GCE AS MARKING SCHEME

SUMMER 2022

AS
BIOLOGY – COMPONENT 1
B400U10-1

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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.

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GCE AS BIOLOGY

COMPONENT 1 – BASIC BIOCHEMISTRY AND CELL ORGANISATION

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.

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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

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			R <u>variable</u> group (/ functional group) NH_2 Amine/ amino group COOH Carboxyl group / carboxylic acid All three for 2 marks, 2 correct for 1 mark	2			2		
	(b)			Sulfur Accept sulphur / S	1			1		
	(c)			**Any two (×1) from:** • Increase or remains the same (1) • As the concentration of isoleucine increases, the rate of activity of threonine deaminase decreases / valid description e.g. fewer enzyme-substrate complexes formed (1) • So less threonine is converted, allowing its concentration to increase. (1) Ignore reference to competitive inhibition / inhibitor binding to active site			2	2		
	(d)	(i)		• {At lower substrate concentrations} the rate increases as substrate concentration increases / substrate concentration limiting (1) variables must be linked • As substrate concentration increases (above 2 a.u.) the curve levels off / plateaus / correct reference to data (1) • Enzyme concentration is limiting / number of available active sites limiting / ref to enzymes working at maximum turnover / all active sites occupied (1)		3		3		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		**Any four (×1) from:** • curve plateaus at a lower substrate concentration / rate of reaction lower at all substrate concentrations (1) • Because isoleucine is acting as a <u>non-competitive inhibitor</u> (1) • Isoleucine binds to a site on the enzyme molecule away from the active site/ allosteric site (1) • causes the shape of the active site to change/ prevents formation of enzyme – substrate complex (1) • Reducing the maximum rate of enzyme activity / inhibition not reduced by increasing substrate concentration. (1)		3	1	4		
				Question 1 total	**3**	**6**	**3**	**12**	**0**	**0**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		-16.67 or 16.66' **2 marks** Award 1 mark for -16.66666667 16.67 -0.7/4.2 x 100		2		2	2	
		(ii)		Because the masses of the cylinders at start were different / to obtain comparable results (1)		1		1		1
		(iii)		• Correct axes with appropriate linear scale using at least 6 large squares (1) • Fully labelled axes (NaCl concentration /mol dm^{-3} on x axis and Percentage change in mass / % on y axis) (1) • Correct plots (1) ±½ small square • Suitable Line – accept line of best fit (1)		4		4	4	
		(iv)		**Any four (×1) from:** A. Between 0.0 and 0.2 mol dm^{-3} water potential of bathing solution is greater than ψ_{cell} / hypotonic to cell ORA (1) B. Water moves into tissue by osmosis down water potential gradient (1) C. 0.6 mol dm^{-3} and 0.8 mol dm^{-3} water potential of bathing solution is lower than ψ_{cell} / hypertonic to cell ORA (1) D. Water moves out of tissue by osmosis down water potential gradient (1) E. Where candidate's line crosses zero on the x axis, tissue and bathing solution are in equilibrium / isotonic / no water potential gradient (1) F. No net movement of water into or out of tissue (1)		4		4		4

