



GCE

Biology A

H420/02: Biological diversity

Advanced GCE

Mark Scheme for June 2019

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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.

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Annotations

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Marking Annotations

Annotation	Use
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
	Benefit of the doubt not given
	Tick
	Omission Mark
	Blank Page
	Level 1 answer in Level of Response question
	Level 2 answer in Level of Response question
	Level 3 answer in Level of Response question

Subject-specific Marking Instructions

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

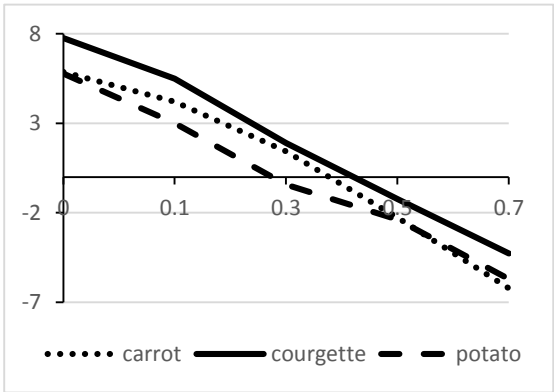
You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question	Answer	Marks	Guidance
<p>DO NOT CREDIT hybrid letters DO NOT CREDIT if more than one letter written inside the box IGNORE letters outside the box if there is a letter in the box ALLOW letters outside the box only if there is no letter in the box or the letter in the box has been crossed out.</p>			
1	A ✓	1	
2	B ✓	1	
3	C ✓	1	
4	D ✓	1	
5	B ✓	1	
6	D ✓	1	
7	C ✓	1	
8	C ✓	1	
9	D ✓	1	
10	B ✓	1	
11	C ✓	1	
12	A ✓	1	
13	D ✓	1	
14	A ✓	1	
15	D ✓	1	
	Total	15	

Question			Answer	Marks	Guidance
16	(a)	(i)	<p><u>diffusion</u> / <u>net</u> movement , of water across a , partially / selectively , permeable membrane ✓</p> <p>down a , <u>water potential</u> / Ψ , gradient ✓</p>	2	<p>IGNORE semi</p> <p>ALLOW from a high water potential to a more negative Ψ</p> <p>IGNORE water concentration</p> <p>IGNORE along</p>
		(ii)	<p>water enters vacuole ✓</p> <p><u>pressure</u> against cell wall ✓</p> <p>turgor (pressure) ✓</p> <p>turgid cells (support plant) ✓</p>	3 max	
	(b)	(i)	<p>FIRST CHECK ON ANSWER LINE</p> <p>If answer = 6.25 or 6.3 award 2 marks ✓✓</p> <p><i>If answer is incorrect ALLOW 1 mark max for any one of...</i></p> <p>correct answer to 1 or >3 s.f.</p> <p>3.125 ± 0.005</p> <p>0.0625 or 0.063</p> <p>$(2 \times 0.5) / (26.5 - 10.5) \times 100$ ✓</p>	2	
		(ii)	<p>Y / solution outside bag , has higher , water potential / Ψ (than X) ✓ ora</p> <p>X / solution inside bag , has higher , solute / AW , concentration / potential (than Y) ✓ ora</p>	2	<p><i>Must be comparative statements</i></p> <p>IGNORE water concentration</p> <p>IGNORE hypertonic / hypotonic</p> <p>ALLOW X has more sugar molecules</p>
	(c)	(i)	<p>different (starting) masses (of plant pieces) ✓</p> <p>allows comparison (between plant pieces of different mass) ✓</p>	2	<p>ALLOW different weights</p> <p>IGNORE to remove effect of starting mass</p>
		(ii)		2 max	IGNORE references to measuring errors

Question	Answer	Marks	Guidance
	inadequate drying ✓ (so) more mass / heavier (than other pieces) ✓ piece cut from different (part of) potato ✓ (so) cells might have different water potential (at start) ✓		CREDIT only 1 limitation and corresponding explanation
(iii)	<ol style="list-style-type: none"> 1 courgette / carrot or courgette ✓ 2 0(%) mass change / <i>idea of intercept</i> , between 0.3 and 0.5 (mol dm⁻³) ✓ 3 (courgette associated with) highest concentration at which there is no mass change ✓ 4 (courgette has) highest mass gain at 0 mol dm⁻³ / least mass loss at 0.7 mol dm⁻³ ✓ 5 change / AW , at , 0.3 (mol dm⁻³) higher than carrot / 0.5 (mol dm⁻³) lower than carrot ✓ 6 AVP calculated linear extrapolation (0.421) ✓ 	3 max	<p>2 ALLOW (isotonic) sucrose concentration is between 0.3 and 0.5 (mol dm⁻³)</p> <p>4 ALLOW units anywhere in answer</p> <p>5 ALLOW 0 change is closer to 0.5 than carrot</p> 
(d)		3 max	ALLOW AW for 'ice' throughout, e.g. solid water

