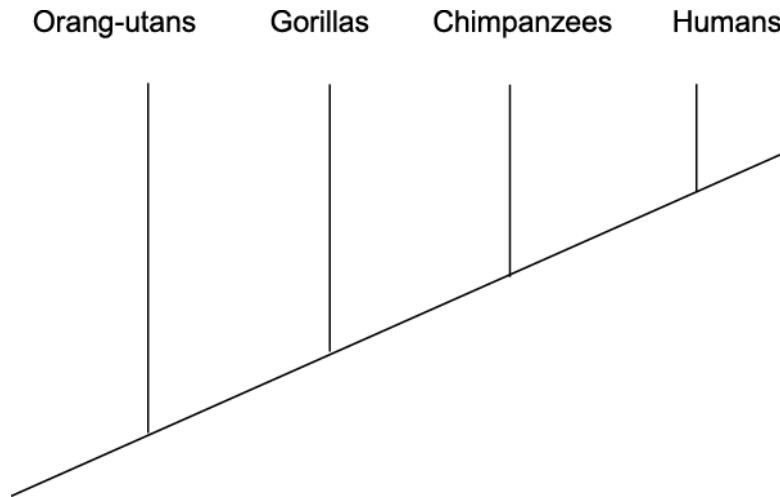


1.

- (i) DNA has been used to help classify organisms. The more DNA we have in common with another species, the more closely related we are to them.

This relationship can be shown in a diagram.



Which species are humans most closely related to?

----- [1]

- (ii) Scientists think chimpanzees are intelligent animals.

Which part of the brain is associated with intelligence?

Put a tick (✓) in the correct box.

Brain stem

Cerebral cortex

Cerebellum

Hypothalamus

[1]

2(a). Dementia is caused by damage to the brain.

People with dementia often have difficulty remembering things they have just done. However, they can clearly remember things from many years ago.

Which part of their memory is still functioning well and which part is not?

-----  
-----  
----- [2]

(b). Name a technique that could be used to find the area of the brain that is damaged.

----- [1]

(c). Emma is trying to remember a phone number but is finding it difficult.

Suggest a method that she could use to help her remember it.

----- [1]

3(a). The human nervous system consists of the central nervous system (CNS) and the peripheral nervous system (PNS).

Name the **two** main parts of the **CNS**.

1

-----

2

-----

[2]

(b). The nervous system has receptors to detect changes in the environment and effectors to carry out responses.

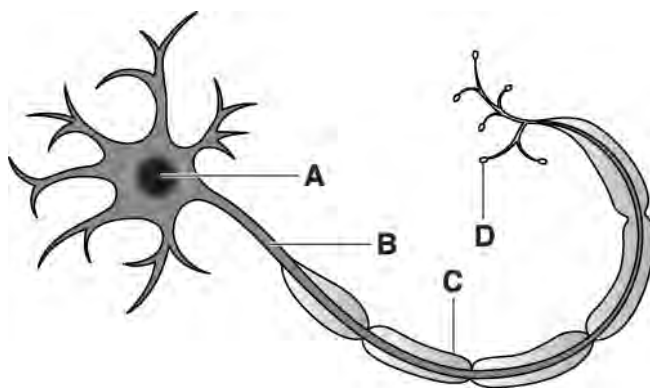
(i) Decide if the following statements are **true** or **false**.

Put a tick (?) in **one** box in each row.

Statement	True	False
Light sensitive cells in the retina are effectors.		
Hormone-secreting cells in a gland are receptors.		
Muscle cells in a muscle are effectors.		

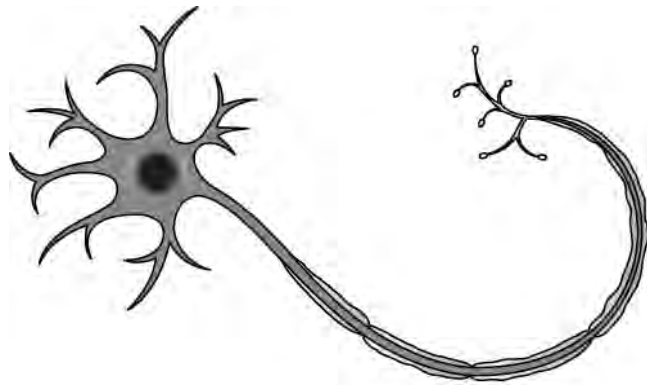
[2]

(ii) The diagram below shows a motor neuron.



Which of the labels, A, B, C or D is the fatty sheath?

(iii) In some diseases motor neurons are damaged as shown in the diagram.



**Damaged motor neuron**

Three friends talk about the effect this will have on people.



**Kavita**

I think it will affect how the synapses work and will stop impulses being passed from one neuron to the next.



**Oliver**

I think electrical impulses will travel faster and cause muscles to contract quicker.



**Tomas**

I think the electrical impulses will travel more slowly and this will affect how the body moves.

Which friend is correct?



4(a). Simple animals rely on **reflex actions** for most of their behaviour.

Simple reflexes are made up of three main processes.

Each process is carried out by a specific structure.

Which structures perform these processes?

