GCE A LEVEL MARKING SCHEME

AUTUMN 2021

A LEVEL
BIOLOGY – COMPONENT 2
A400U20-1

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INTRODUCTION

This marking scheme was used by WJEC for the 2021 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

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GCE A LEVEL BIOLOGY COMPONENT 2

CONTINUITY OF LIFE

AUTUMN 2021 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement. Award the middle mark in the level if most of the content statements are given and the communication statement is partially met. Award the lower mark if only the content statements are matched.

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Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			compare <u>amino acid</u> {sequences / order} (from samples) (1) against sequences of identified insects/ known sequences (1)	2			2		1
	(b)	(i)		Uncaught organisms (dislodged from stream bed) would flow downstream (1) (working upstream) would prevent more organisms being caught than would be actually present in the sample area (1) OWTTE Reject: ensures reliable samples			2	2		2
		(ii)		to minimise effect of banks / similar flow of water / similar light (1) AVP			1	1		1
		(iii)		D = 0.73 (3 marks) Accept 0.732 / 0.731601. Reject 0.731 If incorrect award 2 marks for 0.27 (has not taken result away from 1) If incorrect award 1 mark for each of **Σn(n-1**) = 124 (1 mark) **N(N-1)** = 462 (1 mark)		3		3	3	
		(iv)		The lower the temperature the lower the biodiversity (1) Less kinetic energy for enzyme action / metabolism (1)		2		2		
		(v)		higher altitude lower oxygen levels (1) Not enough oxygen available for respiration / only temperature tested (1) accept suitable alternative explanation	1	1		2		2
				Question 1 total	**3**	**6**	**3**	**12**	**3**	**6**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Eukarya / Eukaryota (1) nucleus / {large / 80S} ribosomes / membrane-bound organelles (1) Ignore refs to multi-celled organisms (does not apply to all organisms in the domain eukarya)	2			2		
		(ii)	I	Kingdom	1			1		
			II	Y = plantae / plants + Z = animalia / animals	1			1		
			III	Y plants cellulose cell wall / chlorophyll / no nervous coordination + Z animals – no cell walls / no chlorophyll / centrioles present / nervous coordination Accept converse for one characteristic or 2 different characteristics	1			1		
	(b)			(ATP) {used / produced} by all (living) organisms (1) (as the) universal energy currency / common source of energy (1) for (nearly) all biochemical reactions / so must have common {DNA / genes} (1)	3			3		
	(c)	(i)		genus + species	1			1		
		(ii)		(tentative) classification based on evidence available / not fixed may not accurately reflect evolutionary relatedness (1) changes as new evidence found/ or given example (1)	2			2		
				Question 2 total	**11**	**0**	**0**	**11**	**0**	**0**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			I D (1) accept anaphase I II J (1) accept telophase II III C (1) accept metaphase I		3		3		3
	(b)	(i)		**in animal cells:** centrioles {organise / produce} spindle fibres (1) {cytokinesis / division of cytoplasm} involves {cleavage / formation of new cell membrane} (1) Accept converse	2			2		
		(ii)		A spermatogonia (1) F secondary spermatocytes (1) K spermatids / spermatozoa (1)		3		3		
		(iii)		(pollen grains / sperm cells) fully differentiated (so cannot re-enter cell cycle) (1)	1			1		
	(c)	(i)		64 = 2 marks If incorrect award 1 mark for 2^6 4096 2^{12}		2		2	2	
		(ii)		metaphase I /C **and** II / H (1)	1			1		
		(iii)		random fertilisation / correct description	1			1		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			**Any four (×1) from** A. Increased atmospheric temperatures (1) B. Trees that flower due to warmer air temperatures could flower earlier / trees with different environmental triggers flower at different times / pollinating insects appear earlier (1) C. Day length not affected by climate change (1) D. Cross pollination cannot take place / receptive stigmas not present (1) E. Lower rates of pollination / description of decreased rate of pollination (leading to reduced crop yield) (1) Reject references to greenhouse effect changing day length Accept reverse arguments if state that crossing climate change boundary could result in decreased atmospheric temperatures			4	4		
				Question 3 total	**5**	**8**	**4**	**17**	**2**	**3**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		secondary (1) hydrogen bonds (1) Ignore reference to peptide bonds	2			2		
		(ii)		hydrophilic (1) in contact with water / in aqueous solution / polar molecules / repelled by hydrophobic fatty acids (1)	2			2		
	(b)	(i)		non-invasive / does not involve taking tissue from the {uterus / amnion / placenta} (1) no risk of test causing {miscarriage / loss of foetus / harm to foetus} / no risk of infection (1) Accept reverse arguments		2		2		
		(ii)	I	homozygous for D = p^2 = 0.36 (2) If incorrect award 1 mark for q^2 = 0.16 so q = $\sqrt{}$0.16 = 0.4 p = 1 – q = 1 - 0.4 = 0.6 Accept proportion only		2		2	2	
			II	2pq = 2 x 0.6 x 0.4 = 0.48 (1) Ecf If answer given as a % accept if (ii) I given as a %		1		1	1	
			III	16% Reject 0.16			1	1	1	

