GCE A LEVEL MARKING SCHEME

SUMMER 2017

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

INTRODUCTION

This marking scheme was used by WJEC for the 2017 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.

UNIT 4 – VARIATION, INHERITANCE AND OPTIONS

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

WJEC GCE BIOLOGY - HUMAN BIOLOGY
SUMMER 2017
UNIT 4 MARK SCHEME

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	*(a)*	(i)		(Genetically) Identical / clone/ the same (1) Mitosis (1)		2		2		
		(ii)		Stigma above anthers/ anthers below stigma/ carpels above stamen/ reference to female parts above male parts/ ORA (1) NOT they are different heights		1		1		
		(iii)		Prevent inbreeding / (Increase) genetic {variation/ diversity}/Prevent homozygosity/ description of homozygosity/ larger gene pool/ ORA (1) increase chances of survival (of plant species)/ selective advantage/ adapt to changing environment/ maintain vigour (1)		2		2		
	(b)	(i)		Gamete 10 Endosperm 30 Petal 20 3 correct = 2 marks, 2 correct = 1 mark		2		2		
		(ii)		A. Chromosome number doubled / 3n to 6n/ triploid to hexaploid/ even number of each chromosome (1) NOT returned to diploid B. ref to endomitosis/ cell does not divide/ non disjunction/ no cytokinesis (1) C. Homologous pairs/ bivalents form (1) D. Prophase 1 (1) E. Meiosis (1) F. (viable) gametes can be produced (1)	4	1		5		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(iii)		outcompeted/ not isolated so able to breed with parental plants / loss of habitat or description of (1)		1		1		
				Question 1 total	**4**	**9**	**0**	**13**		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*	(i)		Intron {does not code / spliced out/ not translated} (1) Exon {codes/ is translated} (for a polypeptide) (1) NOT codes for an amino acid(s)	2			2		
		(ii)		Water potential falls (in the mitochondria)/ solute potential decreases (1) Water enters by <u>osmosis</u> (1) Max 1 if refer to cell		2		2		
	(b)	(i)		Phenotype parents: unaffected male, {unaffected/carrier} female (1) Genotype parents, X^DY , X^DX^d (1) Genotype gametes, X^D. Y. X^D. X^d (1) ECF Genotypes offspring, X^DY, X^dY, X^DX^d X^DX^D (1)ECF		4		4		
		(ii)		They could {have two copies of the healthy gene/ be homozygous dominant} or be {heterozygous / carrier}/ They could be X^DX^d or X^DX^D/ can't determine until they reproduce (1)		1		1		
	(c)			Any 2 x (1) from: Cause immune response against virus/ antibodies may be produced against it (1) Problems introducing gene into muscle (cells)/ may not reach {target (cell)/ muscle (cell)}/ may invade {non target / host} cells(1) Virus may {become pathogenic/ cause disease/ cause infection/ destroy cells}(1) NOT harm/ illness May affect other genes/ reference to oncogenes(1)	2			2		
	(d)	(i)		CCGUUA(1)	1			1		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Shorter / different 1^{o} structure/ less amino acids/ smaller/ ORA (1)	1			1		
		(iii)		do not have to repeat treatment/ more permanent treatment/ change present in daughter cells/ change present after cell replicates/ can pass to next generation (1)	1			1		
		(iv)		Unknown long-term effects /possible activation of oncogenes / modified gene passed on to next generation/ affect {other genes/ later generations}(1)	1			1		
	(e)			Not sex linked / on autosomes (1) Dominant/not recessive (1) Three examples to justify the conclusions for (3) If recessive 1 + 2 could not produce 6/ unaffected {female/ child} 8 + 9 could not produce 13 /14/ unaffected {female/ child} OR must be dominant, otherwise all children of 1+ 2 / 8 + 9 would be affected If sex linked 1 + 2 could not produce 6/ unaffected female 8 + 9 could not produce 13 or 14/ unaffected female 4 + 5 could not produce 10/ an affected male OR must be autosomal, otherwise all **daughters** of 1+ 2 / 8 + 9 would be affected Max (4) if examples are given to only support one conclusion.			5	5		
				Question 2 total	**8**	**7**	**5**	**20**		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*	(i)		Allow 25.4/ 25.6 / 26.0/ 26.3/ 26.25µm for 2 marks Allow 1 mark for (104/20)x 5 or (104/20.5) x 5 or (105/20) x 5 or (105/20.5) x 5 104000/ 4000 or 105000/ 4000 or 104000/ 4100 or 105000/ 4100		2		2	2	1
		(ii)		all from {secondary oocyte/ female/ mother/ egg}(1)		1		1		
		(iii)		✓ ✓ ✓ ✗ 4 correct (2), 2/3 correct (1)		2		2		
		(iv)		{Nucleus/ DNA / nuclear material/ genetic information} from mother/patient (1) {Nucleus/ DNA/ sperm} from father (1) <u>Mitochondria</u> (DNA) from Donor (1)			3	3		
	(b)	(i)		Move (from one square to another)(1)			1	1		1
		(ii)	I II III	10mm × 10mm × 10mm = 1000/ 1 x 10 ^{3}(mm^{3}) 40 x 1 000 000 = 40 000 000/ 4 x 10^{7} (1) 400 000 x 100 = 4 000 000 000 / 4 x 10^{9} (1) ECF from II		3		3	3	3
				Question 3 total		**8**	**4**	**12**	**5**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*	(i)		Any 3 x (1) from: Random mating (1) non disjunction does not occur/ no mutations (1) Large population (1) No immigration/ no emigration / population is isolated (1) No selection/ selective advantage (1)	3			3		
		(ii)	I II III IV	55% (1) 3025 (1) 2025 (1) 4950 (1)		4		4	4	
	(b)			Genetic drift/ founder effect (1) Emigrated (small) group with an abnormally high frequency of N / abnormally low frequency of M (1) Emigrated population did not mate with general Pennsylvanian population/ no {allele / gene} flow (1)		1	2	3		
				Question 4 total	**3**	**5**	**2**	**10**	**4**	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*			Soak some seeds in gibberellic acid (1) Measure clear area/ compare size of clear zone (1) Any two from: Same type/ variety/ age/ size/ mass of seed (1) Soaked for same time (1) Same conc./depth starch agar (1) Same temperature/ light (1)			4	4		4
	(b)			Reject hypothesis/ accept null hypothesis (1) Seeds germinated before increase in amylase (1)			2	2		
				Question 5 total			**6**	**6**		**4**