Write the name of the structure in the box next to each process.

Choose words from the list.

effector

fatty sheath

processing centre

receptor

synapse

Process in a simple reflex	Structure
detection of stimuli	
receiving information and coordinating responses	
producing a response	

[3]

(b). Electrical impulses travel along neurons in a simple reflex.

Jimmy tests three different types of neuron, A, B and C.

He records the speed of electrical impulses along each neuron.

Jimmy repeats his experiment five times.

Neuron	Speed of electrical impulse in m/s					
	1st	2nd	3rd	4th	5th	mean
A	85	60	70	75	80	74
B	45	50	40	35	55	45
C	120	95	100	105	90	

(i) Calculate the **mean** speed of electrical impulse for neuron C.

Write your answer in the box in the table.

[1]

(ii) One of these neurons is surrounded by a fatty sheath.

Which neuron, A, B or C, is surrounded by a fatty sheath?

Use information in the table to justify your choice.

-----  
----- [2]

(iii) Jimmy noticed that the five results obtained for neuron A were all different.

Suggest **two** reasons why the measurements recorded may not be the 'true value' of the speed of the electrical impulses for neuron A.

-----  
----- [2]

(c). Shalina has damaged her spinal reflex arc.

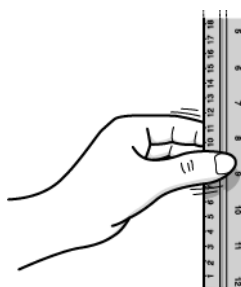
The diagram shows damage to the structure at X on the **left side** of her body.





5(a). Owen and Tamson do an investigation on reaction times.

Owen holds the top of a 1 m ruler and drops it.



Tamson reacts and catches it.

They measure how far the ruler falls before Tamson catches it.

They repeat the investigation with Tamson holding the ruler and Owen catching it.

Here are their results.

Name	Trial	Distance ruler drops (cm)	Mean (cm)
Owen	1	69.0	67.5
	2	80.3	
	3	53.2	
Tamson	1	32.5	
	2	26.8	
	3	24.7	

Calculate the mean value for Tamson's data.

Show your working.

mean = ..... cm [2]

(b). What conclusions can Owen and Tamson make from their results?

Put ticks (✓) in the boxes next to the **two** correct conclusions.

Tamson has the faster reaction times.

Owen's reaction time gets faster with each trial.

The ranges of Owen's and Tamson's reaction times overlap.

Owen had the greater range of reaction times.

The range was the same for both Tamson's and Owen's data.

[2]

(c). Three trials were done for each person.

Explain why.

-----  
-----  
----- [2]

(d). Suggest **three** sources of error in this investigation.

-----  
-----  
-----  
-----  
----- [3]

[Total: 9]



7(a). The human brain is an organ of the nervous system.

Which part of the nervous system in humans is made up of only the brain and spinal cord?

answer \_\_\_\_\_ nervous system [1]

(b). The human brain has a centre for memory.

Which part of the brain acts in this way?

answer \_\_\_\_\_ [1]

8(a). Mirek blinks when he gets dust in his eyes.

Blinking is a reflex action.

What features are typical of a reflex action?

Put a **ring** around the **three** correct features.

involuntary

long-lasting

rapid

short-lived

slow

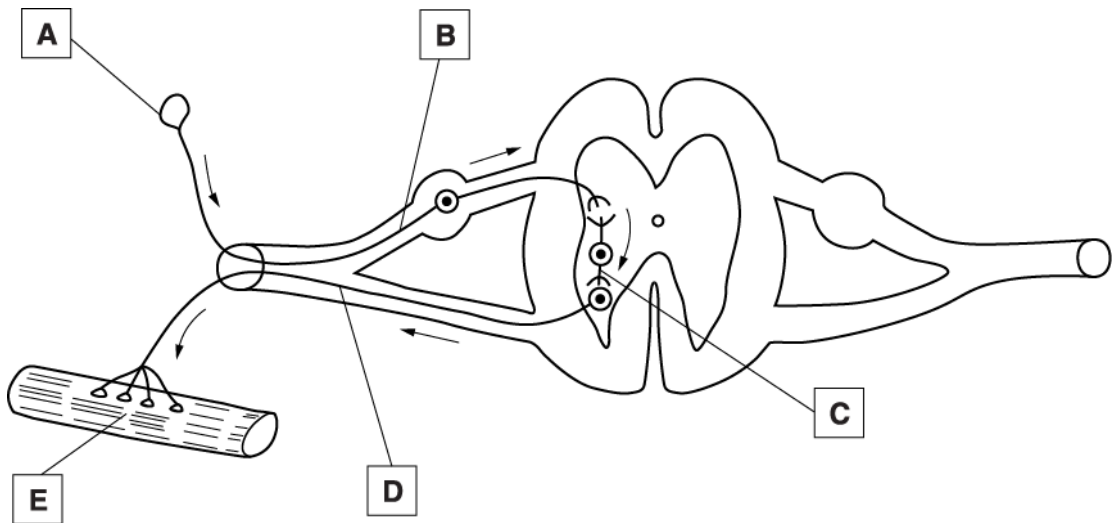
voluntary

[2]

(b). The spinal reflex arc involves a number of structures.

