


Mark scheme - Animal Responses

Question	Answer/Indicative content	Marks	Guidance
1	B ✓	1	
	Total	1	
2	C ✓	1	<p><u>Examiner's Comments</u></p> <p>There were many correct responses to this question with candidates recognising the sympathetic nervous system prompt and its association with heart rate and blood pressure.</p>
	Total	1	
3	C ✓	1	
	Total	1	
4	D ✓	1 (AO1.1)	<p><u>Examiner's Comments</u></p> <p>Many candidates are showing improvement in their knowledge of biochemical concepts. The majority of candidates were aware that collagen is strong and insoluble. However, large number of candidates chose A rather than the correct option D in their response.</p> <p> Misconception</p> <p>There is a common misconception that collagen is 'inflexible'.</p>
	Total	1	
5	D	1 (AO1.1)	
	Total	1	
6	i (greater loss of) memory / thinking / cognition / speech / smell / sight /	2	<p>Mark as prose. Mark first two symptoms given only</p> <p>ACCEPT visual / olfactory / auditory (cortex) if linked to correct loss of speech / smell / sight</p> <p>ACCEPT corpus callosum if linked to loss of cognition</p>

		<p>hearing AND (due to damage to) cerebrum / cerebral cortex ✓</p> <p>(greater loss of) balance / coordination AND (due to damage to) cerebellum ✓</p> <p>(greater loss of) feeding / sleeping patterns / temperature control / water balance AND (due to damage to) hypothalamus ✓</p> <p>(greater loss of)swallowing / bladder control / bowel movement / control of, heart rate / breathing rate AND (due to damage to) medulla oblongata / brain stem ✓</p>		<p>/ balance / memory / thinking</p> <p>ACCEPT (due to damage to) motor cortex</p> <p>Examiner's Comments Generally, candidates seemed to have not understood this question. Candidates often gave vague explanations relating to brain or spinal cord damage, or to a reduction on the speed of reflexes, as an example of a symptom. Many who correctly described a symptom of failed to identify the part of the brain which had been damaged to cause that symptom and so gained no credit.</p>
	<p>ii</p>	<p>fewer / lower frequency / lower rate of, action potentials / impulses, reach NMJ }</p> <p>no / less, acetylcholine / ACh / neurotransmitter, released }</p> <p>no / less, (neurotransmitter) binding to (sarcolemma) receptors }</p> <p>no / less, depolarisation of, post-synaptic membrane / sarcolemma / T tubules</p>	<p>2 max</p>	<p>DO NOT ACCEPT 'signals' / 'messages' / weaker action potentials IGNORE slower action potentials alone (as stated in previous question)</p> <p>ACCEPT takes longer for neurotransmitter to build up</p> <p>IGNORE less neurotransmitter produced</p> <p>ACCEPT fewer action potentials generated</p> <p>Examiner's Comments Stronger candidates answered this question successfully. However, there was frequent confusion amongst other candidates between frequency and speed of impulses (reaching the NMJ), release and production (of neurotransmitter) and (depolarisation</p>

				of) post synaptic membrane and post synaptic neurone.
		Total	4	
7	i	I ✓ medulla (oblongata) ✓	2 (AO1.1)	
	ii	heart rate controlled by, nervous / autonomic, system / AW ✓ parasympathetic / vagus, nerve reduces heart rate / AW ✓ heart rate reduces by (approximately) 30 bpm ✓	max 2 (AO3.1)	ALLOW heart rate controlled by more than one nerve
	ii i	<u>hypothalamus</u> AND <u>pituitary</u> ✓ produce a wide range of hormones / AW ✓ affect other, endocrine / hormone-producing, glands ✓ explanation of symptom caused by injury to G or H from Fig. 16.2 ✓	max 2 (AO2.1)	MP1 ignore letters e.g. damage to thermoregulatory centre in, G / hypothalamus, leads to increased sensitivity to cold e.g. damage to, H / pituitary, means reduction in (named) reproductive hormones which leads to menstrual irregularities
	i v	damage to other endocrine glands could cause similar symptoms ✓ symptoms (may be) caused by, underlying conditions / other disease / co-morbidity ✓ symptoms (may be) result of epigenetic factors ✓	max 1 (AO2.1)	ALLOW e.g. damage to other organs could cause similar symptoms
		Total	7	
8	i	<i>two of</i> ACTH cortisol adrenaline	1	Two answers required for 1 mark.

