GCE A LEVEL MARKING SCHEME

AUTUMN 2020

A LEVEL
BIOLOGY - COMPONENT 2
A400U20-1

© WJEC CBAC Ltd.

INTRODUCTION

This marking scheme was used by WJEC for the 2020 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 CBAC Ltd.

GCE A LEVEL BIOLOGY COMPONENT 2

CONTINUITY OF LIFE

AUTUMN 2020 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.

© WJEC CBAC Ltd.

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 CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		phenotype (1)	1			1		
		(ii)		two organisms of the same phenotype only produce offspring of the same phenotype when bred together / homozygous (1)	1			1		
		(iii)		dominant alleles {only need one allele to be/ always} expressed in the phenotype (1) recessive alleles need both alleles in the pair to be recessive to be expressed in the phenotype/ only expressed when dominant is absent (1)	2			2		
	(b)	(i)		stamens / anthers (removed) (1) pollen has to come from another {flower / plant}/ no pollen available from same flower/ impossible to self-pollinate (1)	1	1		2		1
		(ii)		{enclose/ isolate} the flower (in a bag) to prevent transfer of pollen from another flower (1)			1	1		1
	(c)	(i)		smooth yellow = 9.4 smooth green = 3.2 wrinkled yellow = 3.1 wrinkled green = 1.0 All ✓ = 2; 3 or 2 ✓ = 1; 1 or 0 ✓ = 0 9:3:3:1 = 1 mark		2		2	2	
		(ii)		**Any two (x1) from** F_1 all smooth, yellow therefore smooth and yellow dominant, wrinkled and green recessive (1) Accept use of correct letters both F_1 must have been heterozygous for each characteristic (1) no linkage (1) Accept use of correct letters			2	2		

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		linkage / on same chromosome (1)		1		1		
		(ii)		crossing over / chiasmata formation/ recombination of alleles (1) during prophase I (1) ignore reference to independent assortment unless incorrect	2			2		
				Question 1 total	**7**	**4**	**3**	**14**	**2**	**2**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		**advantage**: can see structures more clearly / that would not otherwise be visible/ provides contrast (1) **disadvantage**: organisms are (usually) {killed/ harmed} in the staining process/ stain is toxic (1)		1 1		2		2
		(ii)		x 4 / x10/ low power (1)			1	1		1
	(b)	(i)		**body cells**: mitosis **+** **gametes:** meiosis	1			1		
		(ii)		10 (mitotic) divisions		1		1		
	(c)			**Any 2 (x1) from:** Each strand acts as a template (1) So each time DNA is replicated the molecule contains one original and one new strand (1) Suitable example from generation 0 to 1 or 1 to 2 (1) e.g. generation 1 all DNA is intermediate in mass/ must contain one strand of ^{14}N DNA and 1 strand of ^{15}N DNA generation 2 half of the DNA is intermediate and half is light Accept arguments against conservative would always have 15N band at bottom (1) dispersive a single broad band at 1 and 2 but getting lighter in mass (1)	1	1		2		

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		proto-oncogenes / oncogenes (1) mutagens/ carcinogens (1)	2			2		
		(ii)		body cells are fully differentiated germ line cells are not (1) Only germ line cells can continue to divide by mitosis (1) Reject reference to meiosis of germ-line cells			2	2		
	(e)			modification does not affect the base sequence of the gene (1) transcription is {affected / reduced}/ gene not expressed (1) translation produces same amino acid sequence (1)		3		3		
				Question 2 total	**4**	**7**	**3**	**14**	**0**	**3**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			ovary wall 56 pollen tube nucleus 28 primary endosperm nucleus 84 All ✓= 2; 2 or 1 ✓= 1; 1 or 0 ✓= 0 Allow 1 mark for 2n, n, 3n (1)		2		2		
	(b)	(i)		large quantity of DNA/ more DNA easier to see			1	1		1
		(ii)		DNA too large a molecule to fit through normal filter paper pores/ allows more {DNA/ filtrate} to pass through (1)			1	1		1
		(iii)		pH is 9 / alkaline **+** due to detergent (1) pepsin has optimum pH of 1 to 2 / acid (1) ORA Allow for 1 mark: pepsin not at optimal conditions (1)		2		2		2
	(c)			PCR (1) **Any two (×1) from:** heating the DNA to 95^{o}C to separate the two strands of DNA (1) cooled to 50-60^{o}C **+** to allow primers to {bind / anneal} to DNA (1) Heating to 70^{o}C **+** allow {thermally stable DNA polymerase /*Taq polymerase}* to add (complementary) nucleotides (1)	3			3		3
	(d)	(i)		Mutation / allele for beta thalassaemia still present in germ-line cells / sperm / individual would still be a carrier (1) somatic stem cell therapy not germ-line therapy / does not replace germ line cells / treats symptoms not heritable (1)			2	2		
		(ii)		the child has no choice / lack of consent/ suitable ethical concern (1) NOT unethical unjustified			1	1		