Look at the structures A, B, C, D and E in the diagram of a spinal reflex arc.

The arrows show the direction of the impulse.



Write the letter, A, B, C, D or E, in each box next to the correct structure in the table.

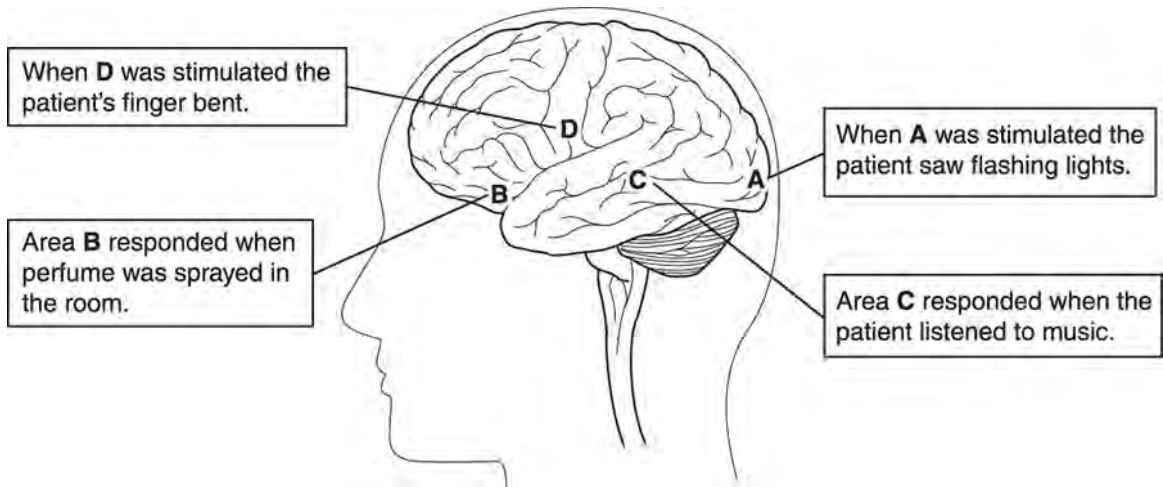
effector	
motor neuron	
receptor	
relay neuron	
sensory neuron	

[2]



10(a) Scientists studied four different areas of the brain, A, B, C and D.

They discovered this information.



Use this information to draw four straight lines linking each area of the brain to its function.

area of brain	function
A	smell
B	movement
C	sight
D	hearing

[3]



(b). Which part of the brain, **A**, **B**, **C** or **D**, is involved with motor responses?

Explain your answer.

-----  
-----  
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[2]

(c). Scientists discover a lot about the brain by studying patients with brain damage.

(i) Two of these statements are **ethical** issues involved in this kind of scientific research.

Put ticks (?) in the boxes next to the **two** correct answers.

The patient's brain contains millions of neurons.

The patient's CNS consists of both motor and sensory neurons.

Some brain damaged patients are paralysed.

The patient may not benefit from the research.

The patient needs to give informed permission for the research.

[2]

(ii) Scientists sometimes ask patients to take part in low risk studies.

Two of these statements describe why patients may be willing to take part in low risk studies.

Put ticks (?) in the boxes next to the **two** best statements.

People are more willing to accept risk when it is something that they choose to do.

A correlation is a link between a factor and an outcome.

Scientists do not believe claims that cannot be repeated by any other scientists.

People are happy to take risks if this leads to the best outcome for most people.

Certain actions are wrong whatever the consequences.

[2]

(d). Synapses are small gaps between the ends of neurons.

Chemicals allow impulses to cross the gap.

Some poisons stop these chemicals from working.

What effect would these poisons have on your fingers?

Put ticks (?) in the boxes next to the **two** best answers.

Your fingers would be painful.

Your fingers would feel numb.

There would be no effect on your fingers.

The muscles in your fingers would contract.

Your fingers would not move.

Your fingers would turn white.

[2]

11. Amir is investigating what happens to pupil size when a person moves from an area of bright light to an area of darkness.

He measures the size of his friend's pupil in bright light.

His results are shown in the table below.

Experiment number	Pupil size (mm)
1	4.0
2	3.8
3	6.0

- (i) Calculate the mean pupil size.

Mean pupil size = ..... mm [2]

- (ii) Amir reads an article that suggests the average pupil size in bright light should be in the range of 2 – 4 mm.

Amir thinks one of his results is an anomalous result.

Which result is most likely to be the anomalous result?

Give a reason for your choice.

.....

.....

..... [2]

- (iii) What can Amir do to make his results more precise?

