



GCE A LEVEL MARKING SCHEME

SUMMER 2022

**A LEVEL
BIOLOGY – UNIT 4
1400U40-1**

INTRODUCTION

This marking scheme was used by WJEC for the 2022 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 and INHERITANCE
SUMMER 2022 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)		Ovulation	1			1		
		(ii)		Any four (×1) from A. (the acrosome reaction) releases {hydrolases/(named) enzymes} which {digest/ break down} the zona pellucida (1) Ignore refs to membranes B. the {genetic material/ DNA/ chromosomes} of the sperm cell enters (the secondary oocyte) (1) C. this triggers {the cortical reaction/ formation of the fertilisation membrane/ or description of} and prevents {polyspermy/ or description of} (1) D. (entry of the genetic material also) triggers meiosis II (1) E. (nuclei of the sperm and ovum/ gametes fuse to) form a <u>diploid</u> {zygote/nucleus} (1)	4			4		
		(iii)		<u>Mitosis</u> + {cleavage/ cytokinesis}	1			1		
	(b)			{Cilia/ they} move / owtte (1) the {secondary oocyte/ zygote/blastocyst} (1) (from the ovary) along the {fallopian tube/ oviduct} towards the {uterus/ endometrium} (1)		3		3		1
	(c)	(i)		Any two (×1) from: (The length of gestation/ 5 months for ewe/ almost a year for mare/ it) means offspring born in spring (1) means that {fresh grass/ more food} will be available for the mother (better nutrition for milk production) / {lamb/foal} will have {grass/ food} in spring (1) Warmer temperatures/not winter/cold / ORA(1)			2	2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Any two (×1) from: More likely to result in fertilisation (1) Sperm need time to swim (to top of/ along) fallopian tube(1) May not mate until later in oestrus (1)			2	2		
				Question 1 total	6	3	4	13	0	1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2.	(a)			Any two (x1) from No hCG {prior to pregnancy/ present before week 4} (1) Rapid rise in levels (if pregnancy is present) (1) Easy to detect/not likely to get false positives (1)		2		2		
	(b)	(i)		A (is positive for pregnancy) (1) has a control (line)/ or description of (1) other line shows hCG is present/ ref to antibody sandwich (1) Ignore reference to position of lines			3	3		
		(ii)		Neither has the control line (1) The unattached enzyme linked antibodies have not bound to the immobilised antibodies (1)			2	2		
	(c)			Maintains the corpus luteum (1) Any two (x1) from (if hCG levels fall) then Corpus luteum degenerates/ is not maintained (1) Levels of progesterone would fall/ corpus luteum does not produce enough progesterone (1) Ignore other hormones The {endometrium/uterus lining} {breaks down/ is shed} (1) Embryo would be shed/ cause miscarriage (1)	3			3		
	(d)			Mutations causing {small shape change/ no change in amino acids} (resulting in a functional/normal pregnancy) (1) (Big) differences in {shape/ polypeptides/ protein} would mean {infertility/ miscarriage/ an effect on the pregnancy} (1)		2		2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)			Any four (x1) from A. (Placenta secretes) progesterone and oestrogen {rise/ increase} (to high levels) (1) B. FSH and LH secretion are inhibited (1) C. Progesterone {suppresses the {uterine (wall's)/ myometrium} ability to contract/ <u>maintains</u> {endometrium/ uterus lining}} (1) D. Oestrogen stimulates the growth of the uterus (to accommodate the growing foetus) (1) E. Oestrogen stimulates the {growth / development} of the mammary glands (1)	4			4		
				Question 2 total	7	4	5	16	0	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3.	(a)	(i)		3.92% of the population are heterozygotes = 3 marks If incorrect award 2 marks for 3.9 4 $2pq = 2 \times (0.02 \times 0.98)$ 0.0392 If incorrect award 1 mark for sight of $p = 1 - 0.02$ $p = 0.98$		3		3	3	3
		(ii)		{more resistant/ owtte} to malaria/ORA (1) Because parasite cannot reproduce/feed in (Tt individuals) RBC's (1) reject survive		2		2		
	(b)	(i)		{Undifferentiated/unspecialised/ multipotent} (can continue to divide) (1) Can {specialise and become / differentiate into} RBC's (1)		2		2		
		(ii)		Less/no chance of rejection/eq (1) Fewer/no ethical concerns (1)	2			2		
		(iii)		Any two (x1) from Identification of position of {Hb gene/ all genes} (1) Need to know base sequence of {normal/ replacement} gene (1) Need to know base sequence to RNA guide (1)		2		2		
				Question 3 total	2	9	0	11	3	3

