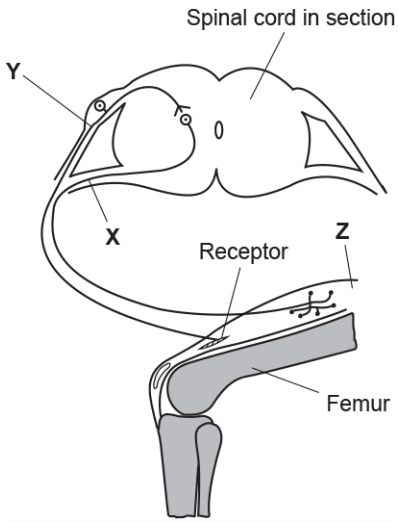
# The Nervous System (H)

**1.** The diagram shows a reflex arc.




A patient needs treatment for a leg injury.

An anaesthetic is injected to block nerve impulses to prevent pain but still allow movement of the leg.

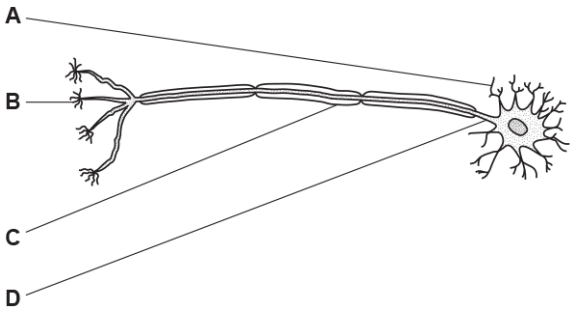
Where was the anaesthetic injected in this patient?

**A** At **X**
**B** At **Y**
**C** At **Z**
**D** At **X**, **Y** and **Z**

Your answer ☐ **[1]**

**2.** A motor neurone is usually stimulated by a relay neurone.

Which part of the motor neurone is first stimulated by a relay neurone?




Your answer ☐ **[1]**

**3.** Which row in the table represents the eye when a person is in a dark room?

| | Front view of iris and pupil | Circular iris muscles |
|---|---|---|
| **A** |  | contracted |
| **B** |  | relaxed |
| **C** |  | relaxed |
| **D** |  | contracted |

Your answer ☐ **[1]**

**4.** Anaesthetics used during operations slow down breathing and heart rate.

Which part of the brain do anaesthetics act on to do this?

**A** Cerebrum
**B** Cerebellum
**C** Medulla
**D** Pituitary

Your answer ☐ **[1]**

**5.** Which condition can be caused by a lens in the eye that is too thick?

**A** Long-sightedness
**B** Colour blindness
**C** Diabetes
**D** Short-sightedness

Your answer ☐ **[1]**

**6.** The eye switches from focusing on a distant television to focusing on a close up newspaper.

Which change happens to the suspensory ligaments and to the lens during this switch?

| | **Suspensory ligaments** | **Lens** |
|---|---|---|
| **A** | slack to tight | thicker |
| **B** | slack to tight | thinner |
| **C** | tight to slack | thicker |
| **D** | tight to slack | thinner |

Your answer ☐ **[1]**

**7 (a).** This question is about coordination.

A nerve to a muscle contains many motor neurones.

**Fig. 21.1** shows two motor neurones supplying a muscle that moves the fingers. **Fig. 21.2** shows the force of contraction of the muscle when the neurones are stimulated separately or both together.