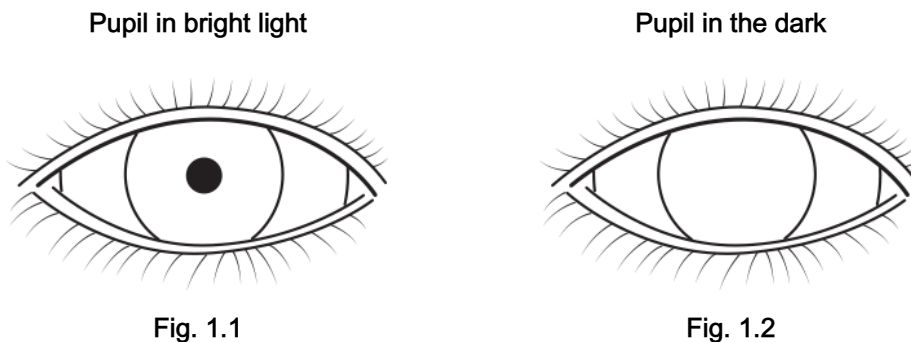
..... [1]

(iv) To create dark conditions Amir asks his friend to put on sunglasses.

Amir draws two diagrams (Fig. 1.1 and Fig. 1.2) to show how the pupil changes when the light conditions change.

Fig. 1.2 is incomplete.

Complete Fig. 1.2 to show the pupil in dark conditions.



[1]

(v) The change in pupil size is an example of a reflex.

Which statement best describes a reflex?

Tick (✓) **one** box.

A rapid and involuntary response.

A rapid and voluntary response.

A slow and involuntary response.

A slow and voluntary response.

[1]

(vi) What name is given to the structure that transmits electrical impulses from the eye to the central nervous

system?

Put a **ring** around the correct answer.

effector

receptor

relay neuron

sensory neuron

[1]

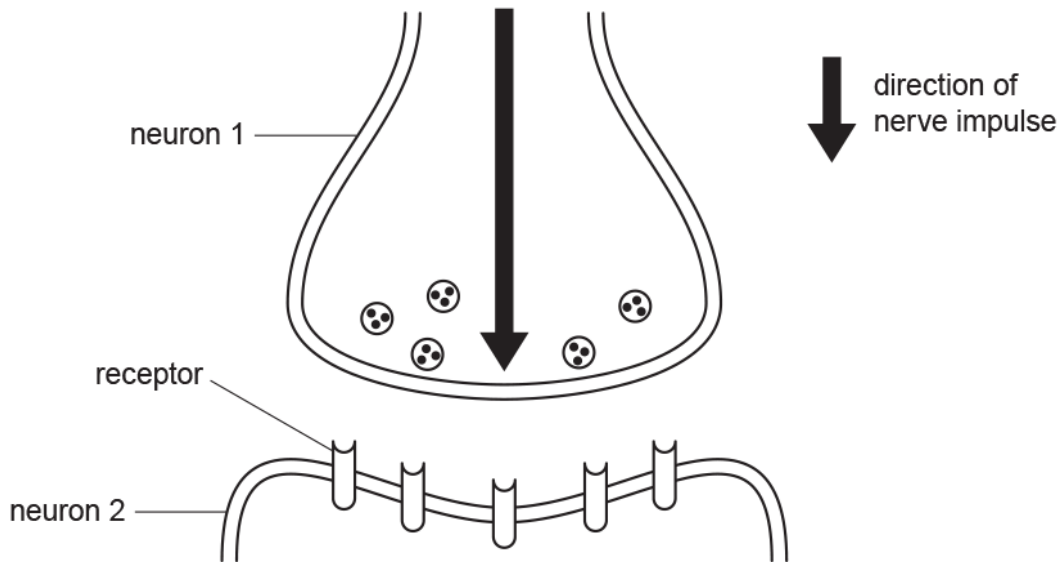
12. Insecticides called neonics are widely used by farmers.

Neonics kill insect pests that live on crop plants.

Neonics block receptors in synapses in the nervous system of an insect.

This stops the transmission of a nerve impulse across the synapse.

The diagram shows these receptors in a synapse.



Explain how neonics blocking receptors in a synapse stops the transmission of a nerve impulse across the synapse.

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[3]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1		i	Chimpanzees ✓	1	
		ii	Cerebral cortex ✓	1	If more than one box is ticked, do not award the mark even if the correct box is also ticked
			<b>Total</b>	<b>2</b>	
2	a		<u>long term memory</u> still works (1) problems with <u>short term memory</u> (1)	2	<b>Accept</b> long term better than short-term (2 marks).  <b>Examiner's Comments</b>  The terms long term and short term memory were quite well known.
	b		MRI / CAT / CT scan	1	<b>Do not accept</b> X rays.  <b>Examiner's Comments</b>  The question asked for a technique to find areas of the brain which are damaged. MRI and CAT scans were quite well known. Brain scan and just "scan" did not gain marks, nor did answers which involved brain surgery or questioning of the patient.
	c		repetition / chunking / pattern / link to stimulus	1	<b>Do not accept</b> write it down unless qualified by repeated. <b>Accept</b> any sensible answer.  <b>Examiner's Comments</b>  Candidates were required to give a way of remembering a telephone number. Answers which suggested writing it down were not credited. Repetition was the commonest correct response.
			<b>Total</b>	<b>4</b>	
3	a		brain (1) spinal cord (1)	2	<b>Ignore</b> spine  <b>Examiner's Comments</b>  Although this was generally quite well answered, many candidates could not correctly give the two parts of the Central Nervous System. Spine was a common incorrect answer.