Animal Responses

		ii	<table border="1"> <tbody> <tr> <td><i>Sino-atrial node</i></td> <td>increases rate of firing impulses (1)</td> <td>increased heart rate circulates blood more quickly (1)</td> </tr> <tr> <td><i>Liver cell</i></td> <td>increases glycogenolysis (1)</td> <td>makes more glucose available for respiration (1)</td> </tr> <tr> <td><i>Erector muscle in skin</i></td> <td>contraction of muscle (1)</td> <td>(causes hairs to be raised and so) makes animal look larger / more aggressive (1)</td> </tr> </tbody> </table>	<i>Sino-atrial node</i>	increases rate of firing impulses (1)	increased heart rate circulates blood more quickly (1)	<i>Liver cell</i>	increases glycogenolysis (1)	makes more glucose available for respiration (1)	<i>Erector muscle in skin</i>	contraction of muscle (1)	(causes hairs to be raised and so) makes animal look larger / more aggressive (1)	6	
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		ii i	<p>catalyses synthesis of cyclic AMP from ATP (1)</p> <p>cyclic AMP activates enzymes responsible for conversion of glycogen to glucose (1)</p>	2										
		i v	<p><i>two from</i></p> <p>prolonged high blood pressure can lead to cardiovascular problems (1)</p> <p>prolonged high blood sugar can lead to, problems with blood sugar regulation / diabetes (1)</p> <p>suppression of the immune system can lead to susceptibility to, disease / infection (1)</p>	2										
		Total		11										


9		i allows baby to , (try to) hold on / grasp ✓ (crying) draws attention (to the baby) ✓	2	<p>ALLOW alerts parent / encourages someone to pick baby up</p> <p>Examiner's Comments</p> <p>Many candidates deduced that a crying baby would alert a carer or parent to gain one mark, but few responses gained credit for a second mark point. Most candidates misunderstood the arm movement of the Moro reflex with very few recognising that the baby was trying to grasp an object. Many candidates attempted to explain the arm movements by stating that it was to enable the baby to 'hold their neck forward' or 'break their fall'.</p>
		ii <i>description:</i> (rapid) blinking / shutting / closing (of eyes) ✓ <i>explanation:</i> involuntary ✓ prevents , damage to / objects entering , eyes ✓	3	<p>ALLOW references to , ducking / raising hands / flinching</p> <p>ALLOW unconscious / automatic / innate / instinctive ALLOW protects the eyes</p> <p>Examiner's Comments</p> <p>Many candidates stated that the child blinked and prevented damage to the eyes so were credited with two marks. Some candidates referred to flinching or raising their arms which was an alternative response to blinking and was also credited. Good responses were seen where candidates knew that this was an example of an involuntary or innate response thereby gaining three marks.</p>
		Total	5	
1 0	a	i action potential / nervous impulse, in sensory neurone ✓ synapse / described ✓ relay / intermediate, neurone ✓ (nervous impulse in) motor neurone, passes to / AW, effector / muscle ✓	3 max	

		ii	<i>idea of</i> maintains balance / efficiency of movement ✓	1	
		ii i	kinetic / movement, energy converted ✓ to, electrical energy / action potential ✓ <i>idea of</i> movement of statolith moves sensory hairs ✓ membrane of sensory hairs depolarises ✓	3 max	
		b	<i>Support is weak because</i> <i>idea that</i> clasification based on phylogeny ✓ statocysts could, have evolved on more than one occasion / be an example of convergent evolution ✓	2	
			Total	9	
1 1			spinal cord ✓ synapses ✓	2 (AO1.1)	DO NOT ALLOW spine ALLOW synaptic junction / synaptic gap
			Total	2	
1 2			Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. In summary: <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)</i> <i>Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, Level 1,</i>	6 (AO1.2) (AO2.5)	Indicative scientific points may include (but are not limited to): <i>AO1.2 Demonstrate knowledge and understanding of scientific processes</i> <i>Endocrine system</i> <ul style="list-style-type: none"> • hypothalamus causes release of ADH from pituitary aldosterone released from adrenal cortex • ADH released from pituitary gland • ADH binds to receptors on the cell membranes of collecting duct cells ... • ... and this increases permeability to water (regulated by aquaporins) • role of cAMP <i>Nervous system:</i>