Question			Answer	Marks	Guidance
			<p>1 ice , is less dense than water / floats ✓</p> <p>2 ice , provides habitat for some species / AW ✓</p> <p>3 (floating) ice <u>insulates</u> (water below) ✓</p> <p>4 (aquatic) animals / gametes / spores , can move</p> <p>or</p> <p>oxygen / nutrients / resources / AW , can circulate ✓</p> <p>5 water is similar density to living organisms ✓</p> <p>6 organisms can float ✓</p>		<p>2 CREDIT examples, e.g. penguins / bacteria</p> <p>4 IGNORE organisms</p> <p>4 ALLOW food particles can move</p> <p>6 ALLOW buoyancy</p> <p>6 ALLOW any named organism floating</p>
			Total	19	

Question			Answer	Marks	Guidance
17	(a)	(i)	break / AW , cell walls ✓	1	IGNORE membranes
		(ii)	breaks down / digests / removes , proteins associated with DNA / histones ✓	1	DO NOT CREDIT proteins in DNA
		(iii)	<p><i>idea that</i> pineapple juice contains DNA ✓</p> <p><i>idea that</i> pH might be too low ✓</p>	1	IGNORE references to incorrect protease
		(iv)	(add) detergent / washing-up liquid ✓	1	DO NOT CREDIT in the context of washing IGNORE lipase
		(v)	<u>precipitation</u> ✓	1	Mark first suggestion only
	(b)	(i)		3 max	IGNORE refs to legality or ethics

Question		Answer		Marks	Guidance
		<p>Somatic</p> <p>cannot be , inherited / passed to offspring</p> <p>(gene introduced into) / body / non-reproductive , cell</p> <p>only some cells get (functional) , gene / allele</p> <p>short-term / temporary / needs repeating / non-permanent</p>	<p>Germ-line</p> <p>can be , inherited / passed to offspring</p> <p>(gene introduced into) sperm / egg / gamete / sex cell / embryo / zygote</p> <p>all cells get (functional) , gene / allele</p> <p>long-term / permanent / does not need repeating</p>	<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>	<p>IGNORE affects / does not affect (offspring)</p> <p>IGNORE adult / diploid</p> <p>DO NOT CREDIT alters DNA</p> <p>ALLOW gamete producing cell</p> <p>ALLOW somatic cell / germ-line cell</p>
	(ii)	<p><u>frameshift</u> ✓</p> <p>altered triplet(s) ✓</p> <p>adjacent / nearby , genes (on same chromosome) switched , on / off ✓</p> <p><i>idea that</i> new gene could disable a functioning gene if inserted into it ✓</p>		2 max	<p>IGNORE mutation without further qualification</p> <p>ALLOW altered codons</p> <p>ALLOW affects , transcription / expression , of the next gene along</p> <p>ALLOW inserted into promoter</p>
	(iii)	<p>(Huntington's) protein / Huntingtin , still , synthesized / present ✓</p>		1	
Total				11	

1 8	(a)	<p>1 <u>ecotourism</u> ✓ 2 <i>idea that</i> money from tourists is used to support conservation ✓ 3 example of conservation project (facilitated by tourism revenue) ✓</p>	2 max	<p>3 CREDIT only if 2 has been awarded e.g. planting trees wildlife rangers maintain footpath rewilding removal of non-native species creating nature reserves reintroduction programmes</p>
	(b)	(i) 10 / 11 / 12 / 13 / 14 ✓	1	DO NOT CREDIT if more than 2 s.f.
		(ii) <p>1 limit size of area that is (felled) ✓ 2 replanting (of trees that have been felled) ✓ 3 minimum distance between (replanted) trees ✓ 4 allow time for new trees to fully grow / AW (before next felling) ✓ 5 reference to limiting soil erosion after felling ✓</p>	2	<p>1 ALLOW strip / rotational , felling 2 ALLOW replace 3 ALLOW optimum distance between (replanted) trees 1&4 'rotate areas that are felled to allow trees to mature' = 2 marks 1&5 'limit the size of the area that is felled to reduce soil erosion' = 2 marks</p>
		(iii)		

