GCE A LEVEL MARKING SCHEME

SUMMER 2018

A LEVEL (NEW)
BIOLOGY - UNIT 4
1400U40-1

INTRODUCTION

This marking scheme was used by WJEC for the 2018 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.

WJEC GCE A LEVEL BIOLOGY
UNIT 4 – VARIATION, INHERITANCE AND OPTIONS

SUMMER 2018 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.

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

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		A = theca/thecal cells/follicle cells/granulosa cells (1) B = Primary oocyte/primary follicle (1) Accept primordial follicle	2			2		1
		(ii)		8.38 x 10^{7} = 3 marks 83800000 = 2 marks Accept any correct standard form 83.8 x 10^{6} = 2 marks 4190/0.00005 = 1 mark Ignore units		3		3	3	
	(b)			Zona pellucida **and** Corona radiata (1)	1			1		
	(c)			acrosome(1) releases {enzymes/named enzyme} which {hydrolyse/digest/break down} (layers)(1)	2			2		
	(d)	(i)		{ Cortical granules rupture/cortical reaction} **+** Zona pellucida {thickens/hardens}/fertilisation membrane forms (1) NOT corona radiata thickening (Secondary oocyte taken from graafian follicle is immature) so cannot form a fertilisation membrane/zona pellucida cannot {harden/thicken}/{fewer/less} developed cortical granules (1)	1	1		2		
		(ii)		**Any three (x1) from :** 1. Fertilisation normally in fallopian tube (1) 2. Embryo needs to reach uterus/ blastocyst to form/allow cleavage to take place(1) 3. If embryo put into uterus immediately, endometrium would not be fully developed/or description (1) 4. {Trophoblastic/chorionic villi} will not have developed (1) 5. {Embryo/blastocyst} would not {implant/survive} (1)			3	3		
				Question 1 total	**6**	**4**	**3**	**13**	**3**	**1**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Continuous **+** complete gradation/ not discrete/there are intermediates (1)	1			1		
		(ii)		B (1) Mean: average of a group of values/description of calculating (1) mode: most {frequent/common} value(1)		3		3	3	
	(b)			**Any four (x1) from:** 1. (Variation due to) <u>mutation</u> (1) 2. so the tolerant plants have a selective advantage/or description of (1) 3. (Survive and) reproduce(1) 4. Pass on alleles (for tolerance to offspring)(1) 5. Repeated over several generations **and** allele frequency for toleration increases(1)	4			4		
	(c)			**Any four (x1) from:** 1. No longer able to {cross pollinate/cross fertilise}/owtte 2. {Reproductive/seasonal/temporal/prezygotic} isolation/gene flow prevented/ 3. Genetic differences accumulate/owtte 4. no longer able to produce fertile offspring 5. Sympatric speciation Accept Parapatric speciation			4	4		
	(d)	(i)		Interspecific (1) **Any two for 1 mark from:** Space Light Water Minerals/named mineral/nutrients Ignore CO_2		2		2		
		(ii)		Density independent **and** copper affects grass plants regardless of density of population (1)		1		1		
				Question 2 total	**5**	**6**	**4**	**15**	**3**	**0**

<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>3</td><td>(a)</td><td>(i)</td><td></td><td>Purple White and
Aa aa (1)
Aa Aa aa aa (1) correct completion of punnett square</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Null hypothesis: There is no <u>significant</u> difference between the observed and expected numbers/ratios (1)
<table>
<tr><th>Phenotype</th><th>O</th><th>E (1)</th><th>O-E</th><th>$(O-E)^2$</th><th>$\frac{(O-E)^2}{E}$ (1)</th></tr>
<tr><td>white</td><td>32</td><td>25</td><td>7</td><td>49</td><td>1.96</td></tr>
<tr><td>purple</td><td>18</td><td>25</td><td>-7</td><td>49</td><td>1.96</td></tr>
</table>
$Chi^2 = 3.92$ (1)</td><td></td><td>4</td><td></td><td>4</td><td>4</td><td>4</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Critical value is 3.84 (1)
because chi^2 value {is greater than/to the right of critical value (at 0.05)} (1)
reject null hypothesis (1)
deviation is not due to chance/there is a significant difference between O and E(1)
ECF from (ii)</td><td></td><td></td><td>4</td><td>4</td><td>4</td><td>4</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>
<table>
<tr><td></td><td>AB</td><td>Ab</td><td>aB</td><td>ab</td></tr>
<tr><td>aB</td><td>AaBB</td><td>AaBb</td><td>aaBB</td><td>aaBb</td></tr>
<tr><td>ab</td><td>AaBb</td><td>Aabb</td><td>aaBb</td><td>aabb</td></tr>
</table>
Gametes (1)
Correct completion (1) [from their gametes]
Phenotype ratio 3 purple : 5 white (1) [from table]</td><td></td><td>3</td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Hypothesis 2 and
The chi squared value is {to the left/less than} the critical value/no <u>significant</u> difference between <u>O and E</u>/probability is between {0.8-0.9/above 0.8/above 5%}/due to chance alone</td><td></td><td></td><td>1</td><td>1</td><td>1</td><td></td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			Hypothesis 1 white x white could only produce white offspring/hypothesis 2 white x white could give purple/or description with genotypes			1	1		1
				Question 3 total	**0**	**9**	**6**	**15**	**9**	**9**

