GCE A LEVEL MARKING SCHEME

SUMMER 2019

A LEVEL
BIOLOGY - UNIT 4
1400U40-1

INTRODUCTION

This marking scheme was used by WJEC for the 2019 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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BIOLOGY - UNIT 4

SUMMER 2019 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)		{Provide {nutrients/ named nutrient}/ nourishes} for {developing cells/ pollen/ tetrad}/ { provides waterproof/ outer coat} for pollen grains/ protects pollen grain from drying out	1			1		
		(ii)		(Pollen mother cell divides by) meiosis (1) Forming four (haploid) {cells/ nuclei } (1) NOT diploid Ignore reference to pollen		2		2		2
	(b)	(i)		{Controls/ directs } pollen tube. (1) {controls synthesis of/ codes for} {enzymes/ hydrolytic enzymes}. (1) Reject makes/ contains/ secretes	2			2		
		(ii)		0.2 = 3 marks **If incorrect award 2 marks for** 0.17 [mm minute^{-1}] 0.166666666666…. 1/6 **If incorrect award 1 mark for** $\frac{20\times10}{20\times60}$ (conversion)		3		3	3	
		(iii)		Both A and B correct (1) Candidate must have an indication of both polar nuclei		1		1		1
		(iv)		Any **three** × (1) from: A. megaspore (mother cell) undergoes meiosis.(1) B. forming four haploid {cells/ nuclei} (1) C. One undergoes three mitotic divisions (1) D. One of these (cells/ nuclei) becomes the {gamete/ oosphere/ egg cell/ ovum} (1)	3			3		1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(v)		Any **three** × (1) from: A. 1 {male gamete/ nucleus} fuses with {gamete/ oosphere/ egg cell/ ovum} (1) NOT oocyte B. to produce a {diploid/ 2n} zygote (1) C. Second male gamete fuses with (two) polar nuclei (1) D. to produce {triploid/ 3n } endosperm (nucleus)(1)		3		3		
				Question 1 total	**6**	**9**	**0**	**15**	**3**	**4**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		frequency of HbA = 0.96 (1) frequency of HbS = 0.04 (1) frequency of heterozygotes = 0.0768/ 0.08/ 0.077 (1) ecf from above % frequency of heterozygotes = 7.68 / 8.0/ 7.7 % (1) ecf from frequency		4		4	4	
	(b)			Any **five** × (1) from: A. {HbS HbS/ or description} are not likely to survive (1) <u>African-Americans</u> B. no (selective) advantage to being heterozygote (1) C. Disadvantage to being {HbS HbA / heterozygotes/ sickle trait} / {HbS HbA / heterozygotes/ sickle trait}are selected against (1) D. there is an advantage to being {HbA HbA/ homozygous HbA} (1) <u>Africa</u> E. HbA HbA more likely to die of malaria / selected against. (1) F. {Heterozygotes/ HbA HbS/ having one HbS } (selective) advantage/ {Heterozygotes/ HbA HbS/ having one HbS } are selected for / or description of(1)			5	5		
	(c)	(i)		Any **two** × (1) from: {Nucleotide /base/DNA} {<u>sequence/ code</u> } (1) Location of genes (1) Accept alleles on chromosomes (1) complete DNA sequence = 2 marks	2			2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Any **two** × (1) from: Make mosquitos susceptible to insecticides (1) Make mosquitoes less fertile (1) Prevent transmission (1) Modification of Plasmodium to reduce pathogenicity (1) Development (of more effective) drugs or vaccines (1)	2			2		
				Question 2 total	**4**	**4**	**5**	**13**	**4**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			Reduced petal size / petals absent / petals not brightly coloured (1) Anthers / stigma {hanging outside (flower)/ exposed/ feathery} (1)		2		2		2
	(b)	(i)		**Any 3 correct points for 2 marks** **Any 2 correct points for 1 marks** • (dry) {mass/ volume} of tissue (1) • age/ stage of development/ ripeness/ size of tomato (1) • volume of solvent/ same solvent (1) • extraction time/ time in solvent (1) • temperature of solvent/ of tissue (1) • environmental growing conditions / or named(1) • position on ovary wall (1)			2	2		2
		(ii)		To remove any {inhibitor/ovary wall tissue} present/ there may be inhibitor present			1	1		1
		(iii)		Inhibitors may be variety-specific/ to see if the inhibitor only affect the variety it was taken from/ owtte			1	1		1
		(iv)		(Repeat experiment) {without extract **/** with water instead of extract} (1) To prove the extract is having an effect (1) Accept inhibitor for extract			2	2		2
				Question 3 total	**0**	**2**	**6**	**8**		**8**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		Genes which can mutate to (oncogenes which) cause {uncontrolled cell division/mitosis/cancer}	1			1		
		(ii)		Control of {gene expression/ owtte e.g. transcribed and translated/ switched on or off} by {factors/ named factors} other than changes in DNA sequence.	1			1		
		(iii)		{Undifferentiated/ unspecialised} cell that has the ability to become {specialised/different/ any/ many} cell(s)/ reference to totipotent/ pluripotent	1			1		
	(b)	(i)		X = Transcription Y = Translation **Both required for 1 mark**	1			1		
		(ii)		Any **three** × (1) from: A. mRNA (from regulator) not produced(1) B. so regulator protein not produced (1) C. Suppressor gene not {expressed/ switched on}/ suppressor gene remains switched off/ suppressor protein not produced(1) D. Uncontrolled {mitosis/ cell division} (1)			3	3		
		(iii)		Any **three** × (1) from: A. Remove acetyl groups (from histones). (1) B. (So) DNA becomes tightly coiled.(1) C. RNA polymerase can't access {gene/DNA} (1) D. cannot be transcribed (1)			3	3		
		(iv)		<u>Increased</u> (risk of) cancer/ <u>increased</u> (risk of) tumour formation/ (1) Passed onto next generation. (1)		2		2		
				Question 4 total	**4**	**2**	**6**	**12**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		AB; Ab; aB; ab; (1) 9:3:3:1 (1)		2		2		
		(ii)		{Genes/alleles} (completely) linked/ or description of/ (gene) linkage too close for chiasma to form between them/ no crossing over occurs (1) Only 2 types of gamete / only AB and ab / no Ab or aB (1)		2		2		
	(b)			Environmental factors/epigenetics (1) Accept another gene affecting the expression of A/ B		1		1		
				Question 5 total	**0**	**5**	**0**	**5**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			FSH causes follicle development (1) LH causes {ovulation / secondary oocytes to be released} (1)		2		2		
	(b)	(i)		• (Stimulates cells in mammary glands) to {secrete/ produce} milk (into ducts)(1) • (lack of FSH) prevents {maturation/ development} of the follicle (1) • {No/ less} ovulation/ or description of (1)		3		3		
		(ii)		• Stimulates contraction of {uterine (wall)/ myometrium} (1) • (which stimulates release of) more oxytocin (1) • which increases the contractions (1)		3		3		
				Question 6 total	**0**	**8**	**0**	**8**	**0**	**0**