		<p>Level 3 (5–6 marks) Describes the processes involved in coppicing in some detail and clearly explains some benefits to biodiversity. <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 some processes involved in coppicing and explains a benefit to biodiversity. <i>There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Describes the process of coppicing or explains a benefit to biodiversity. <i>There is an attempt at a logical structure with a line of reasoning. The information is, in the most part, relevant.</i></p> <p><i>0 marks</i> <i>No response or no response worthy of credit.</i></p>	6	<p>Indicative scientific points may include</p> <p><i>Process of coppicing</i></p> <ul style="list-style-type: none"> • trunk cut close to ground level • several new shoots grow from cut surface • protect young shoots from grazers • process repeated after certain time • broadleaved species • rotational coppicing • can be repeated indefinitely <p><i>Benefits of coppicing...</i></p> <ul style="list-style-type: none"> • new stems grow more rapidly than saplings • lifespan of tree extended • provides variety of light levels • fewer large trees means more light for smaller plants • provides a variety of habitats • roots prevent soil erosion • maintains soil quality • prevents succession • large machinery not needed
(c)	(i)	<p>FIRST CHECK ON ANSWER LINE If answer = 0.648 or 0.649 award 3 marks ✓✓✓</p> <p><i>If answer is incorrect ALLOW 2 marks max for...</i></p> <p>(some) correct values for n/N and $(n/N)^2$ ✓</p> <p>$\Sigma(n/N)^2 = 0.350$ or 0.351 ✓✓</p> <p>1 - calculated $\Sigma(n/N)^2$ to 3 s.f. ✓</p>	3	<p>IGNORE s.f. in working</p> <p>ALLOW 3 correct in each column</p>

			0.65 ✓✓		<table border="1"> <tr> <th>n/N</th> <th>(n/N)²</th> </tr> <tr> <td>0.500</td> <td>0.250</td> </tr> <tr> <td>0.029</td> <td>0.001</td> </tr> <tr> <td>0.071</td> <td>0.005</td> </tr> <tr> <td>0.286</td> <td>0.082</td> </tr> <tr> <td>0.114</td> <td>0.013</td> </tr> </table>	n/N	(n/N) ²	0.500	0.250	0.029	0.001	0.071	0.005	0.286	0.082	0.114	0.013
n/N	(n/N) ²																
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		(ii)	<p>1a species (bio)diversity / variety of species / species evenness</p> <p>2a shown by calculated Simpson’s Index</p> <p>or</p> <p>1b species (bio)diversity / number of species / species richness ✓</p> <p>2b shown by 5 (plant species) ✓</p> <p>3 variety / diversity / range , of habitats ✓</p> <p>4 shown by , coppiced and mature / reference to two woodland , habitats / AW ✓</p> <p>5 <i>idea that</i> genetic diversity not measured by or evident from students’ fieldwork ✓</p>	3 max	<p>1&2 AWARD the pair of marking points that gives the candidate more marks</p> <p>1a ALLOW range of species</p> <p>2a Must be linked to 1a</p> <p>1a ALLOW range of species</p> <p>2b Must be linked to 1b</p> <p>3 IGNORE ‘different habitats’ must be in the context of habitat diversity</p> <p>4 Must be linked to 3</p>												
			Total	17													

19	(a)	(i)	nucleus from , tadpole / donor cell , fuses with / enters / AW , (enucleated) egg ✓ using , needle / micropipette / electric pulse / electrofusion ✓	2	ALLOW electric , current / shock IGNORE injection / electroporation / electricity (unqualified)
		(ii)	<i>idea that</i> embryo not implanted into surrogate mother ✓	1	Must imply embryo

		(iii)	some genes present in mitochondria from egg cell ✓ random / spontaneous , mutations ✓	1	ALLOW mitochondrial DNA
	(b)	(i)	(mouse and <i>Xenopus</i>) have , different / not comparable , lifespans ✓ (mouse and <i>Xenopus</i>) develop / mature , at different rates ✓ frog , has tadpole stage / lays eggs ✓ ora	2 max	ALLOW stage of development at same age is different in each species ALLOW takes mouse longer to grow to an adult
		(ii)	<i>idea of any of the following...</i> 1 (y-axis) does not show health of individual ✓ 2 Dolly was a single individual so perhaps health problems unrelated to cloning ✓ 3 only two species shown so trend might not apply to sheep ✓ 4 only 3 points in , mouse /AW , study ✓ 5 1962 techniques might not be comparable to Dolly the sheep techniques (in 1996) ✓ 6 <u>correlation</u> does not imply <u>causation</u> ✓	3 max	1 IGNORE lifespan 3 ALLOW not done in sheep 5 ALLOW in context of data generated
	(c)	(i)	goats: 31 / 30.8 mice: 13 / 12.8 ✓✓	2	Both answers are required for 2 marks. ALLOW 1 mark if one answer is correct and one is incorrect ALLOW 1 mark if both answers are correctly calculated but one or both are not given to 2 or 3 s.f.