		<p>Level 2 or Level 3, best describes the overall quality of the answer. <i>Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i></p> <ul style="list-style-type: none"> ○ <i>award the higher mark where the Communication Statement has been met.</i> ○ <i>award the lower mark where aspects of the Communication Statement have been missed.</i> <ul style="list-style-type: none"> ● The science content determines the level. ● The Communication Statement determines the mark within a level. <p>Level 3 (5-6 marks) Describes with some detail the roles of the nervous and endocrine systems in enabling water reabsorption. It is likely that the role of more than one hormone is included. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated</i></p> <p>Level 2 (3-4 marks) Describes how the nervous system and</p>		<ul style="list-style-type: none"> ● hypothalamus is part of nervous system ● osmoreceptors in the hypothalamus ... ● ... detect a low water potential in the blood ● ADH is produced in the hypothalamus ● posterior pituitary is extension of hypothalamus ● correct reference to negative feedback <p><i>AO2.5 Apply knowledge and understanding of scientific processes in a theoretical context.</i></p> <p><i>Aldosterone:</i></p> <ul style="list-style-type: none"> ● sodium ions pumped out of collecting duct cells (into tissue fluid) (and potassium ions pumped in) ● lowers water potential in tissue fluid ● concentration gradient established ● sodium ions reabsorbed from the collecting duct lumen ● water diffuses into collecting duct cells / out of lumen via osmosis.
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		<p>endocrine system enable water reabsorption.</p> <p>There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.</p> <p>Level 1 (1-2 marks) Describes how the nervous system or endocrine system enables water reabsorption or Outlines the role of both systems in water reabsorption.</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>		
		Total	6	
1 3		<p>secreted into / travels in , blood ✓</p> <p>binds to receptors on (skin) cell (surface) ✓</p> <p>detail of response inside cell(s) ✓</p>	2 max(AO2.3)	<p>ALLOW transport medium / AW for blood ALLOW specific binding sites for receptors</p> <p>e.g. activates G protein e.g. causes formation of a secondary messenger e.g. enzyme / phosphorylation , cascade</p> <p><u>Examiner's Comments</u></p> <p>This part of the question was generally well-answered provided candidates had not been side-tracked into describing ACh function as a neurotransmitter. Many candidates correctly suggested that ACh could bind to skin cells to trigger secondary messengers within the cell and other good responses applied their knowledge to this unfamiliar situation to suggest that</p>


				ACh would be carried through the circulatory system or blood of the squid.
		Total	2	
1 4	i	<p>A = sinoatrial node / SA node / SAN ✓</p> <p>B = <u>right</u>, atrium / atria ✓</p> <p>C = (inferior) vena cava ✓</p> <p>D = semilunar valve ✓</p> <p>E = bicuspid / (left) atrioventricular / (left) AV, valve ✓</p>	5 (AO1.1)	<p>DO NOT ALLOW sinoarterial</p> <p>ALLOW aortic valve</p> <p>ALLOW mitral valve</p> <p>DO NOT ALLOW tricuspid</p>
	ii	autonomic ✓	1 (AO1.1)	ALLOW parasympathetic / sympathetic
		Total	6	
1 5		<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>In summary: Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)</p> <p>Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.</p> <p>Then, award the higher or lower mark within the level, according to the Communication Statement (shown in</p>		