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)			**advantage**: a virus would transfer the gene directly into the {blood/ host} stem cells (1) **disadvantage**: non-pathogenic virus could mutate and become {pathogenic/ cause harm} insertion of gene could activate oncogene / insertion of gene into another gene could inactivate that gene OWTTE/ immune response (1)			2			
				Question 3 total	**3**	**4**	**7**	**14**	**0**	**7**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	I II III	**Y** (endosperm) (1) **Z** (embryo) (1) **X** (aleurone layer) (1)		3		3		
		(ii)		{layer X / aleurone layer} removed which contains protein (1) (dietary) protein needed for growth (1)	1	1		2		
	(b)			restriction {endonuclease / enzyme} **+** to cut the gene out of DNA (1) DNA ligase **+** to bind the fragment containing the gene into a plasmid (1) Reject just cut or bind DNA Allow 1 mark Both enzymes correct but no/incorrect functions (1)	2			2		2
	(c)	(i)		a region of non-coding DNA (between coding regions) (1)	1			1		
		(ii)		mRNA can be modified/ spliced in different ways/ exons can also be removed during splicing (1) each mRNA would {have a different base sequence/ code for a different polypeptide} (1)		1 1		2		
		(iii)		(functional) mRNA does not contain introns / introns have already been spliced out of mRNA / synthetic DNA would only contain {exons / coding regions} (1) only a single DNA sequence is incorporated into the rice cells (1) no risk of producing {different mRNA / amino acid} sequences (1) bacteria cannot remove introns / introns won't have to be spliced out (1)		1 1	1	3		

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		**Any 3 (x1) from:** extract mRNA from a cell actively synthesising the required protein (1) mRNA used as a template to make DNA (1) reverse transcriptase (1) to form a single stranded DNA (1) DNA polymerase to produce a double stranded cDNA (1)	3			3		3
	(d)			**Any 2 (x1) from** unknown {side effects/ health issues of eating GM crop (1) concerns over use of pathogenic bacterium in gene transfer (1) unknown effect on environment (1) Relevant economic concern / religious opposition (1)	2			2		
				Question 4 total	**9**	**8**	**1**	**18**	**0**	**5**

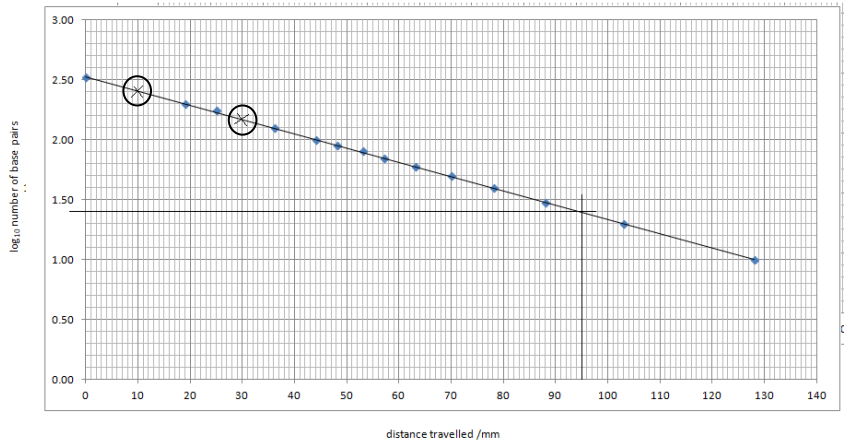
© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		**A** = follicle stimulating hormone **+** **B** = luteinising hormone (1) **X** = anterior pituitary (gland) (1)	2			2		
		(ii)		oestrogen and progesterone inhibit {FSH / hormone A} secretion + follicles do not mature (1) progesterone inhibits {LH / hormone B} secretion + so no ovulation (1) progesterone increases level of mucus in cervix + so blocks entry of sperm (1)			3	3		
	(b)	(i)		spermatogenesis (1)	1			1		
		(ii)		seminiferous tubules (in testes) (1)	1			1		
	(c)	(i)		16g (2) **if incorrect:** 16 000 (mg) (1) 1000 + (500 x 30) (1)		2		2	2	
		(ii)		**Any two (x1) from:** had already fathered a child {in last two years/ recently} (1) same ethnicity (1) same age group/ given ages (1)			2	2		2
		(iii)		855 (2) Accept 854 **if incorrect:** 854.9 / 854.896 (1) 898 - (898 x 4.8/100) (1)		2		2	2	