Question			Answer/Indicative content	Marks	Guidance												
	b	i	<table border="1"> <thead> <tr> <th>Statement</th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>Light sensitive cells.....</td> <td></td> <td>✓</td> </tr> <tr> <td>Hormone secreting cells.....</td> <td></td> <td>✓</td> </tr> <tr> <td>Muscle cells .....</td> <td>✓</td> <td></td> </tr> </tbody> </table>	Statement	True	False	Light sensitive cells.....		✓	Hormone secreting cells.....		✓	Muscle cells .....	✓		2	<p>award 2 marks for 3 correct responses award 1 mark for 2 correct response No marks for 1 correct response</p> <p><b>Examiner's Comments</b></p> <p>Few candidates were able to identify whether three statements about receptors and effectors were True or False to score 2 marks, though many gained one mark for 2 correct responses.</p>
Statement	True	False															
Light sensitive cells.....		✓															
Hormone secreting cells.....		✓															
Muscle cells .....	✓																
		ii	C	1	<p><b>Examiner's Comments</b></p> <p>Most candidates were able to recognise the fatty sheath on a diagram of a neuron.</p>												
		iii	Tomas	1	<p><b>Examiner's Comments</b></p> <p>This question required candidates to identify a correct consequence of damage to the fatty sheath on a motor neuron. A minority were able to state which of three people were stating the correct effect.</p>												

Question		Answer/Indicative content	Marks	Guidance
	c	<p><b>Level 3 (5-6 marks)</b> States several features of both systems and comparison is clear. Quality of written communication does not impede communication of the science at this level</p> <p><b>Level 2 (3-4 marks)</b> States some features of both systems Quality of written communication partly impedes communication of the science at this level</p> <p><b>Level 1 (1-2 marks)</b> States some features of either system. Quality of written communication impedes communication of the science at this level</p> <p><b>Level 0 (0 marks)</b> Insufficient or irrelevant science. Answer not worthy of credit</p>	6	<p>This question is targeted at grades up to E Indicative scientific points may include</p> <p><b>Nervous system features</b></p> <ul style="list-style-type: none"> <li>• receptor/brain</li> <li>• electrical (impulses)</li> <li>• fast (response)</li> <li>• neurones</li> <li>• short lived (response)</li> </ul> <p><b>Endocrine system features</b></p> <ul style="list-style-type: none"> <li>• produced by a gland</li> <li>• chemical</li> <li>• slow response</li> <li>• (transported) in the blood</li> <li>• response lasts a long time</li> </ul> <p><b>Example of comparison - 6 marks at level 3.</b> The nervous system has a fast response whereas the hormonal system is slow. The nervous system uses neurones.</p> <p><b>Allow</b> any evidence of direct comparison e.g. use of “er” or but / whereas etc.</p> <p><b>Examiner's Comments</b></p> <p>Marks were readily available for comparisons between nervous and hormonal systems but many candidates were not able to make explicit comparisons so failed to score the highest marks. Some features of the two systems were credited at the lower levels. Weaker candidates referred to reflexes or emotions.</p>
		<b>Total</b>	<b>12</b>	

Question			Answer/Indicative content	Marks	Guidance
4	a		receptor; processing centre; effector	3	<p><b>Examiner's Comments</b></p> <p>The most common fault was to confuse the receptor with the effector. Many of the incorrect responses had chosen the correct terms, but had not placed them in the correct order – or more accurately, had not matched them to the correct process.</p>
	b	i	102	1	<p><b>Examiner's Comments</b></p> <p>This question showed that the great majority of candidates were able to correctly calculate the mean speed.</p>
		ii	neuron C; fatty sheath speeds up the speed of nerve impulses	2	<p><b>Examiner's Comments</b></p> <p>This part asked the candidates to make a conclusion based on comparing the calculation with the other results in the table. Many who made the correct calculation went on to draw the wrong conclusion because they did not recall the key knowledge that the fatty sheath around neurons speeds up the conduction of the electrical impulses.</p>
		iii	experimenter error; equipment error / malfunction	2	<p><b>Examiner's Comments</b></p> <p>It was interesting to note a number of responses along the lines of operator error with neuron A “because it is the first one he did, and so he might not be as good at doing the experiment” as this is an outstandingly good response. It was a little disappointing to see that most candidates did not offer a response worthy of credit.</p>