Question				Marking details	Marks available																																			
					AO1	AO2	AO3	Total	Maths	Prac																														
4.	(a)	(i)		<ul style="list-style-type: none">Woodland: brown and unbanded snails (1)Meadow: random/more variation/slightly more yellow/ owtte (1)Hedge: (are any colour and/but) mainly banded (1)			3	3		3																														
		(ii)		Due to {camouflage/ temperature/ {selective} predation/ or description of};			1	1																																
	(b)			<table><tr><td>Habitat</td><td>O</td><td>E</td><td>O-E</td><td>(O-E)²</td><td>$\frac{(O-E)^2}{E}$</td></tr><tr><td>Wood</td><td>28</td><td>11</td><td>17</td><td>289</td><td>26.27</td></tr><tr><td>Hedge</td><td>2</td><td>11</td><td>-9</td><td>81</td><td>7.36</td></tr><tr><td>Meadow</td><td>3</td><td>11</td><td>-8</td><td>64</td><td>5.82</td></tr><tr><td></td><td>Total 33</td><td></td><td></td><td></td><td>$\Sigma=39.45$</td></tr></table> <p>$\Sigma=39.45 = 3$ marks If incorrect award 2marks for 39.5 39.44 Correct (O-E)² column If incorrect award 1 marks for Correct Expected column</p>	Habitat	O	E	O-E	(O-E) ²	$\frac{(O-E)^2}{E}$	Wood	28	11	17	289	26.27	Hedge	2	11	-9	81	7.36	Meadow	3	11	-8	64	5.82		Total 33				$\Sigma=39.45$		3		3	3	3
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	(c)			Reject the null hypothesis (1) {39.45/ calculated value} is much greater than the critical value of 5.99 (1) Accept 5.99 circled on table if not mentioned ecf (b) This means that the difference between O and E is significant / therefore the results are not due to chance/ Some other factor is affecting their high numbers in the woodland (1)			3	3	3	3																														
				Question 4 total	0	3	7	10	5	9																														

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5.	(a)	(i)		<ul style="list-style-type: none"> (First male) {gamete/ nucleus} (enters embryo sac,) fuses with {female gamete/ egg cell}, produces the zygote (1) Reject ovum/ egg (Second male) {gamete/ nucleus} fuses with polar {nuclei/nucleus}, forming {endosperm/ triploid} nucleus (1) 	2			2		
		(ii)		<ul style="list-style-type: none"> No {zygote/fertilisation of egg cell/ fertilisation of polar nuclei} means no stored food (1) Saves plant {resources/energy}/ energy used for other processes (1) 		2		2		
	(b)			<ul style="list-style-type: none"> Dandelion (wind dispersal) – seeds have ‘parachutes/eq’ so seed is blown in the wind. (1) Cocklebur (animal dispersal) – seeds has hooks which catch in animal (fur) (1) 		2		2		2
	(c)	(i)		Independent: Presence/absence of embryo (1) Dependent: Presence/absence/size/diameter of {clear area/ halo} (1)		2		2		2
		(ii)		A. without {embryo/ embryo development} there is {no/little} starch {hydrolysis/digestion}/ lack of a halo shows there is {no/little} starch {hydrolysis/digestion} (1) B. gibberellin is {released by the embryo/ present} (1) C. gibberellins {starts the synthesis of/ owtte} amylase (which hydrolyses starch) (1) Accept reverse answer for all mark points		2	1	3		3
				Question 5 total	2	8	1	11	0	7

Question 6				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6.				<p>Indicative content of this level is...</p> <p>Process of geographical isolation Description of Geographical isolation e.g. when a population is separated by a physical <u>barrier</u> Ice as isolating mechanism or description of which {prevents/ interferes with} gene flow/ demes {Founder effect/ or description of} on gene pool/genetic drift/ref to random mutation Effect of selection pressure changing the frequency of alleles in a population Eg of selection pressure for bears eg food availability/hunting new prey/camouflage/ability to metabolise a high fat diet</p> <p>Polar bear has adapted to live in its habitat. Selection of {alleles/ genes/ ref to change in genetic material} allowing a high fat diet The physiological changes had to be {quick/ref to less than 20,500 generations} if they were to subsist on a dangerously high fat diet Bears have evolved to eat (primarily) blubber /Nursing cubs rely on high fat milk Polar Bears must have large fat deposits under their skin to keep warm in Arctic conditions/Rely on metabolic water, a by-product of the breakdown of fat (Change in) fur colour (brown to white) so able to {hunt/camouflage}/The development of a sleeker body for hunting/swimming</p>	4	5		9		

Question 6				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p>Two different species Not separate species as can interbreed to produce fertile offspring Gene pool still sufficiently similar Subsequent interbreeding of hybrids with Brown Bears Overlapping territories (due to receding ice) allows the 2 groups contact for interbreeding Will continue to interbreed so gradual loss of pure Polar Bears May outcompete pure Brown Bears/Loss of genetic biodiversity</p> <p>7-9 marks Detailed coverage of all three sections <i>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.</i></p> <p>4-6 marks Some detail of two sections or less coverage of three sections <i>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.</i></p>						

Question 6				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-3 marks Coverage of one section <i>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.</i> 0 marks <i>The candidate does not make any attempt or give a relevant answer worthy of credit.</i>						
				Question 6 total	4	5		9		

UNIT 4: VARIATION, INHERITANCE AND OPTIONS

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	3	4	13	0	1
2	7	4	5	16	0	0
3	2	9	0	11	3	3
4	0	3	7	10	5	9
5	2	8	1	11	0	7
6	4	5	0	9	0	0
Total	21	32	17	70	8	20