OCR GCSE 21ST CENTURY BIOLOGY B · J257

BIOLOGY



MARK SCHEME

B5.2 HOW DOES THE NERVOUS SYSTEM HELP US RESPOND TO CHANGES? (FOUNDATION)

SCORE	PERCENTAGE
/81	%

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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
			Total	**2**	
2	a		long term memory still works (1) problems with short term memory (1)	2	**Accept** long term better than short-term (2 marks). **Examiner's Comments** The terms long term and short term memory were quite well known.
	b		MRI / CAT / CT scan	1	**Do not accept** X rays. **Examiner's Comments** 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	**Do not accept** write it down unless qualified by repeated. **Accept** any sensible answer. **Examiner's Comments** 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.
			Total	**4**	
3	a		brain (1) spinal cord (1)	2	**Ignore** spine **Examiner's Comments** 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.

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>b</td><td>i</td><td><table><tr><th>Statement</th><th>True</th><th>False</th></tr><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></table></td><td>2</td><td>award 2 marks for 3 correct responses
award 1 mark for 2 correct response
No marks for 1 correct response

Examiner's Comments

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.</td></tr>
<tr><td></td><td></td><td>ii</td><td>C</td><td>1</td><td>Examiner's Comments

Most candidates were able to recognise the fatty sheath on a diagram of a neuron.</td></tr>
<tr><td></td><td></td><td>iii</td><td>Tomas</td><td>1</td><td>Examiner's Comments

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.</td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
	c		**Level 3 (5-6 marks)** States several features of both systems and comparison is clear. Quality of written communication does not impede communication of the science at this level **Level 2 (3-4 marks)** States some features of both systems Quality of written communication partly impedes communication of the science at this level **Level 1 (1-2 marks)** States some features of either system. Quality of written communication impedes communication of the science at this level **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit **Total**	6 12	**This question is targeted at grades up to EIndicative** • receptor/brain • electrical (impulses) • fast (response) • neurones • short lived (response) **Endocrine system features** • produced by a gland • chemical • slow response • (transported) in the blood • response lasts a long time **Example of comparison - 6 marks at level 3.** The nervous system has a fast response whereas the hormonal system is slow. The nervous system uses neurones. **Allow** any evidence of direct comparison e.g. use of “er” or but / whereas etc. **Examiner's Comments** 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.

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Question			Answer/Indicative content	Marks	Guidance
4	a		receptor; processing centre; effector	3	Examiner's Comments 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.
	b	i	102	1	Examiner's Comments This question showed that the great majority of candidates were able to correctly calculate the mean speed.
		ii	neuron C; fatty sheath speeds up the speed of nerve impulses	2	Examiner's Comments 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.
		iii	experimenter error; equipment error / malfunction	2	Examiner's Comments 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.

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Question			Answer/Indicative content	Marks	Guidance
	c		**Level 3 (5–6 marks)** 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. **Level 2 (3–4 marks)** 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. **Level 1 (1–2 marks)** 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. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to C** **Indicative scientific points may include:** **Description** • left senses the heat of the hot plate • right also senses the heat of the hot plate • impulse travels along the sensory neuron on to the motor neuron via the relay neuron on right • impulses transmitted along the sensory neuron and up the spinal cord to the brain on left side **Explanation** • the left motor neuron cannot function due to the damage • the left effector / muscle is not stimulated • muscle does not contract • hand not pulled away. • right side undamaged and operates as normal • the right effector / muscle is stimulated • right pulled quickly away from the hot plate. **Use the L1, L2, L3 annotations in Scoris;** **do not use ticks.** **Examiner's Comments** 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.
			Total	**14**	

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Question			Answer/Indicative content	Marks	Guidance
5	a		$\frac{(32.5 + 26.8 + 24.7)}{3}$ (1) or $\frac{84}{3}$ 28 (1)	2	Credit 2 marks if correct answer is given without any workings shown **Examiner's Comments** This concerned an experiment on reaction timing by dropping a ruler. Calculation of a mean for distance was very capably completed.
	b		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 trial.	2	remove one mark for each additional incorrect answer **Examiner's Comments** Conclusions based on the data were required here, and the question was well answered, with most scoring both marks.
	c		Any two from: allows you to identify **outliers**; gives you greater confidence in conclusion; increases the reliability / repeatability;	2	**Ignore** errors **ignore** references to accuracy or fair test **Examiner's Comments** 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.
	d		*any three from* 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;	3	**accept** any sensible suggestions **Examiner's Comments** 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.

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Question			Answer/Indicative content	Marks	Guidance
			Total	9	

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Question			Answer/Indicative content	Marks	Guidance
6			**Level 3 (5–6 marks)** 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 **Level 2 (3–4 marks)** 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 **Level 1 (1–2 marks)** 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 **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit	6	**This question is targeted at grades up to E** **Indicative scientific points may include:** **How learning occurs** Memory • memory is storage • memory is retrieval of information • memory can be short term • memory can be long term • info from the short term can be transferred • **neural** pathways / connections **Ways to help remember info** • repetition / write out • using a visual image / diagram / poster / cards / mind map / bright colours / patterns • read aloud / recite / make a song • testing • mnemonics • quiet room • rewards "read" on its own is insufficient. **ignore** ref to food, listening in class (not a revision technique) **Examiner's Comments** 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