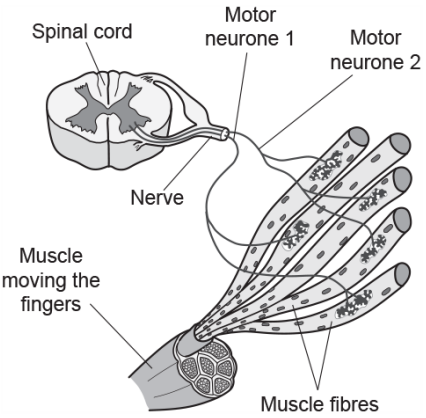



**Fig. 21.1**

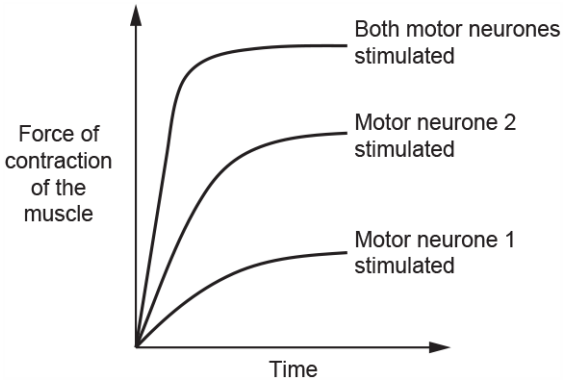



**Fig. 21.2**

i. Suggest how the brain can finely control the force of contraction in the muscles controlling the fingers.

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**[2]**

ii. **Fig. 21.3** shows a motor neurone supplying a muscle that moves the leg.

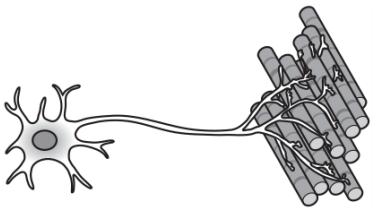

**Fig. 21.3**

Explain the reason for the difference in the neurone supplying this muscle compared to the neurones supplying the muscle that moves the fingers.

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**[3]**

**(b).** * Dart players use their fingers to throw darts at a dart board.

Dart players **A** and **B** have different throwing styles. **Fig. 21.4** shows the throwing styles of the two players.

The release window is the area where the dart is released.

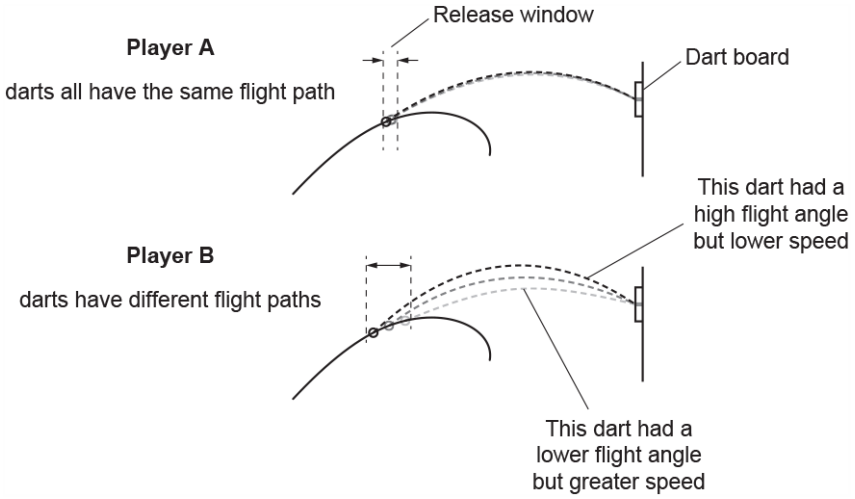


**Fig. 21.4**

To throw a dart accurately at the centre of a dart board involves coordination. The brain needs to coordinate the actions of sense organs and muscles.

Explain the function of the nervous system and muscles in the throwing of a dart at the centre of the dart board and why this process is more complicated in **Player B** than in **Player A**.

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**[6]**

**(c).** Parts of the body, such as the fingers, are moved by the contraction of muscles.

In a voluntary movement the brain sends nerve impulses to muscle fibres along motor neurones.

Name the part of the brain that controls voluntary movement.

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**[1]**

**8 (a).** Investigating brain function may involve the following techniques:

- External recording of the brain using EEG.
- Scanning techniques such as CAT and MRI.
- Case studies of humans with accidental damage.
- Deliberate damage in animal experimentation.

i. Understanding of brain function has increased in recent years. However, there are still problems that scientists face that are preventing a complete understanding.