		<p><i>italics</i>):</p> <ul style="list-style-type: none"> ○ <i>award the higher mark where the Communication Statement has been met.</i> ○ <i>award the lower mark where aspects of the Communication Statement have been missed.</i> <ul style="list-style-type: none"> • The science content determines the level. • The Communication Statement determines the mark within a level. <p>A level annotation should be used where all marks for a level have been achieved eg for 6 marks L3</p> <p>If a candidate has achieved 5 marks then they have reached level 3 but with one mark omitted e.g L3 </p> <p>The same principal should be applied to level 2 and level 1</p> <p>No marks (0) should have a cross</p> <p>Level 3 (5–6 marks) Describes and explains some improvements to the method and the presentation.</p> <p><i>There is a well-developed line of reasoning, which is clear and logically-structured and uses scientific terminology at an appropriate level. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks)</p>	<p>6</p>	<p>Indicative scientific points may include</p> <p><i>Method:</i></p> <ul style="list-style-type: none"> • sample sizes should be increased to improve the accuracy and repeatability of the results • same number of subjects for, smokers / non-smokers / gender, to make comparisons more valid • gender should be controlled / tested separately because heart rate may show an overall difference between genders • other subject factors (e.g. diet, exercise history, other health issues) should be controlled / taken into account because these can influence heart rate • the level of smoking (e.g. casual vs 20 per day) should be controlled because this is likely to be a continuous variable rather than the discrete variable the student has implied • time of day should have been standardised because this may influence heart rate • subjects should have been given an exercise that required a particular intensity (e.g. treadmill running) because effort will have varied • more repeats before calculating mean to identify anomalies <p><i>Presentation:</i></p> <ul style="list-style-type: none"> • smokers and non-smokers should have been presented as separate columns to make comparisons easier • units should be included for the final two columns to show that the three heart rate
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		<p>Describes some improvements to the method and the presentation, and explains improvements to either method or presentation</p> <p><i>There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented in the most part relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Describes some improvements to either method and / or presentation.</p> <p><i>There is an attempt at a logical structure with a line of reasoning.</i></p> <p><i>The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>		<p>measurements were made using the same method</p> <ul style="list-style-type: none"> • the number of significant figures / decimal places should be the same for each measurement to standardise the level of precision • present data graphically to spot trends more easily • label heart rates as mean heart rates for clarity <p>Examiner's Comments Most candidates gained either a Level 2 or Level 3 for this question, with the majority picking up the communication mark too. Candidates generally explained the improvements to the method in much better detail than the improvements to the presentation. All points from the Indicative Scientific Points were seen but most candidates only used two from the method and one or two from the presentation in their answers.</p> <p>Candidates had lots of suggestions about improving the experimental technique and there were some good suggestions for processing the data, but in both cases the explanation was often weak or even non-existent. For example, many thought that increasing the age range would have improved results, rather than introduce another variable, and some candidates could not adequately explain why increasing sample sizes or repeats improved the experiment. There was a lack of the term anomalies when referring to repeats and if they were mentioned, candidates often thought that repeats allow anomalies to be 'eliminated' or 'removed,' rather than just identified.</p> <p>Many candidates struggled with the actual meanings of the terms repeatability, accuracy, precision (all defined in the ASE publication 'Language of Measurement' and reproduced in the OCR A Level Biology Practical Skills Handbook) and reliability (which no longer has any special meaning – see note in the Practical Skills Handbook), often using them in an incorrect context. For example, some candidates noticed that the number of significant figures were not the same but failed to give the correct reason and used the term accuracy instead of precision. Missing units in column headings were on many occasions identified but the reason for their presence was</p>
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				<p>unclear. There was also a common misconception of placing the data in multiple tables, e.g. smokers and non-smokers and males / females. However, many candidates suggested presenting the data graphically to allow trends to be spotted more easily.</p> <p>Examiners would advise candidates to concentrate on fewer improvements and to ensure that both a method and a data improvement is described and explained to gain access to the higher levels.</p> <p>To help prepare candidates for this type of question in the exam, centres are advised to use familiar concepts in a variety of different contexts and also practise designing and criticising experimental design when planning experiments.</p>
		Total	6	
1 6		<p><i>carboxylic acid</i> should be <u>carbonic acid</u> / H₂CO₃ ✓</p> <p><i>vagus</i> (nerve) should be , <u>accelerator</u> / <u>sympathetic</u> / <u>accelerans</u> , (nerve) ✓</p> <p>AVN should be , <u>SAN</u> / <u>sinoatrial node</u> ✓</p> <p><i>baroreceptors</i> should be <u>chemoreceptors</u></p> <p>OR</p> <p><i>pH</i> should be <u>pressure</u> ✓</p> <p><i>smooth muscle</i> should be <u>cardiac muscle</u> ✓</p>	max 4	<p><i>Error</i> and correct term must be clearly identified. ALLOW copied statements where correct terms replace errors. IGNORE carbon dioxide</p> <p>ALLOW specialised striated</p> <p><u>Examiner's Comments</u></p> <p>There were some excellent responses where candidates recognised all the errors and suggested suitable corrections. Many candidates knew that baroreceptors detected pressure change or that chemoreceptors detected pH. Many others also recognised that cardiac muscle is found in the heart and not cardiac muscle.</p> <p>The question presented some problems for lower ability candidates who were not secure in their knowledge about the cardiovascular system. The marking points that were most frequently answered</p>

