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
BOD	Benefit of Doubt
CON	Contradiction
	Cross
ECF	Error Carried Forward
GM	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
I	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
NBOD	Benefit of the doubt not given
	Tick
^	Omission Mark
BP	Blank Page
L1	Level 1 answer in Level of Response question
L2	Level 2 answer in Level of Response question
L3	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
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.					
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)	diffusion / net movement , of water across a , partially / selectively , permeable membrane ✓ down a , water potential / Ψ , gradient ✓	2	**IGNORE** semi **ALLOW** from a high water potential to a more negative Ψ **IGNORE** water concentration **IGNORE** along
		(ii)	water enters vacuole ✓ pressure against cell wall ✓ turgor (pressure) ✓ turgid cells (support plant) ✓	3 max	
	(b)	(i)	**FIRST CHECK ON ANSWER LINE** **If answer = 6.25 or 6.3 award 2 marks** ✓✓ *If answer is incorrect* **ALLOW** *1 mark max for any one of…* correct answer to 1 or >3 s.f. 3.125 ± 0.005 0.0625 or 0.063 (2 x 0.5) / (26.5 – 10.5) x 100 ✓	2	
		(ii)	Y / solution outside bag , has higher , water potential / Ψ (than X) ✓ ora X / solution inside bag , has higher , solute / AW , concentration / potential (than Y) ✓ ora	2	*Must be comparative statements* **IGNORE** water concentration **IGNORE** hypertonic / hypotonic **ALLOW** X has more sugar molecules
	(c)	(i)	different (starting) masses (of plant pieces) ✓ allows comparison (between plant pieces of different mass) ✓	2	**ALLOW** different weights **IGNORE** to remove effect of starting mass
		(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)	**1**	courgette / carrot or courgette ✓	**3 max**	
			2	0(%) mass change / *idea of* intercept , between 0.3 and 0.5 (mol dm^{-3}) ✓		**2 ALLOW** (isotonic) sucrose concentration is between 0.3 and 0.5 (mol dm^{-3})
			3	(courgette associated with) highest concentration at which there is no mass change ✓		**4 ALLOW** units anywhere in answer
			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 ✓		**5 ALLOW** 0 change is closer to 0.5 than carrot
			6	AVP calculated linear extrapolation (0.421) ✓		
	(d)				**3 max**	**ALLOW** AW for 'ice' throughout, e.g. solid water

Question			Answer	Marks	Guidance
			1 ice , is less dense than water / floats ✓ **2** ice , provides habitat for some species / AW ✓ **3** (floating) ice <u>insulate</u>s (water below) ✓ **4** (aquatic) animals / gametes / spores , can move **or** oxygen / nutrients / resources / AW , can circulate ✓ **5** water is similar density to living organisms ✓ **6** organisms can float ✓		**2 CREDIT** examples, e.g. penguins / bacteria **4 IGNORE** organisms **4 ALLOW** food particles can move **6 ALLOW** buoyancy **6 ALLOW** any named organism floating
			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)	*idea that* pineapple juice contains DNA ✓ *idea that* pH might be too low ✓	**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>precipitat</u>ion ✓	**1**	**Mark first suggestion only**
	(b)	**(i)**		**3 max**	**IGNORE** refs to legality or ethics

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Somatic</th><th>Germ-line</th><th></th></tr>
<tr><td>cannot be , inherited / passed to offspring</td><td>can be , inherited / passed to offspring</td><td>✓</td></tr>
<tr><td>(gene introduced into) / body / non-reproductive , cell</td><td>(gene introduced into) sperm / egg / gamete / sex cell / embryo / zygote</td><td>✓</td></tr>
<tr><td>only some cells get (functional) , gene / allele</td><td>all cells get (functional) , gene / allele</td><td>✓</td></tr>
<tr><td>short-term / temporary / needs repeating / non-permanent</td><td>long-term / permanent / does not need repeating</td><td>✓</td></tr>
</table>
</td><td></td><td>IGNORE affects / does not affect (offspring)

IGNORE adult / diploid
DO NOT CREDIT alters DNA
ALLOW gamete producing cell
ALLOW somatic cell / germ-line cell</td></tr>
<tr><td></td><td></td><td>(ii)</td><td><u>frameshift</u> ✓

altered triplet(s) ✓

adjacent / nearby , genes (on same chromosome) switched , on / off ✓

idea that new gene could disable a functioning gene if inserted into it ✓</td><td>2 max</td><td>IGNORE mutation without further qualification

ALLOW altered codons

ALLOW affects , transcription / expression , of the next gene along

ALLOW inserted into promoter</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>(Huntington’s) protein / Huntingtin , still , synthesized / present ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>11</td><td></td></tr>
</table>