		(ii)	<p>1 age / stage of development , of , surrogates / mothers ✓</p> <p>2 (general) health of , surrogates / mothers ✓</p> <p>3 conditions in which , surrogates / mothers, are kept ✓</p> <p>4 age / AW , of (implanted) embryo ✓</p> <p>5 age / AW , of nucleus donor ✓</p> <p>6 age / AW , of , (enucleated) egg / egg donor ✓</p> <p>7 number of eggs implanted in each surrogate ✓</p> <p>8 <i>idea of accounting for advances in technology (over time) available during procedure</i> ✓</p>	3 max	<p>Mark as prose</p> <p>3 ALLOW e.g. diet / healthcare / space</p> <p>4&5&6 ALLOW stage of development</p> <p>5 ALLOW in context of donor animal or cell</p> <p>5 ALLOW type of cell from which nucleus came</p> <p>8 IGNORE method of nuclear transfer</p> <p>8 IGNORE cloning procedure</p>
			Total	14	

Question			Answer	Marks	Guidance
20	(a)	(i)	<p>1 use a healthy shoot / cut shoot from healthy plant ✓</p> <p>2 cut (stem) at a slant ✓</p> <p>3 between nodes ✓</p> <p>4 (dip in) rooting powder / plant hormone / auxin ✓</p> <p>5 place in , soil / compost , and add water ✓</p> <p>6 (to reduce transpiration) cover with plastic bag / remove some leaves ✓</p>	4 max	<p>4 IGNORE add rooting hormone to , soil / agar</p> <p>5 ALLOW place in moist soil</p>
		(ii)			
			Level 3 (5–6 marks)	6	<p>Indicative scientific points may include</p> <p>D increase number of plants in each group</p>

Question	Answer	Marks	Guidance
	<p>Describes in detail how the investigation could be improved and fully explains the advantage of these improvements. <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 some improvements to the investigation and explains the advantage of at least one of these improvements. <i>There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Describes or explains an improvement. <i>There is an attempt at a logical structure with a line of reasoning. The information is, in the most part, relevant.</i></p> <p><i>0 marks</i> <i>No response or no response worthy of credit.</i></p>		<p>E facilitates identification of anomalies E increases accuracy of the mean E allows assessment of repeatability / precision</p> <p>D calculate mean E more representative of treatment</p> <p>D calculate range / standard deviation E add bars to graph E measures variability of results E standard deviation less affected by anomalous results</p> <p>D perform statistical test / (unpaired) Students t-test E assess significance of difference E because comparing 2 means</p>
(b)	<ol style="list-style-type: none"> 1 some crop plants cannot reproduce , sexually / from seed ✓ 2 young seedlings , less likely to survive / AW ✓ 3 quicker than , growing from seed / sexual reproduction ✓ 4 uniform / predictable , shape / size / quality / yield ✓ 5 <i>idea of easier to harvest</i> ✓ 6 (propagation) can be done , at any season / time of year ✓ 	3 max	<p>Mark as prose 1 ALLOW seedless / hard to germinate , plants can be grown</p> <p>4 ALLOW always get a good yield 4 IGNORE many copies</p>

Question	Answer	Marks	Guidance
		Total	13

21	(a)	(i)	<p>FIRST CHECK ON ANSWER LINE If answer = 140 or 141 award 2 marks</p> <p><i>If answer is incorrect allow 1 mark max for...</i></p> <p>$21/2\pi = 3.344 \checkmark$</p> <p>140.5 \checkmark</p>	2	<p><i>If answer incorrect</i> ALLOW 1 mark for evidence of calculation based on 30 ± 1 phospholipid molecules = 287 ± 20</p>
		(ii)	lipid is less dense than protein \checkmark ora	1	ALLOW phospholipids are less dense than protein
	(b)		storage \checkmark carbon \checkmark hydrogen \checkmark insoluble \checkmark stability \checkmark bile \checkmark	6	ALLOW vitamins
	(c)		uses / AW , water \checkmark (to) break 3 ester bonds \checkmark lysis means splitting and fatty acids are , split / AW , from glycerol \checkmark	2	CREDIT points from annotated diagram ALLOW '3' inferred from water molecules used or number of fatty acids
			Total	11	

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

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OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

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