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
7	• **Extract** mRNA from the bacterium (which is synthesising the proteins). • Use **reverse transcriptase** to synthesise a {single strand of DNA/ cDNA} using the mRNA (as a template). • Use **DNA polymerase** to produce double stranded DNA. • **Sticky ends** are added to the end of each DNA strand of the DNA. • The DNA is copied many times using the **PCR.** • Plasmids from bacteria are isolated • **Restriction {endonuclease/ enzymes}** is used to open the plasmid (at a specific point) • producing **sticky ends complementary** to the DNA. • **DNA ligase** is used to bind the DNA into the plasmid. • **Antibiotic resistance genes / markers/ LacZ** are used to select bacteria containing the recombinant plasmids. Concerns: • dispersal of pollen from engineered crops to wild relatives/ contamination of organic crops • unknown effects of eating new protein which is toxic to insects/ health concerns from eating GM crop • a reduction in biodiversity e.g. beneficial insects killed/ affect on food chains • Could result in resistance to protein in insects/ selection pressure						

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
	7-9 marks Indicative content of this level is… Detailed explanation of all three areas in the indicative content. *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 of this level is… Detailed explanation of 2 areas of the indicative content, or partial description of 3 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** Indicative content of this level is… Good explanation of one area of the indicative content or partial description of 2/3 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				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				0 marks *The candidate does not make any attempt or give a relevant answer worthy of credit.*						
				Question7 total	**7**	**2**		**9**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		Skin (connective tissue) / skin flora (bacteria)/ blood clotting / inflammation/ phagocytes / macrophage lysozyme/ stomach acid/ low pH in stomach **Any 3 for 1 mark**	1			1		
		(ii)		{Many organisms/ named organism} live {in/on} the (human) body	1			1		
		(iii)		Cell lysis / cell bursts	1			1		
		(iv)		Any **three** × (1) from: • {Macrophages/ phagocytes} {engulf virus infected cell / carry out phagocytosis}/ antigen presentation (1) • clonal expansion/ T cells {proliferate/divide many times} / (1) • Cytokines stimulate phagocytosis (1) • Killer T cells cause cell lysis (1)	1	2		3		
	(b)	(i)		• Antibiotics can act on {cell wall of bacteria/ or description of/ hydrolyse peptidoglycan} (1) • Antibiotics affect {metabolism/protein synthesis} by bacterial cell (1) • Viruses don't have a {cell wall / metabolism} so not affected by antibiotics (1)	2		1	3		
		(ii)		7250 (mg) (2) If incorrect award 1 mark for any combination of three parts of equation 25mg × 14.5 × 2 × 10		2		2	2	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Amoxycillin is bactericidal + {as the bacterial numbers are reduced / has killed bacteria} (1) Tetracycline is bacteriostatic + {as it has prevented replication/no cell death/cell numbers remain constant }(1)			2	2		
		(iv)		Any **two** × (1) from: Same {concentration/ dosage} of antibiotics (1) same composition of {culture media/agar}/ named constituent of {culture media/agar} (1) Same strain of *S. pyogenes* (1) pH (1) NOT incubation temperature/ oxygen		2		2		2
		(v)		Human pathogen / (close to human) body temperature		1		1		1
	(c)	(i)		• May be {rapid/ high} mutation rate in rhinovirus /antigens change/viruses are antigenically labile (1) • Many {strains/serotypes/ antigenic types} of rhinovirus (1) • Vaccines would need to contain antigens from all strains (to provide complete immunity) (1) • Each antigen must produce a strong immune response/be highly antigenic / be immunogenic(1)		1	2	3		
		(ii)		Religious objections/ safety fears/ side effects/ individual rights/ some people may be too ill for vaccination e.g. due to HIV-AIDS or Chemotherapy		1		1		
				Question 8 total	**6**	**9**	**5**	**20**	**2**	**3**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		Femur	1			1		