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		there is selection {for / against} a phenotype / Rh+ children born to Rh- mothers survive so selected for (1) population is not isolated / immigration and emigration take place (1)		2		2		
				Question 4 total	**4**	**7**	**1**	**12**	**4**	**0**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)	I	3 tall: 1 short (1)	1			1		
			II	9 tall, purple: 3 tall, red: 3 short, purple: 1 short, red (1)	1			1		
		(ii)		(Linkage =) genes present on same chromosome (1) (if on same chromosome) {more likely to be segregated together / cannot be segregated independently} / can only segregate independently if on different chromosomes (1)		2		2		
	(b)			phenotypes: purple, smooth x purple, smooth (1) genotypes: AaBb x AaBb (1) gametes: AB Ab aB ab **for both** (1) F_1 genotypes: (all correct 2 marks; 1 error 1 mark) (2) (purple smooth AABB AaBB AABb AaBb) (purple wrinkled AAbb Aabb) (yellow smooth aaBB aaBb) (yellow wrinkled) aabb		5		5		
	(c)	(i)		no significant difference between the observed and expected numbers of each phenotype / any difference between the observed and expected numbers of each phenotype is due to chance (1)		1		1	1	

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<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>
<table>
<tr><td>phenotype</td><td>O</td><td>E</td><td>O-E</td><td>$(O-E)^2$</td><td>$(O-E)^2 / E$</td></tr>
<tr><td>yellow; smooth</td><td>201</td><td>225</td><td>-24</td><td>576</td><td>2.56</td></tr>
<tr><td>yellow; wrinkled</td><td>84</td><td>75</td><td>9</td><td>81</td><td>1.08</td></tr>
<tr><td>purple; smooth</td><td>81</td><td>75</td><td>6</td><td>36</td><td>0.48</td></tr>
<tr><td>purple; wrinkled</td><td>34</td><td>25</td><td>9</td><td>81</td><td>3.24</td></tr>
<tr><td>Total</td><td>400</td><td></td><td></td><td></td><td>7.36</td></tr>
</table>
Chi ^{2} = 7.36 (3 marks)
correct $(O-E)^2 / E$ values (2 marks)
correct E values (1)
max 1 if record $(O-E)^2$ as negative values and calculate Chi^2
</td><td></td><td>3</td><td></td><td>3</td><td>3</td><td>3</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>A. calculated Chi^2 / 7.36 < critical value (1)
B. of 7.82 (1)
C. at 3df + probability of 0.05 (1)
D. Chi^2 very close to critical value (1)
E. {low probability / less than 0.10 probability / less than 10% chance} that differences were not significant (1)</td><td></td><td></td><td>5</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 5 total</td><td>2</td><td>11</td><td>5</td><td>18</td><td>9</td><td>8</td></tr>
</table>

