

Biology A

General Certificate of Secondary Education

Unit **A222/02**: Modules B4, B5, B6 (Higher Tier)

Mark Scheme for January 2012

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.














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Annotations

Annotation	Meaning
	Indicate uncertainty or ambiguity
	Benefit of doubt
	Contradiction
	Incorrect response
	Error carried forward
	Draw attention to a particular part of a candidate's response
	Draw attention to a particular part of a candidate's response
	Draw attention to a particular part of a candidate's response
	No benefit of the doubt
	Reject
	Correct Response
	Draw attention to a particular part of a candidate's response
	Information omitted

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not/reject	answers which are not worthy of credit
ignore	statements which are irrelevant – applies to neutral answers
allow/accept	answers which can be accepted
(words)	words which are not essential to gain credit
<u>words</u>	underlined words must be present in order to score a mark
ecf	error carried forward
AW/owtte	alternate wording
ORA	or reverse argument

Subject-specific Marking Instructions

- Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).
- If a candidate alters his/her response, examiners should accept the alteration.
- Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

e.g. for a one-mark question where ticks in the third and fourth boxes are required for the mark:

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

This would be worth 1 mark.

This would be worth 0 marks.

This would be worth 1 mark.

- The list principle:
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.
- Marking method for tick-box questions:
If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes. If there is at least one tick, ignore crosses and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

e.g. if a question requires candidates to identify cities in England:

Edinburgh	<input type="checkbox"/>
Manchester	<input type="checkbox"/>
Paris	<input type="checkbox"/>
Southampton	<input type="checkbox"/>

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	x	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	x		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Question		Answer	Marks	Guidance																
1	(a)	(overall/net) movement/diffusion of water from a dilute/low concentrated to a more/high concentrated solution (1) through a partially permeable membrane (1)	2	OWTTE accept from high to low concentration of water (molecules) accept from a high to low concentration – if with ref. to diffusion accept from a less – ve to more – ve/ higher water potential to a lower water potential ignore particles accept semi/selectively/differentially = partially ignore abbreviations																
	(b)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>cells burst</th> <th>cells shrink</th> <th>cells stay the same</th> </tr> </thead> <tbody> <tr> <td>cells in pure water</td> <td style="text-align: center;">✓</td> <td></td> <td></td> </tr> <tr> <td>cells in a salt solution that is the same concentration as inside the cells</td> <td></td> <td></td> <td style="text-align: center;">✓</td> </tr> <tr> <td>cells in a salt solution that is more concentrated than inside the cells</td> <td></td> <td style="text-align: center;">✓</td> <td></td> </tr> </tbody> </table>		cells burst	cells shrink	cells stay the same	cells in pure water	✓			cells in a salt solution that is the same concentration as inside the cells			✓	cells in a salt solution that is more concentrated than inside the cells		✓		2	mark by rows 3 correct responses = 2 marks 1 or 2 correct responses = 1 mark more than 1 tick in a row = negates the response for the row accept any clear indication of correct response eg. shaded boxes/ crosses (but without ticks) ignore crosses if tick shown clearly in correct box
	cells burst	cells shrink	cells stay the same																	
cells in pure water	✓																			
cells in a salt solution that is the same concentration as inside the cells			✓																	
cells in a salt solution that is more concentrated than inside the cells		✓																		
Total			4																	

Question		Answer	Marks	Guidance										
2	(a)	proteins (1) speed up (1)	2	accept any indication of correct response eg. underlined/circled in list and linked to spaces provided										
	(b)	<table border="1"> <tbody> <tr> <td>Enzyme activity is not affected by cold temperature</td> <td></td> </tr> <tr> <td>Enzymes can become denatured at very high temperatures</td> <td>✓</td> </tr> <tr> <td>Enzymes need a specific constant temperature to work at their optimum</td> <td>✓</td> </tr> <tr> <td>Very high temperatures increase the reaction rate between enzymes and other molecules</td> <td></td> </tr> <tr> <td>Small increases in temperature are not linked to the frequency of collisions between an enzyme and other molecules</td> <td></td> </tr> </tbody> </table>	Enzyme activity is not affected by cold temperature		Enzymes can become denatured at very high temperatures	✓	Enzymes need a specific constant temperature to work at their optimum	✓	Very high temperatures increase the reaction rate between enzymes and other molecules		Small increases in temperature are not linked to the frequency of collisions between an enzyme and other molecules		2	<p>1 mark for each correct response</p> <p>more than 2 ticks = deduct one mark for each extra tick</p> <p>accept any clear indication of correct response eg. shaded boxes/ crosses (but without ticks)</p> <p>ignore crosses if tick shown clearly in correct boxes</p>
Enzyme activity is not affected by cold temperature														
Enzymes can become denatured at very high temperatures	✓													
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Very high temperatures increase the reaction rate between enzymes and other molecules														
Small increases in temperature are not linked to the frequency of collisions between an enzyme and other molecules														
	(c)	only molecules/proteins/substrates with the correct shape / can fit /react; (into the) active site of the enzyme; lock and key model;	3	<p>molecules with different shapes will not fit in to the enzyme active site = 2 marks</p> <p>accept the enzyme and molecules fit together</p> <p>ignore ref. to specificity/ ref. to active site of substrate</p>										
		Total	7											