<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>4</td><td>(a)</td><td></td><td></td><td>
<table>
<tr><th>Umbilical artery</th><th>Umbilical vein</th></tr>
<tr><td>Less oxygen</td><td>More oxygen</td></tr>
<tr><td>More CO_2</td><td>Less CO_2</td></tr>
<tr><td>More urea</td><td>Less urea</td></tr>
<tr><td>Less nutrients/named</td><td>More nutrients/named</td></tr>
<tr><td>Less antibodies</td><td>More antibodies</td></tr>
</table>
Ignore ref to water
4 correct for 2 marks
2/3 correct for 1 mark
0/1 = 0 marks</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>Any two (x1) from:
(Barrier) {against hormones/toxic substances/microorganisms/cells/mothers rhesus group/mothers antigens } (1)
Protection against differences in pressure (1)
Protection against mother's {immune system/antibodies} (1)</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td></td><td>Maintain {concentration/diffusion} gradients/prevents equilibrium being reached(1)</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>(Pressure difference) forces materials through (capillaries) (1)</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Large (surface) area for exchange.(1)</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td></td><td>GGC GTA ATT CCC</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>different nucleotide sequence at each end/one primer for each strand of DNA (1).</td><td></td><td></td><td>1</td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Enables {specific/the gene} to be {amplified/to be copied/to be replicated} (1)</td><td></td><td></td><td>1</td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iv)</td><td></td><td>Does not matter how {many cycles in PCR/initial quantity/number of copies made}(1)
Ratio will be same (1)</td><td></td><td></td><td>2</td><td>2</td><td></td><td></td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(v)		**Any four (x1) from** 1. A and B {same/similar} ratio.(1) 2. Equal {numbers/ratios} of {the gene from chromosome 21/chromosome 21} and control chromosome/1:1 ratio (1) 3. C higher proportion of {the gene from chromosome 21/chromosome 21} or example e.g. 3:2/1.5:1 (1) 4. C = Down's syndrome (1) 5. C = Trisomy chromosome 21/three copies of chromosome 21(1)			4	4		
	(e)			**Any two (x1) from:** (Selective) abortion may become more common (1) Moral status of foetus/right to live(1) May cause harm to foetus (1) Could result in false {positive/negative} results(1)		**2**		2		
				Question 4 total	**4**	**6**	**8**	**18**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5				Indicative content **Conditions required for germination** • Water + oxygen + suitable temperature *Water* • Cotyledons swell/ testa softens • Transport – dissolve substances/fluid medium for enzymes *Oxygen* • (Aerobic) respiration – • energy/ATP for metabolism *Suitable temperature* • Speeds up rate of diffusion • Increases enzyme activity **Germination of Peanut** • Non endospermic/endosperm absorbed(into cotyledons)/no endosperm • Amylase digest starch in cotyledons to maltose • {Proteins/fats} broken down into {amino acids/fatty acids and glycerol} • Move to {plumule/radicle/meristem/sink} (Can apply to peanut or barley) • For {mitosis/growth/cell division} (Can apply to peanut or barley) **Germination of barley** • Endospermic/endosperm present • Starch/ proteins/fats in endosperm • Embryo produces {gibberellic acid/gibberellin} • Gibberellic Acid {moves into/stimulates} aleurone layer • Gibberellic Acid causes enzymes to break down protein into amino acids • Amino acids used to synthesise enzymes such as amylase • Amylase breaks down starch in the endosperm into maltose	3	6		9		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				7-9 marks Indicative content All three parts covered in details *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, 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** Indicative content Two parts covered in detail *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** Indicative content Only one part of the question is addressed. *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.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*						
				Question 5 total	**3**	**6**	**0**	**9**	**0**	**0**