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		**Any one (x1) of**: low chance of sperm reaching secondary oocyte (1) intercourse may not coincide with ovulation (1) relevant problem associated with conception/ female fertility (1) pregnancy rate measure male and female fertility (1) may not have been the father (1)		1		1		
	(d)			**Any two (x1) of**: Different ethnicity / different genetic makeup (1) NOT just different countries Wider age group (1) {underlying health of men / diet} which could affect sperm production (1) Award 1 mark if two changes given but not justified (1) Reject references to increasing reliability / larger sample size / longer trial period / different doses			2	2		2
				Question 5 total	**4**	**5**	**7**	**16**	**4**	**4**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		xylem **and** phloem (1)		1		1		
		(ii)		Any 2 of: chlorophyll a / chlorophyll b / carotene / xanthophyll (1) photosystem **+** thylakoid membrane/ antenna complex/ reaction centre (1)	2			2		
		(iii)		photoautotrophic / photosynthetic autotrophic (1)	1			1		
	(b)	(i)		All correct (1) 150 | 2.18 250 | 2.40		1		1	1	
		(ii)		 I x and y axes labelled + correct unit on x axis (1) II values for 150 and 250 bp correctly plotted (circled on graph) (1) III straight line of best fit – drawn with a ruler (1)		3		3	3	

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)	I	1.4 (1) Accept value between 1.35 and 1.45 use of graph – line drawn up from 95mm and across to y axis (1) (as on graph above) accept other answer if they have indicated how they obtained answer from an inaccurate line of best fit.		2		2	2	
			II	number of bases = $10^{1.4}$ = 25.1 (1) ecf from (I)		1		1	1	
		(v)		include fragments in DNA ladder between 20 and 30 base pairs in length (1)			1	1		1
		(vi)		*A.obovatum* provided the female gamete (1) chloroplast DNA only inherited from female gamete (1) *A.obovatum* DNA bands match those of *A.forenzis* (1)			3	3		
				Question 6 total	**3**	**8**	**4**	**15**	**7**	**1**

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				Indicative content **natural selection** • coat colour variation • due to mutation • different patterns give competitive advantage in different habitats • providing camouflage/ survival of the fittest • those best adapted survived and reproduced passing advantageous allele(s) to offspring **sympatric speciation** • animals living in same area diverged through reproductive isolation / sympatric speciation, eg., ref to those in areas marked with ovals or named species from those areas • suitable example of reproductive isolation eg., behaviour / morphological • more likely to breed with animals of same coat colour • genetic drift and speciation **allopatric speciation** • geographical / physical isolation of some groups of giraffe diverged / allopatric speciation eg., West African Giraffe, Thornicroft's Giraffe • gene pool not representative of whole gene pool / founder effect • alleles that did not confer advantage lost from gene pool • different environmental / selection pressures favoured survival of those with advantageous alleles • genetic drift and speciation		9		9		

© WJEC CBAC Ltd.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				7-9 marks Identifies and explains all THREE of • natural selection as the cause of the evolution of coat patterns; • sympatric speciation; • allopatric speciation. 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** Identifies and explains TWO of • natural selection as the cause of the evolution of coat patterns; • sympatric speciation; • allopatric speciation *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** Identifies and explains ONE of • natural selection as the cause of the evolution of coat patterns; • sympatric speciation; • allopatric speciation. *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 7 total	**0**	**9**	**0**	**9**	**0**	**0**

© WJEC CBAC Ltd.

COMPONENT 2: CONTINUITY OF LIFE

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Q	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	7	4	3	14	2	2
2	4	7	3	14	0	3
3	3	4	7	14	0	7
4	9	8	1	18	0	5
5	4	5	7	16	4	4
6	3	8	4	15	7	1
7	0	9	0	9	0	0
TOTAL	30	45	25	100	13	22
	30	45	25	100	10	15

© WJEC CBAC Ltd.