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
6	**A: Hormonal control of ovulation** • FSH stimulates the development of follicles in the ovary. • follicle cells produce oestrogen • which inhibits the production of FSH • and stimulate the production of LH. • LH stimulates production of more oestrogen • and oestrogen stimulates production of LH. • Eventually the LH levels cause ovulation. • increase in FSH levels also aids ovulation. • The corpus luteum produces progesterone. • Which is needed for development of endometrium. **B: Similarities** • Hormonal control similar for both/ same hormones involved in both • Copulation affects ovulation • Copulation increases production of LH and FSH • Copulation increases progesterone levels **C: Differences** • Rabbits only ovulate after copulation/ In humans ovulation occurs even if no copulation • Ovulation is not cyclical in rabbits/ ovulation is cyclical in humans • If no copulation LH and FSH remain low in rabbits • FSH level reach zero in rabbits/ do not reach zero in humans • FSH has single peaks in rabbits/ twin peaks in humans	3	2	4			

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				7-9 marks Indicative content of this level is… Detailed explanation of hormonal control . **And** Similarities **And** Differences *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… Any two from: Explanation of hormonal control. Similarity Difference *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.*						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-3 marks Indicative content of this level is… Brief explanation of hormonal control or A similarity or A difference *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 6 total	**3**	**2**	**4**	**9**		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	*(a)*			A disease which is always present at low levels (in an area)/ frequently at a predictable rate in a specific location (1)	1			1		
7	*(b)*	(i)		A – disulphide bridge/disulphide bond B – Antigen binding site C – Light chain D – Heavy chain All 4 correct = 3 marks, 3 correct = 2 marks, 2 correct =1 mark	3			3		
		(ii)		Antigen –initiates an {immune response/production of antibodies} (1) Antigen-antibody complex- a <u>specific</u> antibody bound to an antigen/ complementary antibody (1)	2			2		
	(c)	(i)		<u>Memory cells</u> (must make IgG during the secondary response/ after second exposure/clonal expansion)(1)		1		1		
		(ii)		Any 2 x (1) from: • The bacteria may have antigenic variation/surface proteins / reference to mutations (1) • (IgM produced again as) no memory cells to new antigen (1) • Primary response each time (1)			2	2		
	(d)	(i)		Delay in detection of bacterial antigen /reference to latent period/clonal selection (1) IgG not produced straight away / IgG non existent until day 7/ Time is needed to produce and secrete antibodies (1)		2		2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Any 5 x (1) from: A. Antibodies maybe already attached to the bacteria/antigen/ a substance within the plasma (1) B. Different strain of bacteria which is not recognised by the test (1) C. more than one type of antigen on the surface of the bacteria (1) D. antibodies not at detectable levels/ Variation amongst peoples' immune response/ colour change not detectable (1) E. Enzyme not functioning/denatured (1) F. lack of control of variables e.g. pH/ temperature/ volume of sample (1)		2	3	5		
	(e)	(i)		35-38 ^{o}C **and** it is a human pathogen/ similar to body temperature (1)		1		1		1
		(ii)		380/ 380.13/ 379.94 mm^2 = 2 marks Allow the following for 1 mark 380 (no units) $(22/2)^2$ x 3.14 = $(11)^2$ v 3.14 =		2		2	2	
		(iii)		The zone of inhibition is a perfect circle/ radius is the same all the way round (1)		1		1		
				Question 7 total	**6**	**9**	**5**	**20**	**2**	**3**