Question Option A				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)		(i)	A disease which is always present at low levels (in an area)/frequently at a predictable rate in a specific location/population (1) Epidemic – {significant/large} increase in the usual number of cases/rapid spread of infectious disease to a large number of people within a short period (1)	2			2		
			(ii)	sewage entered water supply (1) Cholera spread by drinking contaminated water/feco-oral route (1)	1	1		2		
			(iii)	Carriers/someone with the disease brought into Haiti			1	1		
	(b)		(i)	Antibodies are specific to an antigen (1) Different Strains would have different antigens (1) If no agglutination they different strains/if tested using antibodies to O1, O139 would not show agglutination/ORA(1)	1	2		3		
			(ii)	Identify the strain of *V.cholerae* in the peacekeepers in Haiti (1) Compare distribution of known strains in the {world/Nepal} to locate possible source (1)			2	2		2
			(iii)	**Any three (x1)from :** Antibiotics will pass through the gut before all bacteria killed (1) *V. cholerae* is Gram-negative and some antibiotics {less/not} effective/narrow spectrum (1) Kill bacteria but toxin remains (1) Antibiotic resistance (1)		1	2	3		
			(iv)	583/583.3(cm^3) 2 marks 200 x 70 = 1 mark 24		**2**		**2**	**2**	
	(c)		(i)	(First dose-) for a primary (immune) response **and** (Second dose) – for a secondary(immune) response (1) second dose acting as a booster/to increase antibody levels/increase memory cells (1)	**2**			**2**		
			(ii)	The vaccine would pass through the digestive system/ the vaccine would be in the intestine long enough/not {enough/all} absorbed/ vaccine could be broken down / stomach acid stops acid working/owtte		**1**		**1**		

Question Option A				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
			(iii)	**Any two (x1) from** Safety of the patients/side effects (1) Effectiveness /the vaccine might not work (1) costs/logistics of storage issues (needing cold conditions) (1)		**2**		**2**		**1**
				Question 6 Option A total	**6**	**9**	**5**	**20**	**2**	**3**

Question Option B				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)		(i)	cartilage (1) Chondrocytes (1)	2			2		
			(ii)	Compact (bone) **and** Calcium phosphate/hydroxyapatite (1)	1			1		
	(b)		(i)	Osteoblasts – build up bone **and** Osteoclasts – break down bone (1)	1			1		
			(ii)	Oestrogen would decrease osteoclast activity/bring osteoclast activity to normal level/reduce loss calcium from bones(1) Less bone broken down (1)			2	2		
			(iii)	Vitamin D supplements/Calcium supplements (1) increases calcium absorption (in the gut)/increase bone formation (1)		2		2		
			(iv)	10 yr old girls have same BMD as 10 yr olds with TS (1) Difference between normal and TS not obvious til 12+ years (1)			2	2		1
			(v)	Compares the result with the mean/Shows how far the value is from the mean		1		1		1
			(vi)	Bone realignment/immobilisation (in a cast or splint)	1			1		
			(vii)	Less calcium ions bind to troponin so no shape change (1) (No shape change results in) less tropomyosin being moved (1) Exposing less myosin binding sites (on the actin) (1) Resulting in less force exerted (1)		3	1	4		
	(c)		(i)	Third (order lever)	1			1		
			(ii)	333.2/333 =2 marks 39.2 x (34/4) (1)		2		2	2	
			(iii)	Age of the patients/other health issues/general fitness		1		1		1
				Question 7 Option B total	**6**	**9**	**5**	**20**	**2**	**3**

Question Option C				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)		(i)	A Occipital lobe + B Frontal lobe (1) A Vision (1) B reasoning/planning/speech/movement/emotions/problem solving (1)	3			3		
			(ii)	EEG – measures {electrical/functional} activity of the brain (1) CT – gives brain images(1)	2			2		
	(b)		(i)	(During the critical period/between 0-5) synapses are formed and strengthened (1) If {Speech/Language} areas of the brain are not stimulated (1) There is more pruning of unused synapses (1) After critical period – brain is 'hard wired' and more difficult/impossible to form new synapses for language (1)		4		4		
			(ii)	{Less grey matter activity /darker scan } **and** fewer synapses			1	1		1
			(iii)	Any 1 from: high Cortisol levels (1) Epigenetic changes to the brain in the critical period/increased methylation(1) Maternal influence during pregnancy (1) e.g. stress/alcohol/smoking		1		1		

Question Option C				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)		(i)	Hippocampus/temporal lobe	1			1		
			(ii)	Group 1 is rewarded every time – operant conditioning, there is a steady decrease in errors (1) Group 2, is latent learning until day 10 (1) and then operant conditioning because reward given(1) Group 3 latent learning only no reward given (1)			4	4		
			(iii)	(-)70 % = 2 marks 20 -6 x 100 = 1 mark 20		2		2	2	
			(iv)	**Any two (x1) from:** Age/gender of rat (1) length of time left in the maze (1) mass of rat (1) same maze (1) same reward (1)		2		2		2
				Question 8 Option C total	**6**	**9**	**5**	**20**	**2**	**3**

Unit 4: variation

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	4	3	13	3	1
2	5	6	4	15	3	0
3	0	9	6	15	9	9
4	4	6	8	18	0	0
5	3	6	0	9	0	0
6,7,8	6	9	5	20	2	3
TOTAL	24	40	26	90	17	13

Unit 4: options

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
6	6	9	5	20	2	3
7	6	9	5	20	2	3
8	6	9	5	20	2	3
TARGET	6	9	5	20	2	3