		(ii)		M=66 or 67/150 (1) = 0.44 or 0.4 / 0.45 or 0.5 (1)		2		2	2	
		(iii)		hydroxyapatite / calcium ions **and** phosphate ions / calcium phosphate (1)	1			1		
		(iv)		Any **two** × (1) from: • {Haversian/Volkmann} canals contain blood vessels (1) • Diffusion of (named substance/O_2/glucose/amino acids) to {osteoblasts/osteoclasts/ cells} (1) • Canaliculi contains {fluid for exchange with the cells/ tissue fluid} (1)	2			2		
		(v)		Slow fibres are {red /darker} **and** fast fibres are {white/lighter} (1) {Increased blood supply to/ more blood in} slow twitch fibres / Increased myoglobin in slow twitch fibres/ ORA for fast twitch fibres (1)			2	2		
		(vi)		Total number of fibres in each sample {varied/different} (1) Allows comparison (between different athletes) (1)		2		2		2
		(vii)		the activity type is the only variable that changes/ owtte		1		1		1
		(viii)		{High/ 70} % fast twitch (1) Anaerobic respiration (1) Because there are short intense bursts of activity (1)		1	2	3		
	(b)	(i)		Flexibility / support / protection of spinal cord/ attachment of ribs **Any 2 for 1 mark**	1			1		
		(ii)		Thoracic		1		1		
		(iii)		Physiotherapy / weight loss / Exercise to strengthen muscles/ or example		1		1		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		Ball and socket joint	1			1		
		(ii)		Osteoarthritis (1) reduced joint space / reduced cartilage / inflammation /swelling (1)		1	1	2		
				Question 9 total	**6**	**9**	**5**	**20**	**2**	**2**

<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>10</td><td>(a)</td><td>(i)</td><td></td><td>
<table>
<tr><td></td><td>Sympathetic</td><td>Parasympathetic</td></tr>
<tr><td>Neurotransmitter</td><td>Noradrenaline
NOT adrenaline</td><td>Acetylcholine (1)</td></tr>
<tr><td>General effect</td><td>Excitatory/
stimulatory;</td><td>Inhibitory (1)</td></tr>
<tr><td>Effect on heart rate</td><td>Increases</td><td>Decreases; (1)</td></tr>
</table>
1 mark for each row
</td><td>3</td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>The larger the area on the motor cortex + increased movement {complexity/ increased fine movements}
NOT number of motor neurones</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Increased sensory cortex to areas more receptive to stimuli
/ or example increased sensory cortex for genitals/ hand/ tongue etc (1)</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>Cortisol levels raised (1)
Cortisol levels raised all the time (1)
Negative Feedback loop {not working/ overridden/ faulty} (1)</td><td></td><td>2</td><td>1</td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Epigenetic factors (1)
Increased gene expression leading to increased cortisol levels (1)</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td></td><td>Division of labour/ separate working groups/ different groups for different jobs/ 2 examples from: care of offspring/ looking for food/ reproduction/ defence of the colony (1)
Increased efficiency (1)</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>Pheromones/visual cues / touch/ movement</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>Intra-sexual (selection)(1)
Males more aggressive / increases sexual dimorphism / weaker males die off / strong males {survive/ reproduction}/ passing on of advantageous alleles (1)</td><td>1</td><td>1</td><td></td><td>2</td><td></td><td></td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		Kinesis Accept: orthokinesis / klinokinesis	1			1		
		(v)		• Critical value of Chi-squared = 3.841 (1) • Calculated Chi-squared of 5.00 {> critical value/ to the right of the critical value} (1) • Reject {the null hypothesis/ H_0}(1) • there is less than a 0.05 probability the results are due to chance/ Significant difference between {the dry and humid environments/ O and E} (1)			4	4	2	3
				Question 10 total	**6**	**9**	**5**	**20**	**2**	**2**

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	**6**	**9**	**0**	**15**	**3**	4
2	**4**	**4**	**5**	**13**	**4**	**0**
3	**0**	**2**	**6**	**8**	0	**8**
4	**4**	**2**	**6**	**12**	**0**	**0**
5	**0**	**5**	**0**	**5**	**0**	**0**
6	**0**	**8**	**0**	**8**	**0**	**0**
7	7	2	0	**9**	**0**	**0**
8/9/10	**6**	**9**	**5**	**20**	**2**	**2**
TOTAL	27	41	22	90	9	14