<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>8</td><td>(a)</td><td>(i)</td><td></td><td>
<table>
<tr><th></th><th>Actin</th><th>Myosin</th><th>Troponin</th><th>Tropomyosin</th></tr>
<tr><td>A Band</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>I Band</td><td>✓</td><td></td><td>✓</td><td>✓</td></tr>
</table>
(1 mark per correct row)
</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Any 2 x (1) from:

Myosin head binds to actin/cross bridges form between actin and myosin (1)
Myosin head {bends/tilts/ power stroke} so actin is pulled past the myosin(1)
Detail of ATP involvement in release of head (1)</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>Calculate a mean to improve reliability / Identify that there were a range of sarcomere lengths (1)</td><td></td><td></td><td>1</td><td>1</td><td></td><td></td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		1.2 µm = 3 marks 1.2 (no units) = 2 marks (3.6-1.2) / 2 = 1 mark		3		3	3	
		(iii)		Any 2 x (1) The temperature of solution (1) pH of solution (1) same type of muscle (1) Same concentration solution (1) OR 2 controlled variables without solution (1)			2	2		2
		(iv)		Any 2 x (1) from: • no overlap between actin and myosin filaments (1) • no cross-bridges form / no possibility of myosin head moving actin (1) • no contraction possible / sarcomeres cannot get shorter (1)			2	2		
	(c)	(i)		each muscle contracts to 'pull' in each direction / as one contracts the other relaxes to move the limb (1)	1			1		
		(ii)		Any 2 x (1) from: Quadriceps contract (1) The osteoarthritic group has a lower contraction force ORA (1)	1	1		2		

		(iii)		Any 5 x (1) from: A. BMI states they are obese / heavier mass to be moved by quadriceps (1) B. Reference to BMI and the effect on contraction force/ stair climb (1) C. Exercise reduces BMI/ mass(1) D. Exercise strengthens the quadriceps (1) E. supports the joint/ strengthens muscles around the joint (1) F. increases flexibility of the joint / stimulates cartilage growth /reduces joint stiffness (1)		5		5		
				Question 8 total	**6**	**9**	**5**	**20**	**3**	**2**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9	*(a)*			All three for 1 mark A - Cerebral cortex / cerebrum / frontal lobe B - Cerebellum C - Medulla oblongata	1			1		
	(b)	(i)		MRI scan shows {structural anatomy of the brain/pictures which are static} **and** PET scans shows areas of the brain which are functioning at a particular time (1) MRI wouldn't show active areas of the brain, as language is an active process (1)	2			2		
		(ii)		Any 5 x (1) from: A. {Broca's area is the same in both / same colour on scan} as both produce language (1) B. Increased use of motor cortex in BSL / more activity in that area in scan (1) C. because BSL involves more movement than speech alone (1) D. Increased {use/ activity} of the occipital lobe for {vision in BSL / visual stimuli} (1) E. Decreased use of the auditory cortex in BSL/ less activity in that area(1) F. as no link to sound and ear/ no sound detected (1)		2	3	5		
		(iii)		Any 2 x (1) from: Age when became deaf (1) Reason for deafness/ or description of (1) Level of deafness (1)		2		2		2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		Deaf people may exhibit neuroplasticity /'brain has adapted to form new connections as there is no auditory stimuli being received (1) Auditory cortex involved in interpretation of BSL (as near to Wernicke's area) (1) New connections/different connections to hearing between auditory cortex and {Broca's / Wernicke's} area (1)	1		2	3		
	(c)	(i)		Building a nest / to attract a mate/increase reproductive success / protect offspring/eggs / reduce competition with other males for mating (1)	1			1		
		(ii)		sign stimulus - a stimulus which elicits/causes a FAP (fixed action pattern) in the sticklebacks/ produced by one individual, causes a response in a second individual (1) Red belly triggers the aggressive behaviour/ attack/ bite (1) Data reference twice as many bites seen when red bellied model used/ more aggression seen when red bellied model used (1)	1	2		3		
		(iii)		5.6 = 2 marks 5.59 = 1 mark $\sqrt{\frac{343.3}{11}} = 1$ mark		2		2	2	
		(iv)		Reduce confidence in conclusion as SDs overlap (1)		1		1		1
				Question 9 total	**6**	**9**	**5**	**20**	**2**	**3**

UNIT 4 – VARIATION, INHERITANCE AND OPTIONS
SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
Section A						
1	4	9	0	13		
2	8	7	5	20		
3		8	4	12	5	5
4	3	5	2	10	4	
5	0	0	6	6		4
6	3	2	4	9		
Section A - totals	**18**	**31**	**21**	**70**	**9**	**9**
7	**6**	**9**	**5**	**20**	**2**	**3**
8	**6**	**9**	**5**	**20**	**2**	**3**
9	**6**	**9**	**5**	**20**	**2**	**3**
TOTAL	**24**	**40**	**26**	**90**	**11**	**12**