Question		Answer/Indicative content	Marks	Guidance
	c	<p><b>Level 3 (5–6 marks)</b> Gives a description of sensory and motor parts of the reflex arc along with correct explanation of the effect of damage on the left side compared to the right side. Quality of written communication does not impede communication of the science at this level.</p> <p><b>Level 2 (3–4 marks)</b> Gives a description and explanation perhaps giving detail of a logical sequence, but possibly not detailing a comparison of the two sides. Quality of written communication partly impedes communication of the science at this level.</p> <p><b>Level 1 (1–2 marks)</b> Gives a basic description of the reflex or makes a basic statement of left and right sided responses or gives a basic explanation of the response. Quality of written communication impedes communication of the science at this level.</p> <p><b>Level 0 (0 marks)</b> Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to C</p> <p><b>Indicative scientific points may include:</b></p> <p><b>Description</b></p> <ul style="list-style-type: none"> <li>• left senses the heat of the hot plate</li> <li>• right also senses the heat of the hot plate</li> <li>• impulse travels along the sensory neuron on to the motor neuron via the relay neuron on right</li> <li>• impulses transmitted along the sensory neuron and up the spinal cord to the brain on left side</li> </ul> <p><b>Explanation</b></p> <ul style="list-style-type: none"> <li>• the left motor neuron cannot function due to the damage</li> <li>• the left effector / muscle is not stimulated</li> <li>• muscle does not contract</li> <li>• hand not pulled away.</li> <li>• right side undamaged and operates as normal</li> <li>• the right effector / muscle is stimulated</li> <li>• right pulled quickly away from the hot plate.</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p> <p><b>Examiner's Comments</b></p> <p>A six-mark extended-writing question. It is interesting to note that the topic of reflex arcs has been a weak one in some previous examination sessions, and it was again here. It was possible to construct a very high scoring response by recalling the structures of the reflex arc in the correct order and by saying that the damage indicated in the question would prevent a normal response on the left side. Even with the prompt of the diagram many candidates failed to give enough detail to score many of the marks.</p>
		<b>Total</b>	<b>14</b>	

Question		Answer/Indicative content	Marks	Guidance
5	a	$\frac{(32.5 + 26.8 + 24.7)}{3} \text{ (1) or } \frac{84}{3}$ <p>28 (1)</p>	2	<p>Credit 2 marks if correct answer is given without any workings shown</p> <p><b>Examiner's Comments</b></p> <p>This concerned an experiment on reaction timing by dropping a ruler. Calculation of a mean for distance was very capably completed.</p>
	b	<p>Tamson has the faster reaction times. <input checked="" type="checkbox"/></p> <p>Owen's reaction time gets faster with each trial. <input type="checkbox"/></p> <p>The ranges of Owen's and Tamson's reaction times overlap. <input type="checkbox"/></p> <p>Owen had the greater range of reaction times. <input checked="" type="checkbox"/></p> <p>The range was the same for both Tamson's and Owen's trial. <input type="checkbox"/></p>	2	<p>remove one mark for each additional incorrect answer</p> <p><b>Examiner's Comments</b></p> <p>Conclusions based on the data were required here, and the question was well answered, with most scoring both marks.</p>
	c	<p>Any two from: allows you to identify <b>outliers</b>; gives you greater confidence in conclusion; increases the reliability / repeatability;</p>	2	<p><b>Ignore</b> errors <b>ignore</b> references to accuracy or fair test</p> <p><b>Examiner's Comments</b></p> <p>Less well answered, this called for candidates to suggest reasons why 3 trials were done. There were frequent references to increased accuracy and fair testing, rather than improved reliability, confidence in conclusion and recognition of possible outliers which were the required answers.</p>
	d	<p><i>any three from</i></p> <p>difficult to drop the ruler from exactly the same position each time; participant could be distracted; need more trials; may anticipate the drop; not holding the ruler steady;</p>	3	<p><b>accept</b> any sensible suggestions</p> <p><b>Examiner's Comments</b></p> <p>This question required candidates to suggest possible sources of error in the experiment. Some weak suggestions were seen, such as inaccuracies of timing where no timing was actually involved, and that different people took part, which was the point of the experiment. Most common answers which scored were issues with the dropping point/height, the possibility of anticipation of release and the need for a greater number of trials.</p>

Question	Answer/Indicative content	Marks	Guidance		
			Total	9	

Question	Answer/Indicative content	Marks	Guidance
6	<p><b>Level 3 (5–6 marks)</b>            Good description of how learning occurs            AND examples of ways that could be used to help remember the information.            Quality of written communication does not impede communication of the science at this level</p> <p><b>Level 2 (3–4 marks)</b>            Basic description of how learning occurs            AND examples of ways that could be used to help remember the information            Quality of written communication partly impedes communication of the science at this level</p> <p><b>Level 1 (1–2 marks)</b>            Basic description of how learning occurs            OR examples of ways that could be used to help remember the information            Quality of written communication impedes communication of the science at this level</p> <p><b>Level 0 (0 marks)</b>            Insufficient or irrelevant science. Answer not worthy of credit</p>	6	<p>This question is targeted at grades up to E</p> <p>Indicative scientific points may include:</p> <p><b>How learning occurs</b></p> <p>Memory</p> <ul style="list-style-type: none"> <li>• memory is storage</li> <li>• memory is retrieval of information</li> <li>• memory can be short term</li> <li>• memory can be long term</li> <li>• info from the short term can be transferred</li> <li>• neural pathways / connections</li> </ul> <p><b>Ways to help remember info</b></p> <ul style="list-style-type: none"> <li>• repetition / write out</li> <li>• using a visual image / diagram / poster / cards / mind map / bright colours / patterns</li> <li>• read aloud / recite / make a song</li> <li>• testing</li> <li>• mnemonics</li> <li>• quiet room</li> <li>• rewards</li> </ul> <p>“read” on its own is insufficient.</p> <p>ignore ref to food, listening in class (not a revision technique)</p> <p><b><u>Examiner's Comments</u></b></p> <p>There were two aspects to this question – how learning takes place and ways that could help revision for an exam. Most were able to suggest tips for learning, particularly repetition and examples of strong stimuli (use of colours etc.) but the process of learning was less well known. Credit was often given for use of ideas of short term and long term memory, unless they were used wrongly. (Some candidates obviously thought that short term is equivalent to a poor memory.) A</p>