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

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Question			Answer/Indicative content	Marks	Guidance
8	a		involuntary rapid short-lived	2	3 correct responses = 2 marks 1 or 2 correct = 1 mark **accept** any indication of correct response e.g underline delete one mark for each additional incorrect response **Examiner's Comments** 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.
	b		E D A C B	2	5 correct = 2 marks 3 or 4 correct = 1 mark 2 or less correct = 0 marks **Examiner's Comments** Most candidates found the labelling of the diagram difficult. Some had mixed up what A & 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.
			Total	**4**	

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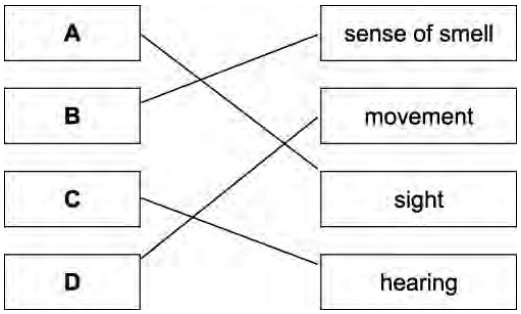
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Question			Answer/Indicative content	Marks	Guidance
9			[Level 3] Some detail of nervous pathway involved, and may include some description of squirrel behaviour. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] 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) [Level 1] Description of squirrel behaviour OR why it does it. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	• receptors • sensory neuron • processing centre • coordination • motor neuron • effector / muscle / adrenaline (epinephrine) • impulses are fast • impulses travel in one direction • reference to synapses • relevant suggestion of what squirrel does • explanation of why squirrel does it / idea of increased survival. Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments 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.
			Total	6	

This question is targeted at grades up to C

Indicative scientific points may include:

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>10</td><td>a</td><td></td><td>
</td><td>3</td><td>4 correct = 3
3 or 2 correct = 2
1 correct = 1

Examiner's Comments

This part was very well answered.</td></tr>
<tr><td></td><td>b</td><td></td><td>D;
Because it makes (fingers) move / all other are sensory;</td><td>2</td><td>need to have D correct for second marking point to be awarded

Examiner's Comments

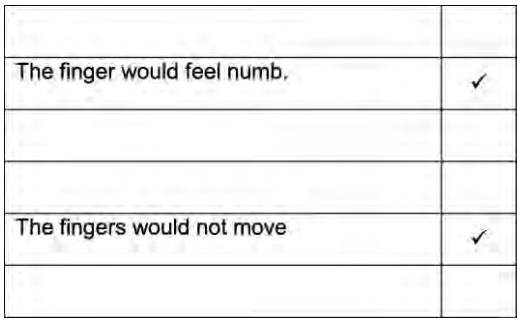
This part was often well answered, with the great majority of candidates at least indicating option D.</td></tr>
<tr><td></td><td>c</td><td>i</td><td><table>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>The patient may not benefit personally from the research.</td><td>✓</td></tr>
<tr><td>The patient needs to give informed permission for the research.</td><td>✓</td></tr>
</table></td><td>2</td><td>Examiner's Comments

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.</td></tr>
<tr><td></td><td></td><td>ii</td><td><table>
<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></td><td>2</td><td>Examiner's Comments

Part ii was very well answered, most candidates choose the correct pair of options.</td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
	d			2	Examiner's Comments This question often yielded one mark, more rarely both for realising that both the sensory and motor neurons would be affected.
			Total	11	

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Question			Answer/Indicative content	Marks	Guidance
11		i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 4.6 (mm) award 2 marks (4.0 +3.8+6.0)/3 ✓ = 4.6 (mm) ✓ OR 13.8/3 ✓ = 4.6 (mm) ✓	2 (AO 3.3 × 2)	Examiner's Comments 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.
		ii	6.0 / experiment 3 ✓ because it is far greater than the other two results / it is greater than the range stated ✓	2 (AO 3.1b ✓ 2)	ALLOW outside the range / the other two results are only 0.2mm different / too high (compared to the other results) / the other results are between 2 -4mm or within the range IGNORE not closely related / 6.0 (it) is the greatest Examiner's Comments 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.

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Question			Answer/Indicative content	Marks	Guidance
		iii	repeat his experiment again ✓	1 (AO 3.3b)	IGNORE do more experiments / repeat it on different people / another experiment / do it more than once Examiner's Comments 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.
		iv	pupil drawn is bigger than that in the first diagram ✓	1 (AO 2.1)	Examiner's Comments This question assessing AO2 was answered particularly well and attempted by almost all candidates.
		v	A rapid and involuntary response ✓	1 (AO 1.1)	more than one tick = 0 marks Examiner's Comments 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.
		vi	sensory neuron ✓	1 (AO 1.1)	more than one ring = 0 marks Examiner's Comments This question also assessed AO1. Around half of candidates correctly identified sensory neuron, but many thought that the answer was receptor.
			Total	8	

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Question			Answer/Indicative content	Marks	Guidance
12			(molecules of) neurotransmitter (substances) diffuse across the synapse/gap ✓ and bind to/stick to/are detected by the receptors ✓ when the receptors are blocked by neonics there is no stimulation of neuron 2 / no generation of a nerve impulse in neuron 2 ✓	3 (AO 1.1) (AO 1.1) (AO 2.1)	IGNORE 'neonics block receptors' unqualified, as this is given in the question <u>Examiner's Comments</u> 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.  Misconception 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.
			Total	3	

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