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		X = transcription + Y = translation (1)	1			1		
		(ii)		more than one polypeptide synthesised from {same gene / genetic code} / 3 {polypeptides /mRNA molecules} synthesised from same gene (1)		1		1		
		(iii)		Some amino acids have more than one codon / ref to degenerative code (1)	1			1		
	(b)			**Any five (×1) from** A. (template) DNA copied into mRNA (1) B. description of role of enzymes (1) C. contains exons and introns (1) D. introns removed from mRNA (1) E. (splicing) can only take place up to exon 49 / mutation in exon 49 prevents copying of whole gene (1) F. so mRNA {is shorter / does not contain code for the whole dystrophin molecule} (1)	1 1 1		1 1	5		
	(c)	(i)		splicing between mRNA for exon 49 cannot bind to mRNA for 51 / exon 49 and 51 not complementary (1)			1	1		
		(ii)		therapy only in muscle tissue not germ-line / somatic not germ-line/ patch does not remove the mutation / patch does not change DNA base sequence / mutation still present in gametes (1)			1	1		
				Question 6 total	**5**	**1**	**4**	**10**	**0**	**0**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		(800m =) intra-specific **+** (1000 to 1250m =) interspecific			1	1		
		(ii)		• Food / water/ prey • same nesting sites • predators • disease / parasites **Three correct for 2 marks** **Two correct for 1 mark** Reject {niche / environment / space / habitat} unqualified Reject mates (interspecific competition)		2		2		
		(iii)		**Advantage:** (Species A) can live at higher altitude where there is less oxygen (1) (higher O_2 affinity means it) can absorb more oxygen (1) **Disadvantage:**(at lower altitudes / higher oxygen levels) haemoglobin does not release oxygen as easily to the tissues (1)		2	1	3		
	(b)	(i)		**Any three (x1) from:** A. mutation (in gene for haemoglobin) (1) B. gave birds with mutation (for higher O_2 affinity) an advantage (at higher altitudes due to lower oxygen levels) / oxygen availability becomes a selection pressure (1) C. more likely to survive and reproduce (1) D. and pass on <u>allele</u> for high oxygen affinity to offspring (1) **Max 2 if answers are not in context**		2	1	3		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		both species live in same {habitat / area} (1) no {physical barrier / geographical} / {only reproductive / behavioural barrier}} to interbreeding (1)		2		2		
				Question 7 total	**0**	**8**	**3**	**11**	**0**	**0**

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Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
8	**HUMAN GENOME PROJECT** • Identify genetic cause of disease / more accurate diagnosis • better prediction of the effect of drugs / improved design of drugs /develop new and improved treatments for disease. • sample size too small • all European origin / do not represent different ethnicities • anonymous so don't know details of health of individuals / cannot relate findings to {genetic disorders / cancer} **100 K PROJECTS** • people in sample selected based on their genetic disorders / cancer status • large samples so can identify variation • more ethnicities / not just Europe • include male / female / different ages • projects do not include eg., Africa, South America, Indian sub-continent • so not wholly representative of whole human population **MALARIA / ANOPHELES** • malaria still killing 1 000 000+ people per year/ • more people dying from malaria than genetic conditions • need to improve drug / insecticide development to control malaria more effectively • need to sequence genomes to find ways to combat high mutation rate in *Plasmodium* and *Anopheles*		4	5	9		

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Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
	7-9 marks Detailed coverage of all three areas with no irrelevancies or errors *The candidate constructs an articulate, integrated account, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately*. **4-6 marks** Detailed coverage of two areas or some coverage of three areas *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately* **1-3 marks** Detailed coverage of any one area; basic coverage of two or three areas *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.*						
	Question 8 total	**0**	**4**	**5**	**9**	**0**	**0**

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SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Q	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	3	6	3	12	3	6
2	11	0	0	11	0	0
3	5	8	4	17	2	2
4	4	7	1	12	4	0
5	2	11	5	18	9	8
6	5	1	4	10	0	0
7	0	8	3	11	0	0
8	0	4	5	9	0	0
TOTAL	30	45	25	100	18	16

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