of sleep on reaction time?

Use **Figure 6**.

[1 mark]

Tick (✓) **one** box.

Reaction time decreased ☐

Reaction time stayed the same ☐

Reaction time increased ☐

0 3 . 7 Suggest **two** ways the students could improve the investigation.

Do **not** refer to using a ruler in your answer.

[2 marks]

1 _____

_____

2 _____

_____

Question 3 continues on the next page

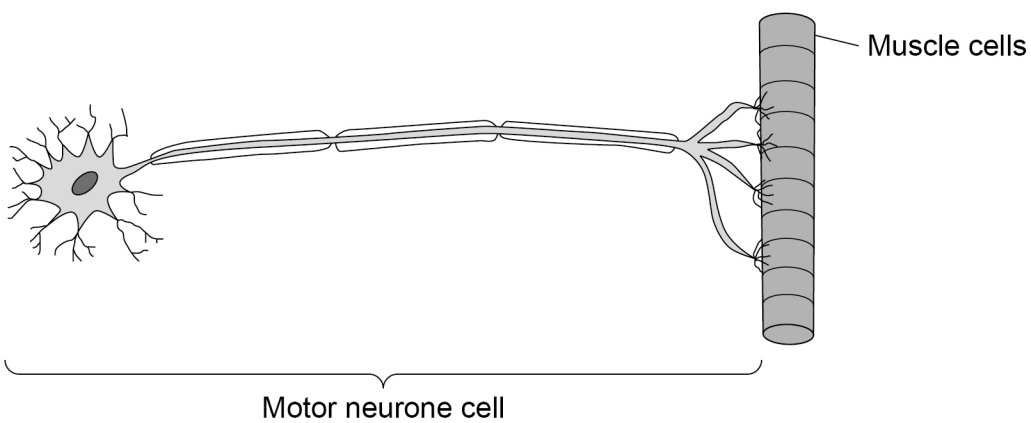
4.5.2 The human nervous system

Question 06 · continued

0 3 . 8 Motor neurones are involved in reactions.

Figure 7 shows a motor neurone.

Figure 7



Explain **one** way the motor neurone cell is adapted for its function.

[3 marks]

13