Question		Answer	Marks	Guidance																														
3	(a)	partially-permeable (1)	1	accept semi/selectively/differentially = partially ignore cellophane/visking tubing																														
	(b)	(i) urea builds up in the fluid (1) (too much in the fluid would) stop diffusion (1)	2	OWTTE ignore ref. to waste accept limits diffusion gradient ignore ref. to stop molecules returning to blood																														
		(ii) <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td></td> <td style="text-align: center;">only going in</td> <td style="text-align: center;">only coming out</td> <td style="text-align: center;">both in and out</td> <td style="text-align: center;">neither in nor out</td> </tr> <tr> <td style="padding-right: 10px;">water</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td style="padding-right: 10px;">glucose</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td style="padding-right: 10px;">protein</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> <tr> <td style="padding-right: 10px;">salt</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td style="padding-right: 10px;">urea</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table>		only going in	only coming out	both in and out	neither in nor out	water	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	glucose	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	protein	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	salt	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	urea	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3	ignore any ticks shown in 'water' row mark by rows (from glucose down to urea) 4 correct rows = 3 marks 3 correct rows = 2 marks 1 or 2 correct rows = 1 mark more than 1 tick in a row = negates response for that row accept any clear indication of correct response eg. shaded boxes/ crosses (but without ticks) ignore crosses if tick shown clearly in correct boxes
	only going in	only coming out	both in and out	neither in nor out																														
water	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>																														
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urea	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																														
Total			6																															

Question			Answer	Marks	Guidance												
4	(a)	(i)	<table border="1"> <tr> <td>Each specialised cell only produces the specific protein it needs.</td> <td>✓</td> </tr> <tr> <td>Many of the genes in a particular cell are not active.</td> <td>✓</td> </tr> <tr> <td>New genes are produced during cell specialisation.</td> <td></td> </tr> <tr> <td>Some of the genes are lost as each cell becomes more specialised.</td> <td></td> </tr> <tr> <td>Specialised cells contain different genes.</td> <td></td> </tr> <tr> <td>The specialised cells only contain half the number of genes needed.</td> <td></td> </tr> </table>	Each specialised cell only produces the specific protein it needs.	✓	Many of the genes in a particular cell are not active.	✓	New genes are produced during cell specialisation.		Some of the genes are lost as each cell becomes more specialised.		Specialised cells contain different genes.		The specialised cells only contain half the number of genes needed.		2	<p>accept any clear indication of correct response eg. shaded boxes/ crosses (but without ticks)</p> <p>more than 2 ticks = negates one mark for each extra tick</p>
Each specialised cell only produces the specific protein it needs.	✓																
Many of the genes in a particular cell are not active.	✓																
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Some of the genes are lost as each cell becomes more specialised.																	
Specialised cells contain different genes.																	
The specialised cells only contain half the number of genes needed.																	
		(ii)	unspecialised; grow;	1	both correct = 1 mark												
	(b)	(i)	<table border="1"> <tr> <td>... breaks down in the dark.</td> <td></td> </tr> <tr> <td>... is evenly distributed across the shoot.</td> <td></td> </tr> <tr> <td>... is no longer produced by the shoot.</td> <td></td> </tr> <tr> <td>... collects on the side of the shoot in the shade.</td> <td>✓</td> </tr> </table>	... breaks down in the dark.		... is evenly distributed across the shoot.		... is no longer produced by the shoot.		... collects on the side of the shoot in the shade.	✓	1	<p>accept any clear indication of correct response eg. shaded box/ cross (but without ticks in other boxes)</p> <p>more than 1 tick = 0 marks</p>				
... breaks down in the dark.																	
... is evenly distributed across the shoot.																	
... is no longer produced by the shoot.																	
... collects on the side of the shoot in the shade.	✓																
		(ii)	<p>any three from:</p> <p>more light;</p> <p>more /faster photosynthesis;</p> <p>more growth/taller/ faster growth;</p> <p>increases its chances of survival/ compete (better);</p>	3	<p>accept sunlight = light ignore sun</p> <p>accept energy – but must be qualified eg. from sun</p> <p>ignore food accept more glucose</p> <p>ignore photosynthesis better</p> <p>ignore 'can survive' unqualified</p>												
			Total	7													

Question		Answer	Marks	Guidance
5	(a)	2, 4, 1, 2 (1)	1	
	(b)	0 (1)	1	more than 1 option circled = 0 marks accept any clear indication of correct response eg. underlined/ other options all crossed out
	(c)	(amino acids) 2 and 4 (1)	1	both responses = 1 mark ignore base letters, A, T, C or G
Total			3	