Question			Answer/Indicative content	Marks	Guidance
					disappointingly low number of candidates referred to neural pathways.
			<b>Total</b>	<b>6</b>	
7	a		central (nervous system) (1)	1	<p><b>accept CNS</b></p> <p><b>Examiner's Comments</b></p> <p>Approximately half of the candidates sitting this paper knew that the answer was the central nervous system.</p>
	b		cerebral cortex / cerebrum (1)	1	<p><b>Examiner's Comments</b></p> <p>This section proved more challenging with less than 15% answering correctly.</p>
			<b>Total</b>	<b>2</b>	



Question		Answer/Indicative content	Marks	Guidance
8	a	involuntary rapid short-lived	2	<p>3 correct responses = 2 marks 1 or 2 correct = 1 mark</p> <p><b>accept</b> any indication of correct response e.g underline delete one mark for each additional incorrect response</p> <p><b>Examiner's Comments</b></p> <p>This was a well answered question where candidates were asked to circle 3 correct features of a reflex action. It was pleasing to see that few were not able to answer this question and over half knew all three correct features.</p>
	b	E D A C B	2	<p>5 correct = 2 marks 3 or 4 correct = 1 mark 2 or less correct = 0 marks</p> <p><b>Examiner's Comments</b></p> <p>Most candidates found the labelling of the diagram difficult. Some had mixed up what A &amp; E were and had therefore labelled up the neurones incorrectly too. Candidates would be advised to look at the direction of the arrows as this indicates the direction of the impulse and gives a clue to which should be the receptor and the effector.</p>
		<b>Total</b>	<b>4</b>	


Question	Answer/Indicative content	Marks	Guidance
9	<p><b>[Level 3]</b> Some detail of nervous pathway involved, and may include some description of squirrel behaviour. Quality of written communication does not impede communication of the science at this level.  (5 – 6 marks)</p> <p><b>[Level 2]</b> Reference to sense organ / receptor / brain / nerves / muscles and may include description of squirrel behaviour. Quality of written communication partly impedes communication of the science at this level.  (3 – 4 marks)</p> <p><b>[Level 1]</b> Description of squirrel behaviour OR why it does it. Quality of written communication impedes communication of the science at this level.  (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit.  (0 marks)</p>	6	<p>This question is targeted at grades up to C</p> <p>Indicative scientific points may include:</p> <ul style="list-style-type: none"> <li>• receptors</li> <li>• sensory neuron</li> <li>• processing centre</li> <li>• coordination</li> <li>• motor neuron</li> <li>• effector / muscle / adrenaline (epinephrine)</li> <li>• impulses are electrical</li> <li>• impulses are fast</li> <li>• impulses are short lived</li> <li>• reference to synapses</li> <li>• relevant suggestion of what squirrel does</li> <li>• explanation of why squirrel does it / idea of increased survival.</li> </ul> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> <p><b>Examiner's Comments</b></p> <p>Candidates were required to give details about how the response would arise within the squirrel and to go beyond the most basic level of what the squirrel would do.</p>
	<b>Total</b>	<b>6</b>	

Question			Answer/Indicative content	Marks	Guidance										
10	a			3	<p>4 correct = 3 3 or 2 correct = 2 1 correct = 1</p> <p><b>Examiner's Comments</b></p> <p>This part was very well answered.</p>										
	b		<p>D; Because it makes (fingers) move / all other are sensory;</p>	2	<p>need to have D correct for second marking point to be awarded</p> <p><b>Examiner's Comments</b></p> <p>This part was often well answered, with the great majority of candidates at least indicating option D.</p>										
	c	i	<table border="1"> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td>The patient may not benefit personally from the research.</td><td>✓</td></tr> <tr><td>The patient needs to give informed permission for the research.</td><td>✓</td></tr> </table>							The patient may not benefit personally from the research.	✓	The patient needs to give informed permission for the research.	✓	2	<p><b>Examiner's Comments</b></p> <p>This part was fairly well answered. Where a mark was dropped it was by choosing one of the wrong options instead of realising that the patient needs to give informed permission for the research.</p>
The patient may not benefit personally from the research.	✓														
The patient needs to give informed permission for the research.	✓														
		ii	<table border="1"> <tr><td>People are more willing to accept risk when it is something that they choose to do.</td><td>✓</td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td>The correct action is the one that leads to the best outcome for most people.</td><td>✓</td></tr> <tr><td></td><td></td></tr> </table>	People are more willing to accept risk when it is something that they choose to do.	✓					The correct action is the one that leads to the best outcome for most people.	✓			2	<p><b>Examiner's Comments</b></p> <p>Part ii was very well answered, most candidates choose the correct pair of options.</p>
People are more willing to accept risk when it is something that they choose to do.	✓														
The correct action is the one that leads to the best outcome for most people.	✓														