				<p>incorrectly were mark points one and three. Candidates often quoted carbon dioxide instead of carbonic acid, and "SAN sends impulse to AVN" instead of impulse sent from nerve to SAN. Some 'errors' were also corrected which were not intended, e.g. changing endocrine to exocrine, adrenaline to noradrenaline and adrenal medulla to adrenal cortex.</p> <p>Exemplar 6</p> <p><i>carboxylic acid... should be carbonic acid ✓</i> <i>vagus nerve should be accelerator nerve ✓</i> <i>baroreceptors should be chemoreceptors ✓</i> <i>more frequently should be less frequently ✓</i> <i>AVN... should be SAN ✓</i></p> <p>This is a very concise correct response where the candidate clearly indicates each error followed by the correction. Some candidates rewrote the prose replacing the errors with the correct terms which was also an acceptable way of presenting their response.</p>
		Total	4	
1 7	i	Z THEN X ✓ Y ✓	2(AO1.2)(AO2.8)	<p>Order MUST be Z, X then Y for two marks</p> <p>Examiner's Comments</p> <p>Many candidates ordered the heart rate patterns correctly. Some candidates were able to score one mark by having Y in the right place, even though X and Z had been reversed.</p>
	ii	large single peaks present ✓ small wavy line between peaks with at least three waves between any two peaks ✓	2(AO2.6)	<p>0 marks if just a wavy line drawn with no peaks</p> <p>Examiner's Comments</p> <p>There was a great deal of variation in the traces drawn by candidates. The majority of candidates achieved one mark for drawing taller peaks, but many struggled to produce a reasonable sketch of the trace between the peaks. Some candidates often drew traces in regular rhythm from the previous question and others drew incomplete traces i.e. only showing 1 beat and not using the entirety of the space provided.</p> <p>Exemplar 5</p>

				 <p>This exemplar shows a good response to this part of the question. The candidate has clearly sketched a trace typical of atrial fibrillation.</p>
		<p>increased stroke volume / AW ✓</p> <p>increased volume of ventricle (chamber) ✓</p> <p>ii</p> <p>i</p> <p>increased , thickness / strength , of heart <u>muscle</u> ✓</p>	2(AO2.7)	<p>ALLOW myocardium for muscle</p> <p>Examiner's Comments</p> <p>Good responses for this part of the question understood that there would be an increased thickness of cardiac muscle and that stroke volume would increase. Few candidates mentioned the increase in ventricular volume.</p> <p>⊕ Misconception</p> <p>There appeared to be a misconception amongst many candidates that aerobically fit people would not need as much oxygen delivered to cells, had more red blood cells or needed less ATP.</p>
		Total	6	
18		<p><i>two from</i></p> <p>cells are able to tolerate, high levels of lactate / acidity / low pH (1)</p> <p>have high phosphocreatine stores (1)</p> <p>use of stored ATP (1)</p>	2	
		Total	2	
19		<p>i</p> <p>liver (tissue) ✓</p>	1	<p>ALLOW hepatic (tissue)</p> <p>IGNORE hepatocytes / cells</p> <p>IGNORE muscle</p> <p>Examiner's Comments</p>

				Many candidates gave liver (tissue) as the correct response but credit was not given for any other muscle (tissue), or incorrectly named cells rather than the tissue.
		ii	<p>(glucose) for respiration / as respiratory substrate / to release energy ✓ to produce ATP ✓</p> <p>ATP needed (in muscle contraction) for breaking cross-bridges between myosin and actin / AW ✓ ATP , hydrolysed / to ADP and Pi , to reset myosin heads ✓</p> <p>ATP for active transport of calcium ions (back) into sarcoplasmic reticulum ✓</p>	<p>DO NOT ALLOW produce energy</p> <p>ALLOW ATP needed for myosin to detach from actin</p> <p>ALLOW ATP hydrolysed for myosin to resume normal position</p> <p>IGNORE power-stroke</p> <p>Examiner's Comments</p> <p>Many candidates scored two marks for glucose being used in respiration to produce ATP. Good responses gave detail of how the ATP was important in muscle contraction such as to break the cross-bridges between myosin and actin. Common misconceptions included ATP being needed for the power stroke or to allow the formation of the cross-bridge between myosin and actin.</p> <p>Key:</p> <p>Misconception</p>
		Total	4	
20		i	<p>cell division / cytokinesis ✓ <i>idea of</i> cell movement ✓</p>	<p>ALLOW binary fission / for replication DO NOT ALLOW mitosis e.g. 'allows flexibility' / 'allows it to bend'</p>
		ii	<p><i>idea of</i> maintaining cell, shape / structure ✓</p>	<p>ALLOW to change cell shape / provide support</p>
		ii i	<p>binds to, actin / cytoskeleton ✓ <i>idea that</i> actin might not function correctly ✓</p>	<p>e.g. stops muscle contraction / causes paralysis</p>
		Total	3	