Evaluate the reasons why understanding has increased but also why problems still exist.

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**[4]**

ii. When scientists complete their research they usually publish it in journals or online.

Give **two** reasons why scientists publish their results.

1

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2

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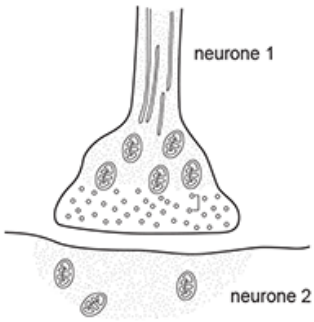
**[2]**

**(b).** Alzheimer's disease involves damage to nerve transmission.

Symptoms include difficulties in judging distance, concentrating and making decisions.

The diagram shows a synapse between two neurones in the brain.




Acetylcholine is a neurotransmitter in the brain. It diffuses across the 32 nanometre synaptic gap.

In a brain from a person with Alzheimer's disease, the time for acetylcholine to diffuse between neurones is $6.4 \times 10^{-7}$ s.

1 metre = $10^9$ nanometres

i. Calculate the speed of diffusion in a person with Alzheimer's disease.

Use this formula: speed = distance ÷ time

Give your answer in metres per second.

Speed of diffusion = ..... metres per second **[3]**

ii. In the brain of a healthy person the speed of diffusion is 0.2 metres per second.

How does the result obtained in part (i) account for the symptoms of Alzheimer's disease?

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_____

_____ **[2]**

**9.** Retinitis pigmentosa is a genetic condition that affects the eyes.

It is caused by a mutation to a gene. This mutation produces a recessive allele.

The condition causes rod cells in the retina to break down.

i. Two people who are heterozygous for retinitis pigmentosa are expecting a baby.

Draw a genetic diagram to calculate the probability that the baby will have the condition.

Use R for the normal allele and r for the allele for retinitis pigmentosa.

Answer = _____ **[3]**

ii. If the baby has retinitis pigmentosa, it will have normal colour vision but will not be able to see well in dim light.

Explain why.

_____

_____

_____

_____ **[3]**

**10 (a).** Diagram A shows the girl's left eye on the beach.

A

B

Diagram **B** shows the girl's left eye after she enters the café.

Explain how you can tell this and how this change happens.

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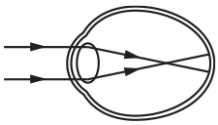
---**[3]**

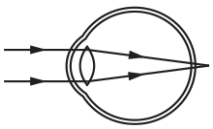
**(b).** Look at the diagrams.

They show how light is focused in people with different eye defects.

Person **X**



Person **Y**



i. Name the eye defect in each person.

Person **X** ---

Person **Y** ---

**[2]**

ii. Identify the type of corrective lens needed by person **X** and **Y** and explain how the lenses work.

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**11 (a).** A class of students investigate if right handed people are faster with their dominant right hand.

Student **A** drops a ruler while student **B** catches it.

They then measure the position of student **B**'s thumb on the ruler, this is the drop distance.

The diagram shows how the measurements were taken.

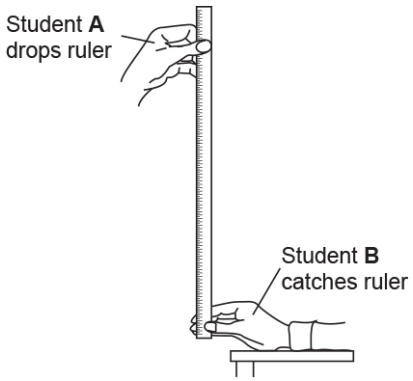


**Fig. 19.1**

The drop distance is converted into a reaction time. The reaction time in seconds for each hand is recorded in a table.

i. Identify **two** possible sources of error in this method of measuring reaction time.