Question		Answer/Indicative content	Marks	Guidance										
	d	<table border="1"> <tr> <td></td> <td></td> </tr> <tr> <td>The finger would feel numb,</td> <td>✓</td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td>The fingers would not move</td> <td>✓</td> </tr> <tr> <td></td> <td></td> </tr> </table>			The finger would feel numb,	✓			The fingers would not move	✓			2	<p><b>Examiner's Comments</b></p> <p>This question often yielded one mark, more rarely both for realising that both the sensory and motor neurons would be affected.</p>
The finger would feel numb,	✓													
The fingers would not move	✓													
		<b>Total</b>	<b>11</b>											

Question		Answer/Indicative content	Marks	Guidance
11	i	<p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 4.6 (mm) award 2 marks</p> <p><math>(4.0 + 3.8 + 6.0) / 3 \checkmark</math> = 4.6 (mm) <math>\checkmark</math></p> <p>OR</p> <p><math>13.8 / 3 \checkmark</math> = 4.6 (mm) <math>\checkmark</math></p>	2 (AO 3.3 × 2)	<p><b>Examiner's Comments</b></p> <p>This question assessed objective AO2. Most candidates were able to correctly calculate the mean, although some demonstrated a correct approach (adding the three values and dividing by 3) without arriving at the correct answer, highlighting the need to check calculations. Some candidates did not know what the term mean meant and gave the median value instead.</p>
	ii	<p>6.0 / experiment 3 <math>\checkmark</math></p> <p>because it is far greater than the other two results / it is greater than the range stated <math>\checkmark</math></p>	2 (AO 3.1b $\checkmark$ 2)	<p><b>ALLOW</b> outside the range / the other two results are <b>only</b> 0.2mm different / too high (compared to the other results) / the other results are between 2 -4mm or within the range</p> <p><b>IGNORE</b> not closely related / 6.0 (it) is the greatest</p> <p><b>Examiner's Comments</b></p> <p>Three quarters of candidates were able to gain one mark for identifying the anomalous result, and around half of candidates were able to give a correct reason, the most common explanation referring to the value of 6.0 mm being outside the range. Some candidates misinterpreted the question and attempted to explain why the anomalous result could have happened. This question assessed objective AO3.</p>

Question			Answer/Indicative content	Marks	Guidance
		iii	repeat his experiment again ✓	1 (AO 3.3b)	<p><b>IGNORE</b> do more experiments / repeat it on different people / another experiment / do it more than once</p> <p><u>Examiner's Comments</u></p> <p>Just over a third of candidates were able to answer this question, assessing AO3, successfully, and these candidates were often the ones who went on to score the highest total marks on the paper. Candidates who did not answer correctly suggested that Amir should do his experiment on different people or simply do "more experiments" without making it clear they meant him to repeat this experiment.</p>
		iv	pupil drawn is bigger than that in the first diagram ✓	1 (AO 2.1)	<p><u>Examiner's Comments</u></p> <p>This question assessing AO2 was answered particularly well and attempted by almost all candidates.</p>
		v	A rapid and involuntary response ✓	1 (AO 1.1)	<p>more than one tick = 0 marks</p> <p><u>Examiner's Comments</u></p> <p>This question assessed AO1. Almost all candidates knew that a reflex action is a rapid response, but approximately a quarter did not know what voluntary and involuntary meant in terms of a reflex action and therefore were not able to gain the mark.</p>
		vi	sensory neuron ✓	1 (AO 1.1)	<p>more than one ring = 0 marks</p> <p><u>Examiner's Comments</u></p> <p>This question also assessed AO1. Around half of candidates correctly identified sensory neuron, but many thought that the answer was receptor.</p>
			<b>Total</b>	<b>8</b>	

Question	Answer/Indicative content	Marks	Guidance
12	<p>(molecules of) neurotransmitter (substances) diffuse across the synapse/gap ✓</p> <p>and bind to/stick to/are detected by the receptors ✓</p> <p>when the receptors are blocked by neonics there is no stimulation of neuron 2 / no generation of a nerve impulse in neuron 2 ✓</p>	<p>3 (AO 1.1)</p> <p>(AO 1.1)</p> <p>(AO 2.1)</p>	<p><b>IGNORE</b> 'neonics block receptors' unqualified, as this is given in the question</p> <p><b>Examiner's Comments</b></p> <p>Two of the three marks in this question were credited for direct recall (from specification statement B5.2.2) of how a nerve impulse is transmitted across a synapse by transmitter substances. However, this question proved to be very challenging for candidates, and very few correct answers were seen.</p> <p> <b>Misconception</b></p> <p>The most common misunderstanding in candidates' responses was that an electrical impulse (rather than chemical transmitter substances) travels across the gap from neuron 1 to neuron 2. Another misunderstanding that was seen occasionally was that the ends of the two neurons move and join, closing the gap, to transmit the nerve impulse.</p>
	<b>Total</b>	<b>3</b>	