18	**(a)**		**1** <u>ecotourism</u> ✓ **2** *idea that* money from tourists is used to support conservation ✓ **3** example of conservation project (facilitated by tourism revenue) ✓	**2 max**	**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
	(b)	**(i)**	10 / 11 / 12 / 13 / 14 ✓	**1**	**DO NOT CREDIT** if more than 2 s.f.
		(ii)	**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 ✓	**2**	**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**
		(iii)			

			Level 3 (5–6 marks) Describes the processes involved in coppicing in some detail **and** clearly explains some benefits to biodiversity. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated* **Level 2 (3–4 marks)** Describes some processes involved in coppicing **and** explains a benefit to biodiversity. *There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Describes the process of coppicing **or** explains a benefit to biodiversity. *There is an attempt at a logical structure with a line of reasoning. The information is, in the most part, relevant.* *0 marks* *No response or no response worthy of credit.*	**6**	**Indicative scientific points may include** *Process of coppicing* • 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 *Benefits of coppicing…* • 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)**	**FIRST CHECK ON ANSWER LINE** **If answer = 0.648 or 0.649 award 3 marks** ✓✓✓ *If answer is incorrect* **ALLOW** *2 marks max for…* (some) correct values for n/N and $(n/N)^2$ ✓ $\Sigma(n/N)^2 = 0.350$ or 0.351 ✓✓ 1 - calculated $\Sigma(n/N)^2$ to 3 s.f. ✓	**3**	**IGNORE** s.f. in working **ALLOW** 3 correct in each column

			0.65 ✓✓		n/N: 0.500, 0.029, 0.071, 0.286, 0.114 ; $(n/N)^2$: 0.250, 0.001, 0.005, 0.082, 0.013
		(ii)	**1a** species (bio)diversity / variety of species / species evenness **2a** shown by calculated Simpson's Index **or** **1b** species (bio)diversity / number of species / species richness ✓ **2b** shown by 5 (plant species) ✓ **3** variety / diversity / range , of habitats ✓ **4** shown by , coppiced and mature / reference to two woodland , habitats / AW ✓ **5** *idea that* genetic diversity not measured by or evident from students' fieldwork ✓	**3 max**	***1&2 AWARD*** *the pair of marking points that gives the candidate more marks* **1a ALLOW** range of species **2a** Must be linked to **1a** **1a ALLOW** range of species **2b** Must be linked to **1b** **3 IGNORE** 'different habitats' must be in the context of habitat diversity **4** Must be linked to 3
			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)	*idea that* 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 *Xenopus*) have , different / not comparable , lifespans ✓ (mouse and *Xenopus*) 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)	*idea of any of the following…* **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** correlation does not imply causation ✓	**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)	**1** age / stage of development , of , surrogates / mothers ✓ **2** (general) health of , surrogates / mothers ✓ **3** conditions in which , surrogates / mothers, are kept ✓ **4** age / AW , of (implanted) embryo ✓ **5** age / AW , of nucleus donor ✓ **6** age / AW , of , (enucleated) egg / egg donor ✓ **7** number of eggs implanted in each surrogate ✓ **8** *idea of* accounting for advances in technology (over time) available during procedure ✓	**3 max**	**Mark as prose** **3 ALLOW** e.g. diet / healthcare / space **4&5&6 ALLOW** stage of development **5 ALLOW** in context of donor animal or cell **5 ALLOW** type of cell from which nucleus came **8 IGNORE** method of nuclear transfer **8 IGNORE** cloning procedure
			Total	**14**	

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

Question			Answer	Marks	Guidance
			Describes in detail how the investigation could be improved **and** fully explains the advantage of these improvements. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated* **Level 2 (3–4 marks)** Describes some improvements to the investigation **and** explains the advantage of at least one of these improvements. *There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Describes **or** explains an improvement. *There is an attempt at a logical structure with a line of reasoning. The information is, in the most part, relevant.* *0 marks* *No response or no response worthy of credit.*		E facilitates identification of anomalies E increases accuracy of the mean E allows assessment of repeatability / precision D calculate mean E more representative of treatment D calculate range / standard deviation E add bars to graph E measures variability of results E standard deviation less affected by anomalous results D perform statistical test / (unpaired) Students t-test E assess significance of difference E because comparing 2 means
	(b)		**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** *idea of* easier to harvest ✓ **6** (propagation) can be done , at any season / time of year ✓	**3 max**	**Mark as prose** **1 ALLOW** seedless / hard to germinate , plants can be grown **4 ALLOW** always get a good yield **4 IGNORE** many copies

Question			Answer	Marks	Guidance
			Total	13	

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

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