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(v)		The solute potential of the bathing solution			1	1		1
		(vi)		Repeats + calculate mean/ standard deviation (1) This increases reliability / allows anomalous results to be excluded/ reduces effect of anomalies (1)		2		2		2
		(vii)		**Any two (×1) from:** Weigh to 0.01g (1) Standardise blotting method (1) Ensure ends are at right angles to cylinder (1) Investigate more concentrations of NaCl around isotonic point (1)			2	2		2
	(b)			Variety B as it has the lowest water potential (1) so would be less likely to lose water through osmosis in soil with a higher salt content (1)			2	2		
				Question 2 total	**0**	**13**	**5**	**18**	**6**	**10**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			**Any five (×1) from:** A. mRNA (produced by transcription) leaves nucleus through nuclear pores B. Protein synthesis on ribosomes / protein in cisternae of rough ER (1) C. Vesicles containing protein pinch off rough ER and fuse with Golgi body / Vesicles from rough ER fuse to form Golgi apparatus (1) D. Protein is modified in Golgi apparatus (1) E. Secretory vesicles pinch off Golgi apparatus and transport enzyme to cell membrane (1) F. Vesicles containing enzyme fuse with the cell membrane and enzyme is released (outside cell) by exocytosis (1) Accept ref to Golgi body in C, D and E.	5			5		
	(b)	(i)		Answer = 18 000 = 2 marks Magnification = $\frac{9}{0.5}$ x1000		2		2	2	2
		(ii)		Mitochondria (1) Produces ATP (1) ATP is a source of energy for exocytosis (1)		3		3		
		(iii)		Mitochondria contain their own DNA / ref to endosymbiont theory (1) Mitochondria have ribosomes and can synthesise their own proteins (1) DNA can be replicated (so both new organelles have copy of DNA) / accept ref. to binary fission (1)		2	1	3		
				Question 3 total	**5**	**7**	**1**	**13**	**2**	**2**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		Metaphase I (1) Bivalents have formed / chromosomes in homologous pairs (1) Arranged at equator of spindle (1)	3			3		
		(ii)		Crossing over has occurred/ or description of (1) Chromosomes aligned independently / independent assortment of {bivalents / homologous pairs of chromosomes} (1)		2		2		
		(iii)		Ovary/ anther	1			1		
	(b)	(i)		Female body nucleus  (1) male body nucleus  (1)			2	2		
		(ii)		Because drones are <u>haploid</u> (1) Cannot halve chromosome number / no homologous pairs / chromosome number maintained for fertilisation (1)			2	2		
		(iii)		Egg cells are produced by meiosis (1) so would vary genetically (1)			2	2		
				Question 4 total	**4**	**2**	**6**	**12**	**0**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		**Any three (×1) from:** • Virus DNA circular, host cell DNA linear (1) • Virus DNA smaller / only 8000 bases, Host DNA has 6 billion bases (1) • Virus only has 8 genes, host cell has many more (20 000) (1)		3		3		
		(ii)		Code for viral proteins / capsid proteins/ enzymes (1)	1			1		
	(b)	(i)		Through the nuclear pores (1)		1		1		
		(ii)		**Any four (×1) from:** A. DNA helicase/ polymerase unzips the DNA (double helix)/ breaks bonds between (complementary) base pairs B. {DNA nucleotides} line up along template/ pair up with exposed bases by <u>complementary base pairing</u> C. Both strands act as templates D. DNA polymerase joins nucleotides/ catalyses formation of covalent bonds to form (sugar-phosphate backbone of) new strand E. DNA polymerase moves up leading and down lagging strand/ in 5' to 3' direction F. Semi-conservative replication/ new DNA molecule made of <u>one original and one new strand</u>	4			4		
		(iii)		**Any one (x1) from:** Replication enzymes (or named) are only found in the nucleus (1) Free DNA nucleotides not outside nucleus (1)		1		1		
		(iv)		One gene one polypeptide	1			1		
				Question 5 total	**6**	**5**	**0**	**11**	**0**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**Section A – levels of protein structure** (definitions/description) primary structure • the sequence/order of amino acids in a polypeptide secondary structure • folding of the primary structure • alpha-helix and beta-pleated sheets formed tertiary structure • further folding/ folding of secondary structure • forms a globular protein/ specific 3D shape **Section B – how levels are maintained** (bonding) primary structure • peptide bonds between amino acids secondary structure • hydrogen bonds between –OH/polar R groups tertiary structure • hydrogen bonds between –OH/polar R groups • ionic bonds between charged R groups • disulphide bonds between sulphur-containing R groups • hydrophobic interactions/ hydrophobic R groups in centre (away from water), hydrophilic R groups on outside of protein **Section C – enzyme action** (induced fit) • active site is complementary to only one substrate • substrate binds to the enzyme's active site • active site changes shape slightly to fit more closely around substrate • this puts strain on the bonds in substrate • less energy needed to break bond/ lowers activation energy • products not complementary to active site so leave/are released						

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				7-9 marks Indicative content of this level is… Detailed description of three levels of protein structure Detailed description of bonding Detailed description of enzyme action To award 9 marks a description of the bonds maintaining each level must be included *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: Description of levels of protein structure Description of bonding Description of enzyme action *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.*						

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-3 marks Indicative content of this level is… Brief description of levels of protein structure OR Brief description of bonding OR Brief description of enzyme action. *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	**9**	**0**	**0**	**9**	**0**	**0**

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COMPONENT 1: BASIC BIOCHEMISTRY AND CELL ORGANISATION

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	3	6	3	**12**	0	0
2	0	13	5	**18**	6	10
3	5	7	1	**13**	2	2
4	4	2	6	**12**	0	0
5	6	5	0	**11**	0	0
6	9	0	0	**9**	0	0
TOTAL	**27**	**33**	**15**	**75**	**8**	**12**

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