6		<p>any four from:</p> <p>(numbers of) organelles increase;</p> <p>chromosomes/DNA copied/ replicates/duplicates;</p> <p>(copies of) chromosomes separate;</p> <p>cell divides/ cell/cytoplasm splits;</p> <p>(daughter) cells are identical;</p>	4	<p>ignore ref. to meiosis or meiotic products</p> <p>ignore refs. to mRNA and bases, A, T, C and G</p> <p>accept number of organelles doubles/ organelles divide/copy themselves</p> <p>accept genetic information = DNA</p> <p>ignore genes/ ref. to cloning</p> <p>ignore chromosomes split</p> <p>accept correct ref. to chromatids</p> <p>ignore ref. to DNA separating</p> <p>ignore ref. to centrioles/ spindle fibres/ details of mitosis stages</p> <p>ignore membrane splits</p> <p>ignore same chromosome number</p>
Total			4	

Question		Answer	Marks	Guidance												
7	(a)	brain; learning and impulses; repetition;	2	3 correct responses = 2 marks 2 correct responses = 1 mark 1 or 0 correct responses = 0 marks												
	(b)	<table border="1"> <tr> <td>Jumping in response to a sudden, loud noise.</td> <td></td> </tr> <tr> <td>Maintaining a constant body temperature.</td> <td></td> </tr> <tr> <td>Quickly moving your hand from a sharp object.</td> <td></td> </tr> <tr> <td>Reducing the size of the pupils in the eyes.</td> <td></td> </tr> <tr> <td>Remembering a telephone number.</td> <td>✓</td> </tr> <tr> <td>Speaking a language.</td> <td>✓</td> </tr> </table>	Jumping in response to a sudden, loud noise.		Maintaining a constant body temperature.		Quickly moving your hand from a sharp object.		Reducing the size of the pupils in the eyes.		Remembering a telephone number.	✓	Speaking a language.	✓	1	2 correct responses = 1 mark accept any clear indication of correct responses eg. shaded boxes/ crosses (but without ticks) more than 2 ticks = 0 marks
Jumping in response to a sudden, loud noise.																
Maintaining a constant body temperature.																
Quickly moving your hand from a sharp object.																
Reducing the size of the pupils in the eyes.																
Remembering a telephone number.	✓															
Speaking a language.	✓															
		Total	3													

Question		Answer	Marks	Guidance										
8	(a)	(B), E, D, A, F	3	<p>E anywhere before D = 1 mark D anywhere before A = 1 mark A anywhere before F = 1 mark</p> <p>if letters are repeated – deduct 1 response for each repeated letter</p>										
	(b)	<table border="1"> <tbody> <tr> <td>The secretion of synapse chemicals will stop.</td> <td></td> </tr> <tr> <td>The motor neuron may stop transmitting impulses.</td> <td>✓</td> </tr> <tr> <td>The synapse chemicals will have a changed shape.</td> <td></td> </tr> <tr> <td>The synapse chemical will not bind to the receptor molecules.</td> <td>✓</td> </tr> <tr> <td>The concentration of synapse chemical in the gap between the two neurons will suddenly drop.</td> <td></td> </tr> </tbody> </table>	The secretion of synapse chemicals will stop.		The motor neuron may stop transmitting impulses.	✓	The synapse chemicals will have a changed shape.		The synapse chemical will not bind to the receptor molecules.	✓	The concentration of synapse chemical in the gap between the two neurons will suddenly drop.		2	<p>accept any clear indication of correct response eg. shaded boxes/ crosses (but without ticks)</p> <p>more than 2 ticks = negates one mark for each extra tick</p>
The secretion of synapse chemicals will stop.														
The motor neuron may stop transmitting impulses.	✓													
The synapse chemicals will have a changed shape.														
The synapse chemical will not bind to the receptor molecules.	✓													
The concentration of synapse chemical in the gap between the two neurons will suddenly drop.														
		Total	5											

Question		Answer	Marks	Guidance												
9	(a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>simple</td> <td style="text-align: center;">✓</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td>involuntary</td> <td style="text-align: center;">✓</td> </tr> <tr> <td> </td> <td> </td> </tr> </table>	simple	✓							involuntary	✓			1	2 correct responses = 1 mark accept any clear indication of correct responses eg. shaded boxes/ crosses (but without ticks) more than 2 ticks = 0 marks
simple	✓															
involuntary	✓															
	(b)	B, F, C, E, D, (A)	2	B anywhere before F, F anywhere before C, C anywhere before E, E anywhere before D 4 correct responses = 2 marks 2 or 3 correct responses = 1 mark 1 or 0 correct responses = 0 marks if letters are repeated – deduct 1 mark for each repeat												
		Total	3													

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