1 ----------

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2 ----------

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**[2]**

ii. A second method of measuring reaction time involves a computer reaction time program shown in **Fig. 19.2**.

Each student is asked to click the “Start” button. After a 3-second delay a number randomly flashes up. The student moves the mouse to click on the flashing number.

Left hand is used first then the right hand.

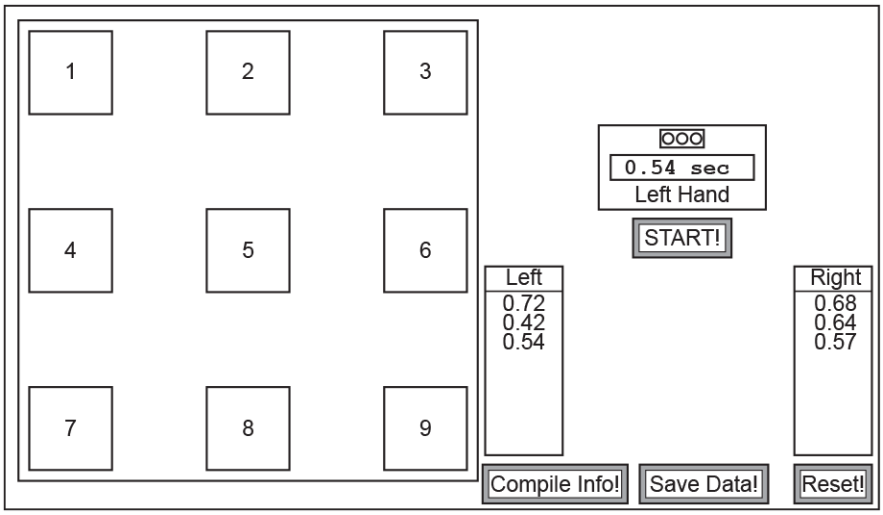


**Fig. 19.2**

This second method is a better design than the first method but it could still be improved.

Explain why it is a better designed experiment than the first method and suggest how this second method could be improved.

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**[3]**

**(b).** The table shows the results for ten **right handed** students in the class.

| Reaction time (seconds) | |
|---|---|
| **Left non-dominant hand** | **Right dominant hand** |
| 0.22 | 0.21 |
| 0.23 | 0.25 |
| 0.27 | 0.23 |
| 0.24 | 0.24 |
| 0.25 | 0.24 |
| 0.25 | 0.25 |
| 0.25 | 0.26 |
| 0.25 | 0.26 |
| 0.25 | 0.26 |
| 0.25 | 0.26 |
| 0.27 | 0.28 |
| Mean = 0.25 | Mean = 0.25 |

i. Calculate the **median** for the right dominant hand.

Answer = _____ mg **[2]**

ii. The mean and median for the left non-dominant hand are identical.

What **other** conclusions can be made about reaction times in these ten students?

_____

_____

_____ **[2]**

**(c).**

i. Motor neurone disease (MND) is a condition that affects reaction times. MND affects the speed of nerve impulse in motor neurones.

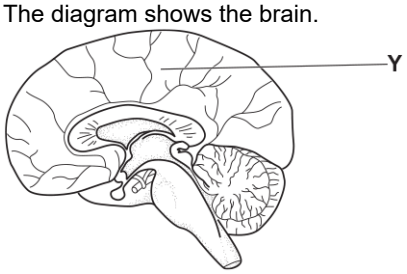
Stem cells taken from the skin of people with MND are used in research. The stem cells can be grown in the lab and used to measure the speed of the nerve impulse.

Which special feature of stem cells makes this possible?

_____

_____ **[1]**

ii. The diagram shows the brain.




Name part **Y** and explain why it is an important area of the brain in the research of MND.

Part **Y**:

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Explanation:

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**[2]**

iii. Measuring the speed of the nerve impulse in the brain is more difficult than using stem cells.

Suggest **two** reasons why.

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**[2]**

**END OF QUESTION PAPER**